September 18, 2023

VIA ELECTRONIC SUBMISSION

April Tabor
Secretary of the Federal Trade Commission
600 Pennsylvania Avenue, N.W.
Washington, D.C. 20580

Re: Draft Merger Guidelines

Dear Ms. Tabor:

The American Investment Council ("AIC") appreciates the opportunity to comment on the July 2023 draft Merger Guidelines (the "Draft Guidelines") issued by the Federal Trade Commission (the "FTC") and the Antitrust Division of the U.S. Department of Justice (the "DOJ" and, together with the FTC, the "Agencies"). The AIC submits this letter on behalf of our members, which are the world's leading private equity and private credit firms.[1] Our members are united by their commitment to growing and strengthening the companies in which they invest on behalf of millions of U.S. investors.

The Agencies should revise the Draft Guidelines to retain the focus on consumer welfare rather than publishing 13 vague guidelines, two additional Sections whose potential application to each individual guideline is often unclear, and four Appendices that collectively would not serve as a meaningful guide for parties evaluating potential transactions.[2] Moreover, the Draft Guidelines could be used by the Agencies to justify any attempt to micromanage the economy for purposes that extend beyond the Agencies' authority.[3] In particular, we are concerned that the

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1 For purposes of this letter, we generally use the term "private equity" to encompass private equity funds, private credit funds, and other private investment vehicles.

2 The term "consumer welfare" also incorporates non-price effects. *See, e.g.*, Fed. Trade Comm'n & U.S. Dep't of Justice, Horizontal Merger Guidelines (2010), p. 2 ("Enhanced market power can also be manifested in non-price terms and conditions that adversely affect customers, including reduced product quality, reduced product variety, reduced service, or diminished innovation. Such non-price effects may coexist with price effects, or can arise in their absence."), https://www.justice.gov/sites/default/files/atr/legacy/2010/08/19/hmg-2010.pdf

3 These policy changes are not subject to consensus within the FTC. For instance, former Commissioner Christine Wilson voiced significant criticism of the current FTC's "attempts to remake federal antitrust law," and its "disregard for the rule and due process." *See* Christine Wilson, *Why I'm Resigning as an FTC Commissioner*, WSJ OPINION (Feb. 14, 2023), https://www.wsj.com/articles/why-im-resigning-from-the-ftc-commissioner-ftc-lina-khan-regulation-rule-violation-antitrust-339f115d?st=71ps0dsup1qr083&reflink=desktopwebshare_permalink. Former Commissioners Christine Wilson and Noah Phillips, among others, also dissented from multiple statements adopted by the FTC for deviating from binding legal precedents, including, for instance, the withdrawal of the FTC's 2015 guidance on Section 5 of the FTC Act. *See* Fed. Trade Comm'n, *Dissenting Statement of Commissioners Noah Joshua Phillips and Christine S. Wilson on the "Statement of the Commission on the Withdrawal of the Statement of Enforcement Principles Regarding 'Unfair Methods of Competition' Under Section 5 of the FTC Act*" (July 9, 2021),

Draft Guidelines seek to eradicate the role of markets in regulating competition and tilt the balance too far towards the government managing the economy.

The Draft Guidelines depart from recent enforcement actions and court decisions, and instead seek to create new standards ostensibly premised on decades-old case law that predate our modern markets, do not reflect advances in industrial economics, and are premised on the incorrect assumption that large businesses necessarily hurt consumers. In seeking to broaden the scope of what the Agencies view as anticompetitive, the Draft Guidelines threaten to chill procompetitive merger activity. Taken together with the notice of proposed rulemaking regarding the Hart-Scott-Rodino Notification and Report Form, the Agencies appear to be attempting to radically redefine long-standing enforcement policies without sufficiently demonstrating the need, or the legal basis, to do so. The Agencies should not depart from long-standing practice merely to increase their enforcement power without a compelling showing of why such power is necessary or appropriate.

In this letter, we provide our perspective on the Draft Guidelines, and recommend several revisions, including revisions to address the Draft Guidelines' open and baseless animus towards private equity.[4] We welcome further opportunity to constructively engage with the Agencies on the Draft Guidelines and to discuss any of the points that we raise in this letter.[5]

I. The Draft Guidelines Should Be Revised to Remove Their Characterization of Historical Precedents.

The Draft Guidelines state that they "reflect the collected experience of the Agencies over many years of merger review in a changing economy."[6] In reality, the Draft Guidelines reflect a drastic departure from the enforcement policies of the Reagan, Bush, Clinton, Bush, Obama, and Trump Administrations and the law as courts have developed it over the last 40 years. The

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https://www.ftc.gov/system/files/documents/public_statements/1591710/p210100phillipswilsondissentsec5enforcementprinciples.pdf.

[4] For instance, the guidelines target roll up strategies and serial acquisitions for particular scrutiny. While it is not new for the Agencies to review a proposed transaction in light of prior acquisitions, the proposed Guidelines go much further by noting that the Agencies may investigate whether a "pattern or strategy of serial acquisitions by the acquiring firm" could raise competitive concerns "even if no single acquisition on its own would risk substantially lessening competition or tending to create a monopoly." *See* Draft Guidelines, p. 22. In addition to imposing unnecessary costs, the mere threat of unjustified scrutiny, and the concomitant delay associated with it, would increase market uncertainty and lead to a loss of market opportunities. As another example, Guideline 12 allows the Agencies to consider the competitive effects of the acquisition of non-controlling "partial ownership or minority interests." *Id.* at 27-28. While analyzing minority or partial interests is not breaking new ground, the Agencies push the boundaries of reasonable inquiry by suggesting that nonvoting interests could raise competitive concerns.

[5] Before publishing the 2010 Horizontal Merger Guidelines, the Agencies solicited public comments and held five joint public workshops to "explore the possibility of updating the Horizontal Merger Guidelines" and "take into account legal and economic developments" since the last significant revisions to the Guidelines. *See* FTC, *Horizontal Merger Guidelines Review Project*, https://www.ftc.gov/news-events/events/2010/01/horizontal-merger-guidelines-review-project. By contrast, the Agencies only convened public workshops *after* they published these Draft Guidelines. *See* FTC, *2023 Draft Merger Guidelines Workshop*, https://www.ftc.gov/news-events/events/2023/09/2023-draft-merger-guidelines-workshop#:~:text=The%20Federal%20Trade%20Commission%20and%20Justice%20Department%20are,being%20submitted%20to%20the%20agencies%20by%20the%20public.

[6] Draft Guidelines, p. 4.

Agencies should acknowledge that their efforts at "revision"[7] are entirely in keeping with President Biden's remarks at the signing ceremony for the Executive Order on Promoting Competition in the American Economy, when he "encouraged" the Agencies to review the horizontal merger guidelines: "[f]orty years ago, we chose the wrong path, in my view, following the misguided philosophy of people like Robert Bork, and pulled back on enforcing laws to promote competition."[8] The Agencies should acknowledge that they have broken sharply with the last 40 years of case law and practice. Indeed, the Agencies' approach to merger review as set out in the Draft Guidelines is patently inconsistent with the rulings from the Supreme Court over the past 40 years,[9] which expressly and repeatedly endorsed the guiding principle that the antitrust laws should focus on consumer welfare.[10]

Indeed, the Draft Guidelines have already received significant criticism, which helps evidence their lack of a sound, consensus footing. For instance, Lawrence Summers, Former Treasury Secretary, cautioned that "[t]hese guidelines—by moving away from lower prices for consumers to broader abstractions—are a substantial risk."[11] Other commentators criticized the Draft Guidelines for prioritizing the Agencies' "interpretation of case law over widely accepted economic principles," "selectively interpreting the law," and "relying on outdated precedents."[12]

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7 *Id.*, p. 1.

8 THE WHITE HOUSE, *Remarks by President Biden At Signing of An Executive Order Promoting Competition in the American Economy* (July 9, 2021), https://www.whitehouse.gov/briefing-room/speeches-remarks/2021/07/09/remarks-by-president-biden-at-signing-of-an-executive-order-promoting-competition-in-the-american-economy/.

9 Note also that the Agencies' dismissal of well-developed and more recent district and appellate court decisions in favor of decades-old Supreme Court decisions ignores the important structural shift with the 1974 amendment to the Expediting Act, which made direct appeals to the Supreme Court in government civil antitrust cases discretionary, rather than mandatory, and gave lower courts a more significant role in shaping the jurisprudence of antitrust laws. *See* 15 U.S.C. § 29(b).

10 *See, e.g.*, *Nat'l Collegiate Athletic Assoc.* v. *Alston*, 141 S. Ct. 2141 (2021) (noting that "[j]udges must remain aware that markets are often more effective than the heavy hand of judicial power **when it comes to enhancing consumer welfare**") (emphasis added); *Ohio* v. *Am. Express Co.*, 138 S. Ct. 2274, 2284 (2018) (holding that the government has not carried its burden of proving that the anti-steering provisions at issue have "a **substantial anticompetitive effect that harms consumers** in the relevant market," noting that the goal is to "distinguis[h] between restraints with anticompetitive effect that are harmful to the consumer and restraints stimulating competition that are in the consumer's best interest") (emphasis added); *Leegin Creative Leather Prod., Inc.* v. *PSKS, Inc.*, 551 U.S. 877, 902 (2007) (holding that vertical price restraints are to be judged by the rule of reason, reasoning that holding otherwise would "**hinder[] competition and consumer welfare because manufacturers are forced to engage in second-best alternatives** and because consumers are required to shoulder the increased expense of the inferior practices") (emphasis added); *Nat'l Collegiate Athletic Assoc.* v. *Board of Regents*, 468 U.S. 85, 107 (1984) ("Congress designed the Sherman Act as a **consumer welfare prescription**") (internal quotations omitted) (emphasis added).

11 Ana Monteiro, *Summers Says Tougher US M&A Rules Seem Like 'War on Business,'* BLOOMBERG (July 20, 2023), https://www.bloomberg.com/news/articles/2023-07-20/summers-says-tougher-us-m-a-rules-seem-like-war-on-business#xj4y7vzkg.

12 *See, e.g.*, Herbert Hovenkamp, *Competitive Harm and the 2023 Draft Merger Guidelines*, PROMARKET (July 27, 2023) (criticizing the Draft Guidelines' presumptions and lack of clarity, for example, their "rel[iance] on case law and many concepts from the 1960s and 1970s," and "the [questionable] treatment of general economic effects as if they were matters of law, thus placing them beyond empirical review"), https://www.promarket.org/2023/07/27/herbert-hovenkamp-competitive-harm-and-the-2023-draft-merger-guidelines/; Bilal Sayyed, *The Draft Merger Guidelines Abandon the Persuasiveness of Their Predecessors*,

The reception to the Draft Guidelines is in stark contrast to the generally positive reactions to the Agencies' consensus-based efforts at updating the Horizontal Merger Guidelines in 2010.[13]

Instead of claiming that the Draft Guidelines reflect the "learning and experience" already incorporated into prior Guidelines and successive revisions, the Agencies should transparently acknowledge that the Draft Guidelines are an attempt to rewrite the antitrust law as it has developed under both Democratic and Republican administrations and in the courts over the last 40 years. Indeed, 75% of the decisions cited in the Draft Guidelines are more than 40 years old. Instead of modernizing the regulatory infrastructure, the Agencies are using decisions that predate the modern markets. Below are a few examples where the Agencies rely on outdated, obsolete precedents that ignore modern market infrastructure and more recent case law that directly contradicts the positions set forth in the Draft Guidelines:

Decrease in the concentration thresholds triggering a presumption of harm for horizontal mergers. Both the current Horizontal Merger Guidelines and the Draft Guidelines include a presumption that a merger should be challenged if it increases market concentration above a certain threshold. Market concentration is measured using the Herfindahl-Hirschman Index ("HHI"), which is calculated by adding together the squares of the market shares of the firms in the relevant market.[14] In the 2010 Horizontal Merger Guidelines, adopted during the Obama Administration, the Agencies stated that, "[b]ased on their experience," transactions resulting in a post-merger HHI greater than 2,500 and a change in 200 points "will be presumed to be likely to enhance market power."[15] Thirteen years later under new Guideline 1, the Agencies now assert that presuming harm from "a post-merger 1,800 HHI and an increase in HHI of 100… better reflect[s] both the law and the risks of competitive harm."[16] But Guideline 1 does not cite a single

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PROMARKET (Aug. 30, 2023) ("The (dis)utility of the proposed Guidelines is compounded by their failure to align with the Agencies' ability to enforce these guidelines. The Agencies do not and will not have the resources to enforce to the analytic framework of the proposed Merger Guidelines. Thus, if they mean to adhere to this analytic framework, they will have to pick and choose between those mergers they challenge and those they do not. How will they do that? The Guidelines provide no clue."), https://www.promarket.org/2023/08/30/bilal-sayyed-the-draft-merger-guidelines-abandon-the-persuasiveness-of-their-predecessors/; Jason Furman & Carl Shapiro, *How Biden Can Get Antitrust Right*, WSJ OPINION (July 27, 2023) ("The new draft guidelines depart sharply from previous iterations by elevating regulators' interpretation of case law over widely accepted economic principles. The guidelines have long helped courts use economic reasoning to evaluate government challenges to mergers. They shouldn't become a debatable legal brief or, worse, a political football."), https://www.wsj.com/articles/how-biden-can-get-antitrust-right-khan-ftc-justice-department-guidelines-11364639; Gus Hurwitz & Geoffrey Manne, *Antitrust Regulation by Intimidation*, WSJ OPINION (July 24, 2023) ("Judicial acceptance of prior guidelines was a result of the agencies' reputation as honest brokers of judicial precedent. The proposed guidelines jeopardize that reputation by selectively interpreting the law, relying on outdated precedents, and disregarding more-recent case law."), https://www.wsj.com/articles/antitrust-regulation-by-intimidation-khan-kanter-case-law-courts-merger-27f610d9.

13 *See Lawyers React to Proposed New Merger Guidelines*, LAW360 (April 20, 2010), https://www.law360.com/articles/163312/lawyers-react-to-proposed-new-merger-guidelines (consolidating comments generally reflecting consensus that the revised guidelines reflect actual agency practices and experience, rather than charting a path towards new development of the law).

14 The HHI is a commonly used measure of market concentration that takes into account the relative size distribution of firms in a market. *Herfindahl-Hirschman Index*, DOJ, https://www.justice.gov/atr/herfindahl-hirschman-index (last updated July 31, 2018).

15 Fed. Trade Comm'n & U.S. Dep't of Justice, Horizontal Merger Guidelines (2010), p. 19.

16 Draft Guidelines, p. 7.

court decision since 2010 finding that a merger resulting in post-merger HHI between 1,800 and 2,500 was illegal. The Agencies do not substantiate this departure from long-standing agency practice: the pre-2010 decisions that the Merger Guidelines *do* cite to as support for the 1,800 HHI threshold all involved markets with HHIs *well over* the current 2,500 threshold.[17] Indeed, in *Fed. Trade Comm'n* v. *Hackensack Meridian Health, Inc.*, for example, while the Third Circuit affirmed the decision to enjoin a proposed merger with a 2,835 post-merger HHI and a 841-point increase, it noted that these were "the lowest [HHI numbers] that the FTC has relied on in any recent hospital-merger case involving [general acute care] services."[18] The Agencies should retain the 2,500 HHI threshold, or, alternatively, transparently acknowledge that the lower HHI thresholds that they propose in the new Guideline 1 are based on policy preference and are not in keeping with enforcement practice, or court decisions, over the last 40 years.

Guideline 1 also seeks to create a presumption of illegality for mergers resulting in a combined market share of greater than 30% and a 100-point increase in HHI, citing a 60-year-old Supreme Court Case, *United States* v. *Philadelphia Nat'l Bank*, 374 U.S. 321 (1963).[19] The Agencies fail to acknowledge that since then, the Supreme Court has adopted a more nuanced, effects-based analysis starting with *United States* v. *General Dynamics Corp.* There, the Court held that "statistics concerning market share and concentration, while of great significance, were not conclusive indicators of anticompetitive effects."[20] Consistent with binding legal precedents, the 2010 Horizontal Merger Guidelines do not provide any such market share presumptions. The Draft Guidelines should similarly not adopt a bright-line presumption based on market share.

Vertical mergers. Guideline 6 states that, for vertical mergers, "[a]t or near 50% share, market structure alone indicates the merger may substantially lessen competition."[21] Proposing that any vertical merger should be deemed presumptively harmful is radically out of step with actual practice: indeed, the Agencies fail to cite a single court decision from the last 40 years in which any vertical merger was found to be illegal.[22] And the proposal to adopt a presumption regarding vertical mergers is contrary to settled law. As the court noted in its recent rejection of the FTC's attempt to block Microsoft's proposed acquisition of Activision, unlike horizontal mergers, courts have never endorsed a presumption of, or a "short-cut way of showing," illegality

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[17] *Chicago Bridge & Iron Co. N.V.* v. *FTC*, 534 F.3d 410, 431 (5th Cir. 2008) (post-merger HHIs of 5,845, 8,380, 10,000, and 10,000 for the four markets at issue); *FTC* v. *H.J. Heinz Co.*, 246 F.3d 708, 716 (D.C. Cir. 2001) (pre-merger HHI of 4,775); *FTC* v. *University Health, Inc.*, 938 F.2d 1206, 1211 n.12 (11th Cir. 1991) (post-merger HHI of 3,200); *FTC* v. *PPG Indus., Inc.*, 798 F.2d 1500, 1503 (D.C. Cir. 1986) (post-merger HHI of 3,295); *United States* v. *Baker Hughes Inc.*, 908 F.2d 981, 983 n.3 (D.C. Cir. 1990) (pre-merger HHI of 2,878 increasing post-merger to 4,303).

[18] 30 F.4th 160, 172 (3d Cir. 2022).

[19] *See* Draft Guidelines, pp. 6-7.

[20] 415 U.S. 486 (1974).

[21] Draft Guidelines, p. 3.

[22] Indeed, Guideline 6, which provides a bright-line threshold long rejected by courts in vertical merger cases, stands in stark contrast with Guideline 5, which respects the ability/incentive framework of analysis that courts have consistently endorsed. *See* Draft Guidelines, pp. 14-17.

for vertical mergers.[23] Instead, courts have always required that the government make "a fact-specific showing that the proposed [vertical] merger is likely to be anticompetitive."[24] The *Microsoft* court's recent rejection of the FTC's theory illustrates the disconnect between the Agencies' attempt to create a presumption of illegality that applies to vertical mergers and the way courts have construed the antitrust laws in the context of actual merger litigation over the last 40 years.[25]

Conglomerate mergers. While Guideline 7 never uses the phrase "conglomerate mergers," which is defined by the Supreme Court as mergers where "there are no economic relationships between the acquiring and the acquired firm,"[26] it alludes to the Agencies' intention to scrutinize such mergers, citing "[concerns over the extension of a dominant position] can arise in mergers that are neither strictly horizontal nor vertical."[27] To be consistent with the case law, Guideline 7 should expressly use the phrase "conglomerate merger," instead of resorting to terminology that appears to have no basis other than a desire to avoid the decades of criticism about antitrust challenges to conglomerate mergers.[28] Moreover, the Draft Guidelines should be revised to acknowledge that it has been more than 50 years since a court found a conglomerate merger to be illegal.[29]

In addition, Guideline 7 introduces a concept—dominance—that does not have a grounding in U.S. law. Although the law in other jurisdictions uses the concept of dominance,[30] U.S. law does not. Importing standards from other jurisdictions is inappropriate and unwarranted.

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23 *See, e.g.*, *Fed. Trade Comm'n* v. *Microsoft Corp.*, 2023 WL 4443412, at *8 (N.D. Cal. July 10, 2023) (holding that proposed merger should not be halted, cautioning that "in vertical merger cases, 'there is no short-cut way to establish anticompetitive effects, as there is with horizontal mergers'") (citations omitted).

24 *See, e.g.*, *United States* v. *AT&T, Inc.*, 916 F.3d 1029, 1032 (D.C. Cir. 2019) (holding that in vertical merger cases, "the government must make a fact-specific showing that the proposed merger is likely to be anticompetitive").

25 *Fed. Trade Comm'n* v. *Microsoft Corp.*, 2023 WL 4443412, at *8.

26 *F.T.C.* v. *Procter & Gamble Co.*, 386 U.S. 568, 577 (1967).

27 *See, e.g.*, Guideline 7, Draft Guidelines, p. 19.

28 *See, e.g.*, Phillip E. Areeda & Donald F. Turner, *Antitrust Law* (1980), ¶ 1103c, at 9 (showing that condemning conglomerate mergers is contrary to sound antitrust policy because cost savings are socially desirable); Robert H. Bork, *The Antitrust Paradox* (1978), at 256-57 (arguing that conglomerate mergers that generate efficiencies will force small competitors to "improve, rather than worsen, their competitive performance," leaving consumers better off).

29 In May 2023, the FTC filed a complaint seeking to enjoin Amgen Inc.'s proposed acquisition of Horizon Therapeutics, the first time in over 40 years that the Agencies challenged a conglomerate merger. Right before trial, the FTC reached a settlement with Amgen upon Amgen's "narrow assurance" that the merger would "have no impact on Amgen's business." *See* Dave Michaels & Joseph Walker, *Amgen's $278 billion Deal for Horizon Therapeutics Clears Key Hurdle*, WSJ (Sept. 1, 2023), https://www.wsj.com/business/ftc-settles-with-amgen-over-27-8-billion-deal-for-horizon-therapeutics-b96a2d69; *Amgen and Horizon Therapeutics plc Resolve FTC Lawsuit, Clearing Path to Close Acquisition*, AMGEN (Sept. 1, 2023), https://www.amgen.com/newsroom/press-releases/2023/09/amgen-and-horizon-therapeutics-plc-resolve-ftc-lawsuit-clearing-path-to-close-acquisition. We are unaware of any cases in over 50 years, since *Kennecott Copper Corp.* v. *F.T.C.*, in which a court found a conglomerate merger to be illegal. *See* 467 F.2d 67, 78 (10th Cir. 1972).

30 *E.g.*, Article 102 of the Treaty on the Functioning of the European Union.

Efficiencies. In 1997, during the Clinton Administration, the DOJ and the FTC revised the Horizontal Merger Guidelines to make clear that they "will not challenge a merger if cognizable efficiencies are of a character and magnitude such that the merger is not likely to be anticompetitive in any relevant market."[31] The DOJ and the FTC included that same language in the 2010 Horizontal Merger Guidelines.[32] The Draft Guidelines drop that statement, and instead provide in Section IV.3 that "possible economies [from a merger] cannot be used as a defense to illegality," citing two court decisions from the 1960s. The Draft Guidelines ignore that many courts have addressed efficiencies since the 1960s, and should be revised to acknowledge that evidence of efficiencies can rebut the government's prima facie case.[33]

II. The Draft Guidelines Should Be Revised to Eliminate Their Open and Baseless Animus Toward the Private Equity Industry, Which Plays a Critical Role in the U.S. Economy.

The Draft Guidelines should also be revised to eliminate statements evidencing the Agencies' open and unsubstantiated animus towards the private equity industry. By helping allocate capital and resources to the benefit of workers, communities, and the economy, the private equity industry benefits all Americans, including entrepreneurs who look to private equity to help bring their innovations to market, small businesses that depend on private equity for their financial health and long-term growth, and unions and pension funds that entrust their members' savings to private equity investment. The AIC has included as an appendix to this letter a selection of relevant literature for the Agencies' review and consideration.

In 2022, the private equity sector in the United States generated approximately 6.5% of the U.S. gross domestic product (GDP): $1.7 trillion in total.[34] The sector also directly employed 12 million workers earning $1 trillion in wages and benefits, and approximately 85% of PE-backed businesses are small businesses with fewer than 500 employees.[35] That tremendous investment in the American economy supports competition and jobs. Workers employed by private equity-backed companies earn higher salaries than the average American, which provides crucial support as historic inflation makes it more difficult for families to afford everyday goods.[36] Private

[31] Fed. Trade Comm'n & U.S. Dep't of Justice, Horizontal Merger Guidelines (1997), p. 28, https://www.justice.gov/sites/default/files/atr/legacy/2007/07/11/11251.pdf.

[32] Fed. Trade Comm'n & U.S. Dep't of Justice, Horizontal Merger Guidelines (2010), p. 30.

[33] *See, e.g.*, *New York* v. *Deutsche Telekom AG*, 439 F. Supp. 3d 179, 207 (S.D.N.Y. 2020) (holding that efficiencies of proposed transaction were sufficiently verifiable to be considered, noting that "[t]he trend among lower courts has thus been to recognize or at least assume that evidence of efficiencies may rebut the presumption that a merger's effects will be anticompetitive, even if such evidence could not be used as a defense to an actually anticompetitive merger"); *F.T.C.* v. *H.J. Heinz Co.*, 246 F.3d 708, 720 (D.C. Cir. 2001) ("[T]he trend among lower courts is to recognize the defense."); *ProMedica Health Sys., Inc.* v. *F.T.C.*, 749 F.3d 559, 571 (6th Cir. 2014) ("[T]he parties to a merger often seek to overcome a presumption of illegality by arguing that the merger would create efficiencies that enhance consumer welfare.") (citing *FTC* v. *Univ. Health, Inc.*, 938 F.2d 1206, 1222 (11th Cir. 1991)).

[34] *See* Ernst & Young, *Economic contribution of the US private equity sector in 2022* (April 2023), p. 5, https://www.investmentcouncil.org/wp-content/uploads/2023/04/EY-AIC-PE-economic-contribution-report-FINAL-04-20-2023.pdf ("EY Report").

[35] *Id.* at 5, 9.

[36] *Id.*

equity's tremendous investment in the American economy directly supports jobs, competition, and better standards of living for all American workers. From 2018 to 2022, the U.S. private equity sector invested approximately $4.5 trillion in the U.S. economy.[37]

Those investments also bear fruit for investors. Over 89% of U.S. public pensions serving 34 million American workers have exposure to U.S. private equity and have enjoyed returns that have outperformed other asset classes.[38] Year after year, private equity delivers the strongest returns of any asset class for investors across the U.S.—helping support public pension funds and strengthen retirements for American workers across all industries. Starting in 2000 to June 2022, private equity allocations by state pensions produced an 11.4% net-of-fee annualized return, exceeding by 5.6% the 5.8% annualized return that otherwise would have been earned by investing in public stocks.[39] From 2011 to 2021, the median annualized return for pension plan private equity investments was 15.1%.[40] Moreover, such higher returns were accompanied by lower volatility: the annualized standard deviation of returns for private equity investments equaled 15.7% for the 22-year period, compared to 17.5% for public stocks.[41]

In addition, private equity contributes to the long-term growth of the U.S. economy. The U.S. private equity sector, its suppliers, and related consumer spending employed or supported 31 million workers in 2022 and generated $4 trillion of gross domestic product during the same time period (approximately 15% of U.S. GDP).[42] The vast majority of companies supported by U.S. private equity were small businesses, the backbone of the U.S. economy.[43] Moreover, private equity investment helps enable businesses to achieve efficient scale to generate efficiencies that help all Americans. Studies show that private ownership has become a favored source of company financing because equity firms provide innovative options for financing the growth of small and emerging businesses and helping those businesses raise capital more efficiently.[44] Investment capital provided by private equity firms also helps companies raise productivity,[45] enabling companies to grow, hire, build, innovate, become more competitive, and better serve customer needs. For example, post-buyout labor productivity is large relative to contemporaneous outcomes at non-PE-backed firms.[46] Private equity investment also contributes to enhancement of worker

37 *See* Pitchbook, *Q2 2023 US PE Breakdown* (July 11, 2023), p. 8, https://files.pitchbook.com/website/files/pdf/Q2_2023_US_PE_Breakdown.pdf.

38 American Investment Council, 2022 Public Pension Study (July 2022) at 2, https://www.investmentcouncil.org/wp-content/uploads/2022/07/22AIC002_2022-Report_SA-2226.pdf ("2022 Study"); *see also* EY Report at ii.

39 *See* CLIFFWATER, *Long-Term Private Equity Performance: 2000 to 2022* (Feb. 28, 2023), p. 2.

40 *See* 2022 Study.

41 *See id.*

42 *See* EY Report at ii.

43 *Id.* at 9. For a detailed analysis of U.S. private equity support of the U.S. economy, please refer to the EY Report supra n. 34.

44 *See* Jakob Wilhelmus & William Lee, *Companies Rush to Go Private* (Aug. 2018), p. 5, https://milkeninstitute.org/sites/default/files/reports-pdf/WP-083018-Companies-Rush-to-Go-Private-FINAL2.pdf.

45 *See* EY Report, p. 3.

46 *See* Gregory W. Brown & Steven N. Kaplan, *Have Private Equity Returns Really Declined?* (Apr. 2019), p. 10, https://www.kenaninstitute.unc.edu/wp-content/uploads/2019/05/HavePrivateEquityReturnsDeclined_

safety.[47] Everyday Americans who participate in pension funds that invest in private equity, including teachers, union members, and others across the country who hold debt or equity investments as part of their retirement savings, continue to benefit from these PE-derived efficiencies.

Footnote 25 to the Draft Guidelines baselessly suggests that "a leveraged buyout" can, in itself, raise competitive "concerns."[48] But incurring debt to help finance an acquisition is not illegal under the antitrust laws, and the Agencies do not cite a single court decision in support of the claim that the amount or type of third party debt raised to finance an acquisition in itself can raise antitrust "concerns," and this footnote should be removed. To the contrary, private equity's ability to efficiently use debt and equity financing to acquire and help grow and develop businesses generates economic growth and efficiencies that help all Americans. Private equity investors make prudent decisions about appropriate leverage levels, and raise funding from third-party lenders and investors who make their own independent decisions about whether debt levels are appropriate for the business. In fact, studies show that private equity acquirers create value by relaxing financing constraints for firms with strong investment opportunities and improving the importance of weak firms, while financial engineering plays a limited role.[49] The average proportion of debt financing for leveraged buyouts have also been decreasing since 2005.[50] Studies also show that the risk of losing any capital with a diversified private equity portfolio is very low.[51] If issues arise (and business is not a riskless enterprise), studies published by the Federal Reserve show that PE-ownership reduced the expected cost of financial distress, leading to substantially higher levels of optimal (value-maximizing) leverage.[52] Private equity also more effectively manages high leverage and its potential costs when compared to other investments.[53] The investments made by AIC's members in companies support competition and provide long-term stability in turbulent

05022019.pdf; Josh Lerner et al., *The (Heterogeneous) Economic Effects of Private Equity Buyouts* (July 8, 2021), p. 1, https://www.nber.org/system/files/working_papers/w26371/w26371.pdf.

47 *See* Jonathan Cohn, Nicole Nestoriak & Malcolm Wardlaw, *Private Equity Buyouts and Workplace Safety*, 34 REV. FINANCIAL STUDIES 10, 4832-75 (October 2021), https://academic.oup.com/rfs/article-abstract/34/10/4832/6081024?redirectedFrom=fulltext.

48 Draft Guidelines, p. 6 n.25.

49 *See* Jonathan Cohn, Edith Hotchkiss & Erin Towery, *Sources of Value Creation in Private Equity Buyouts of Private Firms*, 26 REV. FINANCE 2, 257-85 (Mar. 2022), https://academic.oup.com/rof/article/26/2/257/6516584.

50 *See* American Investment Council, *2023-Q2 Private Equity Trends*, p. 5.

51 *See* Christian Diller, Christoph Jäckel & Montana Capital Partners, *Risk in Private Equity*, BRITISH PRIVATE EQUITY & VENTURE CAPITAL ASSOCIATION (Oct. 2015), p. 23, https://www.bvca.co.uk/Portals/0/library/documents/Guide%20to%20Risk/Risk%20in%20Private%20Equity%20-%20Oct%202015.pdf.

52 *See* Sharjil M. Haque, *Does Private Equity Over-Lever Portfolio Companies?* (Feb. 2023), Finance and Economics Discussion Series 2023-009, pp. 2-3, https://www.federalreserve.gov/econres/feds/files/2023009pap.pdf.

53 *See* Greg Brown, Robert Harris & Shawn Munday, *Capital Structure and Leverage in Private Equity Buyouts*, 33.3 J. APPLIED CORPORATE FINANCE 42, 43.

economic times. For example, research indicates that private equity contributed to restoring stability to the financial system following the 2008 financial crisis.[54]

In light of the substantial benefits to all Americans created by private equity investment, the Agencies should also delete the baseless assertion in the Draft Guidelines that a series of transactions can somehow collectively be illegal "even if no single acquisition on its own would risk substantially lessening competition or tending to create a monopoly."[55] The Agencies should also delete the suggestion that the Agencies may examine an acquiring party's "future strategic incentives."[56] The Agencies do not cite a single court decision in support of the claim that an otherwise permissible merger should be deemed illegal under the antitrust laws because of other (including hypothetical future) mergers.[57]

Despite the Agencies' animus in the Draft Guidelines, courts are not biased against private equity investment. Notably, in *United States* v. *UnitedHealth Grp.*, the court found that in assessing the competitive effects of the proposed acquisition, the Agencies must account for the acquirer's proposed sale of a business of the target company to a private equity buyer through a divestiture agreement. In holding so, the court specifically rejected the DOJ's "misplaced" argument that the divestiture buyer's "lack of experience in claims editing, as well as its status as a private-equity firm, doom" the effectiveness of the divestiture.[58] Rather, the court found that the private equity investor's "incentives are geared toward preserving, and even improving, [the business's] competitive edge," and that it was "well-positioned to maintain, and perhaps even

[54] *See* Emily Johnston-Ross et al., *Private Equity and Financial Stability: Evidence from Failed Bank Resolution in the Crisis* (May 2021), https://www.nber.org/system/files/working_papers/w28751/w28751.pdf; Shai Bernstein, Josh Lerner & Filippo Mezzanotti, *Private Equity and Financial Fragility During the Crisis* (July 2017), https://www.nber.org/papers/w23626.

[55] Draft Guidelines, p. 22. Notably, studies rebut any assertion suggesting a link between private equity firms' serial acquisitions and depressed wages. *See, e.g.*, EY Report, p. 5 ("This amounts to an average worker in the US private equity sector earning approximately $80,000 in wages and benefits. The comparable average wages and benefits for the US economy is approximately $73,000.").

[56] Draft Guidelines, p. 22.

[57] The Draft Guidelines' attack on serial acquisitions is reminiscent of the "monopoly broth theory" as set out in *City of Mishawaka* v. *Am. Elec. Power Co.*, that "[i]t is the mix of various ingredients. . . in a monopoly broth that produces the unsavory flavor," 616 F.2d 976, 986 (7th Cir. 1980), a theory that has been rejected by many other courts and discredited by scholars. *See, e.g.i Ne. Tel. Co.* v. *Am. Tel. & Tel. Co.*, 651 F.2d 76, 95 n.28 (2d Cir. 1981) (finding that "treating [the plaintiff's] claims collectively cannot have any synergistic effect" when the plaintiffs "argue[d] strenuously that it should be given the full benefit of (its) proof without tightly compartmentalizing the various factual components and wiping the slate clean after scrutiny of each") (citations omitted); Daniel A. Crane, *Does Monopoly Broth Make Bad Soup?*, 76 ANTITRUST L.J. 3, 663-76 (2010), https://repository.law.umich.edu/cgi/viewcontent.cgi?article=1130&context=articles.

Similarly, the Agencies' suggestion in Guideline 8 that "a trend towards concentration" alone would provide sufficient basis for antitrust challenges finds no support in case law. As discussed *supra* in Section I., courts have adopted a more nuanced approach and do not view concentration statistics as an independent reason to block a merger. For instance, when the FTC recently challenged Microsoft's acquisition of Activision asserting a "trend toward concentration in the industry," the district court declined, reasoning that the agency "fails to explain how this trend is anticompetitive here." *Fed. Trade Comm'n* v. *Microsoft Corp.*, 2023 WL 4443412, at *8 (N.D. Cal. July 10, 2023).

[58] 630 F. Supp. 3d 118, 136 (D.D.C. 2022), *dismissed*, 2023 WL 2717667 (D.C. Cir. Mar. 27, 2023).

improve," the business's performance.[59] The court also cited the DOJ's Merger Remedies Manual, which recognized that "in some cases a private equity purchaser may be preferred" to a strategic buyer because a private equity firm has more "flexibility in investment strategy, [i]s committed to the divestiture, and [i]s willing to invest more when necessary."[60]

III. The Draft Guidelines Should Be Revised to Include All Relevant Case Law.

If the Draft Guidelines were intended to reflect "binding legal precedent,"[61] as the Agencies claim, they should be revised to include all case law, including the many court decisions that rejected this Administration's recent enforcement efforts as unjustified under the law. In addition to *United States* v. *UnitedHealth Grp. Inc.*, the Agencies have failed multiple times on their challenges. For instance, the FTC failed to convince the court to enjoin Meta's vertical acquisition of Within Unlimited.[62] The Agencies fared no better even when they proposed a very narrow market definition in the challenge to Booz Allen's acquisition of EverWatch.[63] So far, the Agencies have won only approximately 30% of their litigated merger challenges during the Biden administration, compared to approximately 65% between 2001 and 2020.[64]

In light of this context, the Draft Guidelines should not be based on the Agencies' selective representation of case law. Rather, the Agencies must revise the Draft Guidelines to reflect these binding legal precedents that are unfavorable to their position.

* * *

The AIC appreciates the opportunity to comment on the Draft Guidelines and is available to answer any questions.

Respectfully submitted,

/s/ Rebekah Goshorn Jurata
General Counsel
American Investment Council

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59 *Id.*

60 *Id.* at 137.

61 Draft Guidelines, p. 5.

62 *See Fed. Trade Comm'n* v. *Meta Platforms Inc.*, 2023 WL 2346238, at *32-33 (N.D. Cal. Feb. 3, 2023) (denying the FTC's motion for preliminary injunction to enjoin the acquisition, finding that the FTC did not produce sufficient evidence to show that the acquirer's presence "had a direct effect on the firms in the relevant market"). In addition, the administrative law judge rejected the FTC's vertical challenge of Illumina's vertical acquisition of Grail (which the FTC later reversed and is now on appeal). *See Illumina, Inc., and Grail, Inc.*, Docket No. 9401 (OALJ Sept. 9, 2022), https://www.ftc.gov/system/files/ftc_gov/pdf/D09401InitialDecisionPublic.pdf.

63 *See United States* v. *Booz Allen Hamilton Inc.*, 2022 WL 9976035, at *14 (D. Md. Oct. 17, 2022) (finding that the government failed to show likely or significant competitive harm even when they sought to "put [the relevant product] under a microscope").

64 *See* Jon B. Dubrow, *Assessing the state of affairs in FTC/DOJ merger enforcement*, REUTERS (July 10, 2023), https://www.reuters.com/legal/transactional/assessing-state-affairs-ftcdoj-merger-enforcement-2023-07-10/.

APPENDIX

AIC Prepared Literature Review for The U.S. Department of Justice and the Federal Trade Commission Proposed Merger Guidelines

1 **Building Competition – How Buy-and Build Helps the American Economy**
American Investment Council

2 **Diamonds in the Rough – How Private Equity Breaths New Life into Unloved Businesses**
American Investment Council

3 **Economic Contribution of the US Private Equity Sector in 2022**
Prepared for the American Investment Council by Ernst & Young

4 **Financial Stability Report**
Board of Governors of the Federal Reserve System

5 **PitchBook's Q2 2023 US PE Breakdown**
PitchBook Reports

6 **Does Private Equity Over-Lever Portfolio Companies?**
Finance and Economics Discussion Series - Federal Reserve Board
Sharjil Haque, Economist on the Board of Governors of the Federal Reserve

7 **Long-Term Private Equity Performance: 2000 to 2022**
Cliffwater
Stephen L. Nesbitt, CEO of Cliffwater

8 **Have Private Equity Returns Really Declined?**
Kenan Institute Report
Gregory W. Brown, UNC Kenan-Flagler Business School. Steven N. Kaplan, University of Chicago Booth School of Business

9 **Capital Structure and Leverage in Private Equity Buyouts**
Journal of Applied Corporate Finance
Greg Brown, University of North Carolina at Chapel Hill. Robert Harris, University of Virginia. Shawn Munday, University of North Carolina at Chapel Hill

10 **The (Heterogenous) Economic Effects of Private Equity Buyouts**
Steven J. Davis, University of Chicago, National Bureau of Economic Research, Hoover Institution. John Haltiwanger, University of Maryland – Department of Economics, National Bureau of Economic Research, Institute for the Study of Labor. Kyle Handley, University of California, San Diego – School of Global Policy & Strategy; National Bureau of Economic Research. Ben Lipsius, Department of Economics; University of Michigan, College of Literature, Science and the Arts, Department of Economics, Students. Josh Lerner, Harvard Business School – Finance Unit; Harvard University –

Entrepreneurial Management Unit; National Bureau of Economic Research. Javier Miranda, US Census Bureau – Economy-Wide Statistics Division.

11 Private Equity and Financial Stability: Evidence from Failed Bank Resolution in the Crisis

Emily Johnston-Ross, FDIC. Song Ma, Yale University, Manju Puri, Duke University, FDIC, and NBER.

12 Private Equity and Financial Fragility During the Crisis

National Bureau of Economic Research

Shai Bernstein, Research Associate at NBER. Josh Lerner, Research Associate, Director of the Productivity, Innovation, and Entrepreneurship Program at NBER. Filippo Mezzanotti, Kellogg School of Management at Northwestern University.

13 Companies Rush to Go Private

Milken Institute

Jakob Wilhelmus, Associate Director in the International Finance and Macroeconomics team at the Milken Institute. William Lee, Ph.D. Chief Economist at the Milken Institute.

14 Private Equity in the Global Economy: Evidence on Industry Spillovers

UNC Kenan-Flagler Research

Gregory W. Brown, Sarah Graham Kenan Distinguished Scholar of Finance, Kenan-Flagler Business School, The University of North Carolina, Chapel Hill. Serdar Aldatmaz, Assistant Professor of Finance, School of Business, George Mason University.

Building Competition

How buy-and-build helps the American economy

FEBRUARY 2023

AMERICAN INVESTMENT COUNCIL

Data provided by PitchBook

Executive summary

Add-ons are a common transaction spearheaded by private equity (PE) sponsors. Investors can grow their portfolio companies both organically and "inorganically"—meaning add-ons—and typically use both strategies at the same time. Over the last decade or so, add-ons have become much more common in PE.

During those years, PE sponsors have employed something called the "buy-and-build" model, which investors use to acquire several smaller companies to create a new, more competitive business. "Buy-and-build" is a useful tool to help cost-intensive industries become more efficient and lower their costs, savings that are ultimately passed on to their customers.

Most add-ons are done in highly competitive, highly fragmented industries, where incumbents lack the market share to affect prices or create a monopoly. In fact, PitchBook data shows that more than 60% of today's add-ons are done by only a handful of fragmented industries in which PE is active. Buy-and-build is most common in industries such as insurance, where more than 400,000 brokers and agencies compete for customers in the United States.[1] It's also common in outpatient clinics, landscaping, construction, IT consulting, pest control and waste management services, among others. Not every "fragmented" industry is appropriate for buy-and-build, which is why PE sponsors look for predictability and reliable cash flows before investing. Sponsors look for companies and situations that can benefit from an institutional mindset, rather than simply buying a company and looking for cost reductions.

The buy-and-build model is often guided by operating partners, who are typically ex-CEOs or ex-COOs of big companies. Ex-CEOs tend to have extensive experience with acquisitions and integrating new products and services into a larger organization. They can also help PE sponsors look for operational shortcomings of unsponsored companies, given their backgrounds as former executives. While operating partners bring plenty of operational expertise, they also have significant industry expertise that can inform a PE sponsor's strategy and change the trajectory of a portfolio company. That's why LPs are looking to operating partners, rather than financial engineering, to drive value at private equity firms. In the same vein, it's also why PE sponsors use the buy-and-build approach: In the end, the sum is greater than all the parts put together, benefitting stakeholders, companies, employees and the communities that they serve.

1: "Insurance Brokers & Agencies in the US—Number of Businesses 2003-2028," IBISWorld, Updated June 23, 2022.

Why buy-and-build helps the American economy

What's an "add-on"?

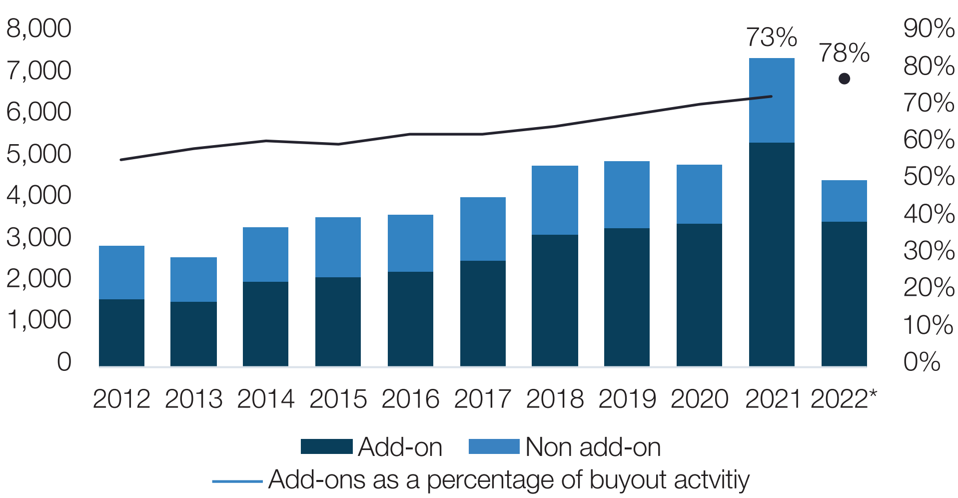
Add-ons refer to acquisitions made on behalf of PE-backed portfolio companies, and they're planned many months in advance by their financial sponsors. Sometimes they are done to bolster a portfolio company's product offerings. For example, a PE firm may invest in a dog food producer and identify a promising cat food producer to acquire; the combined company would be able to offer more products to their customers while reducing operating costs across the board. In the same vein, add-ons can be made on behalf of software companies so they can keep up with shifting customer demand more easily. In other instances, a brick-and-mortar company could "add on" a technology-based company operating in the same market.

The focus of this report is to highlight add-ons in fragmented markets, which are also common. In these cases, PE sponsors are looking to grow portfolio companies that operate in highly competitive markets, such as insurance or outpatient health care clinics, with reliable and sustainable cash flows and high operating costs. Fragmented markets have no dominant players and have virtually no risk of monopolization. In most cases, PE sponsors are looking to consolidate local companies into regional ones, creating more cost-efficient companies that can better serve their customers.

Today, about 78% of majority PE transactions are add-ons. That's up from 56% a decade ago. The Federal Trade Commission has expressed concern about this percentage, but the ratio requires context about the nature of the companies that are being acquired.

Using the same PitchBook methodology, 62% of add-ons are happening in 10% of the industry codes tracked by PitchBook. That indicates the 78% ratio is heavily influenced by a handful of markets. The nature of those markets is highly fragmented, which means there are tens of thousands, and in some cases hundreds of thousands, of similar companies operating in those industries. In every case, there is no

Add-ons as a percentage of PE buyouts



Source: PitchBook | Geography: US
*As of October 25, 2022

Why buy-and-build helps the American economy

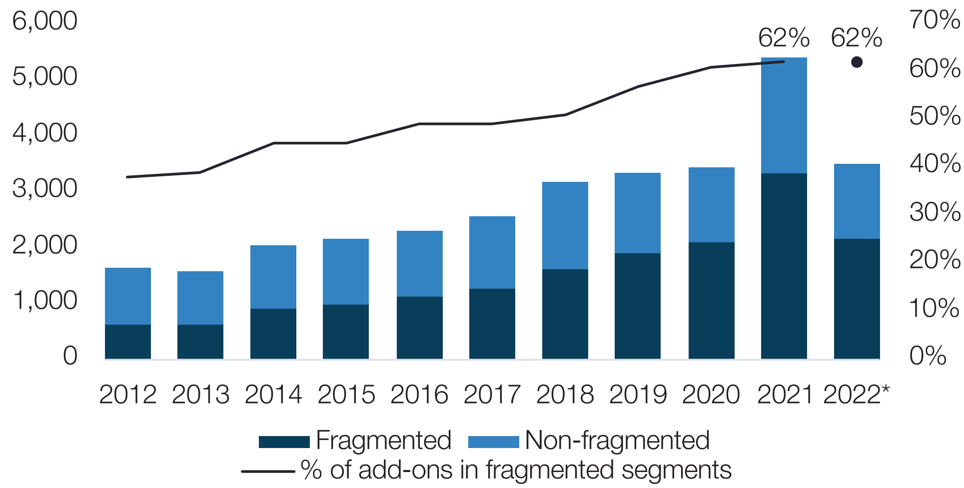
market participant that occupies a dominant position. To the contrary, 17 of these industries have at least 10,000[2] market participants, including eight with at least 100,000 market participants.[3]

In 2021, there were 5,392 PE-backed add-ons occurring in the US, which was a record. Of those, 3,321 were in fragmented markets favored by PE firms, and there were more than 7 million companies active in those industries around the country, according to IBISWorld.[4]

The buy-and-build model has to be geared toward fragmented industries to be used in the first place. PE sponsors take the buy-and-build approach seriously and only select companies that help the platform company grow its value. The results, if done well, are platform companies that are:

- More competitive and better organized for their employees
- Provide better goods and services at a lower price for their customers
- Create more channels of growth for the companies themselves
- Generate higher returns for long-term investors such as public pension plans.

Add-ons by industry fragmentation



Source: PitchBook | Geography: US
*As of October 25, 2022

Percentage of PE-backed platforms that added on in another state

88%

Among PE-sponsored companies that acquire other companies, almost 90% of them have acquired businesses in another state. While inter-state acquisitions are fairly common in M&A, they are usually deliberate for PE sponsors. Buy-and-build allows investors to transform portfolio companies into regional, more competitive businesses while producing economies of scale, which helps drive down costs. These acquisitions also mean new products and services are reaching new customers. For example, if a mental health provider is acquired in Ohio, that provider will receive the additional capabilities of the platform company, which could be a significantly bigger provider based in California. In this case, that means more patients have more access to more services than they did before the investment happened. For a detailed example, please see page 7.

2: Including insurance, landscaping, management consulting, IT consulting, manufacturing, construction & engineering, HVAC services, property management and wholesale distributors, advertising & marketing agencies, pest control, car washes, dry cleaners, elevator installation & services, business products and services software, and public relations firms
3: Including insurance, landscaping, management consulting, IT consulting, manufacturing, construction & engineering, HVAC services, property management, and wholesale distributors
4: 7 million figure compiled from the individual reports referenced in the graphic below. Individual reports can be searched at "Expert Industry Research You Can Trust," IBISWorld, Accessed October 28, 2022.

Common buy-and-build markets

Figures denote how many companies were in business in each market as of 2022

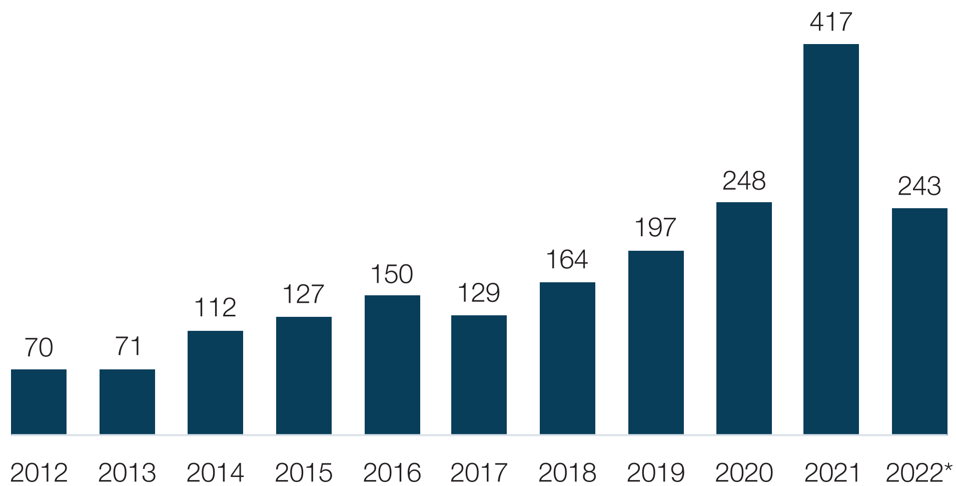
Construction	Management consulting	Manufacturing	Distributors/wholesale	Landscaping
2,128,809	1,121,512	718,796	701,229	632,895
IT consulting	Insurance brokerages	Property management	Engineering	HVAC
501,985	415,446	307,621	141,898	122,638
Advertising & marketing	Car washes	Public relations	Outpatient health care clinics	Pest control
87,712	67,163	54,581	34,752	29,535
Dry cleaners	Elevator services	Software publishing	Urgent care centers	Waste management
27,745	20,469	16,431	9,616	8,352

All datapoints provided by IBISWorld, accessed October 28, 2022. Individual reports can be searched at https://www.ibisworld.com

Creating new insurance markets

The insurance industry is among the most fragmented industries in the US. The largest brokerage in the US, State Farm, commands just 16% of market share, according to the National Association of Insurance Commissioners.[5] Over 400,00 other brokerages compete for the other 84%.[6] Insurance companies span the spectrum in size, from large, multi-billion-dollar platforms to much smaller regional brokerages that do business on a more personal basis. Regional consolidation helps build economies of scale and reduce operating costs—savings that can be passed on to retail and commercial customers.

PE-sponsored add-ons in insurance brokerages



Source: PitchBook | Geography: US
*As of October 25, 2022

Confie Seguros

Confie Seguros is one of the most underreported success stories in PE's history. It began with an unexpected insight from an insurance executive, Mordy Rothberg. While researching insurance trends in the US Hispanic community, Rothberg realized that the fastest-growing demographic in the country was wildly underserved as insurance customers. In 2008, he set about to change that by creating the country's first Hispanic-focused insurance company.[7]

Thanks to its financial resources and industrial know-how, Rothberg decided to partner with PE to achieve that goal. After acquiring a "platform company" in California alongside a PE sponsor, he renamed it to Confie Seguros, which means "trust insurance" in Spanish. With Confie Seguros in place, the platform began acquiring hundreds of insurance brokerages where Hispanic customers were underserved. Staff were retrained or hired to provide bi-lingual, personalized services to Hispanic customers, who preferred face-to-face meetings and translated insurance policies before purchasing insurance products.[8] More than a decade later, Confie Seguros grew into the first leading Hispanic insurance brokerage in American history while ranking first in every category in which it competed between 2016 and 2021, according to Insurance Journal.[9]

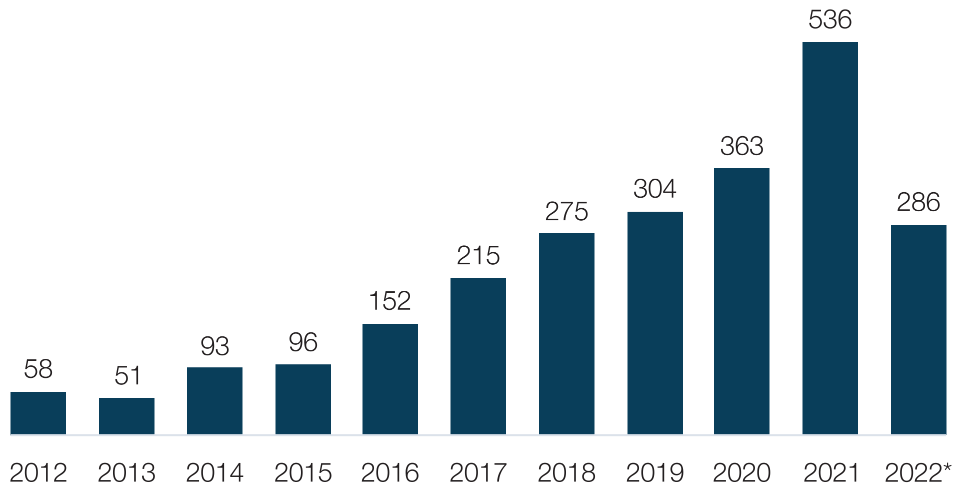
5: "Property and Casualty Insurance Industry 2021 Top 25 Groups and Companies by Countrywide Premium," National Association of Insurance Commissioners, 2022.
6: "Insurance Brokers & Agencies in the US—Number of Businesses 2003-2028," IBISWorld, Updated June 23, 2022.
7: "Storefront Marketer Grows by Acquisition: Confie Seguros Reaches $200 Million in Revenues Catering to the Hispanic Market," Rough Notes, Susan R.A. Honeyman, April 2012.
8: Ibid
9: "Closer Look: Personal Lines Leaders," Insurance Journal, September 6, 2021.

Streamlining health care costs

The buy-and-build model is used extensively in outpatient health care services. Specialties such as dermatology, cardiology, and oncology are often small, local providers that employ five or fewer doctors. In many cases, specialized clinics only have one doctor after whom the practice is named. Especially in the smallest cases, doctors in single-practice providers must perform their medical duties while also weighing in on administrative matters. Sometimes they even help hire new staff. But the country's physicians weren't trained in business management—they were trained to be doctors. In the real world, that means their most valuable skills are underused, their hours are longer, and they're performing business-related functions at which they might not be very good. It's also exhausting.

That's why PE investors are helping these industries—and ultimately helping patients while reducing their bills. When physicians can focus on their patients, and the organizations that employ them can become more efficient, health care providers can streamline costs and pass those savings into patients' pocketbooks.

PE-sponsored add-ons in outpatient healthcare clinics



Source: PitchBook | Geography: US
*As of October 25, 2022

Greater scale at the provider level leads to improved relationships with payors, further reducing costs at the patient level. It also creates a more welcoming environment for new physicians, who can join efficient regional providers without having to build a practice from scratch.

Representative markets

Veterinary services, dermatology, dentistry & orthodontics, radiology, oncology, cardiology, orthopedics, mental and behavioral health

PE at work: BayMark Health Services

BayMark HEALTH SERVICES

BayMark Health Services is based in Lewisville, TX, and specializes in treating opioid addiction. It was acquired by Webster Capital Management in 2015 and set about expanding into more pockets of the country. Webster's buy-and-build strategy wasn't limited to geographic expansion, as important as that was. The plan also included expanding into new service lines to better serve BayMark patients. In 2017, BayMark acquired a Louisiana-based provider called AppleGate, which offers office-based buprenorphine treatments. "With the state of opioid abuse in the country, BayMark is focusing on providing care through multiple approaches in as many areas as possible to address the epidemic," the firm said.[10]

10: "Webster Capital-Backed BayMark Health Services Makes Two Acquisitions," Citybizlist, February 6, 2017.

Bringing urgent care to rural communities

According to the Urgent Care Association, only 1% of urgent care centers operate in rural communities. Metropolitan areas, by contrast, account for 86.2% of all urgent care operations.[11] While urgent care facilities aren't the only health care providers around, they have become ubiquitous in wealthier communities across the country and help lighten the load for local hospitals and emergency rooms.

How PE is helping

Even with those barriers in place, PE is actively addressing the problem. Urgent care centers are natural candidates for growth capital and the buy-and-build model, since the model is scalable, replicable, and in high demand. PE firms start by investing in urgent care providers that have identified business models that work in their communities. Once partnered with PE, they can use their new capital to open new locations in underserved areas. Using a "buy-and-build" approach, PE-sponsored providers can increase the number of care facilities under their umbrella, reducing overhead costs and, ultimately, patients' bills. For many patients without urgent care options, relatively "local" hospitals are their only option, and emergency room bills can be stratospheric. A 2017 study from West Virginia University, which analyzed the impact of one urgent care chain—MedExpress—on the Appalachian area, found that "MedExpress's entry would seem to be freeing up valuable resources for more serious medical situations" and that urgent care centers "lead to a substitution to a lower cost option" for patients.[12]

Usually under the radar, PE firms have been leading the charge on rural health care expansion. According to The Journal of Urgent Care Medicine, there is "probably the potential for another 1,500 urgent care centers in rural/secondary markets" across the country,[13] and that pent-up demand would be welcomed with gratitude and loyalty by local towns. To meet that demand, PE firms are partnering with entrepreneurial physicians who have built sustainable business models and want to see their companies expand into underserved markets. As they often do, PE firms also bring experienced managerial help to urgent care portfolio companies. Sverica Capital, for example, acquired Med First in Jacksonville, NC, in 2016. As part of the partnership, two former CEOs of major hospitals joined the company's board. Sverica aimed to expand the company's model into other rural markets in the southeast and has almost doubled the number of Med First clinics over the span of five years.

PE at work: Fast Pace Urgent Care

Fast Pace Urgent Care has been under PE sponsorship for almost ten years, first with Shore Capital and now with Revelstroke Capital Partners. Under Shore Capital, Fast Pace executed an accelerated growth plan, resulting in 29 new locations across rural Tennessee and Kentucky. It also increased foot traffic from 40,000 patients in 2012 to about 400,000 in 2016. That success allowed Fast Pace to increase employee headcount from 50 to 700 in the same time span.

11: "Benchmarking Report," Urgent Care Association, 2022.
12: "The Effect of Health Care Entrepreneurship on Local Health: The Case of MedExpress in Appalachia," JRAP, Joshua Hall and Amir B. Ferreira Neto, July 24, 2018.
13: "Rural and Tertiary Markets: The Next Urgent Care Frontier," JUCM, Alan A. Ayers, December 2, 2019.

PRIVATE EQUITY
INVESTING IN AMERICA

From urban to rural and everywhere in between, private equity is making a positive impact across America and investing in every community to:

- Back small businesses
- Support good-paying jobs
- Boost the American economy
- Strengthen public pensions

The American Investment Council (AIC) is an advocacy and resource organization established to develop and provide information about the private investment industry and its contributions to the long-term growth of the U.S. economy and retirement security of American workers. Member firms of the AIC consist of the country's leading private equity and growth capital firms united by their successful partnerships with limited partners and American businesses.

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AMERICAN INVESTMENT COUNCIL

Diamonds in the Rough

How PE breathes new life into unloved businesses

SEPTEMBER 2022

AMERICAN INVESTMENT COUNCIL

Data provided by PitchBook

Executive summary

Private equity's calling card is fixing companies. Sometimes they are household-name companies, and sometimes they are small, family-led companies known only to locals. Sometimes they aren't even companies at all, but PE sponsors see them becoming valuable contributors to the economy if given the chance.

This report covers "carveouts," a creative strategy employed by today's most innovative investors. These carveouts are for "noncore assets," which is a polite way of saying underloved, under-resourced, or misaligned business units nestled in much larger companies. Every year, PE firms identify hundreds of those businesses, buy them from their parent corporations, and make them independent companies—often with new names, logos, and management teams. PE can also help with antitrust situations: When regulators require divestitures in order for mergers to get approval, PE can step in and buy those assets and save a potentially transformational deal. Because they are fiduciaries for their own investors, PE firms need to make deliberate plans for how they will add value to those divested assets and make them attractive for future buyers.

This report, produced in conjunction with PitchBook, shows that thousands of new companies have been created over the past decade across every pocket of the US economy.

To take just one example, in 2018, PE firm Francisco Partners reached out to Discovery Communications, which runs the Discovery Channel, Animal Planet, and dozens of other media outlets. Francisco had an idea to build a new science education company and wanted to buy Discovery's Education platform as a starting point. A couple years later, Francisco acquired a promising startup called Mystery Science, which makes digital science and STEM curricula for grade schools, and merged it with its Discovery team. By the time it sold Discovery Education in early 2022, Francisco had created an innovative approach to education that gets grade schoolers more excited about science.

There are hundreds of other examples to mention. Once they stand on their own, these companies are motivated to prove themselves and do something new and beneficial for the economy.

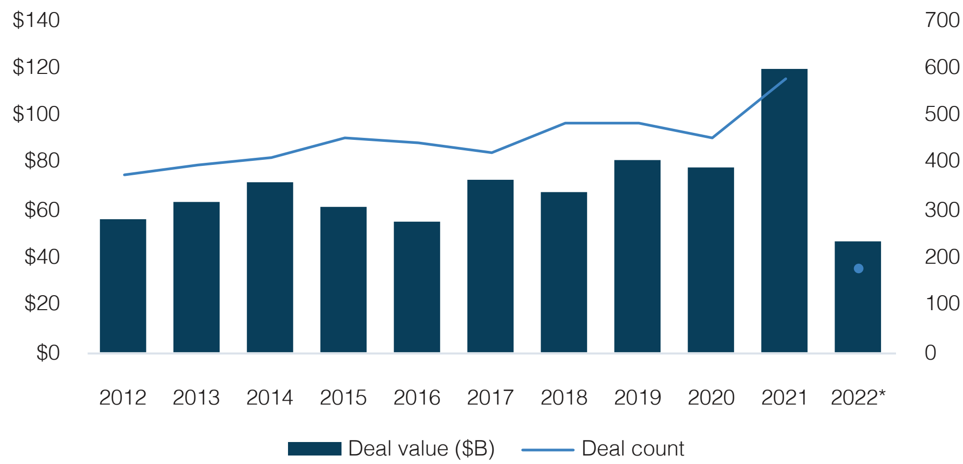
Rejuvenating businesses

PE carveouts are a popular and creative type of transaction that often go under the radar. But they happen all the time. According to PitchBook, there were more than 500 last year alone. Over the past decade, PE firms have carved out over 4,000 new, standalone companies, investing over $700 billion in the process.

Like normal buyouts, carveouts require vision and a clear roadmap to be successful. But instead of turning entire companies around, carveouts are about identifying teams and businesses that are lagging in their current situations and giving them a chance to prove themselves. Instead of being on the backburner of bigger corporations, these business units are given the resources they need to operate as their own companies.

Many of today's most successful companies started out as underloved divisions of other companies. Perhaps they didn't have adequate budgets to grow enough, or perhaps their old bosses were looking for ways to get rid of them. With PE sponsors in their corner, they no longer needed to worry about those things. With new names and logos and a new lease on life, those businesses could reach their full potential. There are countless success stories across dozens of sectors, including manufacturing, energy, healthcare services, pharmaceutical drug production, and retail, to name several. We highlight a few examples later in this report.

PE carveout deal activity

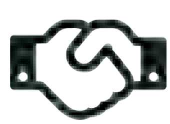


Source: PitchBook | Geography: US
*As of June 15, 2022

Step 1: "Noncore" business unit operates below the radar of a much larger company.

Step 2: Private equity recognizes potential of the business and pays the parent company to "carve it out."

Step 3: PE sponsor gives the company a new name, logo, and management team, then builds it into an independent success.



Step 4: PE sponsor exits the portfolio company by taking it public or selling it to a buyer that values it.

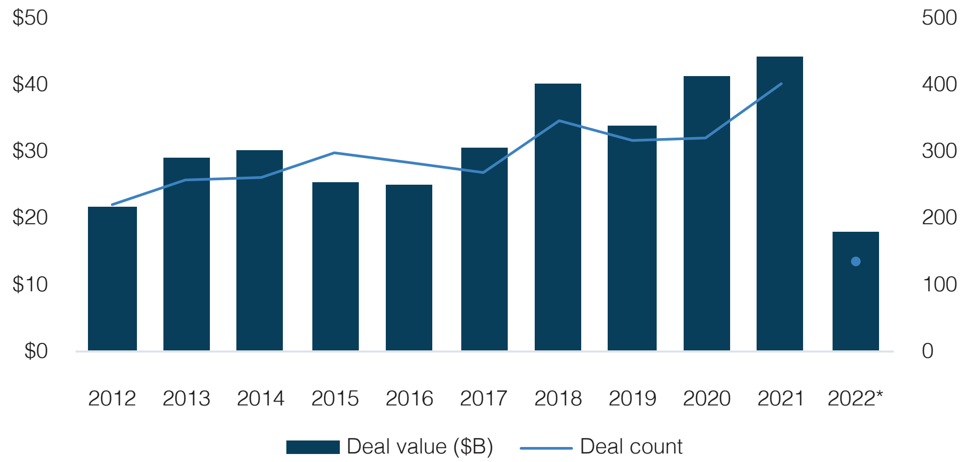
Rejuvenating businesses

Not every carveout turns into a new, independent company. Just as often, private equity sponsors will identify under-resourced businesses that can transform their existing portfolio companies. While those businesses don't always get the full, standalone treatment, they're appreciated just as much by their new owners.

Take GE Lighting, a former business unit of General Electric. AIC member KKR bought the business in summer 2020 and merged it with Savant Systems, which was already sponsored by KKR. Savant, a Boston-based company, provides smart home technology through a single interface, including climate, lighting, entertainment, security, and home energy settings. GE Lighting's technology was incorporated into Savant, which is investing in lamp space innovation and other advanced products. Under KKR, Savant's mission is to become the number one intelligent lighting company worldwide."[1] Acquiring talent and assets from a reputable company such as GE helps it get there.

Those types of transactions happen hundreds of times every year. PE-backed energy companies acquire unused properties from names such as BP and Shell; PE-backed food companies pick up noncore brands from companies such as Nestlé; the list goes on. But private equity has the playbook, financial resources, and creativity to initiate those transformative deals, thereby resulting in stronger portfolio companies and innovative solutions across every sector of the economy.

PE carveout deal activity (add-ons to existing companies)

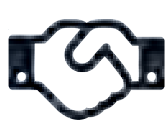


Source: PitchBook | Geography: US
*As of June 15, 2022

Step 1: "Noncore" business unit operates below the radar of a much larger company.

Step 2: Private equity recognizes potential of the business and pays the parent company to "carve it out."

Step 3: PE sponsor blends the business into an existing portfolio company, where it can thrive.



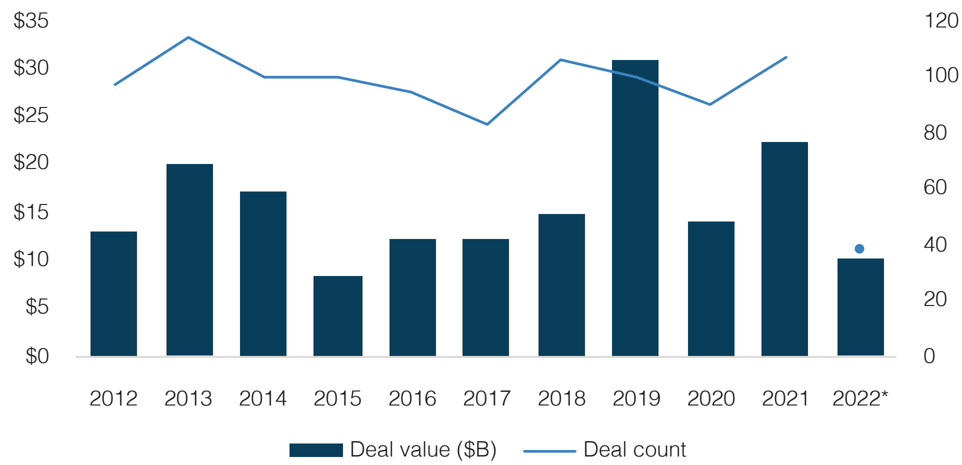
Step 4: PE sponsor exits the portfolio company by taking it public or selling it to a buyer that values it.

1: "Savant Systems, Inc. Completes Acquisition of GE Lighting," GE Lighting, July 1, 2020.

Manufacturing new companies

According to PitchBook, PE firms have created almost 1,000 new manufacturing companies over the past decade, including visionary deals in machinery, building products, consumer nondurables, food production, electrical equipment, and industrial parts suppliers. Many of those new businesses were carved out of household name, such as John Deere, Johnson & Johnson, General Electric, Pitney Bowes, and Dow Chemicals. With more resources behind them, those new manufacturing companies can hire more, without relying on approval from indifferent management teams.

Manufacturing PE carveout deal activity



Source: PitchBook | Geography: US
*As of June 15, 2022

Private equity at work

Core & Main used to be known as HD Supply Waterworks, a subsidiary of HD Supply. That changed in 2017, when AIC member Clayton, Dubilier & Rice (CD&R) made the company independent. Core & Main makes storm drainage, fire protection, and wastewater products for a range of industries, including contractors and municipalities. When CD&R bought the business, it employed about 2,900 people and operated 246 branches throughout the US. By the time it went public as an independent company in 2021, its headcount had increased to 3,700, and its footprint expanded to 285 locations. It also became much more valuable, almost tripling in value in about four years.

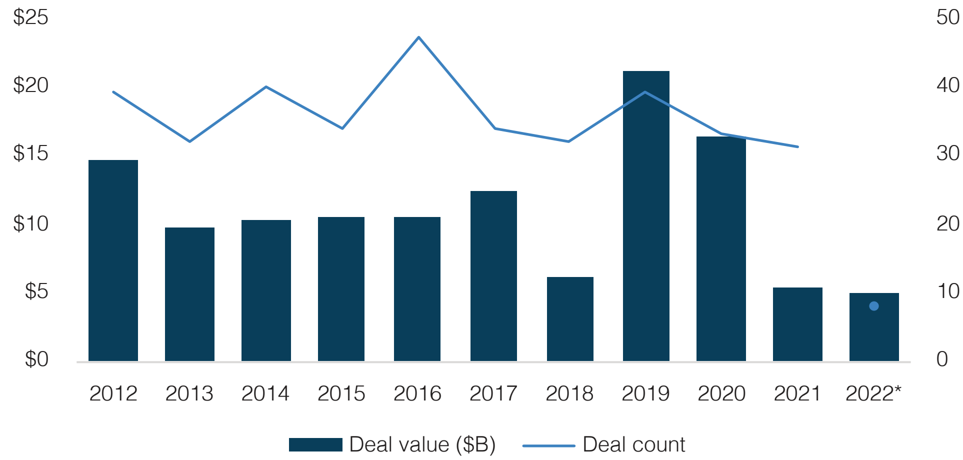
Beyond the numbers, Core & Main also transformed as a workplace under CD&R sponsorship. CD&R is behind the Lean Forward women's leadership summit, which promotes career growth at CD&R portfolio companies. Laura Schneider, Core & Main's chief human resources officer, said that the "customized training [its] team has received… has been a game changer for developing the next generation of leaders for Core & Main."[2]

2: "Clayton, Dubilier & Rice Summit Focuses on Women Leaders," Core & Main, August 1, 2019.

Creating new energy producers

Private equity takes a creative approach to the energy sector. That includes carveouts, which can come in the form of underutilized or undeveloped properties. PE firms are capable of buying those assets from sprawling producers such as Shell or BP and turn them into smaller but independent producers. In fact, PE investors can create energy producers from scratch—hiring management teams and oilfield workers within months—and provide those new producers with whatever resources they need to get off the ground.

Energy PE carveout deal activity



Source: PitchBook | Geography: US
*As of June 15, 2022

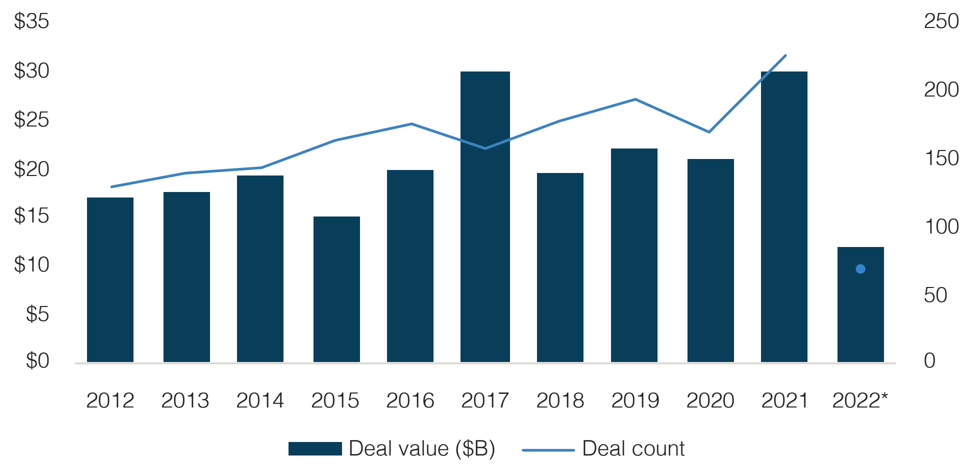
Private equity at work

In 2014, AEA Investors acquired the water technologies business of Siemens AG. Renamed Evoqua Water Technologies, the business provided water treatment solutions to a range of customers. In Evoqua, AEA recognized several improvements to be made and recruited new senior talent to implement them. Under AEA, Evoqua expanded its footprint in medical water, irrigation systems, industrial wastewater, and several other types of water purification systems. By the time Evoqua was taken public in 2017, the company's financial performance had improved thanks to organizational and process upgrades—transforming it into one of the best standalone water companies in the world.

Carving out business products & services

The business services sector is a valuable source for new companies. Among other companies, PE firms have rejuvenated business units from AIG, Thompson Reuters, PricewaterhouseCoopers, Aramark, and Waste Management. Thanks to creative carveouts, the US economy benefits from new companies in human capital, media, accounting, logistics, educational training, and environmental services.

Business products & services PE carveout deal activity



Source: PitchBook | Geography: US
*As of June 15, 2022

Private equity at work

In 2013, AIC member Platinum Equity took over the equipment rental business of Volvo for $1.1 billion. Volvo Rents had been in business since 2001, but Volvo leadership felt that "Volvo Rents' business [did] not have a sufficiently strong connection with [Volvo's] core operation to motivate continued ownership."[3] Its new owner, Platinum Equity, had a long history of transforming under-resourced businesses into new, standalone companies. Platinum Equity renamed the company BlueLine Rental and set it on an ambitious growth path, servicing industries such as construction, oil & gas, power, metals, and industrial manufacturing.

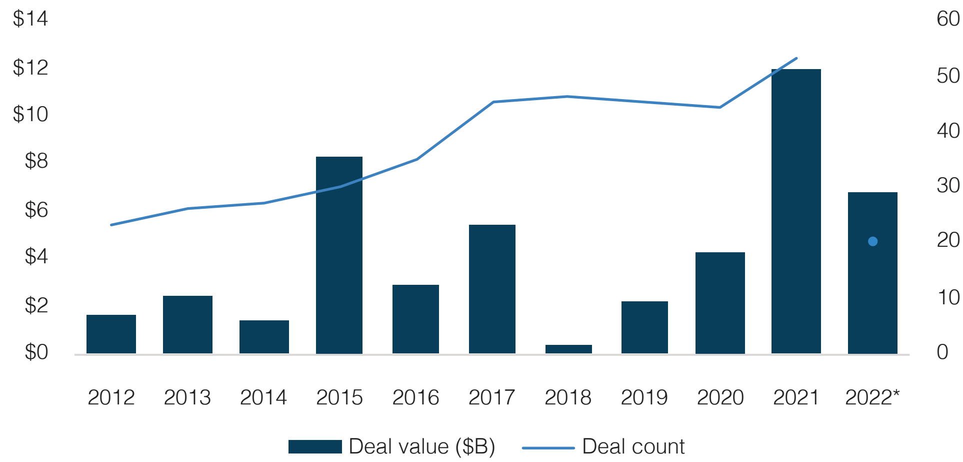
After five years under PE sponsorship and earnings improvements, BlueLine Rental was sold to United Rentals for $2.1 billion. BlueLine evolved into an industry leader and brought substantial assets to United Rentals, which felt it was going to market "with more talent, capacity and customer diversification than ever before."[4]

3: "AB Volvo To Sell Volvo Rents in North America," Volvo, December 10, 2013.
4: "United Rentals To Acquire BlueLine Rental for $2.1 Billion," United Rentals, September 10, 2018.

Downloading software units

The software sector is becoming an increasingly rich source of new, independent companies. Over the past decade, PE's expertise in software has strengthened, which makes it easier to identify promising business units and their growth trajectories. Innovative deals have been struck with Dell Technologies, Intuit, and Compuware, and software's rise as a market means more independent companies in operating systems, network management, financial and educational software, and productivity tools in the years ahead.

Software PE carveout deal activity



Source: PitchBook | Geography: US
*As of June 15, 2022

Private equity at work

Changepoint

In 2014, AIC member Marlin Equity Partners acquired three divisions of Compuware, with plans to create a new company. At the time, Compuware was under pressure to make changes from activist investors, and Marlin was able to come up with its acquisition plan in less than six weeks. The deal included two software units, as well as an IT services business unit. Marlin's plan was to merge all three into a new software company called Changepoint, which would offer professional services automation and project portfolio management software to professional service organizations. After seven years of growth under Marlin, Changepoint was acquired by Planview, a similar company backed by AIC members TPG and TA Associates. At the end of Changepoint's long journey came "an unmatched level of expertise, IP, and resources to ensure [Planview's customers'] more important outcomes are delivered with efficiency, urgency, and transparency."[5]

5: "Planview Announces Strategic Acquisitions of Clarizen and Changepoint to Accelerate Strategy to Delivery for Enterprises," Planview, January 12, 2021.

Economic contribution of the US private equity sector in 2022

Prepared for the American Investment Council

April 2023

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Executive summary

This report estimates the current economic activity of, and related to, the US private equity sector – i.e., US private equity firms and private equity-backed companies – within the US economy in 2022.

Key findings include:

Economic activity of the US private equity sector

- **Employment and wage contribution.** The US private equity sector provides employment and earnings for millions of workers. Overall, in 2022, the US private equity sector directly employed 12 million workers earning $1 trillion in wages and benefits.[1] The average US private equity sector worker earned approximately $80,000 in wages and benefits in 2022. For a full-time worker this is approximately $41 per hour.[2] The median full-time US private equity sector worker earned approximately $50,000 in 2022.[3]

- **Share of US economic activity.** The US private equity sector directly generated $1.7 trillion of gross domestic product (GDP) in the United States in 2022. GDP measures a sector's or industry's contribution to the production of final goods and services produced in the United States. The US private equity sector comprised approximately 6.5% of US GDP in 2022.

- **PE-backed small businesses.** In 2022, the median PE-backed business employed 69 workers. Moreover, approximately 85% of PE-backed businesses were small businesses (i.e., had fewer than 500 employees). PE-backed small businesses directly employed a total of 1.4 million workers throughout the US economy in 2022. These workers earned $135 billion in wages and benefits and generated $240 billion of GDP.

- **Tax contribution.** The US private equity sector generates tax revenue through US private equity firms, private equity-backed companies, and its employees. In 2022, the US private equity sector paid $304 billion of federal, state, and local taxes. Approximately two-thirds of these were federal taxes ($208 billion) with the remaining taxes paid to state and local governments ($95 billion).

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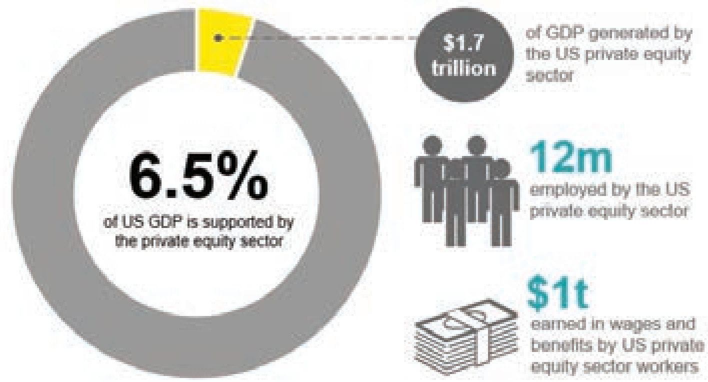
[1] All numbers are prorated to account for cases where private equity owns less than 100% of a company.
[2] This $80,000 is computed prior to rounding the wages and benefits and employment estimates. In particular, the $1 trillion of wages and benefits is approximately $961 billion and 12 million employees is approximately 11.957 million employees.
[3] By comparison, the comparable median wage for the US economy is approximately $50,000 and comparable average wage is approximately $73,000. See report for more detail.

Figure E-1. Economic contribution of the US private equity sector, 2022



Note: Figure only includes economic activity of the US private equity sector (i.e., the economic activity at US private equity firms and private equity-backed companies). Wages and benefits includes all labor income (i.e., employee cash compensation and benefits, as well as proprietors' income). Wages and benefits is a component of GDP.
Source: PitchBook; Dun & Bradstreet; US Bureau of Economic Analysis; EY analysis.

Economic activity related to the US private equity sector

- **Suppliers to the US private equity sector.** Suppliers to the US private equity sector employed an additional 7.8 million workers throughout the US economy earning $700 billion in wages and benefits and generating $1.1 trillion of US GDP in 2022. Suppliers to PE-backed small businesses (i.e., a subset of this) employed 1.3 million workers earning $110 billion of wages and benefits and generating $180 billion of US GDP. Wages and benefits is a component of GDP. This economic activity supported $207 billion of taxes – federal ($142 billion) and state and local ($65 billion).

- **Related consumer spending.** The consumer spending of workers of the US private equity sector and the sector's suppliers supported an additional 11.5 million workers throughout the US economy earning $700 billion in wages and benefits and generating $1.3 trillion of US GDP in 2022. Consumer spending related to PE-backed small businesses and their suppliers (i.e., a subset of this) supported 1.8 million workers earning $115 billion of wages and benefits and generating $195 billion of US GDP. Consumer spending related to the US private equity sector supported $235 billion of taxes – federal ($161 billion) and state and local ($74 billion).

Total economic activity of, and related to, the US private equity sector

In total, the US private equity sector, the sector's US suppliers, and the related US consumer spending supported an estimated 31.3 million workers earning $2.4 trillion in wages and benefits and generating $4.0 trillion in US GDP in 2022. PE-backed small businesses, their suppliers, and related consumer spending (i.e., a subset of this) together supported 4.4 million workers earning $360 billion in wages and benefits and generating $615 billion GDP. Additionally, the federal, state, and local taxes paid by, and related to, the US private equity sector totaled more than $700 billion in 2022.

Table E-1. Total economic activity of, and related to, the US private equity sector, 2022
Millions of jobs; trillions of dollars

	US private equity sector	Suppliers to US private equity	Related consumer spending	Total
Employment	12.0	7.8	11.5	31.3
Wages and benefits	$1.0	$0.7	$0.7	$2.4
GDP	$1.7	$1.1	$1.3	$4.0
Taxes paid	$0.3	$0.2	$0.2	$0.7

Note: Wages & benefits includes all labor income (i.e., employee cash compensation and benefits, as well as proprietors' income). Wages & benefits is a component of GDP. Figures may not sum due to rounding.
Source: EY analysis.

Contents

Economic contribution of the US private equity sector in 2022

I. Introduction

This report estimates the current economic activity of, and related to, the US private equity sector – US private equity firms and private equity-backed companies – within the US economy in 2022, a single point in time. As such, the estimates provide a snapshot of the economic footprint of the sector as measured by employment, wages & benefits, gross domestic product (GDP), and taxes. By providing information on the overall scope of the industry, measured and defined in several different ways, this report attempts to shed light on the reach of the private equity industry with the US economy.

Overall, the US private equity sector provides employment and earnings for millions of workers and contributes jobs and earnings to other sectors of the US economy that relate to private equity operations. In 2022, the US private equity sector directly employed 12 million workers throughout the US economy earning $1 trillion in wages and benefits and generating $1.7 trillion of GDP. Suppliers to the US private equity sector employed an additional 7.8 million workers throughout the US economy earning $700 billion in wages and benefits and generating $1.1 trillion of GDP. The consumer spending of workers of the US private equity sector and the sector's suppliers supported an additional 11.5 million workers throughout the US economy earning $700 billion in wages and benefits and generating $1.3 trillion of GDP.

Overview of private equity

Private equity firms partner with investors to form funds that invest in companies, primarily those in need of retooling or that are on the cusp of growth. The aim of the investment, which most often takes the form of a majority stake, is to help bolster the company through use of the private equity firm's access to capital and its strategic, financial, and operational expertise. Ultimately, transforming the target company's operations generates returns for the private equity fund, the private equity firm that manages the fund, and the fund's investors.

Private equity firms partner with a variety of investor types, including pension funds, university endowments, charitable foundations, and insurance companies. Private equity funds invest across a range of industries such as energy, healthcare, manufacturing, retail, and technology. In 2022, the US private equity sector included approximately 5,000 private equity firms and 18,000 PE-backed companies. Jobs at private equity firms are estimated to be less than 1% of US private equity sector employment.

Though some sector participants use the term private equity in different ways, for the purposes of this analysis private equity only includes private investment in growth capital or established companies aiming to improve the company. In contrast, venture capital – which is not included in the definition of private equity used for this analysis – consists of private investment in startup and early-stage companies.

The most common private equity fund types are: (1) buyout funds, and (2) growth equity funds. For the purposes of this study all deals in both subcategories will be referred to as private equity funds.

Private equity funds that invest in more mature businesses

An established company may, perhaps due to increased competition, the changing structure of an industry or its markets, or high overhead costs, perform below its potential. Identifying and addressing the root cause of underperformance, however, often requires expertise and potentially significant infusions of capital. A private equity fund can provide both.

Obtaining a controlling stake in such a company often requires significant investment. A private equity fund often finances acquisitions, in part through debt issuance, sometimes a cost-effective method for such transactions. In a typical case, the target company's future cash flows are the collateral. The private equity fund generates returns on its investment by maximizing profits net of interest expenses and payments of the debt principal. A successful private equity fund often has expertise in helping lift the performance of target companies, and both the private equity fund and target company can benefit from a buyout.

In addition, achieving higher performance may involve changes in higher-level management or refocusing of the target's business purposes by spinning off peripheral business components. Sweeping changes to a company are not always welcome by all stakeholders, particularly in the short term. The intervention of an outside actor can be not only beneficial, but critical to achieve change and realign a target company.

Growth equity funds

Growth equity funds are private equity funds that invest in companies to foster expansion. Growth equity target companies often have established business models, revenues, and operating profits, but are unable to raise sufficient capital to undertake a significant expansion. Such an expansion could include moving the company into new markets, facilitating new product development, or possibly a strategic acquisition.

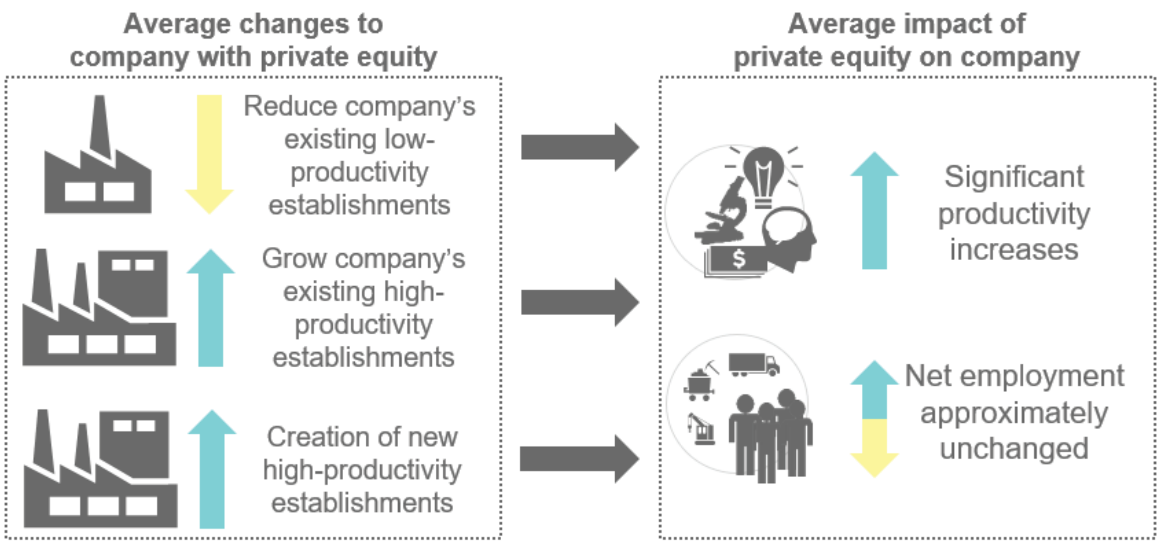
The target company for a growth equity fund, were it not for such investors, could be in a difficult spot. There are significant cost and regulatory hurdles to raising public capital. The target company might also not be able to rely on venture capital investment. Venture capital generally specializes in providing relatively smaller levels of financing and generating returns from very high revenue growth from very young companies that might be less likely from a more established company. Growth equity private equity funds, in effect, are a middle ground between venture capital that targets startup companies and private equity funds that focus on well-established companies in need of retooling.

Growth equity investors rely on the company's revenue growth to generate returns, which can be accomplished by providing additional capital, as well as through strategic and operational support from the private equity firm. Growth equity funds typically undertake a significant role in the target company's day-to-day operations.

Private equity-backed company performance

Notably, given the access to capital and expertise of private equity firms, private equity-backed companies often have better prospects for experiencing rapid growth and restructuring as compared to similar companies without a private equity investment. For example, as seen in Figure 1, a recent study analyzing the performance of 3,200 private equity-backed companies with more than 150,000 establishments from 1980 through 2005 estimates that, on average, two years after a private equity investment the productivity of a private equity-backed company increases significantly with a near-zero net employment change relative to a comparable company without private equity investment.[1] The study found that, relative to a comparable company, an average private equity-backed company was more likely to reduce a company's low-productivity establishments, grow a company's high-productivity establishments, and create new high-productivity establishments; that is, refocus the company on its higher-productivity activities.

Figure 1. Estimated average impact of private equity investment in a company after two years



Note: Figure shows the average changes to a company with a private equity investment relative to a comparable company without it. That is, the changes displayed are estimates of what would have happened to a private equity-backed company, on average, if not for a private equity investment. Results are from an analysis of 3,200 PE-backed companies with more than 150,000 establishments over the 1980-2005 period for two years after the LBO.
Source: Davis et al. (2014) and Davis et al. (2019).

II. Economic activity of the US private equity sector

The US private equity sector, comprised of US private equity firms and private equity-backed companies, provides employment and income for millions of workers and contributes to jobs in other sectors of the economy that are connected to private equity operations.

The economic activity described in this report includes the following indicators:

- **Employment.** Employment is measured as the total headcount of workers. For example, a company with three full-time workers and a company with two full-time workers and one part-time worker would both be measured as having three workers.

- **Wages and benefits.** Wages and benefits includes employee cash compensation and benefits as well as proprietor income.[2] Wages and benefits is a component of GDP.

- **GDP.** GDP measures a sector's contribution to the production of all final goods and services produced in the United States.

As displayed in Table 1, the US private equity sector supported 12 million jobs in 2022. The table also displays the type of economic activity of these jobs.[3] The largest share of US private equity sector employment was estimated to be in business services. Business services accounted for 4.3 million jobs, or 36% of US private equity sector employment in 2022. These services include finance and insurance, real estate and rental and leasing, professional, scientific, and technical services, management of companies and enterprises, administrative and support services, and waste management and remediation services. Included in business services are US private equity firms. However, the vast majority of US private equity sector workers were estimated to be employed at private equity-backed companies, as opposed to private equity firms. Jobs at private equity firms are estimated to comprise less than 1% of US private equity sector employment.[4]

Personal services employed the second largest share of US private equity sector workers with 3.1 million jobs, or 26% of US private equity sector employment. Personal services includes healthcare, accommodation, food services, recreation, and other personal services. US private equity sector employment in manufacturing is the third largest segment of the sector's employment. In particular, 1.5 million workers were estimated to be employed in manufacturing in 2022. This is 13% of total US private equity sector employment. These three segments of the US private equity sector – personal services, business services, and manufacturing – comprise approximately three-quarters of the sector's total employment. Other significant segments of the sector include retail trade (0.8 million jobs; 7% of total), information (0.8 million jobs; 6% of total), wholesale trade (0.4 million jobs; 4% of total), transportation and warehousing (0.4 million jobs; 3% of total), and construction (0.3 million jobs; 3% of total).

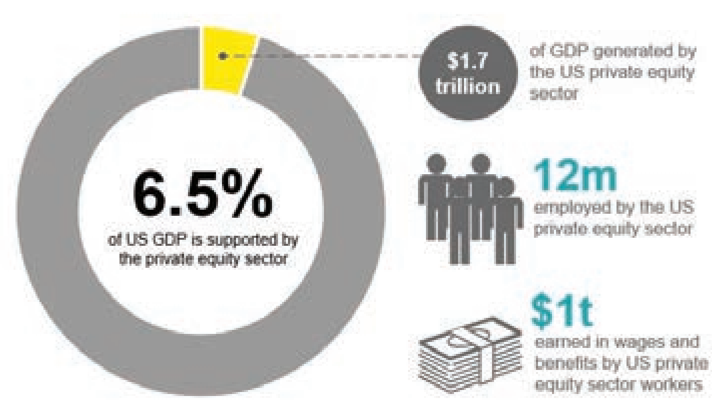
Table 1. US private equity sector employment by type of economic activity, 2022
Millions of jobs

	Jobs	% of total
Business services	4.3	36%
Personal services	3.1	26%
Manufacturing	1.5	13%
Retail trade	0.8	7%
Information	0.8	6%
Wholesale trade	0.4	4%
Transportation and warehousing	0.4	3%
Construction	0.3	3%
Utilities	0.2	1%
Mining, quarrying, and oil and gas extraction	0.1	1%
Agriculture, forestry, fishing, and hunting	*	*
Total employment	**12.0**	**100%**

*Less than 0.05 million jobs or 0.5%
Note: Companies industry classifications use the North American Industry Classification System (NAICS), which is commonly used in government statistics. Company NAICS classifications were generally identified using Dun & Bradstreet. Figures may not sum due to rounding.
Source: PitchBook; Dun & Bradstreet; and EY analysis.

Overall, in 2022, the US private equity sector employed 12 million workers throughout the US economy who earned $1 trillion in wages and benefits and generated $1.7 trillion of GDP.[5] Wages and benefits is a component of GDP. This amounts to an average worker in the US private equity sector earning approximately $80,000 in wages and benefits.[6] The comparable average wages and benefits for the US economy is approximately $73,000.[7] For a full-time worker this is approximately $41 per hour.[8] The median full-time US private equity sector worker earned approximately $50,000 in 2022.[9] The comparable median for the US economy is also approximately $50,000.[10] Additionally, as summarized in Figure 2, the $1.7 trillion of GDP of the US private equity sector in 2022 was approximately 6.5% of US GDP ($25.5 trillion in 2022).[11]

Figure 2. Economic contribution of the US private equity sector, 2022



Note: Figure only includes economic activity of the US private equity sector (i.e., the economic activity at US private equity firms and private equity-backed companies). Wages and benefits includes all labor income (i.e., employee cash compensation and benefits, as well as proprietors' income). Wages and benefits is a component of GDP.
Source: PitchBook; Dun & Bradstreet; US Bureau of Economic Analysis; EY analysis.

III. Economic activity related to the US private equity sector

In addition to the economic activity of the US private equity sector, this report also estimates the related economic activity of: (1) suppliers to the US private equity sector, and (2) related consumer spending:

- **Suppliers to the US private equity sector.** The US private equity sector purchases goods and services from other businesses, which support jobs, wages and benefits, and GDP at these supplier businesses. For example, the US private equity sector's expenditures on utilities, telecommunications, raw materials, and security, among other goods and services, support sales at suppliers. Moreover, demand for these goods and services leads to additional rounds of economic activity as suppliers to the US private equity sector purchase operating inputs from their own suppliers. Goods and services imported from abroad are not included in this report's estimates of US economic activity.

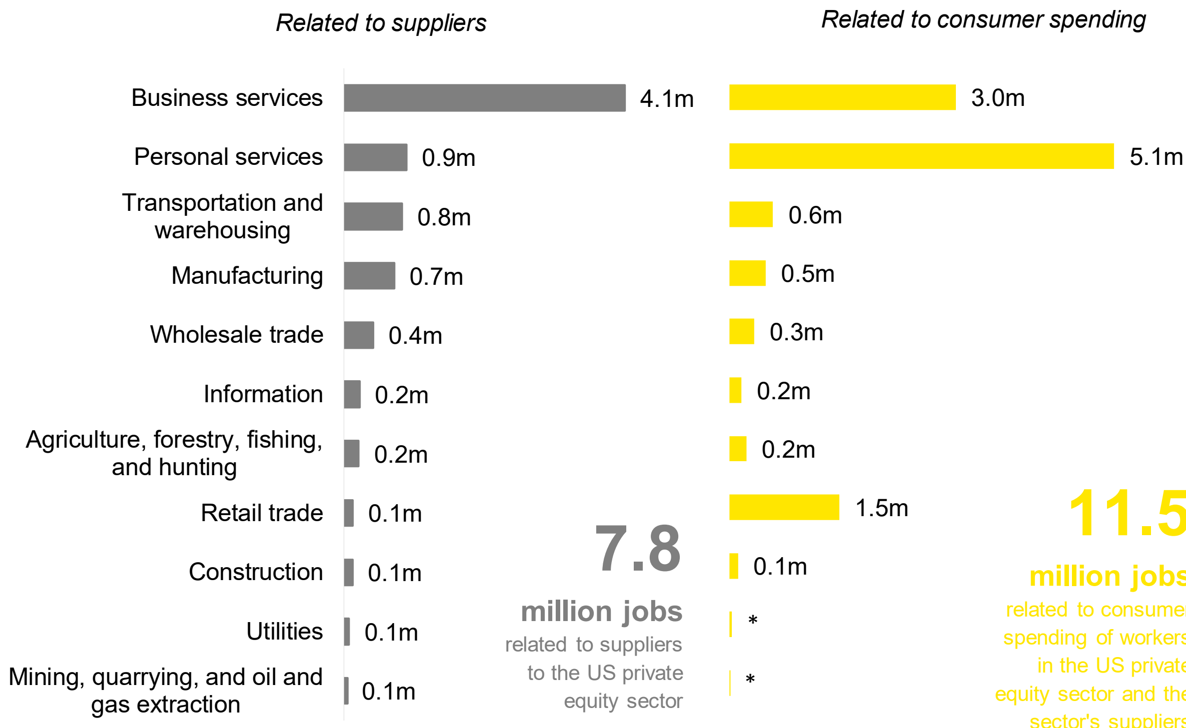
- **Related consumer spending.** Related consumer spending refers to the consumer spending supported by workers in the US private equity sector and their suppliers. When these workers spend their earnings at US businesses (e.g., grocery stores, retailers, movie theaters), they support economic activity in those sectors. The earnings that these workers spend on food at a restaurant, for example, creates jobs at the restaurant and at farms, transportation companies, and other industries that are involved in the restaurant's supply chain.

The magnitude of the economic activity related to the US private equity sector is estimated with the 2021 Impacts for Planning (IMPLAN) input-output model of the United States. Unlike other economic models, IMPLAN includes the interaction of more than 500 industries, thus identifying the interaction of specific industries that are related to the US private equity sector. See the Appendix for further details.

As displayed in Figure 3, suppliers to the US private equity sector were estimated to support 7.8 million jobs throughout the US economy in 2022. The largest segments of suppliers to the US private equity sector were estimated to be business services (4.1 million jobs; 52% of total), personal services (0.9 million jobs; 12% of total), and transportation and warehousing (0.8 million jobs; 11% of total). These three supplier industries comprise three-quarters of the total employment related to suppliers to the US private equity sector. The remaining related supplier employment includes manufacturing (0.7 million jobs; 9% of total), wholesale trade (0.4 million jobs; 5% of total), information (0.2 million jobs; 3% of total), agriculture, forestry, fishing, and hunting (0.2 million jobs; 3% of total), retail trade (0.1 million jobs; 2% of total), construction (0.1 million jobs; 2% of total), utilities (0.1 million jobs; 1% of total), and mining, quarrying, and oil and gas extraction (0.1 million jobs; 1% of total).

Consumer spending of workers in the US private equity sector and the sector's suppliers was estimated to support 11.5 million jobs throughout the US economy in 2022. The largest segments of employment related to the consumer spending of workers in the US private equity sector and the sector's suppliers were estimated to be personal services (5.1 million jobs; 44% of total), business services (3.0 million jobs; 26% of total), and retail trade (1.5 million jobs; 13% of total). These three industries comprise more than three-quarters of the related economic activity. The remaining employment related to the consumer spending of workers in the US private equity sector and the sector's suppliers includes transportation and warehousing (0.6 million jobs; 5% of total), manufacturing (0.5 million jobs; 4% of total), wholesale trade (0.3 million jobs; 3% of total), agriculture, forestry, fishing, and hunting (0.2 million jobs; 2% of total), information (0.2 million jobs; 1% of total), and construction (0.1 million jobs; 1% of total).

Figure 3. Economic activity related to the US private equity sector, 2022



*Less than 0.05m
Note: Industry definitions are based on the North American Industry Classification System (NAICS).
Figures may not sum due to rounding.
Source: EY analysis.

Table 2 summarizes the estimated economic activity of, and related to, the US private equity sector in the 2022 US economy. The private equity sector directly employed a total of 12 million workers throughout the US economy who earned $1 trillion in wages and benefits and generated $1.7 trillion of GDP. Wages and benefits is a component of GDP. Suppliers to the US private equity sector employed an additional 7.8 million workers throughout the US economy who earned $700 billion in wages and benefits and generated $1.1 trillion of GDP. In addition, the consumer spending of workers in the US private equity sector and its suppliers employed 11.5 million workers throughout the US economy who earned $700 billion in wages and benefits and generated $1.3 trillion of GDP.

Table 2. Total economic activity of, and related to, the US private equity sector, 2022

Millions of jobs; trillions of dollars

	US private equity sector	Suppliers to US private equity	Related consumer spending	Total
Employment	12.0	7.8	11.5	31.3
Wages and benefits	\$1.0	\$0.7	\$0.7	\$2.4
GDP	\$1.7	\$1.1	\$1.3	\$4.0

Note: Wages & benefits include all labor income (i.e., employee cash compensation and benefits, as well as proprietors' income). Wages and benefits is a component of GDP. Figures may not sum due to rounding.
Source: EY analysis.

IV. Economic contribution of US PE-backed small businesses

As previously noted, in 2022, the private equity sector included approximately 18,000 PE-backed companies. As seen in Table 3, approximately 85% were businesses with fewer than 500 employees. Moreover, 14% had fewer than 10 employees, 40% had fewer than 50 employees, and more than 60% had fewer than 100 employees. Throughout this report, small businesses refers to PE-backed companies with fewer than 500 employees. The median PE-backed business employed 69 employees.

Table 3. PE-backed companies and jobs, by company size
Thousands of companies; thousands of jobs

Number of employees	Companies	Share of companies	Jobs	Share of jobs
<10	2.6	14%	14	*
11 to 50	4.8	26%	127	1%
51 to 100	3.9	21%	275	2%
101 to 500	4.4	24%	1,024	9%
501 to 1,000	1.0	6%	771	7%
1,001 to 5,000	1.3	7%	2,839	24%
5,001+	0.4	2%	6,816	57%
Total	**18.4**	**100%**	**11,867**	**100%**

*Less than 0.5%
Note: Figures are rounded. The numbers are reflecting PE-backed companies only, without PE firms themselves.
Source: PitchBook; Dun & Bradstreet; and EY analysis.

As displayed in Table 4, PE-backed small businesses supported 1.4 million jobs in 2022. The largest share of PE-backed small business employment was in business services, which included 476,000 jobs, or 35% of PE-backed small business employment in 2022. The second largest sector was manufacturing, which included 265,000 jobs, or 19% of PE-backed small business employment. The third largest sector was personal services, which included 207,000 jobs, or 15% PE-backed small business employment. These three sectors (business services, manufacturing, and personal services) comprised approximately 70% of total PE-backed small business employment in 2022.

Table 4. PE-backed small businesses by type of economic activity, 2022
Thousands of jobs

	Jobs	% of total
Business services	476	35%
Manufacturing	265	19%
Personal services	207	15%
Information	118	9%
Wholesale trade	109	8%
Retail trade	61	4%
Construction	52	4%
Transportation and warehousing	34	2%
Mining, quarrying, and oil and gas extraction	24	2%
Utilities	19	1%

Agriculture, forestry, fishing, and hunting	6	*
Total employment	**1,371**	**100%**

*Less than 0.5%
Note: Companies industry classifications use the North American Industry Classification System (NAICS), which is commonly used in government statistics. Company NAICS classifications were generally identified using Dun & Bradstreet. Figures may not sum due to rounding.
Source: PitchBook; Dun & Bradstreet; and EY analysis.

Table 5 summarizes the estimated economic activity of, and related to, PE-backed small businesses in 2022. PE-backed small businesses directly employed a total of 1.4 million workers throughout the US economy. These workers earned $135 billion in wages and benefits and generated $240 billion of GDP. Wages and benefits is a component of GDP.

Suppliers to PE-backed small businesses employed an additional 1.3 million workers throughout the US economy. These workers earned $110 billion in wages and benefits and generated $180 billion of GDP. In addition, the consumer spending of workers at PE-backed small businesses and their suppliers employed 1.8 million workers throughout the US economy. These workers earned $115 billion in wages and benefits and generated $195 billion of GDP.

In total, the economic activity of, and related to, PE-backed small businesses supported 4.4 million jobs, $360 billion of wages and benefits, and $615 billion of GDP.

Table 5. Total economic activity of, and related to, the US PE-backed small businesses, 2022

Millions of jobs; billions of dollars

	US private equity sector	Suppliers to US private equity	Related consumer spending	Total
Employment	1.4	1.3	1.8	4.4
Wages & benefits	$135	$110	$115	$360
GDP	$240	$180	$195	$615

Note: Wages & benefits include all labor income (i.e., employee cash compensation and benefits, as well as proprietors' income). Wages and benefits is a component of GDP. Figures may not sum due to rounding.
Source: EY analysis.

IV. State distribution of economic activity of, and related to, the US private equity sector

The distribution of jobs, wages and benefits, and GDP by state (plus the District of Columbia) of the economic activity of the US private equity sector is displayed in Table 6 and Figure 4. The states estimated to have the most US private equity sector employment are: (1) California (1.5 million jobs), (2) Texas (1.1 million jobs), (3) Florida (760,000 jobs), (4) New York (739,000 jobs), and (5) Illinois (491,000 jobs).

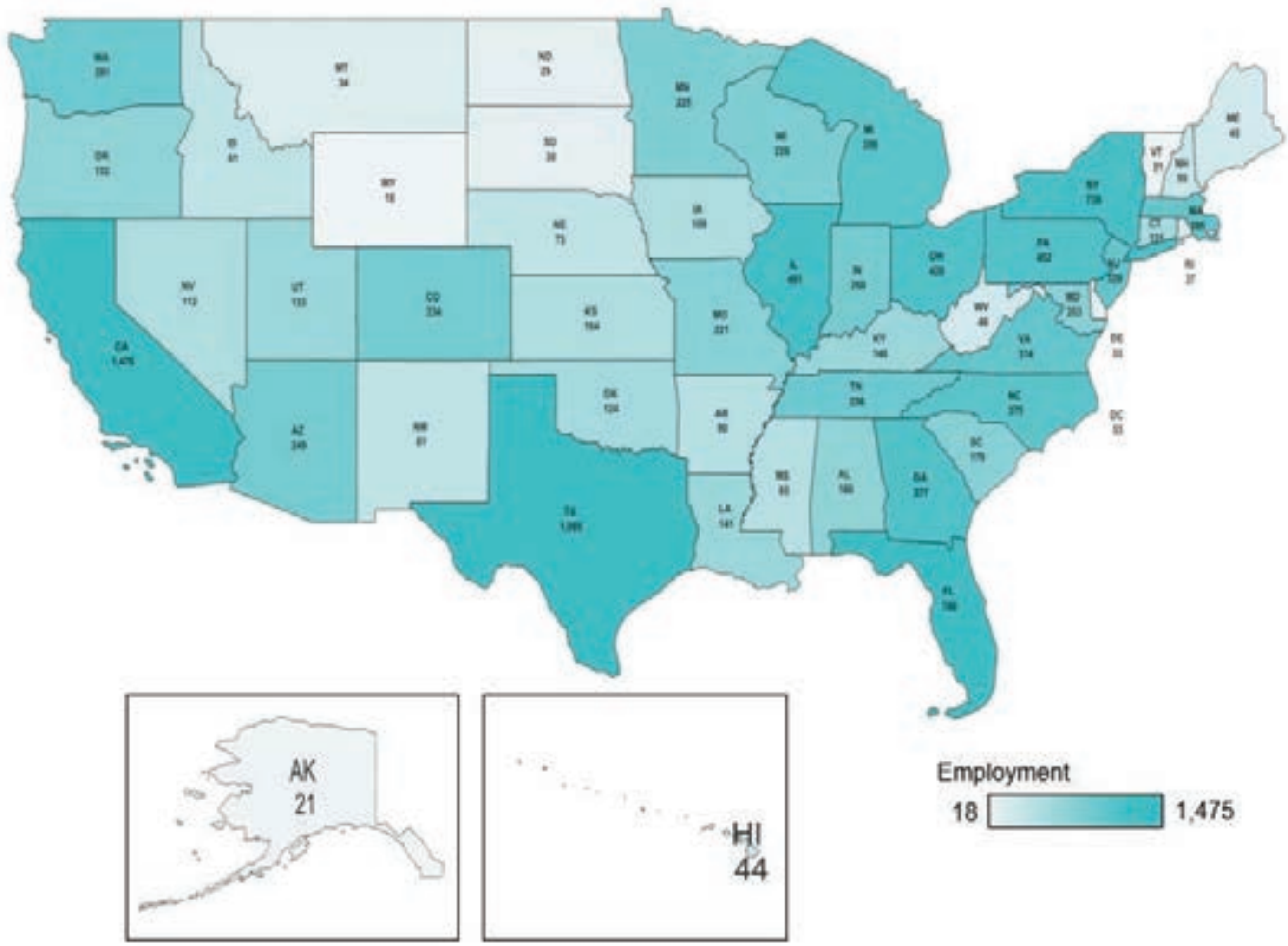
Table 6. Direct economic activity of the US private equity sector by state, 2022

Thousands of jobs; billions of dollars

	Jobs	Wages & benefits	GDP		Jobs	Wages & benefits	GDP
Alabama	160	13	22	Montana	34	3	4
Alaska	21	2	3	Nebraska	73	6	11
Arizona	249	19	33	Nevada	112	8	12
Arkansas	90	7	12	New Hampshire	55	4	7
California	1,475	123	211	New Jersey	329	26	45
Colorado	234	20	35	New Mexico	61	5	8
Connecticut	131	10	18	New York	739	60	102
Delaware	33	2	4	North Carolina	375	29	50
District of Columbia	53	5	7	North Dakota	29	3	5
Florida	760	56	95	Ohio	428	34	59
Georgia	377	30	51	Oklahoma	124	10	18
Hawaii	44	3	5	Oregon	152	12	21
Idaho	61	5	8	Pennsylvania	452	36	62
Illinois	491	39	65	Rhode Island	37	3	5
Indiana	250	19	34	South Carolina	179	13	23
Iowa	109	9	15	South Dakota	30	2	4
Kansas	104	8	15	Tennessee	256	20	34
Kentucky	148	12	20	Texas	1,085	93	161
Louisiana	141	12	20	Utah	133	11	19
Maine	45	3	6	Vermont	21	2	3
Maryland	203	16	26	Virginia	314	25	41
Massachusetts	295	26	44	Washington	291	26	48
Michigan	350	28	47	West Virginia	48	4	7
Minnesota	225	19	32	Wisconsin	226	18	31
Mississippi	85	6	11	Wyoming	18	2	3
Missouri	221	18	30	**United States**	**11,957**	**$961**	**$1,652**

Note: Table only includes employment at US private equity firms and private equity-backed companies. Wages and benefits includes all labor income (i.e., employee compensation and proprietor income). Wages and benefits is a component of GDP. Figures may not sum due to rounding.
Source: EY analysis.

Figure 4. Economic activity of the US private equity sector by state, 2022
Thousands of jobs



Note: Figure only includes employment at US private equity firms and private equity-backed companies. Figures may not sum due to rounding.
Source: EY analysis.

The distribution of jobs, wages and benefits, and GDP by state (plus the District of Columbia) of economic activity of, and related to, the US private equity sector is displayed in Table 7 and Figure 5. The states estimated to have the most employment in or related to the US private equity sector are: (1) California (3.9 million jobs), (2) Texas (2.8 million jobs), (3) Florida (2.0 million jobs), (4) New York (1.9 million jobs), and (5) Illinois (1.3 million jobs).

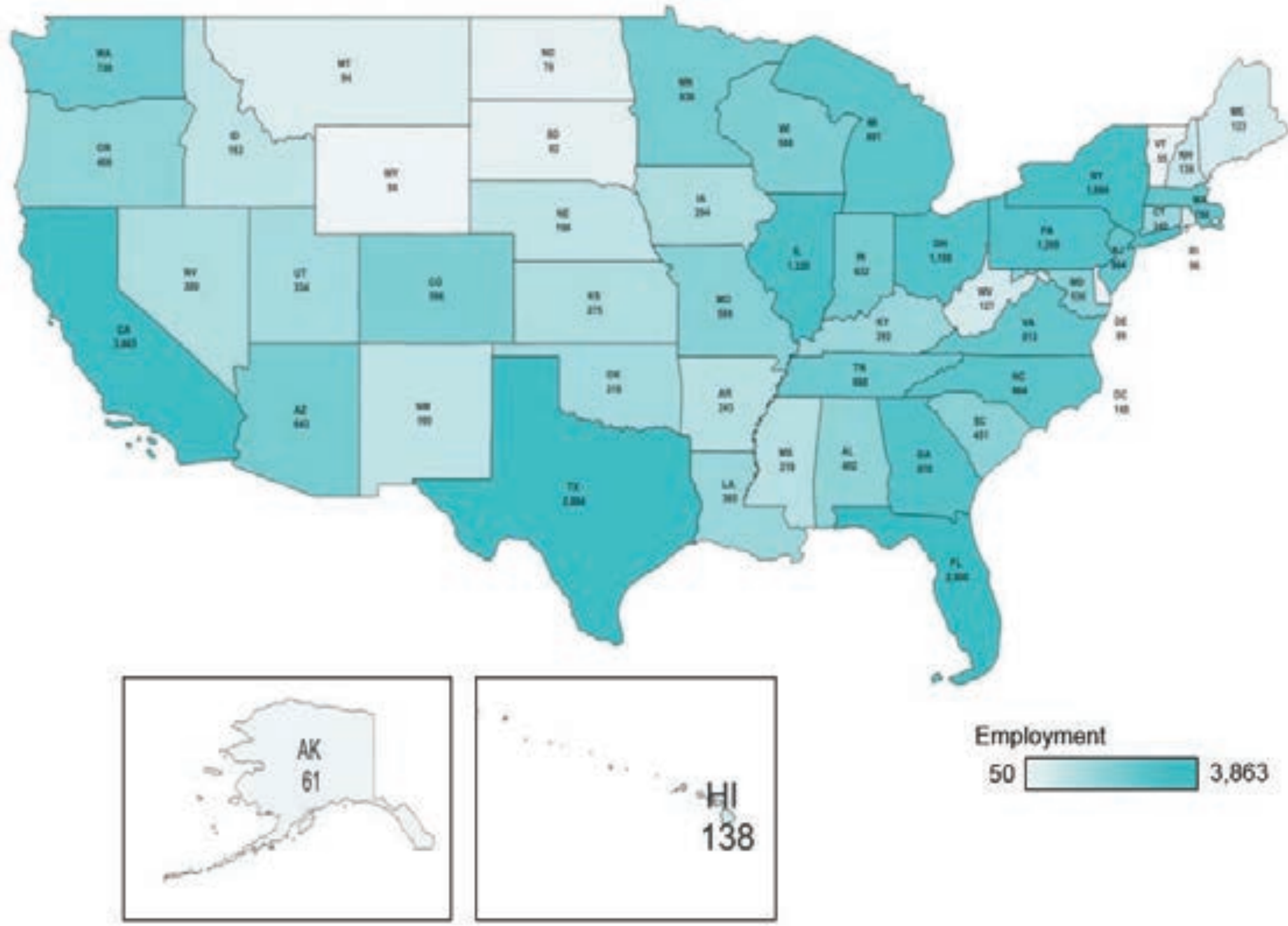
Table 7. Total economic activity of, and related to, the US private equity sector by state, 2022

Thousands of jobs; billions of dollars

	Jobs	Wages & benefits	GDP		Jobs	Wages & benefits	GDP
Alabama	402	30	51	Montana	94	7	11
Alaska	61	5	8	Nebraska	198	15	25
Arizona	643	47	80	Nevada	300	20	33
Arkansas	243	18	30	New Hampshire	139	10	17
California	3,863	295	509	New Jersey	864	65	108
Colorado	596	46	82	New Mexico	160	12	20
Connecticut	340	25	43	New York	1,984	149	254
Delaware	89	6	10	North Carolina	964	71	121
District of Columbia	148	12	19	North Dakota	78	6	11
Florida	2,000	142	245	Ohio	1,108	84	141
Georgia	970	72	123	Oklahoma	318	24	42
Hawaii	138	10	15	Oregon	406	30	51
Idaho	163	11	19	Pennsylvania	1,205	91	150
Illinois	1,320	100	174	Rhode Island	96	7	11
Indiana	632	46	79	South Carolina	451	32	56
Iowa	294	22	36	South Dakota	82	6	10
Kansas	275	21	35	Tennessee	668	49	82
Kentucky	392	28	47	Texas	2,804	222	393
Louisiana	365	28	49	Utah	334	25	43
Maine	123	9	15	Vermont	58	4	7
Maryland	536	40	65	Virginia	813	62	99
Massachusetts	758	60	99	Washington	730	57	104
Michigan	881	67	113	West Virginia	127	10	17
Minnesota	636	51	92	Wisconsin	588	44	74
Mississippi	219	15	26	Wyoming	50	4	7
Missouri	584	44	74	**United States**	**31,289**	**$2,356**	**$4,021**

Note: Table includes employment at US private equity firms and private equity-backed companies as well as the related supplier and consumer spending employment. Wages and benefits includes all labor income (i.e., employee compensation and proprietor income). Wages and benefits is a component of GDP. Figures may not sum due to rounding.
Source: EY analysis.

Figure 5. Total economic activity of, and related to, the US private equity sector by state, 2022
Thousands of jobs



Note: Figure includes employment at US private equity firms and private equity-backed companies as well as the related supplier and consumer spending employment. Figures may not sum due to rounding.
Source: EY analysis.

V. Taxes paid by, and related to, the US private equity sector

The US private equity sector generates tax revenue through US private equity firms, private equity-backed companies, and their employees. Additionally, taxes are paid by the suppliers of the US private equity sector and paid on worker-related consumer spending. Table 8 summarizes the federal, state, and local taxes paid by, and related to, the US private equity sector in 2022. The estimates of taxes paid include all major federal, state, and local taxes (e.g. corporate and individual income taxes, sales and excise taxes, property taxes), where applicable. Taxes paid by the US private equity sector are displayed separately for those paid by businesses and those paid by its employees.

As seen in Table 8, the US private equity sector generated $304 billion of federal, state, and local taxes in 2022. Approximately two-thirds of these were federal taxes ($208 billion) with the remaining taxes being paid to state and local governments ($95 billion). About two-thirds of the $208 billion of federal taxes paid were employee taxes ($141 billion). These were primarily individual income taxes ($102 billion) and payroll taxes ($33 billion). State and local taxes were more evenly split between major tax types: property taxes ($30 billion), sales taxes ($23 billion), individual income taxes ($22 billion), excise, license, and other taxes ($17 billion), and corporate income taxes ($3 billion).

Table 8 also summarizes the federal, state, and local taxes related to the US private equity sector. Suppliers to the US private equity sector paid $207 billion of federal ($142 billion) and state and local ($65 billion) taxes. Additionally, consumer spending related to the US private equity sector supported $235 billion of federal ($161 billion) and state and local ($74 billion) taxes. Overall, the federal, state, and local taxes paid by, and related to, the US private equity sector totaled nearly $750 billion in 2022.

Table 8. Federal, state, and local taxes paid by, and related to, the US private equity sector, 2022

Billions of dollars

	US private equity sector			Suppliers of US private equity	Related consumer spending	Total
	Business taxes	Employee taxes	Total			
Federal taxes	**$67**	**$141**	**$208**	**$142**	**$161**	**$511**
Individual income taxes	14	102	116	79	90	284
Payroll taxes	33	33	66	45	51	161
Corporate income taxes	19	0	19	13	14	46
Excise taxes	1	3	4	3	3	10
Customs duties and fees	1	4	4	3	3	11
State and local taxes	**$38**	**$57**	**$95**	**$65**	**$74**	**$234**
Property taxes	16	13	30	20	23	73
Sales taxes	10	13	23	15	18	56
Individual income taxes	0	22	22	15	17	55
Excise, license, and other taxes	9	8	17	12	13	43
Corporate income taxes	3	0	3	2	3	8
Total taxes	**$106**	**$198**	**$304**	**$207**	**$235**	**$746**

Note: Figures may not sum due to rounding.
Source: EY analysis.

The distribution of state and local taxes paid by state (plus the District of Columbia) by the US private equity sector is displayed in Table 9. The states estimated to have the most taxes paid by the US private equity sector are: (1) California ($13.8 billion), (2) New York ($8.4 billion), (3) Texas ($8.2 billion), (4) Illinois ($4.2 billion), and (5) Florida ($4.1 billion).

Table 9. State and local taxes paid directly by the US private equity sector by state, 2022
Billions of dollars

Alabama	1.0	Montana	0.2
Alaska	0.1	Nebraska	0.6
Arizona	1.7	Nevada	0.7
Arkansas	0.7	New Hampshire	0.4
California	13.8	New Jersey	2.9
Colorado	1.8	New Mexico	0.6
Connecticut	1.2	New York	8.4
Delaware	0.3	North Carolina	2.6
District of Columbia	0.7	North Dakota	0.4
Florida	4.1	Ohio	3.3
Georgia	2.5	Oklahoma	0.9
Hawaii	0.4	Oregon	1.2
Idaho	0.4	Pennsylvania	3.6
Illinois	4.2	Rhode Island	0.3
Indiana	1.9	South Carolina	1.1
Iowa	0.9	South Dakota	0.2
Kansas	0.8	Tennessee	1.5
Kentucky	1.1	Texas	8.2
Louisiana	1.1	Utah	1.1
Maine	0.4	Vermont	0.2
Maryland	1.7	Virginia	2.3
Massachusetts	2.5	Washington	2.4
Michigan	2.5	West Virginia	0.4
Minnesota	2.1	Wisconsin	1.8
Mississippi	0.6	Wyoming	0.1
Missouri	1.5	United States	**$95.4**

Note: Table reports state and local tax contribution of the private equity sector. This table does not include the state and local taxes paid by suppliers of the private equity sector or state and local taxes supported by consumer spending related to the private equity sector. Figures may not sum due to rounding.
Source: EY analysis.

The distribution of state and local taxes paid by state (plus the District of Columbia) by the US private equity sector and related economic activity is displayed in Table 10. The states estimated to have the most taxes paid by, and related to, the US private equity sector are: (1) California ($33.3 billion), (2) New York ($21.0 billion), (3) Texas ($19.5 billion), (4) Illinois ($11.0 billion), and (5) Florida ($10.4 billion).

Table 10. Total state and local taxes paid by, and related to, the US private equity sector by state, 2022
Billions of dollars

Alabama	2.5	Montana	0.6
Alaska	0.4	Nebraska	1.5
Arizona	4.1	Nevada	1.8
Arkansas	1.7	New Hampshire	0.8
California	33.3	New Jersey	7.2
Colorado	4.2	New Mexico	1.4
Connecticut	2.9	New York	21.0
Delaware	0.7	North Carolina	6.3
District of Columbia	1.8	North Dakota	0.9
Florida	10.4	Ohio	8.0
Georgia	6.0	Oklahoma	2.1
Hawaii	1.3	Oregon	3.1
Idaho	1.0	Pennsylvania	9.1
Illinois	11.0	Rhode Island	0.7
Indiana	4.5	South Carolina	2.7
Iowa	2.3	South Dakota	0.5
Kansas	2.1	Tennessee	3.6
Kentucky	2.7	Texas	19.5
Louisiana	2.6	Utah	2.5
Maine	1.1	Vermont	0.5
Maryland	4.2	Virginia	5.7
Massachusetts	5.9	Washington	5.3
Michigan	6.0	West Virginia	1.0
Minnesota	5.8	Wisconsin	4.3
Mississippi	1.6	Wyoming	0.3
Missouri	3.7	**United States**	**$234.2**

Note: Table reports state and local taxes paid by, and related to, the private equity sector. This table includes the state and local taxes paid by suppliers of the private equity sector and the state and local taxes supported by consumer spending related to the private equity sector. Figures may not sum due to rounding.
Source: EY analysis.

VI. Caveats and limitations

The estimates of the economic contribution of the US private equity sector presented in this report are based on an input-output model of the US economy and the data and assumptions described elsewhere in the report. Readers should be aware of the following limitations of the modeling approach and limitations specific to this analysis.

- **The results show a snapshot of current economic contributions.** The input-output modeling approach used in this analysis shows the 2022 economic contribution of the US private equity sector based on its relationships with other industries and households in the US economy. The analysis is at a single point in time (i.e., 2022). The results do not reflect or attempt to estimate an expansion, contraction, or any other changes, or related impacts, of the sector.
- **Estimates are limited by available public information.** The analysis relies on information reported by federal government agencies (primarily the US Bureau of Economic Analysis, US Bureau of Labor Statistics, US Census Bureau, and Congressional Budget Office), and other publicly available sources (i.e., PitchBook, Dun & Bradstreet, and IMPLAN model). The analysis did not attempt to verify or validate this information using sources other than those described in the report.
- **Modeling the economic contribution of the US private equity sector relies on government industry classifications.** This report relates the activities of US private equity sector companies to the operating profiles of various industries as defined by the North American Industry Classification System (NAICS) to most effectively estimate the economic contribution of the US private equity sector. Workers in the US private equity sector are assumed to receive the average wages and benefits of workers in their respective industry and to require the level of operating input purchases characteristic of the industries into which they have been categorized. This analysis relies on estimates of the domestically purchased inputs from the IMPLAN economic model, which are estimated using aggregate trade flow data and may vary by industry.
- **Modeling the average and median wage of the US private equity sector relies on industry averages.** This report relates the activities of US private equity sector companies to the operating profiles of various industries as defined by the NAICS industry classification system to most effectively estimate the average and median wage of the US private equity sector. Workers in the US private equity sector are assumed to receive the average wages and benefits of workers in their respective industry and to require the level of operating input purchases characteristic of the industries into which they have been categorized.
- **Estimates do not reflect the economic impact of the PE industry.** This analysis does not attempt to estimate or indicate the effect or impact of the PE industry or sector on the US economy. Rather, the analysis presents estimates of the economic contribution or footprint of the PE sector. An economic impact analysis might instead analyze the impact on the US economy of a change to or in an industry or sector, perhaps due to a policy change, natural disaster, or some other exogenous factor. An economic impact analysis might attempt to account for the economic dynamics that occur in response to such a change and show the

impact net of shifts of economic activity across different parts of the economy (e.g., industries, sectors) as impacts ripple through the economy.[12]

- **Input-output modeling can include double counting.** Input-output modeling can include double counting in its indirect and induced estimates. For example, a PE-backed company's suppliers or suppliers of suppliers could be a PE-backed company and consumer re-spending of income supported by private equity could be at PE-backed businesses or businesses with PE-backed suppliers. This limitation is due to the use of industry averages in estimating indirect and induced economic contributions in input-output modeling. This analysis attempts to remove double counting by assuming the private equity sector is included in the indirect and induced contributions, by industry, proportional to its direct employment share in each industry.

- **State-level results are high-level estimates.** The state-level results are an allocation of the national results to the 50 states (plus the District of Columbia) with a high-level estimate based on the industries in which the private equity sector operates. An allocation approach is necessary because sufficiently detailed data on the US private equity sector are not available by state from publicly available sources. For example, for a given private equity-backed company only a total employment number is available, not a state-by-state number.

- **Taxes paid by, and related to, the US private equity sector based on historical averages.** In general, estimates of federal, state, and local taxes paid are based on the historical relationship between federal, state, and local tax collections (by tax type) to economic activity.

- **Results are not sensitive to including or excluding employment and labor income of private equity firms.** Employment and labor income at private equity firms contribute less than 1% of the total for the private equity sector. Results included throughout this report are not sensitive to including or excluding private equity. That is, the economic and tax contribution estimates are primarily a result of PE-backed companies.

Appendix. Modeling approach

Technical details: IMPLAN model of the US economy

This analysis uses an input-output model to estimate the economic contribution of the US private equity sector in 2022. The economic multipliers in this report were estimated using the 2021 Impacts for Planning (IMPLAN) input-output model of the United States. IMPLAN is used by more than 500 universities and government agencies. Unlike other economic models, IMPLAN includes the interaction of more than 500 industries, thus identifying the interaction of specific industries that are related to the US private equity sector.

The multipliers in the IMPLAN model are based on the Leontief production function, which estimates the total economic requirements for every unit of direct output in a given industry based on detailed inter-industry relationships documented in the input-output model. The input-output framework connects commodity supply from one industry to commodity demand by another. The multipliers estimated using this approach capture all of the upstream economic activity (or backward linkages) related to an industry's production by attaching technical coefficients to expenditures. These output coefficients (dollars of demand) are then translated into dollars of GDP and wages and benefits and number of employees based on industry averages.

The multipliers presented in this report include the US private equity sector, suppliers to US private equity, and related consumer spending. Economic activity at suppliers to the US private equity sector is attributable to operating input purchases from US suppliers. Economic activity related to consumer spending is attributable to spending by US private equity sector and supplier employees based on household spending patterns. The US private equity sector is estimated to have an employment multiplier of 2.6, a wages and benefits multiplier of 2.5, and a GDP multiplier of 2.4.

In general, estimates of federal, state, and local taxes paid are based on the historical relationship between federal, state, and local tax collections (by tax type) to economic activity (measured as personal income). This ratio estimates the effective tax rates for each tax type as a share of total personal income.

Endnotes

[1] In particular, the analysis' estimates of the net differential in the employment growth rate of the private equity-backed companies relative to the comparable companies not backed by private equity after two years range from a 0.26 percentage-point increase to a 0.88 percentage-point decrease. This reflects the net effect of (1) higher rates of job destruction at a company's shrinking and exiting establishments, (2) greater job creation at a company's expanding establishments, and (3) greater job creation at new company establishments. See Steven J. Davis, John Haltiwanger, Kyle Handley, Ron Jarmin, Josh Lerner, and Javier Miranda, (2014), "Private equity, jobs, and productivity," *American Economic Review* 104(12): pp. 3956-3990. An analysis using a similar methodology for approximately 5,100 private equity buyouts between 1980 and 2011 found similar results (i.e., a statistically insignificant impact on employment and significant productivity increases), but highlighted heterogeneity within the data. In particular, on average, public-to-private buyouts resulted in significant employment declines and private-to-private buyouts and secondary deals resulted in significant employment increases. See Steven J. Davis, John Haltiwanger, Kyle Handley, Ben Lipsius, Josh Lerner, and Javier Miranda, (2019), "The Social Impact of Private Equity Over the Economic Cycle."

[2] Proprietor income includes the payments received by self-employed individuals and unincorporated business owners.

[3] Companies are classified based on the North American Industry Classification System (NAICS), which is commonly used for industry classification in government statistics. Company NAICS classifications were generally identified using Dun & Bradstreet. All numbers are prorated to account for cases where private equity owns less than 100% of a company.

[4] The only available employment data from PitchBook on US private equity firms was for the number of investment professionals. This report estimated the total number of employees at US private equity firms based on the ratio of non-investment professionals to investment professionals for the securities, commodity contracts, and other financial investments and related activities industry with data from the US Bureau of Labor Statistics.

[5] EY was provided data on 2022 private equity-backed companies by PitchBook. Private equity-backed companies only included those headquartered in the United States with an ownership status of privately held (backing), in IPO registration, or publicly held. Companies backed by venture capital were not included in these data. In order to classify each company based on the NAICS hierarchy, as well as supplement PitchBook's data with additional employment data for entities lacking this information through PitchBook, the PitchBook company list was matched to data from Dun & Bradstreet (D&B). The resulting dataset was reviewed and cleaned as per the following steps: verifying NAICS code matching for a subset of companies, as well as additional review of the top 250 companies (based on PitchBook employment data, or D&B employment data when PitchBook data was missing).

The next step of the data cleaning procedure was to verify NAICS code matching for a subset of companies, given that certain issues arise in the process of matching PitchBook data to D&B data. For instance, certain companies were classified under NAICS codes associated with holding companies as opposed to the NAICS code associated with the company's primary activity. In addition, companies may have been matched incorrectly, resulting in an incorrect NAICS code classification, or a NAICS code may simply not be provided. To address these issues, EY manually reviewed the NAICS codes for the top 250 companies (based on PitchBook employment data, or D&B employment data when PitchBook data was missing), and when errors were identified, manually updated the NAICS codes based on PitchBook descriptions of the company's primary function.

For the top 250 companies, EY verified whether there are active investors in the business according to PitchBook, and manually reviewed and excluded transactions involving portfolio acquisitions.

The wages and benefits paid to employees of private equity-backed companies and GDP generated by private equity-backed companies were estimated from industry averages with the IMPLAN model, which is discussed in the appendix to this report.

[6] This $80,000 is computed prior to rounding the wages and benefits and employment estimates. In particular, the $1 trillion of wages and benefits is approximately $961 billion and 12 million employees is approximately 11.957 million employees.

[7] The $80,000 average wage estimated in this analysis is based on industry-level labor income data from the IMPLAN model. Accordingly, the comparable average wage is the average wage for the overall US economy in the IMPLAN model, which is approximately $73,000. The main IMPLAN economic data sources are Census of Employment and Wages (Bureau of Labor Statistics), Regional Economic Accounts (Bureau of Economic Analysis), County Business Patterns (Census Bureau), and National Income and Product Accounts (Bureau of Economic Analysis).

[8] In particular, the average wages and benefits per worker number was converted to a full-time equivalent average wages and benefits per worker number and then divided by the number of hours a full-time worker works. This estimate assumes that a full-time worker works 40 hours per week 52 weeks a year (i.e., 2,080 hours).

[9] In order to calculate the median wage of employees in the private equity sector, this analysis used the American Community Survey (ACS) 2021 micro-level data of individual wage earners. The ACS is a survey conducted by the US Census Bureau that is representative of the overall United States. In particular, this analysis assumes that the wage distribution of employees in the private equity sector, by industry, follows that of the overall United States. This

assumption then facilitates the calculation of a median wage for the private equity sector. This calculation excludes proprietor income.

[10] As discussed in endnote 9, to calculate the median wage of employees in the private equity sector, this analysis used the American Community Survey (ACS) 2021 micro-level data of individual wage earners. The comparable calculation of median earnings for the overall US economy is approximately $50,000 (full-time, year-round workers 16 years and over with earnings).

[11] This is 2022 US GDP as reported by the US Bureau of Economic Analysis.

[12] A key point is that an economic impact analysis typically attempts to estimate impacts that net out shifts in economy activity across industries and sectors as the economy moves from its initial equilibrium to its new equilibrium. In contrast, an economic contribution analysis shows the gross amount of economic activity tied to an industry or sector directly, and through its suppliers and related consumer spending. The EY Quantitative Economics and Statistics (QUEST) practice has other modeling frameworks it uses to account for the shifts in economic activity and estimate net impacts.

Financial Stability Report

May 2023

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM

The Federal Reserve System is the central bank of the United States. It performs five key functions to promote the effective operation of the U.S. economy and, more generally, the public interest.

The Federal Reserve

- **conducts the nation's monetary policy** to promote maximum employment and stable prices in the U.S. economy;
- **promotes the stability of the financial system** and seeks to minimize and contain systemic risks through active monitoring and engagement in the U.S. and abroad;
- **promotes the safety and soundness of individual financial institutions** and monitors their impact on the financial system as a whole;
- **fosters payment and settlement system safety and efficiency** through services to the banking industry and the U.S. government that facilitate U.S.-dollar transactions and payments; and
- **promotes consumer protection and community development** through consumer-focused supervision and examination, research and analysis of emerging consumer issues and trends, community economic development activities, and administration of consumer laws and regulations.

To learn more about us, visit www.federalreserve.gov/aboutthefed.htm.

Contents

Note: This report generally reflects information that was available as of April 21, 2023.

Purpose and Framework

This report presents the Federal Reserve Board's current assessment of the stability of the U.S. financial system. By publishing this report, the Board intends to promote public understanding by increasing transparency around, and creating accountability for, the Federal Reserve's views on this topic. Financial stability supports the objectives assigned to the Federal Reserve, including full employment and stable prices, a safe and sound banking system, and an efficient payments system.

A financial system is considered stable when banks, other lenders, and financial markets are able to provide households, communities, and businesses with the financing they need to invest, grow, and participate in a well-functioning economy—and can do so even when hit by adverse events, or "shocks."

Consistent with this view of financial stability, the Federal Reserve Board's monitoring framework distinguishes between shocks to, and vulnerabilities of, the financial system. Shocks are inherently difficult to predict, while vulnerabilities, which are the aspects of the financial system that would exacerbate stress, can be monitored as they build up or recede over time. As a result, the framework focuses primarily on assessing vulnerabilities, with an emphasis on four broad categories and how those categories might interact to amplify stress in the financial system.[1]

More on the Federal Reserve's Monitoring Efforts

See the Financial Stability section of the Federal Reserve Board's website for more information on how the Federal Reserve monitors the stability of the U.S. and world financial systems.

The website includes:

- a more detailed look at our monitoring framework for assessing risk in each category;
- more data and research on related topics;
- information on how we coordinate, cooperate, and otherwise take action on financial system issues; and
- public education resources describing the importance of our efforts.

1. **Valuation pressures** arise when asset prices are high relative to economic fundamentals or historical norms. These developments are often driven by an increased willingness of investors to take on risk. As such, elevated valuation pressures may increase the possibility of outsized drops in asset prices (see Section 1, Asset Valuations).

[1] For a review of the research literature in this area, see Tobias Adrian, Daniel Covitz, and Nellie Liang (2015), "Financial Stability Monitoring," *Annual Review of Financial Economics*, vol. 7 (December), pp. 357–95.

2. Excessive **borrowing by businesses and households** exposes the borrowers to distress if their incomes decline or the assets they own fall in value. In these cases, businesses and households with high debt burdens may need to cut back spending, affecting economic activity and causing losses for investors (see Section 2, Borrowing by Businesses and Households).
3. Excessive **leverage within the financial sector** increases the risk that financial institutions will not have the ability to absorb losses without disruptions to their normal business operations when hit by adverse shocks. In those situations, institutions will be forced to cut back lending, sell their assets, or even shut down. Such responses can impair credit access for households and businesses, further weakening economic activity (see Section 3, Leverage in the Financial Sector).
4. **Funding risks** expose the financial system to the possibility that investors will rapidly withdraw their funds from a particular institution or sector, creating strains across markets or institutions. Many financial institutions raise funds from the public with a commitment to return their investors' money on short notice, but those institutions then invest much of those funds in assets that are hard to sell quickly or have a long maturity. This liquidity and maturity transformation can create an incentive for investors to withdraw funds quickly in adverse situations. Facing such withdrawals, financial institutions may need to sell assets quickly at "fire sale" prices, thereby incurring losses and potentially becoming insolvent, as well as causing additional price declines that can create stress across markets and at other institutions (see Section 4, Funding Risks).

The Federal Reserve's monitoring framework also tracks domestic and international developments to identify near-term risks—that is, plausible adverse developments or shocks that could stress the U.S. financial system. The analysis of these risks focuses on assessing how such potential shocks may spread through the U.S. financial system, given our current assessment of vulnerabilities.

While this framework provides a systematic way to assess financial stability, some potential risks may be novel or difficult to quantify and therefore are not captured by the current approach. Given these complications, we rely on ongoing research by the Federal Reserve staff, academics, and other experts to improve our measurement of existing vulnerabilities and to keep pace with changes in the financial system that could create new forms of vulnerabilities or add to existing ones.

Federal Reserve actions to promote the resilience of the financial system

The assessment of financial vulnerabilities informs Federal Reserve actions to promote the resilience of the financial system. The Federal Reserve works with other domestic agencies directly and through the Financial Stability Oversight Council (FSOC) to monitor risks to financial stability and to undertake supervisory and regulatory efforts to mitigate the risks and consequences of financial instability.

Actions taken by the Federal Reserve to promote the resilience of the financial system include its supervision and regulation of financial institutions. In the aftermath of the 2007–09 financial crisis, these actions have included requirements for more and higher-quality capital, an innovative stress-testing regime, and new liquidity regulations applied to the largest banks in the United States. In addition, the Federal Reserve's assessment of financial vulnerabilities informs decisions regarding the countercyclical capital buffer (CCyB). The CCyB is designed to increase the resilience of large banking organizations when there is an elevated risk of above-normal losses and to promote a more sustainable supply of credit over the economic cycle.

Overview

This report reviews conditions affecting the stability of the U.S. financial system by analyzing vulnerabilities related to valuation pressures, borrowing by businesses and households, financial-sector leverage, and funding risks. It also highlights several near-term risks that, if realized, could interact with these vulnerabilities.

Since the November 2022 *Financial Stability Report* was released, Silicon Valley Bank (SVB), Signature Bank, and First Republic Bank failed following substantial deposit outflows prompted by concerns over poor management of interest rate risk and liquidity risk. In March, to prevent broader spillovers in the banking system, the Federal Reserve, together with the Federal Deposit

Overview of financial system vulnerabilities

Asset valuations

- Yields on Treasury securities declined across all maturities in March amid heightened financial market volatility.
- Risk premiums in equity and corporate bond markets continued to be near the middle of their historical distributions.
- Real estate valuations remained very elevated even though activity weakened. Both house prices and commercial property prices have shown recent declines.

Borrowing by businesses and households

- The ratio of total private debt to gross domestic product (GDP) edged down but was still at a moderate level.
- The business debt-to-GDP ratio remained at a high level, but debt issuance by the riskiest companies slowed markedly. Interest coverage ratios for publicly traded firms declined a bit from historically high levels.
- Household debt remained at modest levels relative to GDP and was concentrated among prime-rated borrowers.

Leverage in the financial sector

- Poor management of interest rate risk and liquidity risk contributed to three sizable bank failures since March 2023. Concerns over broader spillovers in the banking sector led to official interventions by the Federal Reserve, the Federal Deposit Insurance Corporation, and the U.S. Department of Treasury.
- Broker-dealer leverage rested near historically low levels. The limited willingness and ability of dealers to intermediate during times of distress can amplify volatility.
- Hedge fund leverage remained elevated. Bank lending to nonbank financial institutions stabilized at high levels.

Funding risks

- Some banks experienced notable funding strains following the failures of Silicon Valley Bank and Signature Bank. The actions by the official sector reduced funding strains in the banking system.
- Structural vulnerabilities persisted at money market funds, other cash-management vehicles, and stablecoins. Certain types of mutual funds continued to be susceptible to large redemptions.
- Liquidity risks for life insurers remained elevated as the share of illiquid and risky assets continued to edge up.

Insurance Corporation (FDIC) and the Department of the Treasury, took decisive actions to protect bank depositors and support the continued flow of credit to households and businesses. Owing to these actions and the resilience of the banking and financial sector, financial markets normalized, and deposit flows have stabilized since March, although some banks that experienced large deposit outflows continued to experience stress. These developments may weigh on credit conditions going forward.

A summary of the developments in the four broad categories of vulnerabilities since the last report is as follows:

1. **Asset valuations.** Yields on Treasury securities declined in March amid heightened financial market volatility. Measures of equity prices relative to expected earnings were volatile over the period but remained above their historical median, while risk premiums in corporate bond markets stayed near the middle of their historical distributions. Valuations in residential real estate remained elevated despite weakening activity. Similarly, commercial real estate (CRE) valuations remained near historically high levels, even as price declines have been widespread across CRE market segments (see Section 1, Asset Valuations).
2. **Borrowing by businesses and households.** On balance, vulnerabilities arising from borrowing by nonfinancial businesses and households were little changed since the November report and remained at moderate levels. Business debt remained elevated relative to gross domestic product (GDP), and measures of leverage remained in the upper range of their historical distributions, although there are indications that business debt growth began to slow toward the end of last year. Measures of the ability of firms to service their debt stayed high. Household debt remained at modest levels relative to GDP, and most of that debt is owed by households with strong credit histories or considerable home equity (see Section 2, Borrowing by Businesses and Households).
3. **Leverage in the financial sector.** Concerns over heavy reliance on uninsured deposits, declining fair values of long-duration fixed-rate assets associated with higher interest rates, and poor risk management led market participants to reassess the strength of some banks (discussed in the box "The Bank Stresses since March 2023"). Overall, the banking sector remained resilient, with substantial loss-absorbing capacity. Broker-dealer leverage remained historically low. Leverage at life insurance companies edged up but stayed below its pandemic peak. Hedge fund leverage remained elevated, especially for large hedge funds (see Section 3, Leverage in the Financial Sector).
4. **Funding risks.** Substantial withdrawals of uninsured deposits contributed to the failures of SVB, Signature Bank, and First Republic Bank and led to increased funding strains for some other banks, primarily those that relied heavily on uninsured deposits and had substantial interest rate risk exposure. Policy interventions by the Federal Reserve and other agencies helped mitigate these strains and limit the potential for further stress (discussed in the box

"The Federal Reserve's Actions to Protect Bank Depositors and Support the Flow of Credit to Households and Businesses"). Overall, domestic banks have ample liquidity and limited reliance on short-term wholesale funding. Structural vulnerabilities remained in short-term funding markets. Prime and tax-exempt money market funds (MMFs), as well as other cash-investment vehicles and stablecoins, remained vulnerable to runs. Certain types of bond and loan funds experienced outflows and remained susceptible to large redemptions, as they hold securities that can become illiquid during periods of stress. Life insurers continued to have elevated liquidity risks, as the share of risky and illiquid assets remained high (see Section 4, Funding Risks).

This report also discusses potential near-term risks based in part on the most frequently cited risks to U.S. financial stability as gathered from outreach to a wide range of researchers, academics, and market contacts conducted from February to April (discussed in the box "Survey of Salient Risks to Financial Stability"). Frequently cited topics in this survey included persistent inflation and tighter monetary policy, banking-sector stress, commercial and residential real estate, and geopolitical tensions. The box "Transmission of Stress Abroad to the U.S. Financial System" describes how financial stresses abroad can spill over to the U.S. financial system.

Finally, the report contains additional boxes that analyze salient topics related to financial stability: "Update on the Transition to the Secured Overnight Financing Rate," "Financial Institutions' Exposure to Commercial Real Estate Debt," and "Financial Stability Risks from Private Credit Funds Appear Limited."

Survey of salient risks to the U.S. financial system

Survey respondents cited several risks to the U.S. financial system. For more information, see the box "Survey of Salient Risks to Financial Stability."

	Persistent inflation; monetary tightening	Banking-sector stress	U.S.–China tensions	Commercial and residential real estate	Russia–Ukraine war
May 2023	56% of contacts surveyed	56% of contacts surveyed	56% of contacts surveyed	52% of contacts surveyed	52% of contacts surveyed
November 2022	62% of contacts surveyed	12% of contacts surveyed	42% of contacts surveyed	12% of contacts surveyed	62% of contacts surveyed

1 | Asset Valuations

Asset valuation pressures remained moderate despite notable fluctuations in financial markets

Since the November report, significant strains in the banking sector, along with increased uncertainty about the economic outlook and the path of monetary policy, led to notable fluctuations in financial asset prices. Yields on Treasury securities declined across all maturities. Broad equity indexes were volatile but have increased, on net, since the previous report. Corporate credit spreads were moderately lower, on net, and near their historical averages.

Liquidity in short-term Treasury markets experienced notable strains associated with the high volatility and elevated uncertainty that roiled financial markets in the middle of March, while equity and corporate bond markets also saw liquidity deteriorate during that period. Despite these worsened liquidity conditions, market functioning proved largely resilient.

As has been the case for some time now, valuation pressures remained elevated in property markets. In residential real estate, valuations remained near all-time highs despite weakening activity and falling prices in recent months. Valuations in the commercial segment also remained near historical highs even though price declines have been widespread. In addition, fundamentals have weakened, particularly for the office segment. Farmland prices were also historically elevated relative to rents, reflecting higher crop prices and limited inventories of land.

Table 1.1 shows the sizes of the asset markets discussed in this section. The largest asset markets are those for residential real estate, equities, Treasury securities, and CRE.

Treasury yields declined sharply following the Silicon Valley Bank and Signature Bank failures, particularly for shorter-maturity securities

On net, yields on Treasury securities moved lower since the November report (figure 1.1). However, the monthly averages plotted in the figure obscure some important daily movements during the month of March. Throughout February and into early March, the yields on Treasury securities moved notably higher following stronger-than-expected economic data but abruptly reversed course following the failures of SVB and Signature Bank. These failures raised uncertainty about the economic outlook and future path of interest rates, prompting investors to reallocate portfolios toward safer assets. The market for two-year Treasury securities was most acutely affected, with the two-year yield falling by more than 60 basis points on March 13, the single largest daily decline since 1987. Yields on longer-term Treasury securities also declined in March, but by a smaller amount.

Table 1.1. Size of selected asset markets

Item	Outstanding (billions of dollars)	Growth, 2021:Q4–2022:Q4 (percent)	Average annual growth, 1997–2022:Q4 (percent)
Residential real estate	55,670	10.4	6.4
Equities	46,819	−21.0	8.7
Treasury securities	23,845	5.7	8.1
Commercial real estate	23,796	−1.4	6.8
Investment-grade corporate bonds	7,116	4.8	8.1
Farmland	3,188	10.1	5.7
High-yield and unrated corporate bonds	1,677	−6.6	6.6
Leveraged loans*	1,424	6.2	13.9
Price growth (real)			
Commercial real estate**		−1.9	3.1
Residential real estate***		.3	2.5

Note: The data extend through 2022:Q4. Growth rates are measured from Q4 of the year immediately preceding the period through Q4 of the final year of the period. Equities, real estate, and farmland are at nominal market value; bonds and loans are at nominal book value.

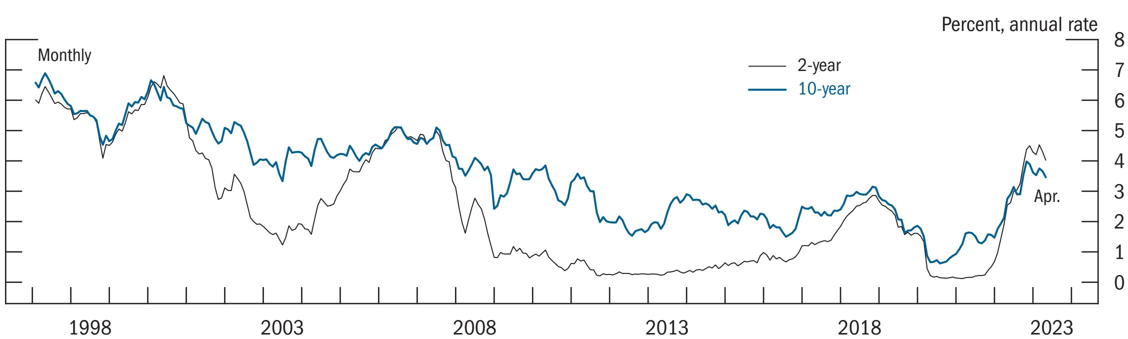
* The amount outstanding shows institutional leveraged loans and generally excludes loan commitments held by banks. For example, lines of credit are generally excluded from this measure. Average annual growth of leveraged loans is from 2000 to 2022:Q4, as this market was fairly small before then.

** One-year growth of commercial real estate prices is from December 2021 to December 2022, and average annual growth is from 1998:Q4 to 2022:Q4. Both growth rates are calculated from equal-weighted nominal prices deflated using the consumer price index (CPI).

*** One-year growth of residential real estate prices is from December 2021 to December 2022, and average annual growth is from 1997:Q4 to 2022:Q4. Nominal prices are deflated using the CPI.

Source: For leveraged loans, PitchBook Data, Leveraged Commentary & Data; for corporate bonds, Mergent, Inc., Fixed Income Securities Database; for farmland, Department of Agriculture; for residential real estate price growth, CoreLogic, Inc.; for commercial real estate price growth, CoStar Group, Inc., CoStar Commercial Repeat Sale Indices; for all other items, Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States."

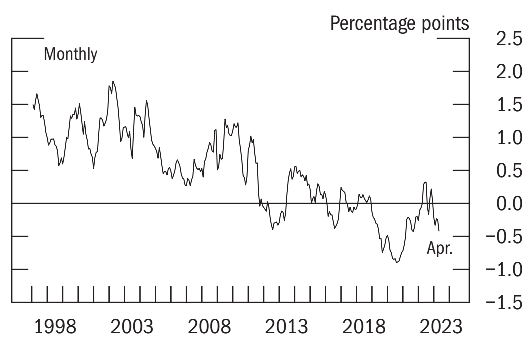
Figure 1.1. Nominal Treasury yields fell in March and April



Source: Federal Reserve Board, Statistical Release H.15, "Selected Interest Rates."

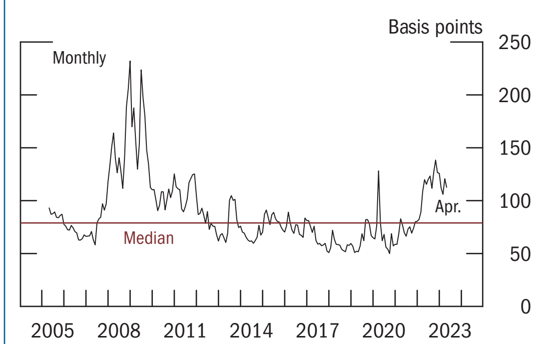
A model-based estimate of the nominal Treasury term premium—a measure of the compensation that investors require to hold longer-term Treasury securities rather than shorter-term ones—remained low relative to its long-run history (figure 1.2). Treasury market volumes, particularly in the on-the-run segment, increased dramatically in March as well. Interest rate volatility implied by options remained well above its historical median (figure 1.3).

Figure 1.2. An estimate of the nominal Treasury term premium remained low



Source: Department of the Treasury; Wolters Kluwer, Blue Chip Financial Forecasts; Federal Reserve Bank of New York; Federal Reserve Board staff estimates.

Figure 1.3. Interest rate volatility remained above its long-term median



Source: For data through July 13, 2022, Barclays Trading and IHS Markit; for data from July 14, 2022, onward, ICAP, Swaptions and Interest Rate Caps and Floors Data.

Equity market valuation pressures increased modestly

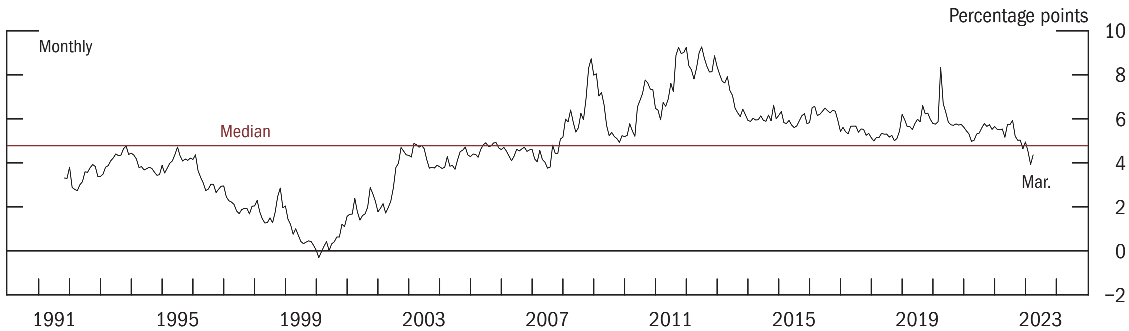
Equity prices in the banking sector fell following the SVB and Signature Bank failures to levels well below those that prevailed at the time of the November report. Broad equity indexes experienced considerable volatility but, smoothing through the ups and downs, were up a bit from the previous report. All told, equity market valuation pressures increased modestly since the November report as equity price growth outpaced growth in earnings forecasts, pushing the forward price-to-earnings ratio higher to a level notably above its historical average (figure 1.4).

Figure 1.4. The price-to-earnings ratio of S&P 500 firms continued to be above its historical median

Source: Federal Reserve Board staff calculations using Refinitiv, Institutional Brokers' Estimate System.

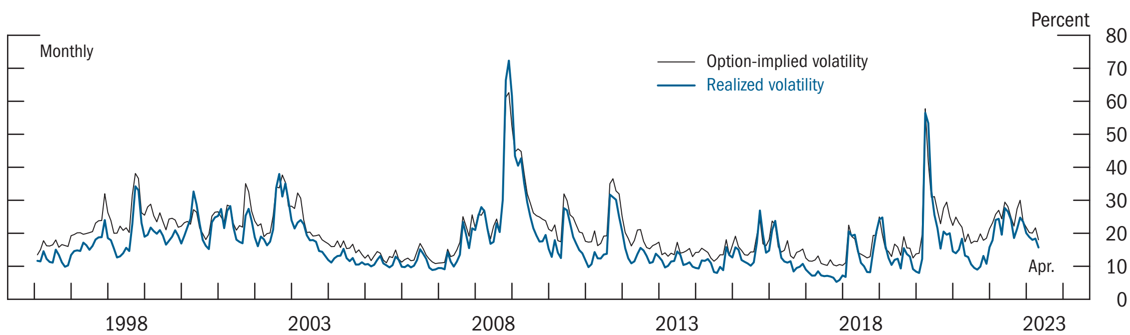
An estimate of the expected equity premium—one measure of the additional return that investors require for holding stocks relative to risk-free bonds—declined since the November report to somewhat below its historical median (figure 1.5).[2] Equity market volatility remained elevated during the first quarter of 2023, reflecting strains in the banking system and continued uncertainty around monetary policy and future economic conditions, but fell to near its historical median in April (figure 1.6).

Figure 1.5. An estimate of the equity premium fell below its historical median



Source: Federal Reserve Board staff calculations using Refinitiv (formerly Thomson Reuters), Institutional Brokers' Estimate System; Department of the Treasury; Federal Reserve Bank of Philadelphia, Survey of Professional Forecasters.

Figure 1.6. Volatility in equity markets remained elevated



Source: Refinitiv, DataScope Tick History; Federal Reserve Board staff estimates.

Market liquidity worsened in key markets amid heightened uncertainty

Market liquidity refers to the ease and cost of buying and selling an asset. Low liquidity can amplify the volatility of asset prices and result in larger price moves in response to shocks. In extreme cases, low liquidity can threaten market functioning, leading to a situation in which participants are unable to trade without incurring a significant cost.

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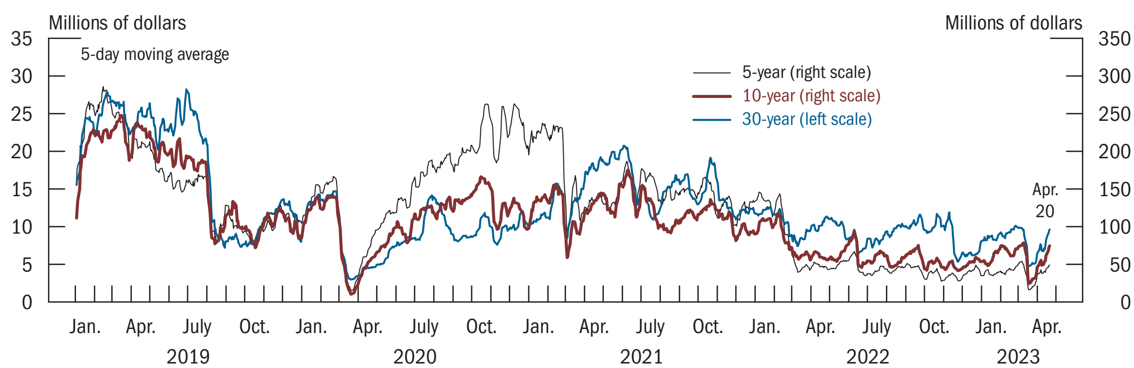
[2] This estimate is constructed based on expected corporate earnings for 12 months ahead. Alternative measures of the equity premium that incorporate longer-term earnings forecasts suggest more elevated equity valuation pressures.

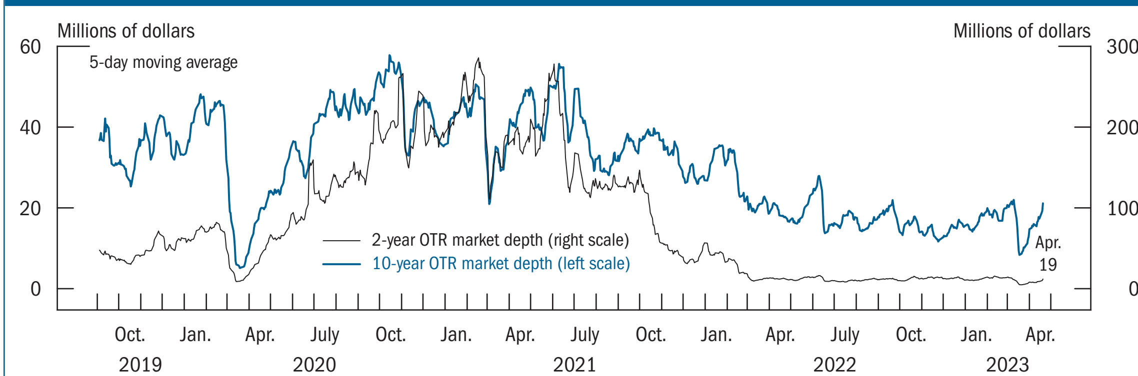
Liquidity conditions in the market for Treasury securities are particularly important due to the key role those securities play in the financial system. Throughout much of last year and into early 2023, various measures of liquidity—the average size of bid and ask orders posted on electronic platforms at the best prices ("market depth") and bid-ask spreads—indicated that liquidity in the Treasury market was lower and less resilient than is typical.[3] Market liquidity conditions came under even greater strain as a result of distress in the banking sector. Market depth in on-the-run Treasury securities, normally the most liquid segment, fell substantially in mid-March (figures 1.7 and 1.8), and bid-ask spreads rose marketwide, with particularly notable increases for shorter-maturity notes. Further, the intraday volatility of bid-ask spreads on short-maturity securities rose to levels last seen in March 2020.[4] These additional liquidity strains in March 2023 appeared to

Figure 1.7. Treasury market depth remained below historical norms



Source: Inter Dealer Broker Community.

Figure 1.8. On-the-run market depth worsened in March then recovered



Source: BrokerTec; Federal Reserve Board staff calculations.

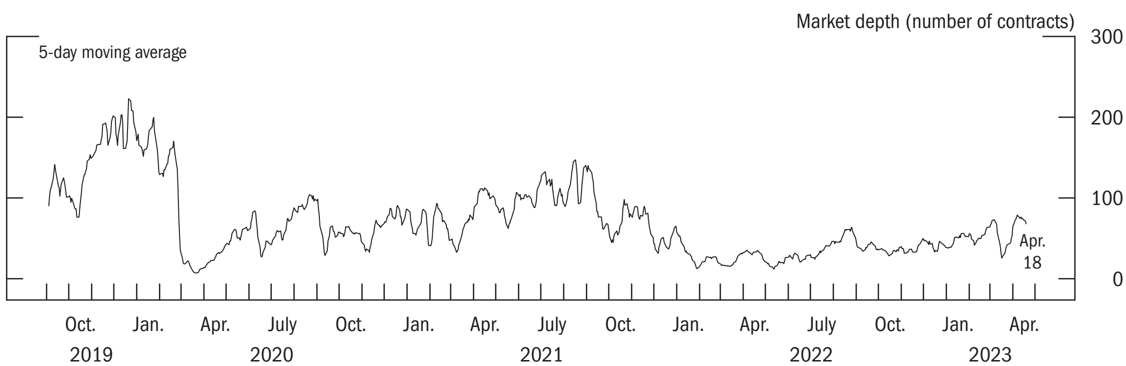
3 The bid-ask spread is the difference between the best "bid" quote to buy an asset and the best "ask" quote to sell that asset; smaller bid-ask spreads indicate lower trading costs and, hence, more liquid markets.

4 For further discussions about the liquidity risks posed by volatile bid-ask spreads, see Dobrislav Dobrev and Andrew Meldrum (2020), "What Do Quoted Spreads Tell Us about Machine Trading at Times of Market Stress? Evidence from Treasury and FX Markets during the COVID-19-Related Market Turmoil in March 2020," FEDS Notes (Washington: Board of Governors of the Federal Reserve System, September 25), https://doi.org/10.17016/2380-7172.2748.

be a consequence of the elevated interest rate volatility that followed the heightened uncertainty around the future economic outlook and path of monetary policy. Despite these strains, Treasury markets continued to function throughout the episode without severe dislocations or reports of investors being unable to transact. By early April, the most acute strains had dissipated, and liquidity conditions in Treasury markets returned to the levels that prevailed for much of the past year.

Liquidity deteriorated in a range of other markets in March as well. Bid-ask spreads on corporate bonds widened, particularly for investment-grade financial bonds, although these spreads remained well below pandemic levels. In equity markets, depth in the S&P 500 futures markets declined before stabilizing at below-average levels (figure 1.9). Equity and corporate bond market functioning remained largely smooth despite the rising transaction costs associated with lower liquidity, and liquidity conditions normalized by early April.

Figure 1.9. A measure of liquidity in equity markets fell sharply in March



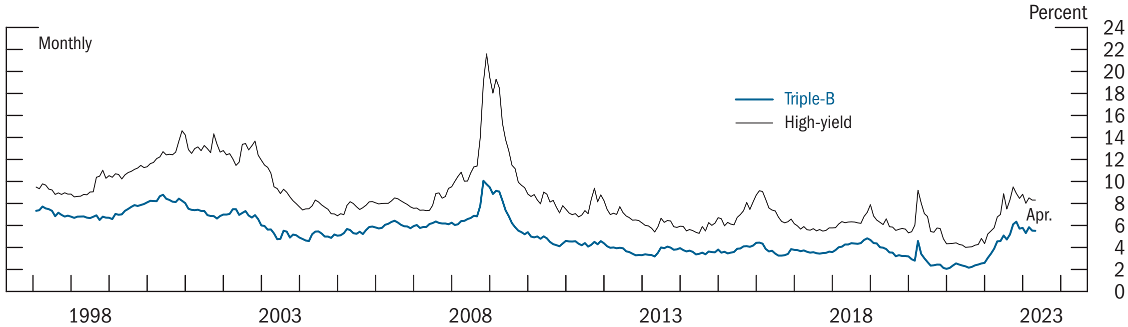
Source: Refinitiv, DataScope Tick History; Federal Reserve Board staff calculations.

Corporate debt market valuations remained near their historical averages

Yields on corporate bonds fell since the November report and by more than yields on comparable-maturity Treasury securities (figure 1.10). Consequently, corporate bond spreads, measured as the difference in yields between corporate bonds and comparable-maturity Treasury securities, were moderately lower since November and near their historical average levels (figure 1.11). The excess bond premium—a measure that captures the gap between corporate bond spreads and expected credit losses—has remained near its historical average (figure 1.12).

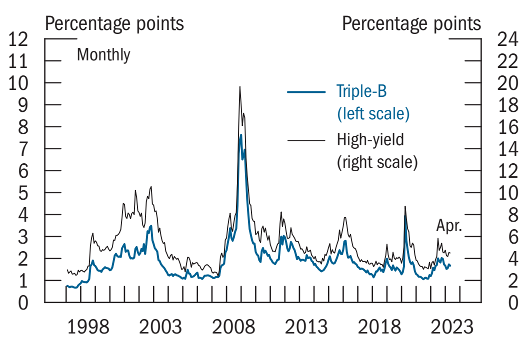
Valuation pressures in leveraged loan markets were little changed from the November report. The average spread on leveraged loans above their benchmark rates in the secondary market declined moderately and was near its average over the past decade (figure 1.13). The excess loan

Figure 1.10. Corporate bond yields fell to near their historical averages



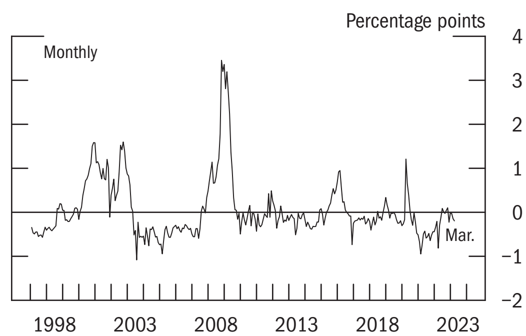
Source: ICE Data Indices, LLC, used with permission.

Figure 1.11. Spreads to similar-maturity Treasury securities edged down



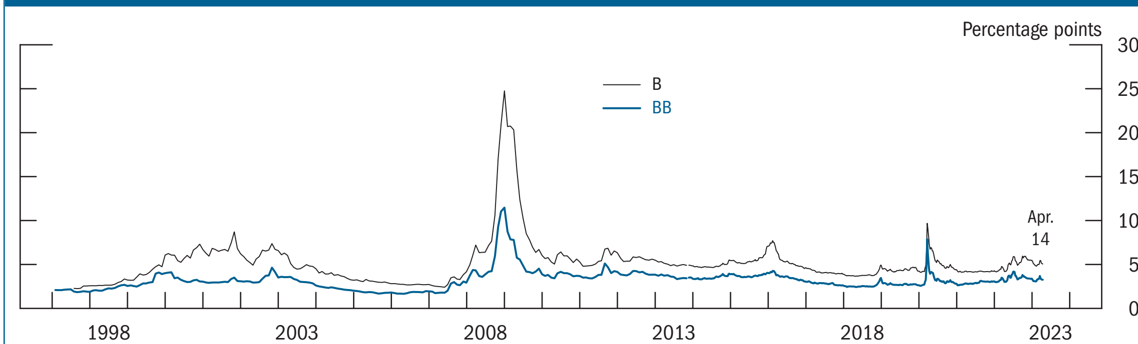
Source: ICE Data Indices, LLC, used with permission.

Figure 1.12. The excess bond premium stayed near its historical average



Source: Federal Reserve Board staff calculations based on Lehman Brothers Fixed Income Database (Warga); Intercontinental Exchange, Inc., ICE Data Services; Center for Research in Security Prices, CRSP/Compustat Merged Database, Wharton Research Data Services; S&P Global, Compustat.

Figure 1.13. Spreads in the leveraged loan market fell modestly



Source: PitchBook Data, Leveraged Commentary & Data.

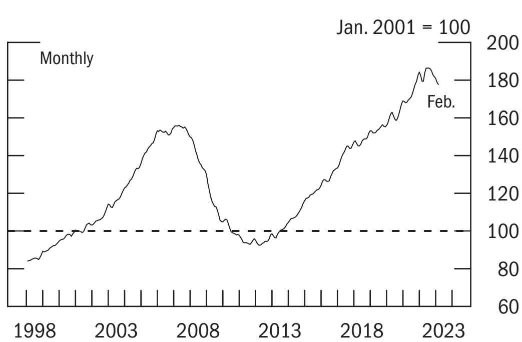
premium, a measure of the risk premium in leveraged loans, increased notably during March and remained at an elevated level, indicating subdued investor risk appetite. The trailing 12-month loan default rate increased moderately but remained somewhat below its historical median, while the year-ahead expected default rate rose moderately, suggesting a mild deterioration of the credit quality of leveraged loan borrowers and a worsening outlook.

The transition away from LIBOR as the benchmark rate in the leveraged loan market was nearly complete, with almost all new leveraged loan activity being conducted using the Secured Overnight Financing Rate (SOFR) (see the box "Update on the Transition to the Secured Overnight Financing Rate").

Commercial real estate prices declined, but valuations remained high

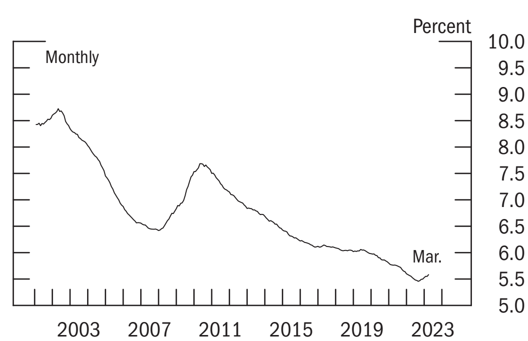
Valuation pressures in the CRE sector have eased slightly since the November report but remained at high levels. Aggregate CRE prices measured in inflation-adjusted terms have declined (figure 1.14). These prices are based on repeat sales and may mask growing weaknesses, as more distressed properties are generally less likely to trade. Capitalization rates at the time of property purchase, which measure the annual income of commercial properties relative to their prices, have turned up modestly from their historically low levels (figure 1.15). While price declines were widespread across all property types, fundamentals in the office sector were particularly weak for offices in central business districts, with vacancy rates increasing further and rent growth declining since the November report. In the January 2023 Senior Loan Officer Opinion Survey (SLOOS), banks reported weaker demand and tighter standards for all CRE loan categories over

Figure 1.14. Commercial real estate prices, adjusted for inflation, declined



Source: CoStar Group, Inc., CoStar Commercial Repeat Sale Indices; consumer price index, Bureau of Labor Statistics via Haver Analytics.

Figure 1.15. Income of commercial properties relative to prices turned up but remained near historically low levels



Source: Real Capital Analytics; Andrew C. Florance, Norm G. Miller, Ruijue Peng, and Jay Spivey (2010), "Slicing, Dicing, and Scoping the Size of the U.S. Commercial Real Estate Market," *Journal of Real Estate Portfolio Management,* vol. 16 (May–August), pp. 101–18.

Box 1.1. Update on the Transition to the Secured Overnight Financing Rate

The banks contributing to the U.S. dollar (USD) LIBOR rates are due to end their submissions after June 30, 2023, marking the end of LIBOR as a representative benchmark. The transitions from the euro, Swiss franc, Japanese yen, and sterling LIBOR rates, which ended last year, went smoothly, but the transition from USD LIBOR poses particular risks because of the very large exposures to these rates both domestically and abroad. The Alternative Reference Rates Committee (ARRC) has estimated that USD LIBOR is used in $74 trillion of financial contracts maturing after June 2023, and it is also used extensively in nonfinancial contracts.

New activity

Following guidance issued by the Federal Reserve, FDIC, and Office of the Comptroller of the Currency warning that most new use of USD LIBOR in contracts after 2021 would create safety and soundness risks, almost all new transactions have moved to SOFR. Adjustable-rate retail mortgage originations and almost all floating-rate debt issuance are now based on SOFR, and SOFR represents more than 90 percent of risk traded in new derivatives activity. Although SOFR just began publication in 2018, there are now more than $60 trillion of SOFR derivatives and $4 trillion in SOFR loans and debt instruments outstanding.

While most new derivatives, floating-rate debt, and consumer products reference SOFR or averages of SOFR directly, the bulk of new lending activity has moved to term SOFR rates. The term SOFR rates are forward-looking benchmarks with 1-, 3-, 6- , and 12-month maturities similar to LIBOR. They are derivatives products based on futures markets for SOFR rather than drawing directly from transactions in the Treasury repurchase agreement (repo) market that overnight SOFR is based on and, thus, depend on the continued high level of transaction depth in overnight SOFR futures and other derivatives markets in order to be robustly produced.

Recently, CME Group, the administrator of the term SOFR rates, has moved to explicitly incorporate limits on the use of its rates that mirror the ARRC's recommendations in its licensing agreements, which should help ensure that use of these rates remains in line with financial stability considerations. The FSOC and Financial Stability Board have both recognized the use of these types of term rates in legacy LIBOR cash products and some business loans but have warned against more widespread use. In line with these recommendations, the ARRC has recognized the use of term SOFR rates as a fallback in legacy cash products and certain new issuances of cash products, particularly business loans, but has recommended that use of term SOFR rates in derivatives and most other cash markets remain limited.

Legacy products

In December, the Board issued its final rule implementing the Adjustable Interest Rate (LIBOR) Act (LIBOR Act). The LIBOR Act directed the Board to select spread-adjusted benchmark replacements based on SOFR for LIBOR contracts that mature after June 30, 2023, and do not have clear and practicable fallback language. While the International Swaps and Derivatives Association and the ARRC have worked over the past several years to develop and encourage the use of fallback language that adequately addresses the impending cessation of LIBOR, many older contracts only have fallbacks appropriate for a temporary outage of LIBOR rather than its permanent cessation, and some contracts do not have any fallbacks at all. This is a particular problem for legacy floating-rate debt, securitizations, and consumer products, all of which are difficult to amend. The Board's final rule will replace (or allow for the replacement of) LIBOR in these products with spread-adjusted versions of CME Group's term SOFR rates or averages of SOFR following June 30, 2023.

(continued)

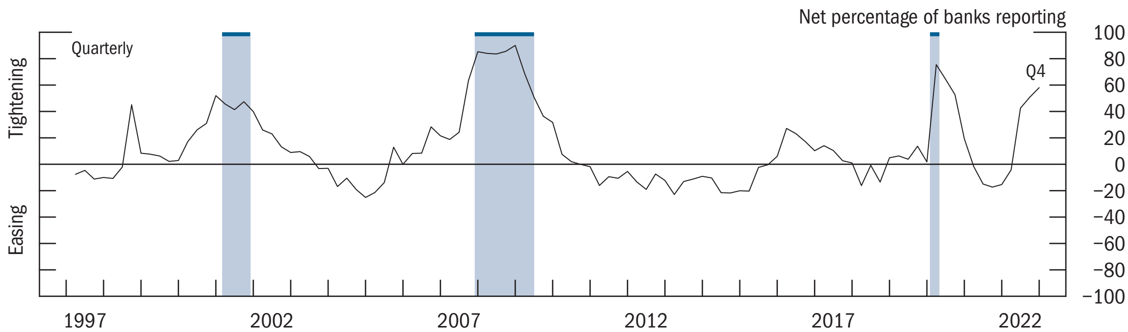
Box 1.1—*continued*

While the banks submitting to the remaining USD LIBOR rate panel will withdraw as of June 30, 2023, the U.K. Financial Conduct Authority (FCA) has announced that it will require the administrator of LIBOR to continue publishing 1-, 3-, and 6-month USD LIBOR on a "synthetic" basis for an additional 15 months, through September 2024. The FCA has stated that these synthetic LIBOR rates will be nonrepresentative, meaning that, in the FCA's official judgement, they will not reflect the underlying market that LIBOR was intended to represent. The FCA has also stated that it intends the publication of these synthetic rates to help the transition of legacy contracts not subject to U.S. law and therefore not covered by the LIBOR Act. The synthetic version of USD LIBOR will be published as LIBOR but would match the spread-adjusted term SOFR rates that the Board has selected under the LIBOR Act as the benchmark replacement rate applicable to most nonconsumer cash products. Most contracts under U.S. law will not be affected by the publication of these synthetic rates either because they have more recent fallback language designed to move away from LIBOR once it is declared to be nonrepresentative or because they are covered by the LIBOR Act. Nonetheless, there are some contracts issued under U.S. law that would fall back to a non-LIBOR rate (and so are not covered by the LIBOR Act) that may reference the synthetic LIBOR rates, primarily older loan agreements that otherwise would fall back to the prime rate (which is much higher than LIBOR) if LIBOR is unavailable.

LCH and CME Group are implementing plans to convert outstanding LIBOR derivatives that they clear to SOFR over April and May 2023. The Board has encouraged banks to similarly remediate their LIBOR loans ahead of June 30, 2023, where feasible, citing operational risks that could arise from attempting to convert a large book of LIBOR loans in a short period of time following June 2023. While firms have set deadlines to complete the remediation of their outstanding LIBOR loans ahead of June 30, 2023, there are risks that they will fall behind schedule. Progress in remediating syndicated leveraged loans, which can require consent or nonobjection from a majority of the lenders—in many cases including nonbank financial institutions (NBFIs)—has been particularly slow, although there have been recent signs that the pace of remediation may be increasing. Many firms had planned to use refinancing as an opportunity to move these loans off of LIBOR, but refinancing activity has declined over the past year. Securities cannot easily be remediated ahead of the June 30, 2023, deadline, but the ARRC and FSOC have encouraged issuers and other relevant parties to use the Depository Trust and Clearing Corporation's LIBOR Replacement Index Communication Tool in order to inform investors about the rate changes that will take effect after June 2023.

the fourth quarter of 2022 (figure 1.16). The box "Financial Institutions' Exposure to Commercial Real Estate Debt" offers more detail on where losses might arise in the event of a significant correction in CRE prices.

Figure 1.16. Banks reported tightening lending standards in commercial real estate loans

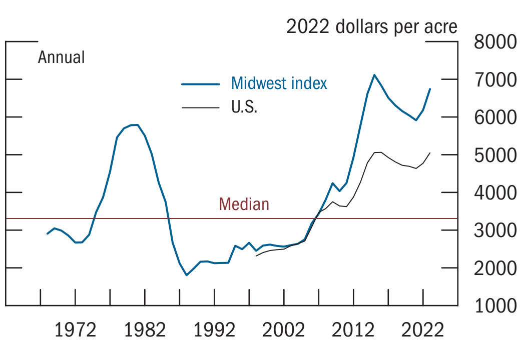


Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices; Federal Reserve Board staff calculations.

Farmland valuations remained at high levels

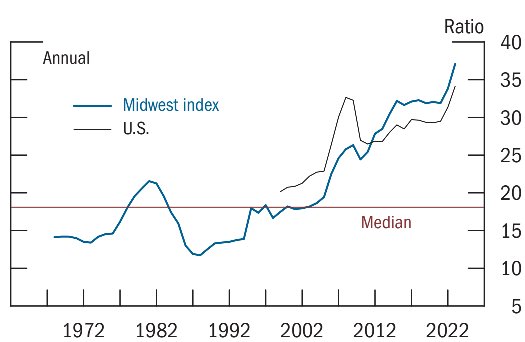
Farmland prices were near the peak values of their historical distribution, remaining unchanged since the November report (figure 1.17). Similarly, the ratios of farmland prices to rents remained historically high (figure 1.18). These high valuations were driven by strong agricultural commodity prices, limited inventory of farmland, and significant increases in cropland revenues that had more than offset higher operating costs.

Figure 1.17. Farmland prices reached near historical highs



Source: Department of Agriculture; Federal Reserve Bank of Minneapolis staff calculations.

Figure 1.18. Farmland prices grew faster than rents



Source: Department of Agriculture; Federal Reserve Bank of Minneapolis staff calculations.

Box 1.2. Financial Institutions' Exposure to Commercial Real Estate Debt

The shift toward telework in many industries has dramatically reduced demand for office space, which could lead to a correction in the values of office buildings and downtown retail properties that largely depend on office workers. Moreover, the rise in interest rates over the past year increases the risk that CRE mortgage borrowers will not be able to refinance their loans when the loans reach the end of their term. With CRE valuations remaining elevated (see Section 1, Asset Valuations), the magnitude of a correction in property values could be sizable and therefore could lead to credit losses by holders of CRE debt.[1] This discussion presents data on the exposures of various financial institutions to CRE mortgage debt, focusing on nonfarm nonresidential properties (a diverse category that includes office buildings, hotels, retail stores, and warehouses) and the construction and land development loans associated with these property types.[2]

Table A shows the dollar volume of nonfarm nonresidential CRE loans outstanding held by different categories of financial institutions. Banks hold about 60 percent of these CRE loans, of which more than two-thirds are held by banks other than Category I–IV banks.[3] Insurance companies and holders of commercial mortgage-backed securities (CMBS) also have significant exposures to CRE mortgages. Insurance companies hold higher-rated tranches of CMBS and shares of equity real estate investment trusts (REITs) that own CRE properties, so the exposure of insurance companies to CRE is larger than their exposure through whole loans shown in the table. Institutions that hold lower-rated tranches of CMBS include private equity funds, mortgage REITs, and finance companies. Mortgages specifically backed by office or downtown retail property tend to be about one-third of each set of institutions' CRE holdings, on average. That said, individual institutions can specialize in certain types of loans, so the portfolio composition of any given institution may differ from the average shown for its category. Loans for construction or land development of nonfarm nonresidential properties (included in column 1 but not shown separately) are about 15 percent of aggregate bank nonfarm nonresidential CRE holdings.

Losses on CRE loans will depend on their leverage because owners of buildings with substantial equity cushions are less likely to default. Also, loans with high loan-to-value (LTV) ratios are typically harder to refinance or modify. As of the fourth quarter of 2022, current LTVs (that is, ratios that incorporate recent estimates of building value rather than building value at loan origination) of mortgages backed by office and downtown retail properties were in the range of 50 to 60 percent, on average, for the loan-level data that are available (Category I–IV banks, insurance companies, and CMBS pools). Current LTVs were in a similar range for the broader category of nonfarm nonresidential CRE mortgages. LTVs were low for many mortgages because for most property types—retail being a notable exception—values rose materially in the years leading up to the pandemic. Even so, some CRE mortgages do have fairly high LTVs, in particular at some Category I–IV banks. Two important caveats are worth emphasizing. First, information on the LTVs of CRE mortgages held by banks other than Category I–IV banks is limited. Second, CRE property valuations are elevated, and current LTVs could rise considerably if CRE property valuations were to fall.

(continued)

1 For example, Gupta, Mittal, and Van Nieuwerburgh (2022) estimate that the shift to remote work will lead to a drop in commercial office property values of nearly 40 percent; see Arpit Gupta, Vrinda Mittal, and Stijn Van Nieuwerburgh (2022), "Work from Home and the Office Real Estate Apocalypse," NBER Working Paper Series 30526 (Cambridge, Mass.: National Bureau of Economic Research, September), https://www.nber.org/papers/w30526.

2 Specifically, this analysis does not include multifamily mortgages (for example, mortgages backed by apartment buildings) because the fundamentals of that sector are substantially different. In addition, although financial institutions are also exposed to a potential CRE market correction if they hold CRE properties directly, that channel is outside the scope of this discussion.

3 Category I banks are U.S. G-SIBs. Category II–IV banks tend to have assets greater than $100 billion and are defined according to the tailoring rule of 2019 as listed on page 2 of a visualization of the rule on the Board's website at https://www.federalreserve.gov/aboutthefed/boardmeetings/files/tailoring-rule-visual-20191010.pdf. Other banks include remaining depository institutions.

Box 1.2—*continued*

The ability of an institution to withstand CRE-related credit losses also depends critically on the fraction of loans to this sector relative to the institution's overall portfolio. Nonfarm nonresidential CRE mortgages tend to be a small share of total assets held by banks overall, but about one-fifth of total assets of banks other than Category I–IV banks. Importantly, some banks may have more concentrated exposures to CRE mortgages than average and therefore may experience higher-than-average losses should CRE conditions weaken. In response to concerns about CRE, the Federal Reserve has increased monitoring of the performance of CRE loans and expanded examination procedures for banks with significant CRE concentration risk.

Table A. Commercial real estate holdings in 2022:Q4: Nonfarm nonresidential, including office and downtown retail, by investor type

Investor type	Holdings of nonfarm nonresidential CRE (trillions of dollars)	Percent of total CRE loans outstanding	Holdings of office and downtown retail CRE (trillions of dollars)	Total assets held by each investor type (trillions of dollars)
Total	3.57			
Banks	2.17	61	.72	28.5
Category I banks (U.S. G-SIBs)	.28	8	.10	14.3
Category II–IV banks	.34	9	.11	6.8
Other	1.55	43	.51	7.4
Life insurers	.47	13	.17	5.4
Holders of non-agency CMBS	.53	15	.17	
Other nonbank	.40	11		

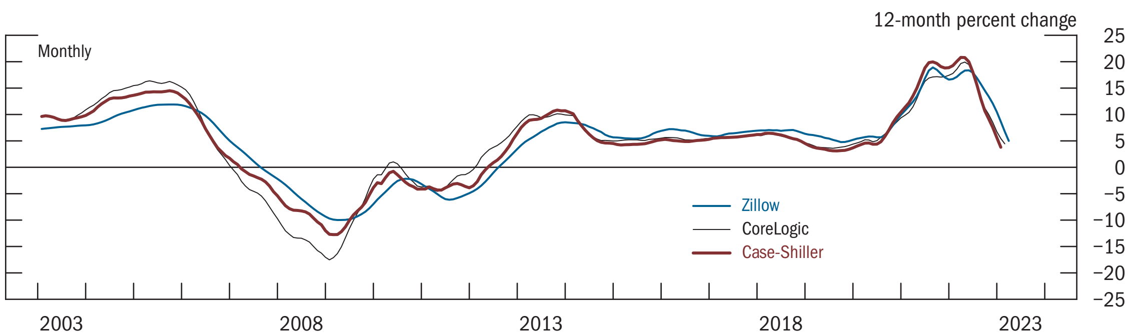
Note: Total nonfarm nonresidential commercial real estate (CRE) is all commercial mortgage assets as reported in Table L.220: Commercial Mortgages in the "Financial Accounts of the United States." For banks, the data are private depository institutions' CRE loans. For life insurers, the data are life insurers' CRE loans. Life insurer total assets do not consider reinsurance. For holders of non-agency commercial mortgage-backed securities (CMBS), the data include real estate investment trust (REIT) holdings of CMBS. For other nonbank holders of CRE mortgages, the data are computed as total commercial mortgages less banks, life insurers, and holders of CMBS. This category includes REITs, government, and nonfinancial businesses, among other sectors. Category I U.S. G-SIBs are global systemically important bank holding companies. Totals for banks are constructed as the sum of loans secured by nonfarm nonresidential properties and a fraction (0.847) of non–one- to four-family construction lending. This fraction reflects the estimated fraction of non–one- to four-family construction lending that is not multifamily. A list of banks in each category is available on the Board's website at https://www.federalreserve.gov/aboutthefed/boardmeetings/files/tailoring-rule-visual-20191010.pdf. The office loan holdings for the groups adjust the groups' CRE holdings by staff estimates for the office loan holdings as a share of nonfarm nonresidential CRE loans in the group. Other banks' CRE lending is constructed by subtracting Category I U.S. G-SIBs' and Category II–IV banks' CRE lending from the bank total. Total assets for these banks are calculated using data from the FR Y-9C and Call Reports. The office and downtown retail share for other banks is assumed to be consistent with the average loan-balance weighted share of Category II–IV banks. Holder percentages may not sum due to rounding.

Source: Federal Reserve Board staff calculations based on the following: Federal Reserve Board, Form FR Y-14Q (Schedule H.2), Capital Assessments and Stress Testing; Morningstar, Inc., Morningstar CMBS data; National Association of Insurance Commissioners, Schedule B; CBRE Econometric Advisors; Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States"; Federal Reserve Board, Form FR Y-9C, Consolidated Financial Statements for Holding Companies; S&P Global, Capital IQ Pro; and Federal Financial Institutions Examination Council, Call Report Forms FFIEC 031, FFIEC 041, and FFIEC 051, Consolidated Reports of Condition and Income (Call Reports).

House prices declined in recent months, but valuations remained high

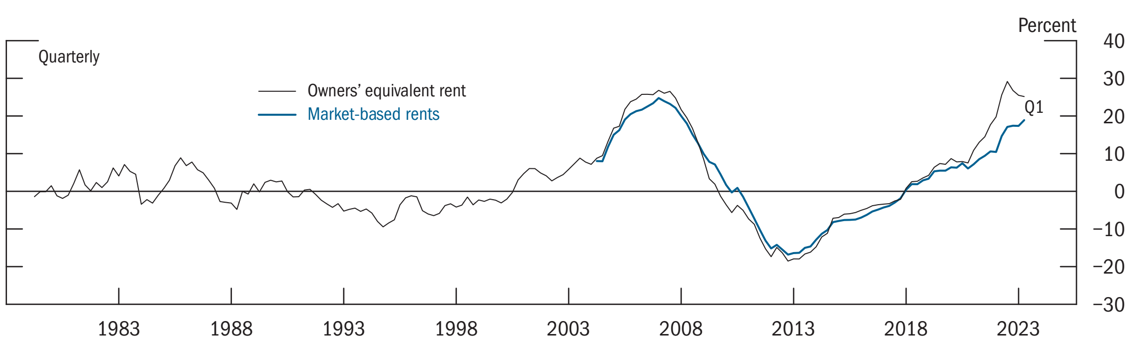
Rising borrowing costs have contributed to a moderation of prices in housing markets, as year-over-year house price increases have decelerated (figure 1.19), and some data suggested small declines in recent months. Nevertheless, valuation pressures in residential real estate remain elevated. A model of house price valuation based on prices relative to owners' equivalent rent and the real 10-year Treasury yield remained near historically high levels despite having fallen somewhat in the first quarter. Another measure based on market rents also pointed to stretched valuations, although to a lesser extent (figure 1.20). Similarly, while price-to-rent ratios have declined across a wide distribution of geographic areas since the November report, the median price-to-rent ratio remained above its previous peak in the mid-2000s (figure 1.21). While housing fundamentals have weakened, foreclosures and distressed sales, which could amplify downward pressure on prices, remained limited because mortgage underwriting standards did not loosen substantially

Figure 1.19. House price growth decelerated sharply



Source: CoreLogic, Inc., Real Estate Data; Zillow, Inc., Real Estate Data; S&P Case-Shiller Home Price Indices.

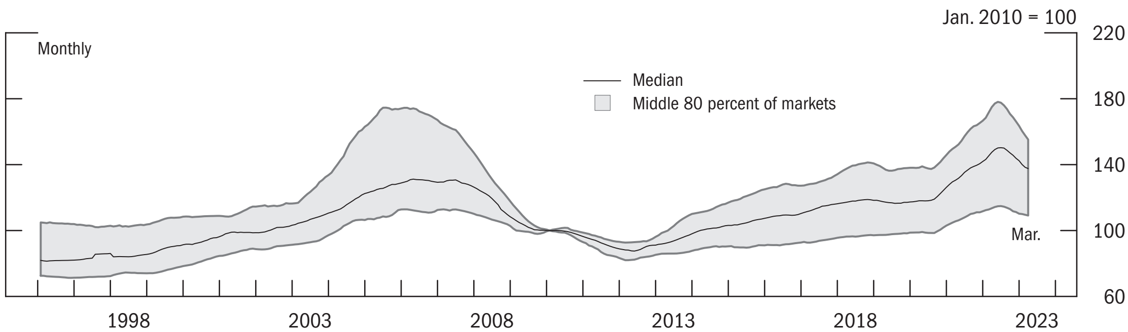
Figure 1.20. Model-based measures of house price valuations remained historically high



Source: For house prices, Zillow, Inc., Real Estate Data; for rent data, Bureau of Labor Statistics.

as they did in the early 2000s. In addition, homeowner equity cushions remained considerable, and the share of second-home buyers also remained near historical lows.

Figure 1.21. House price-to-rent ratios remained elevated across geographic areas



Source: For house prices, Zillow, Inc., Real Estate Data; for rent data, Bureau of Labor Statistics.

2 | Borrowing by Businesses and Households

Vulnerabilities from business and household debt remained moderate

On balance, vulnerabilities arising from borrowing by businesses and households were little changed since the November report and remained at moderate levels. For businesses, both the business debt-to-GDP ratio and gross leverage remained at high levels, although they were significantly lower than the record highs reached at the onset of the pandemic. Nevertheless, median interest coverage ratios remained high, supported by strong earnings growth. Recent data show that earnings growth has started to slow for the largest firms. In the event of an economic downturn, sizable declines in corporate earnings could weaken the debt-servicing capacity of firms. Indicators of household vulnerabilities, including the household debt-to-GDP ratio and the aggregate household debt service ratio, remained at modest levels. However, if household nominal income fails to keep pace with higher prices, tighter budgets may make it more difficult to service existing debt. In addition, an economic downturn or a correction in real estate prices remain risks for household credit performance.

Table 2.1 shows the amounts outstanding and recent historical growth rates of forms of debt owed by nonfinancial businesses and households as of the fourth quarter of 2022. Total outstanding private credit was split about evenly between businesses and households, with businesses owing $19.9 trillion and households owing $19.0 trillion. The combined total debt of nonfinancial businesses and households grew more slowly than nominal GDP since the November report, leading to a modest decline in the debt-to-GDP ratio, which moved back closer to the level that had prevailed for much of the decade before the pandemic (figure 2.1). The decline in the overall ratio was driven by a larger decline in household debt-to-GDP ratio compared to the business debt-to-GDP ratio (figure 2.2).

Key indicators point to little change in business debt vulnerabilities, which remained moderate relative to historical levels

Overall vulnerabilities from nonfinancial business debt remained moderate since the November report, as measures of leverage remained elevated and robust earnings boosted interest coverage ratios. There are some indications that business debt growth has slowed. Nonfinancial real business debt adjusted for inflation declined slightly (figure 2.3). In addition, net issuance of risky debt dropped sharply as institutional leveraged loan issuance turned negative for the first time since 2020 amid rapidly increasing borrowing costs and weaker investor demand driven by elevated uncertainty and market volatility (figure 2.4). Further, the net issuance of high-yield and unrated

Table 2.1. Outstanding amounts of nonfinancial business and household credit

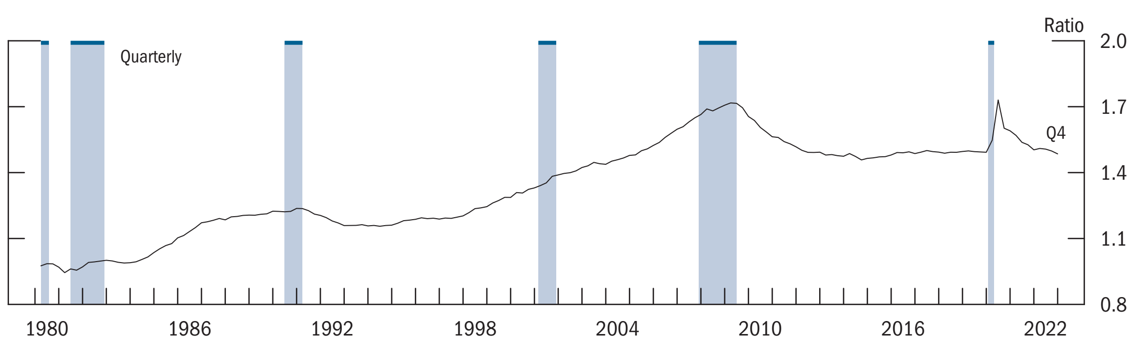
Item	Outstanding (billions of dollars)	Growth, 2021:Q4–2022:Q4 (percent)	Average annual growth, 1997–2022:Q4 (percent)
Total private nonfinancial credit	38,832	6.0	5.6
Total nonfinancial business credit	19,877	5.9	5.9
Corporate business credit	12,765	5.5	5.3
Bonds and commercial paper	7,545	.7	5.5
Bank lending	2,171	20.9	4.2
Leveraged loans*	1,388	11.3	14.1
Noncorporate business credit	7,111	6.6	7.0
Commercial real estate credit	3,069	8.1	6.3
Total household credit	18,955	6.2	5.4
Mortgages	12,515	7.2	5.6
Consumer credit	4,781	7.9	5.2
Student loans	1,757	1.4	8.0
Auto loans	1,412	7.5	5.1
Credit cards	1,203	15.5	3.5
Nominal GDP	26,145	7.2	4.5

Note: The data extend through 2022:Q4. Outstanding amounts are in nominal terms. Growth rates are measured from Q4 of the year immediately preceding the period through Q4 of the final year of the period. The table reports the main components of corporate business credit, total household credit, and consumer credit. Other, smaller components are not reported. The commercial real estate (CRE) row shows CRE debt owed by nonfinancial corporate and noncorporate businesses as defined in Table L.220: Commercial Mortgages in the "Financial Accounts of the United States." Total household credit includes debt owed by other entities, such as nonprofit organizations. GDP is gross domestic product.

* Leveraged loans included in this table are an estimate of the leveraged loans that are made to nonfinancial businesses only and do not include the small amount of leveraged loans outstanding for financial businesses. The amount outstanding shows institutional leveraged loans and generally excludes loan commitments held by banks. For example, lines of credit are generally excluded from this measure. The average annual growth rate shown for leveraged loans is computed from 2000 to 2022:Q4, as this market was fairly small before 2000.

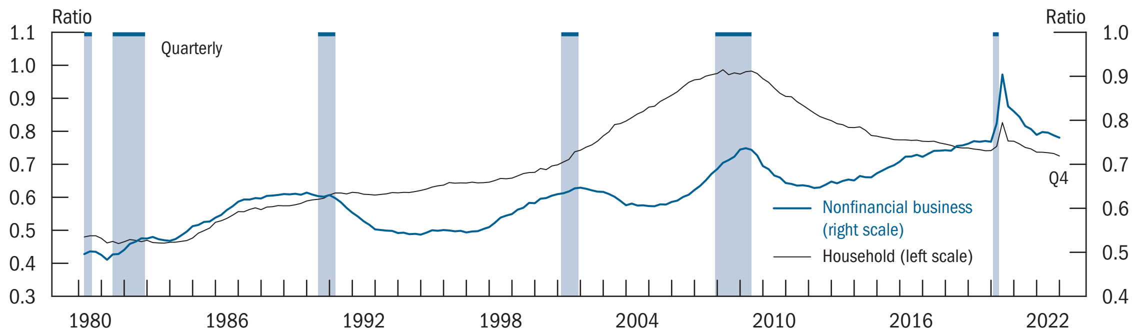
Source: For leveraged loans, PitchBook Data, Leveraged Commentary & Data; for GDP, Bureau of Economic Analysis, national income and product accounts; for all other items, Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States."

Figure 2.1. The total debt of households and businesses relative to GDP declined further



Source: Federal Reserve Board staff calculations based on Bureau of Economic Analysis, national income and product accounts, and Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States."

Figure 2.2. Both business and household debt-to-GDP ratios edged down

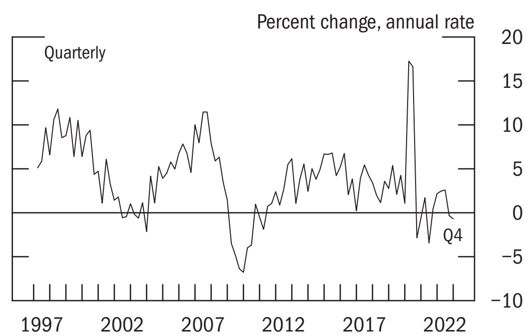


Source: Federal Reserve Board staff calculations based on Bureau of Economic Analysis, national income and product accounts, and Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States."

bonds remained negative. Gross leverage—the ratio of debt to assets—of all publicly traded nonfinancial firms remained high by historical standards, roughly unchanged from the values seen in 2021 and lower than its historical peak in mid-2020 (figure 2.5). Net leverage—the ratio of debt less cash to total assets—continued to edge up among all large publicly traded businesses and remained high relative to its history.

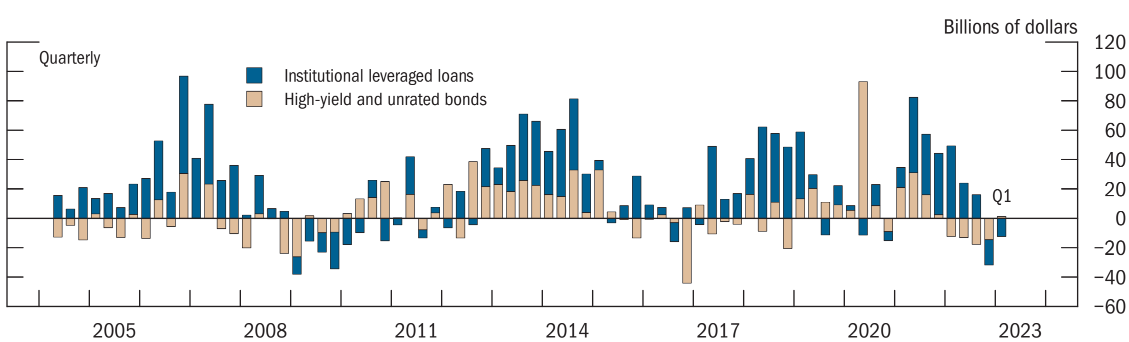
The interest coverage ratio for all publicly traded firms, measured by the median ratio of earnings to interest expenses, retreated from its recent high but nonetheless remained in

Figure 2.3. Business debt adjusted for inflation declined modestly



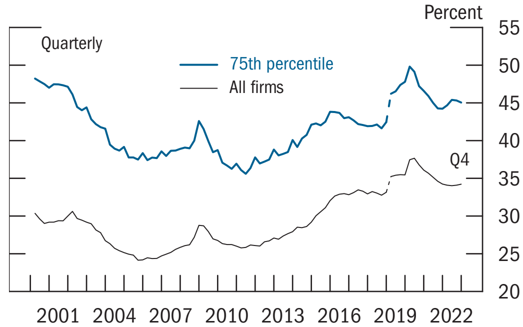
Source: Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States."

Figure 2.4. Net issuance of risky debt remained subdued



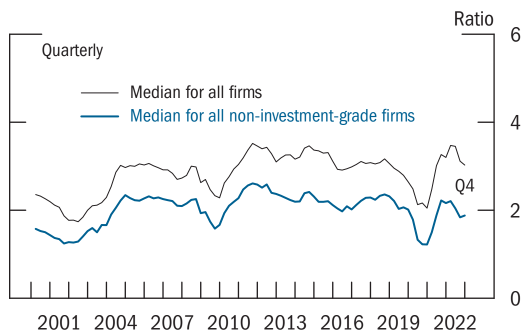
Source: Mergent, Inc. Fixed Income Securities Database; PitchBook Data, Leveraged Commentary & Data.

Figure 2.5. Gross leverage of large businesses remained at high levels



Source: Federal Reserve Board staff calculations based on S&P Global, Compustat.

Figure 2.6. Firms' ability to service their debt, as measured by the interest coverage ratio, was strong



Source: Federal Reserve Board staff calculations based on S&P Global, Compustat.

the upper range of its historical distribution, suggesting that large businesses were able to service their debt (figure 2.6). The absence of significant deterioration in the level of the median interest coverage ratio despite rising interest rates over the past year has reflected the combination of solid earnings and the sizable share of fixed-rate bonds in corporations' debt liabilities.[5] A higher share of fixed-rate liabilities mutes the pass-through of increased interest rates into debt-servicing costs. That said, earnings have shown some signs of weakness. In the future, a sharper-than-expected slowing or a decline in economic activity could make debt obligations more challenging to meet for some businesses. For riskier firms with a non-investment-grade rating, interest coverage ratios remained below their historical median levels.[6]

The credit performance of outstanding corporate bonds remained strong since the November report. The volume of downgrades and defaults remained low, but market expectations of defaults over the next year rose as investor perceptions of the economic outlook worsened. More than half of investment-grade bonds outstanding continued to be rated in the lowest category of the investment-grade range (triple-B). If a large share of these bonds were downgraded, debt cost would increase when the bonds need to roll over, putting pressure on firms' balance sheets.

Meanwhile, the available data for smaller middle-market firms that are privately held—which have less access to capital markets and primarily borrow from banks, private credit and equity funds, and sophisticated investors—also indicated that leverage declined over the second half of 2022. The interest coverage ratio for the median firm in this category remained high during the same

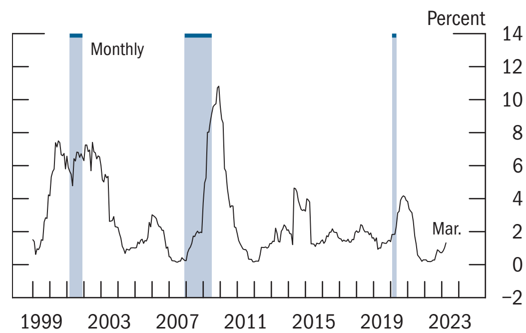
[5] Only about 5 percent of outstanding bonds rated triple-B and 1 percent of outstanding high-yield bonds are due within a year.

[6] While these firms represent a large share of the number of publicly traded firms (85 percent), their debt constitutes only 35 percent of the total debt in the sector.

period and was above the level at publicly traded firms. However, an important caveat is that the data on smaller middle-market firms are not as comprehensive as those on large firms.

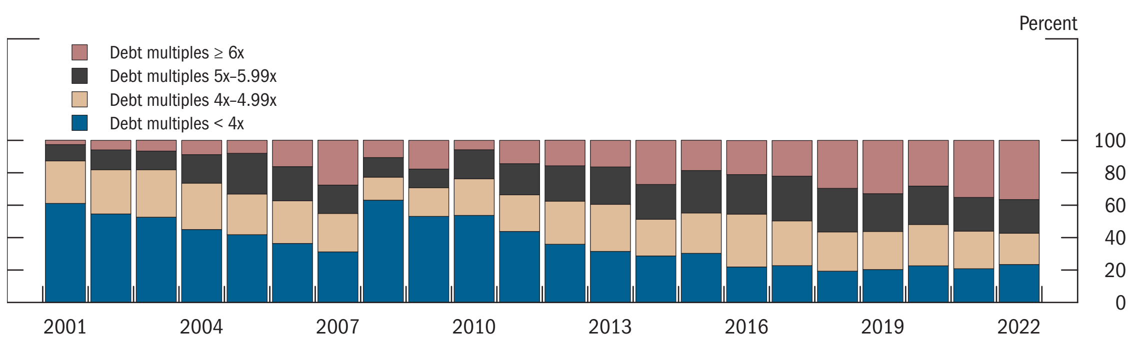
The credit quality of leveraged loans remained solid through the second half of 2022 but has shown some signs of deterioration. The volume of credit rating downgrades exceeded the volume of upgrades over this period, and default rates inched up for four consecutive quarters, albeit from historically low levels (figure 2.7). The share of newly issued loans to large corporations with debt multiples—defined as the ratio of debt to earnings before interest, taxes, depreciation, and amortization—greater than 5 remained at a historically high level in 2022, indicating stable tolerance for additional leverage among investors in this market (figure 2.8). Rising interest rates, in combination with a potential slowdown in earnings growth posed by the less favorable economic outlook, could put pressure on the credit quality of outstanding leveraged loans, as their floating debt service costs would increase.

Figure 2.7. Default rates on leveraged loans inched up from historically low levels



Source: PitchBook Data, Leveraged Commentary & Data.

Figure 2.8. The majority of new leveraged loans last year have debt multiples greater than 5



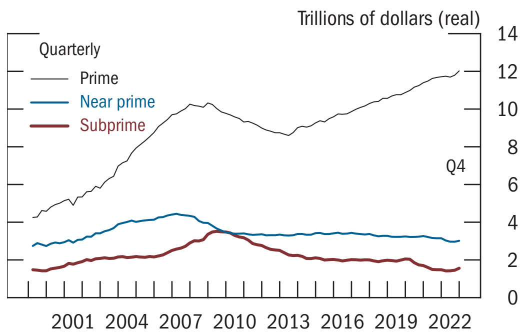
Source: Mergent, Inc., Fixed Income Securities Database; PitchBook Data, Leveraged Commentary & Data.

Delinquencies at small businesses edged up, but credit quality remained solid

Delinquency rates for small businesses edged up from relatively low levels, but overall credit quality remained solid. Borrowing costs increased in 2022 and now stand a touch higher than prevailing pre-pandemic rates. In addition, the share of small businesses that borrow regularly increased according to the National Federation of Independent Business Small Business Economic Trends Survey but remained low relative to historical levels; the share of firms with unmet financing needs also remained quite low.

Vulnerabilities from household debt remained moderate

Figure 2.9. Real household debt edged up



Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax; consumer price index, Bureau of Labor Statistics via Haver Analytics.

Elevated levels of liquid assets and still-large home equity cushions helped households maintain strong balance sheets through the second half of last year. That said, some borrowers remained financially stretched and more vulnerable to future shocks.

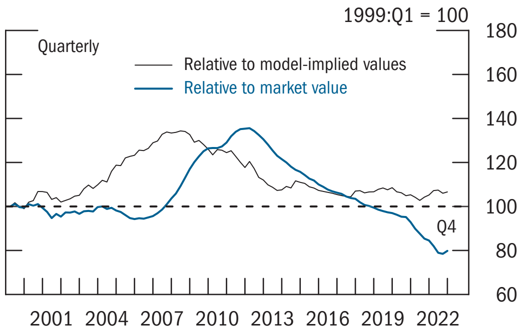
Outstanding household debt adjusted for inflation edged up in the second half of 2022 (figure 2.9). While the increase was broad based across the credit score distribution, most of the growth was driven by borrowers with prime credit scores, who accounted for more than half of the total number of borrowers.

Credit risk of outstanding household debt remained generally low

The ratio of total required household debt payments to total disposable income (the household debt service ratio) increased slightly since the November report. This increase means that some borrowers allocated a larger portion of their income to pay the interest and principal on their loans, potentially weakening their ability to withstand shocks to their income. Nonetheless, the ratio remained at modest levels after reaching a historical low in the first quarter of 2021 amid extensive fiscal stimulus, credit card paydowns, and low interest rates. With the increase in interest rates over the past year only partially passed through to household interest expenses, the household debt service ratio could increase further. With the exception of credit card debt, only a small share of household debt is subject to floating rates, which should limit the effect of increased interest rates in the near term. For most other types of household debt, rising interest rates increase borrowing costs only for new loan originations.

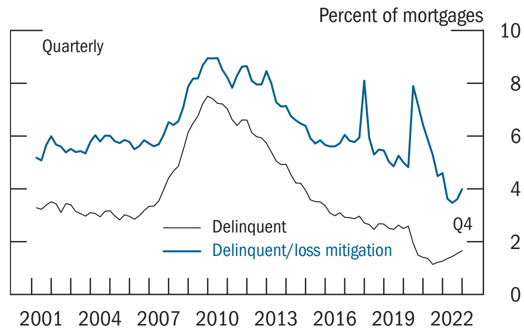
Mortgage debt, which accounts for roughly two-thirds of total household debt, grew a bit more slowly than GDP in 2022:Q4. Estimates of housing leverage when measuring home values as a function of rents and other market fundamentals remained flat and significantly lower than their peak levels before 2008 (figure 2.10, black line). The overall mortgage delinquency rate ticked up

Figure 2.10. A model-based estimate of housing leverage was flat



Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax; Zillow, Inc., Real Estate Data; Bureau of Labor Statistics via Haver Analytics.

Figure 2.11. Mortgage delinquency rates remained at historically low levels

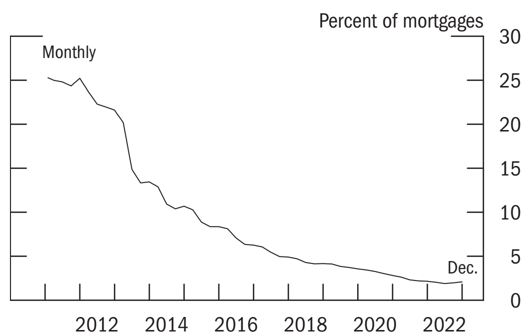


Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax.

from a historically low level (figure 2.11), and the share of mortgage balances in a loss-mitigation program remained low. A very low share of borrowers had negative home equity in the last quarter of 2022 (figure 2.12).

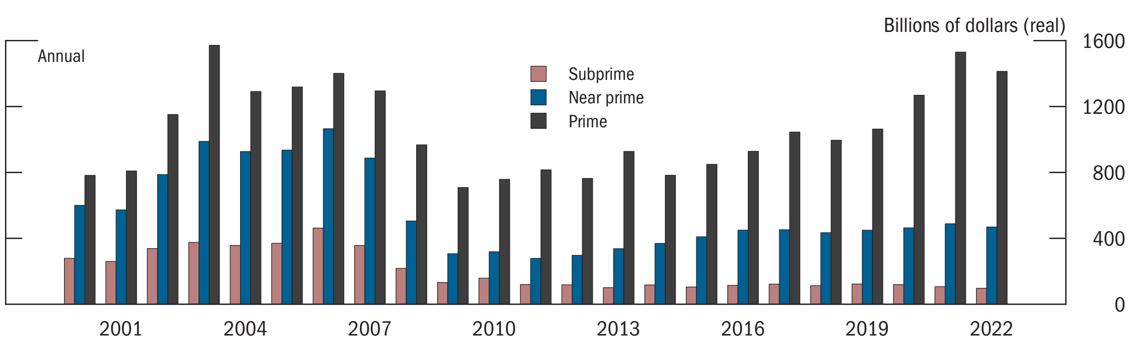
New mortgage extensions, which have skewed heavily toward prime borrowers in recent years, declined in the last quarter of 2022 against the backdrop of higher mortgage rates and slower activity in the housing market (figure 2.13). New mortgage loans with low

Figure 2.12. Very few homeowners had negative equity in their homes



Source: CoreLogic, Inc., Real Estate Data.

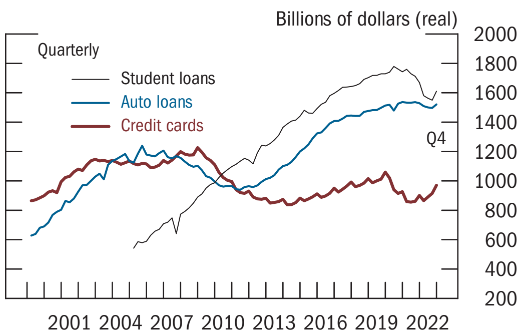
Figure 2.13. New mortgage extensions to nonprime borrowers have been subdued



Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax; consumer price index, Bureau of Labor Statistics via Haver Analytics.

down payments were seen in about half of the newly originated purchase loans in 2022. Such highly leveraged originations, which also tended to have lower average credit scores, remained vulnerable to house price declines, as their equity could quickly become negative. With the share of adjustable-rate mortgages in new home purchases at 10 percent in recent months, the interest rate risk for mortgage borrowers remained limited. That said, the early payment delinquency rate—the share of balances becoming delinquent within one year of mortgage origination—continued to rise.

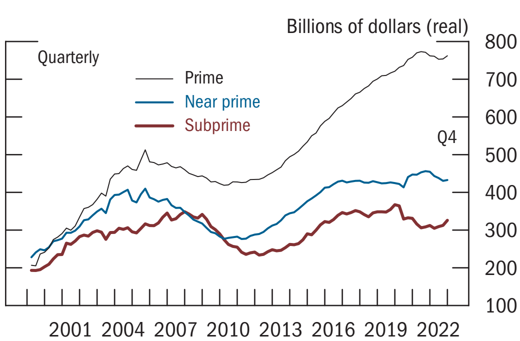
Figure 2.14. Real consumer credit edged up in the second half of 2022



Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax; consumer price index, Bureau of Labor Statistics via Haver Analytics.

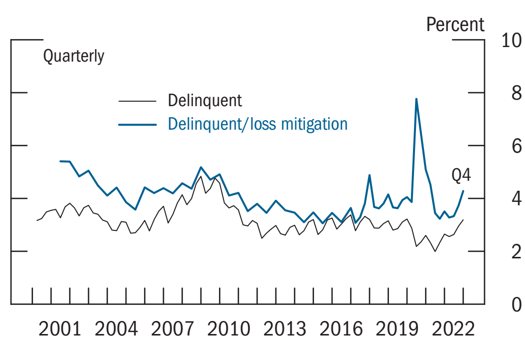
The remaining one-third of household debt was consumer credit, which consisted primarily of student loans, auto loans, and credit card debt (as shown in table 2.1). On net, inflation-adjusted consumer credit growth increased a bit since the November report (figure 2.14), at a slightly higher pace than GDP. Real auto loan balances ticked up that period, mostly driven by prime borrowers, but balances for near-prime and subprime borrowers also increased to a lesser extent (figure 2.15). The share of auto loan balances in loss mitigation continued to decline and stood at a low level at the end of 2022, but those in delinquent status have increased in the past several quarters, returning to a level that is in line with its history over the previous decade (figure 2.16).

Figure 2.15. Real auto loans outstanding ticked up



Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax; consumer price index, Bureau of Labor Statistics via Haver Analytics.

Figure 2.16. Auto loan delinquencies moved up in 2022 but still remained at modest levels

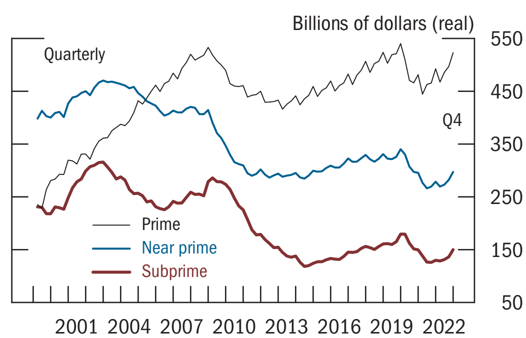


Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax.

Aggregate real credit card balances continued to increase in the second half of last year (figure 2.17). Rates paid on these balances increased in line with short-term rates over the past year. Delinquency rates have also increased over the same period (figure 2.18). The outsized nature of the increase in subprime delinquency rates in large part is because of a compositional change in the pool of borrowers arising from fiscal support and forbearance programs implemented during the pandemic.[7]

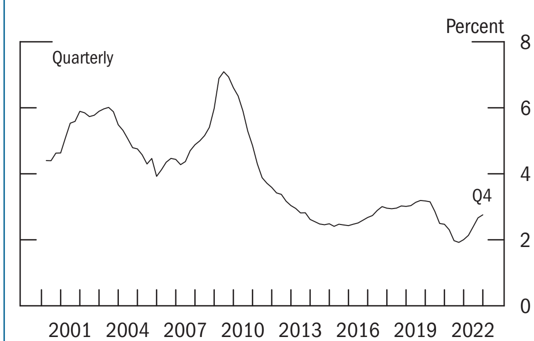
After rising rapidly for more than a decade, real student loan debt declined with the onset of the pandemic. More recently, student loan balances have ticked up.

Figure 2.17. Real credit card balances have increased in 2022, partially reversing earlier declines



Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax; consumer price index, Bureau of Labor Statistics via Haver Analytics.

Figure 2.18. Credit card delinquencies increased but remained at low levels



Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax.

[7] As a result of these programs, many borrowers from the subprime group migrated to the near-prime or prime groups. The remaining subprime borrowers had lower credit scores, on the whole, than the pool of subprime borrowers before the pandemic. See Sarena Goodman, Geng Li, Alvaro Mezza, and Lucas Nathe (2021), "Developments in the Credit Score Distribution over 2020," FEDS Notes (Washington: Board of Governors of the Federal Reserve System, April 30), https://www.federalreserve.gov/econres/notes/feds-notes/developments-in-the-credit-score-distribution-over-2020-20210430.html.

3 | Leverage in the Financial Sector

Poor risk management undermined some banks, while the broader banking system remained sound and resilient; meanwhile, leverage at some types of nonbank financial institutions appeared elevated

Vulnerabilities related to overall financial-sector leverage appeared to remain moderate. In March 2023, poor interest rate and liquidity risk management contributed to runs on SVB and Signature Bank and stresses at some additional banks, subsequently leading to the failure of First Republic Bank on May 1. Actions taken by the official sector reassured depositors, and the broad banking system remained sound and resilient. For the banking system as a whole, aggregate bank capital levels were ample. At potentially vulnerable banks, examiners have increased the frequency and depth of monitoring, with examination activities directed to assessing the current valuation of investment securities, deposit trends, the diversity of funding sources, and the adequacy of contingency funding plans.

Broker-dealer leverage remained low, but vulnerabilities persisted regarding their willingness and ability to intermediate in fixed-income markets during periods of stress. Some types of nonbank financial firms continued to operate with high leverage.

Table 3.1 shows the sizes and growth rates of the types of financial institutions discussed in this section.

Concerns over interest rate risk and declines in the fair value of some assets led to stress in the banking sector and raised concerns about spillovers

Rising interest rates affect banks in several ways. Higher interest rates on floating-rate and newly acquired fixed-rate assets lead to higher interest income for banks. The costs of bank funding also increase, but generally much more slowly than market rates. As a result, the net interest margins of most banks typically increase in a rising rate environment as the rates they receive on their assets outpace their funding costs.[8] Over the past year, interest rates increased considerably as policy rates rose from near-zero levels. The overall banking sector has remained profitable and resilient as rates have risen, with net interest margins reflecting higher interest income on floating-rate loans coupled with interest expense on many deposits staying well below market rates (figure 3.1).

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[8] Net interest margin measures a bank's yield on its interest-bearing assets after netting out interest expense.

Table 3.1. Size of selected sectors of the financial system, by types of institutions and vehicles

Item	Total assets (billions of dollars)	Growth, 2021:Q4–2022:Q4 (percent)	Average annual growth, 1997–2022:Q4 (percent)
Banks and credit unions	25,594	-.1	6.1
Mutual funds	17,333	-22.0	8.9
Insurance companies	11,867	-8.5	5.5
Life	8,844	-10.3	5.6
Property and casualty	3,023	-2.5	5.5
Hedge funds*	9,067	-5.7	7.9
Broker-dealers**	4,927	-.7	4.8
	Outstanding (billions of dollars)		
Securitization	13,161	9.1	5.6
Agency	11,698	9.5	6.1
Non-agency***	1,464	5.8	3.6

Note: The data extend through 2022:Q4 unless otherwise noted. Outstanding amounts are in nominal terms. Growth rates are measured from Q4 of the year immediately preceding the period through Q4 of the final year of the period. Life insurance companies' assets include both general and separate account assets.

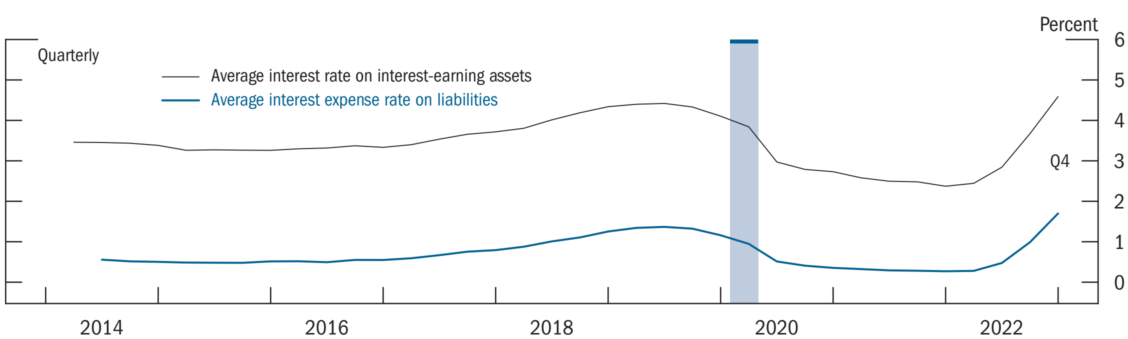
* Hedge fund data start in 2012:Q4 and are updated through 2022:Q3. Growth rates for the hedge fund data are measured from Q3 of the year immediately preceding the period through Q3 of the final year of the period.

** Broker-dealer assets are calculated as unnetted values.

*** Non-agency securitization excludes securitized credit held on balance sheets of banks and finance companies.

Source: Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States"; Federal Reserve Board, "Enhanced Financial Accounts of the United States."

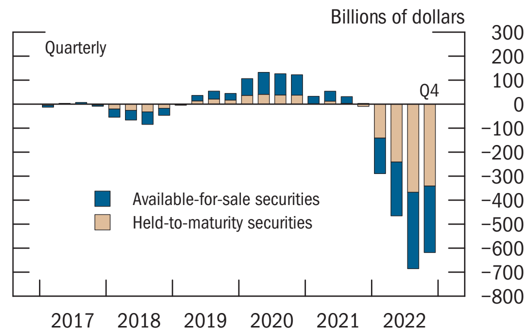
Figure 3.1. Banks' average interest rate on interest-earning assets and average expense rate on liabilities increased



Source: Federal Reserve Board, Form FR Y-9C, Consolidated Financial Statements for Holding Companies.

In the aggregate, more than 45 percent of bank assets reprice or mature within a year, reducing exposure to legacy fixed-rate assets in the overall banking system. Nonetheless, higher interest rates substantially affected the value of banks' existing holdings of fixed-rate assets in 2022. In 2020 and 2021, banks added nearly $2.3 trillion in securities to their balance sheets, primarily fixed-rate U.S. Treasury securities and agency-guaranteed mortgage-backed securities, most of which were placed in their available-for-sale (AFS) and held-to-maturity (HTM) securities portfolios. By the end of 2022, banks had declines in fair value of $277 billion in AFS portfolios and $341 billion in HTM portfolios (figure 3.2).[9] Additionally, banks have other long-duration fixed-rate assets, such as fixed-rate residential mortgages, whose interest income did not increase with rising interest rates.

Figure 3.2. The fair values of banks' securities portfolios declined in 2022 as interest rates rose



Source: Federal Financial Institutions Examination Council, Call Report Form FFIEC 031, Consolidated Reports of Condition and Income (Call Report); Federal Reserve Board, Form FR Y-9C, Consolidated Financial Statements for Holding Companies.

As discussed in the box "The Bank Stresses since March 2023," SVB did not effectively manage the interest rate risk associated with its securities holdings or develop effective interest rate risk measurement tools, models, and metrics. SVB also had a concentrated business model and failed to manage the liquidity risks of liabilities that were largely composed of uninsured deposits from venture capital firms and the tech sector.

In early March 2023, depositors became increasingly concerned about the health of SVB, and the bank experienced substantial deposit outflows. On March 10, SVB failed. The equity prices of some banks declined sharply, and some banks saw sizable outflows from uninsured depositors. On March 12, Signature Bank failed. Concerns over stresses in the banking sector led the U.S. Department of the Treasury, the Federal Reserve, and the FDIC to intervene on March 12 to assure depositors of the safety of their deposits (see the box "The Federal Reserve's Actions to Protect Bank Depositors and Support the Flow of Credit to Households and Businesses"). Deposit outflows slowed considerably thereafter. Nonetheless, First Republic Bank continued to experience continued stress, leading to its failure and subsequent acquisition on May 1 by JPMorgan Chase Bank with government support. The Federal Reserve will continue to closely monitor conditions in the U.S. banking system, and it is prepared to use all its tools for institutions of any size, as needed, to support the safety and soundness of the U.S. banking system.

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9 In addition, there was a decline in fair value of $28 billion related to securities transferred from AFS to HTM accounts.

Box 3.1. The Bank Stresses since March 2023

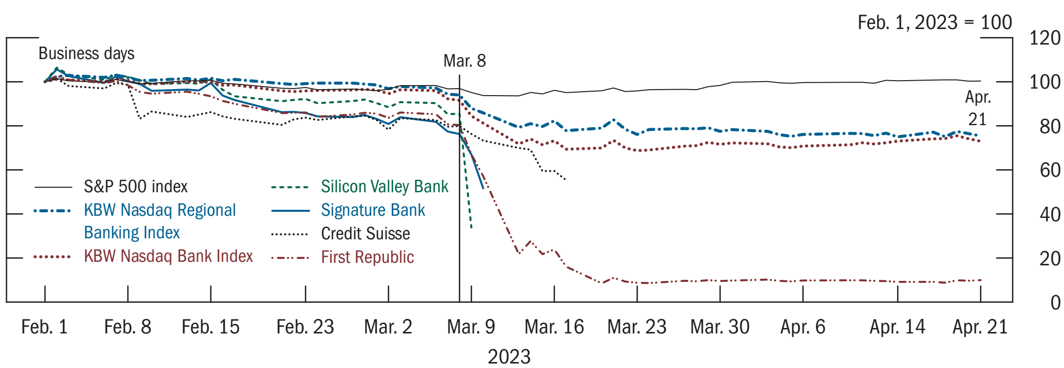
The banking system came under severe stress late in the week of March 6, 2023. On Wednesday, March 8, Silvergate Bank, an institution supervised by the Federal Reserve with $11 billion in assets at the end of 2022, announced its intention to voluntarily wind down its operations and to fully repay all deposits.[1]

On that Wednesday afternoon, SVB, an institution supervised by the Federal Reserve with $209 billion in assets at the end of 2022, announced it had sold $21 billion from its AFS securities portfolio at an after-tax loss of $1.8 billion, was planning to increase nondeposit borrowing from $15 billion to $30 billion, and was commencing a public offering to raise capital by $2.25 billion.[2] The bank also noted that it had been in dialogue with a rating agency that was considering a negative rating action, with the possibility that another agency would follow suit. Later that day, the bank received a one-notch rating downgrade, and its rating outlook was changed from stable to negative. These announcements led to a loss of confidence in the bank, as reflected in the sharp decline in SVB's stock market price, illustrated in figure A, and unprecedented deposit withdrawals from customers, totaling $42 billion in a single business day on Thursday, March 9. As additional deposit withdrawal requests accumulated, the bank informed regulators on the morning of Friday, March 10, that $100 billion in deposit withdrawals were scheduled or expected for that day.[3] The bank was unable to pay those obligations, and, on the morning of Friday, March 10, the Department of Financial Protection and Innovation of the State of California declared SVB insolvent, took possession of the bank, and appointed the FDIC as receiver.

It appeared that contagion from SVB's failure could be far-reaching and cause damage to the broader banking system. The prospect of uninsured depositors not being able to access their funds appeared to raise concerns about the possibility of destabilizing runs at other U.S. commercial banks. This

(continued)

Figure A. Bank stock prices and stock indexes



Source: Center for Research in Security Prices, CRSP/Compustat Merged Database, Wharton Research Data Services; Federal Reserve Bank of St. Louis, Federal Reserve Economic Data.

1 See Silvergate Bank (2023), "Silvergate Capital Corporation Announces Intent to Wind Down Operations and Voluntarily Liquidate Silvergate Bank," press release, March 8, https://ir.silvergate.com/news/news-details/2023/Silvergate-Capital-Corporation-Announces-Intent-to-Wind-Down-Operations-and-Voluntarily-Liquidate-Silvergate-Bank/default.aspx. The announcement followed deposit outflows in the fourth quarter of 2022 that reduced deposit balances by more than 50 percent.

2 See Silicon Valley Bank (2023), "Strategic Actions/Q1'23 Mid-Quarter Update" (Santa Clara, Calif.: SVB, March 8), available at https://ir.svb.com/events-and-presentations/default.aspx.

3 The $42 billion in deposit withdrawals on March 9 comes from the order taking possession of property and business from the Department of Financial Protection and Innovation of the State of California available on the department's website at https://dfpi.ca.gov/wp-content/uploads/sites/337/2023/03/DFPI-Orders-Silicon-Valley-Bank-03102023.pdf?emrc=bedc09. The $100 billion in scheduled or expected deposit withdrawals for March 10 comes from *Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank* available on the Federal Reserve's website at https://www.federalreserve.gov/publications/files/svb-review-20230428.pdf.

Box 3.1—*continued*

concern over broader contagion led to sizable declines in bank stocks, as reflected by the declines in the KBW bank indexes (as shown in figure A). On March 10, Signature Bank, an institution supervised by the FDIC with $110 billion in assets at the end of 2022, continued experiencing stock price declines and suffered a run, with depositors withdrawing 20 percent of deposit balances.[4] Signature Bank was closed on Sunday, March 12, by the New York State Department of Financial Services, and the FDIC was named receiver.[5] The speed and magnitude of the runs on uninsured deposits at SVB and Signature Bank generated broader concerns about the resilience of banks with a large concentration of uninsured deposits and significant declines in the fair value of fixed-rate assets in a rising rate environment. The bank runs at SVB and Signature Bank contributed to a further deterioration of confidence in banks, amplifying the initial bank stresses. Other banks also saw notable deposit outflows, threatening households' and businesses' ability to access accounts they routinely use to make payments. In contrast, the largest banks saw significant deposit inflows. On Sunday, March 12, the Federal Reserve, together with the FDIC and the U.S. Department of the Treasury, announced decisive actions to protect households and businesses (see the box "The Federal Reserve's Actions to Protect Bank Depositors and Support the Flow of Credit to Households and Businesses").

The runs on SVB and Signature Bank were of unprecedented speed compared with previous runs. During the run on Washington Mutual in 2008—to date, the run that caused the largest failure of an insured depository institution by inflation-adjusted total assets—depositors withdrew about $17 billion over the course of eight business days, with the largest deposit withdrawal in one day reaching just over 2 percent of pre-run deposits.[6] By comparison, the highest one-day withdrawal rate was more than 20 percent in the case of SVB and Signature Bank, at the time the second- and third-largest depository institutions by inflation-adjusted total assets, respectively, that failed due to a bank run (figure B).[7] At SVB, withdrawals would have been even larger had regulators not closed the bank on the morning of March 10. Figure B also compares the speed of the runs on Washington Mutual, SVB, and Signature Bank with the run on Continental Illinois, the fifth-largest depository institution by inflation-adjusted total assets to fail due to a bank run. Continental Illinois sustained sizable withdrawals of uninsured deposits for six consecutive days in May 1984, with a peak one-day withdrawal rate of 7.8 percent of deposits, before a public assistance package was put in place.[8] The unprecedented speed of the run on SVB was likely facilitated by widespread adoption among SVB's tightly networked depositor base of technologies enabling depositors to submit withdrawal requests electronically and to share messages about the bank's perceived problems via messaging apps and on social media. But the faster speed of the run in the Continental Illinois case relative to Washington Mutual also points to the role of the concentration of uninsured deposits.

In international markets, Credit Suisse came under renewed pressure. In recent years, Credit Suisse had experienced a succession of risk-management, corporate-governance, and compliance failures. And in 2022, it reported the largest after-tax loss since the 2007–09 financial crisis and experienced significant deposit outflows in the last quarter of the year. During the week of March 13, the firm published its annual report, which was originally scheduled for publication the previous week, and its

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4 See Federal Deposit Insurance Corporation (2023), *FDIC's Supervision of Signature Bank* (Washington: FDIC, April), https://www.fdic.gov/news/press-releases/2023/pr23033a.pdf.

5 See New York State Department of Financial Services (2023), "Superintendent Adrienne A. Harris Announces New York Department of Financial Services Takes Possession of Signature Bank," press release, March 12, https://www.dfs.ny.gov/reports_and_publications/press_releases/pr20230312.

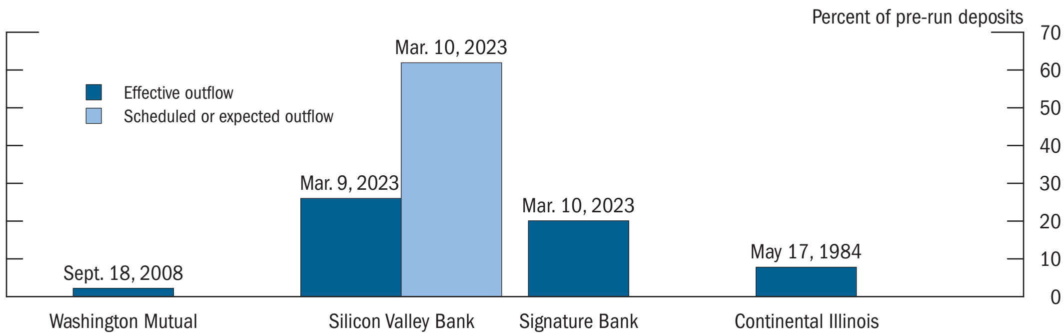
6 See Office of Thrift Supervision (2008), "OTS Fact Sheet on Washington Mutual Bank," September 25, www.fcic.gov/documents/view/905. The one-day deposit withdrawal rate is estimated using only consumer and small business deposits; see Declaration of Thomas M. Blake to the U.S. Bankruptcy Court, District of Delaware, Chapter 11 Case No. 08-12229 (MFW) and Adversary Proceeding No. 09-50934 (MFW) (2009).

7 After the data close on April 21, 2023, First Republic Bank failed, making it the second-largest depository institution to fail due to a bank run.

8 See Mark Carlson and Jonathan Rose (2019), "The incentives of Large Sophisticated Creditors to Run on a Too Big to Fail Financial Institution," *Journal of Financial Stability,* vol. 41 (April), pp. 91–104.

Box 3.1—*continued*

Figure B. Peak 1-day withdrawal rates for runs on the largest banks, by inflation-adjusted total assets



Sources: For Washington Mutual, Jonathan D Rose (2015), "Old-Fashioned Deposit Runs," Finance and Economics Discussion Series 2015-111 (Washington: Board of Governors of the Federal Reserve System, December). For Silicon Valley Bank, Financial Institutions Examination Council, Consolidated Reports of Condition and Income; California Department of Financial Protection and Innovation (2023), "Order Taking Possession of Property and Business" (San Francisco: DFPI, March 10); and Board of Governors of the Federal Reserve System (2023), *Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank* (Washington: Board of Governors, April). For Signature Bank, Federal Deposit Insurance Corporation (2023), *FDIC's Supervision of Signature Bank*, (Washington: FDIC, April). For Continental Illinois, Mark Carlson and Jonathan Rose (2019), "The Incentives of Large Sophisticated Creditors to Run on a Too Big to Fail Financial Institution," *Journal of Financial Stability*, vol. 41 (April), pp. 91–104.

largest shareholder announced it would not buy additional shares in the bank. The bank stock price declined further, and on March 16, Credit Suisse announced its intention to access emergency liquidity support provided by the Swiss National Bank for up to CHF 50 billion. Despite the announcement of this liquidity support, investors' confidence continued to deteriorate, as reflected by the continued price decline of Credit Suisse shares (as shown in figure A). On Sunday, March 19, UBS agreed to merge with Credit Suisse in a deal that involved triggering the write-off of a certain type of Credit Suisse's contingent convertible capital instruments, as well as liquidity support and loss sharing from the Swiss government. In addition, on Sunday, March 19, the Federal Reserve, together with other central banks, announced measures to enhance the provision of liquidity in global funding markets (see the box "The Federal Reserve's Actions to Protect Bank Depositors and Support the Flow of Credit to Households and Businesses"). The spillovers of the stresses related to Credit Suisse to the U.S. have so far been muted.

Following the runs on SVB and Signature Bank, First Republic Bank, an institution supervised by the FDIC with $213 billion in assets at the end of 2022, experienced notable deposit outflows between March 10 and March 16. The bank's equity price declined significantly through the end of March and declined even further following the publication of its first quarter earnings on April 24. The California Department of Financial Protection and Innovation took possession of First Republic Bank before markets opened on Monday, May 1, appointing the FDIC as receiver.[9] At the same time, the FDIC entered into a purchase and assumption agreement with JPMorgan Chase Bank to assume all of the deposits and most of the assets of the failed bank, with the bank and the FDIC entering into a loss-sharing agreement.[10]

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[9] See the order taking possession of property and business from the Department of Financial Protection and Innovation of the State of California available on the department's website at https://dfpi.ca.gov/2023/05/01/california-financial-regulator-takes-possession-of-first-republic-bank/.

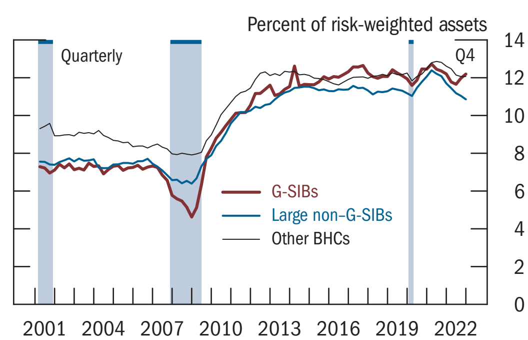
[10] See Federal Deposit Insurance Corporation (2023), "JPMorgan Chase Bank, National Association, Columbus, Ohio Assumes All the Deposits of First Republic Bank, San Francisco, California," press release, May 1, https://www.fdic.gov/news/press-releases/2023/pr23034.html.

On April 28, 2023, the Federal Reserve published a report examining the factors that contributed to the failure of SVB and the role of the Federal Reserve, which was the primary federal supervisor for the bank and its holding company, Silicon Valley Bank Financial Group.[10] That same day, the FDIC published a report examining the failure of Signature Bank, whose primary federal supervisor was the FDIC.[11]

Banks' risk-based capital remained within the range established over the past decade, but tangible common equity declined at non–global systemically important banks

Notwithstanding the banking stress in March, high levels of capital and moderate interest rate risk exposures mean that a large majority of banks are resilient to potential strains from higher interest rates. As of the fourth quarter of 2022, banks in the aggregate were well capitalized, especially U.S. global systemically important banks (G-SIBs). The common equity Tier 1 (CET1) ratio—a regulatory risk-based measure of bank capital adequacy—remained close to the median of its range since the end of the 2007–09 financial crisis (figure 3.3). In the second half of 2022, G-SIBs increased their CET1 ratios by cutting back on stock repurchases and reducing risk-weighted assets to meet higher capital requirements resulting from an increase in their 2023 G-SIB surcharges—that is, the amount of capital G-SIBs must have above their minimum capital requirements and stress capital buffers. In contrast, CET1 ratios decreased at large non-G-SIB and other banks that continued to grow their risk-weighted assets, though their CET1 ratios remained well above requirements.

Figure 3.3. Banks' risk-based capital ratio remained near the median level since the 2007–09 financial crisis



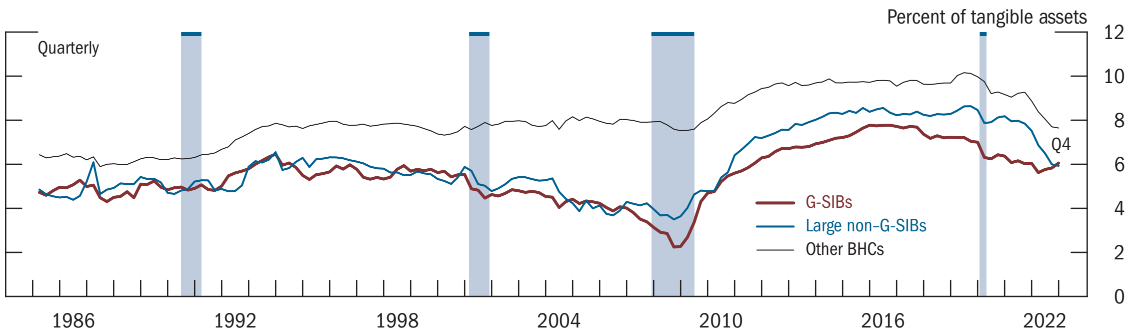
Source: Federal Reserve Board, Form FR Y-9C, Consolidated Financial Statements for Holding Companies.

The ratio of tangible common equity to total tangible assets—a measure of bank capital that does not account for the riskiness of credit exposures and, like CET1, excludes intangible items such as goodwill from capital—edged up at G-SIBs in the fourth quarter of 2022 but continued to decline at large non-G-SIB and other banks (figure 3.4). The decreases in tangible common equity ratios of

[10] See Board of Governors of the Federal Reserve System (2023), *Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank* (Washington: Board of Governors, April), https://www.federalreserve.gov/publications/files/svb-review-20230428.pdf.

[11] See Federal Deposit Insurance Corporation (2023), *FDIC's Supervision of Signature Bank* (Washington: FDIC, April), https://www.fdic.gov/news/press-releases/2023/pr23033a.pdf.

Figure 3.4. The ratio of tangible common equity to tangible assets increased for global systemically important banks but decreased for other banks



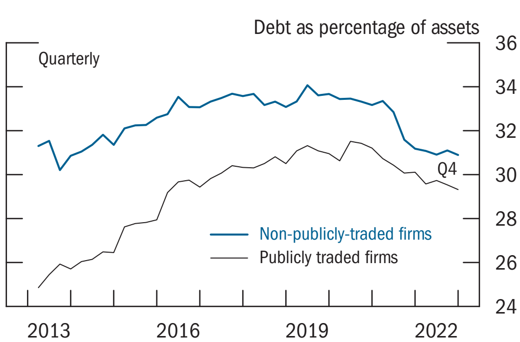
Source: For data through 1996, Federal Financial Institutions Examination Council, Call Report Form FFIEC 031, Consolidated Reports of Condition and Income (Call Report). For data from 1997 onward, Federal Reserve Board, Form FR Y-9C, Consolidated Financial Statements for Holding Companies; and Federal Financial Institutions Examination Council, Call Report Form FFIEC 031, Consolidated Reports of Condition and Income (Call Report).

non–G-SIBs were partly due to a substantial drop in tangible equity from declines in fair value on Treasury and agency-guaranteed mortgage-backed securities in AFS portfolios.

Banks' overall vulnerability to future credit losses appeared moderate

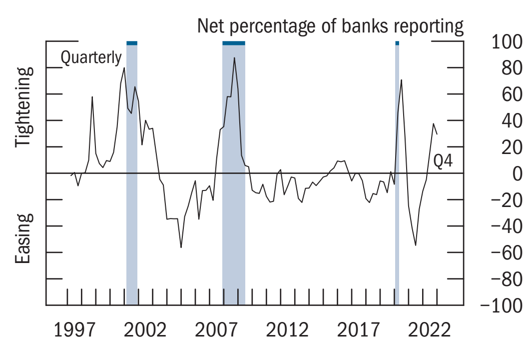
Aggregate credit quality in the nonfinancial sector remained strong even as delinquency rates in certain loan segments—such as auto loans, credit cards, and CRE loans backed by office and retail buildings—have increased. Borrower leverage for bank commercial and industrial (C&I) loans continued to trend downward in the fourth quarter of 2022 relative to the start of the year (figure 3.5). Moreover, according to data from the January 2023 SLOOS, banks continued to tighten lending standards on C&I loans and CRE loans in the second half of 2022 (figure 3.6;

Figure 3.5. Borrower leverage for bank commercial and industrial loans continued to decrease



Source: Federal Reserve Board, Form FR Y-14Q (Schedule H.1), Capital Assessments and Stress Testing.

Figure 3.6. Lending standards for bank commercial and industrial loans have tightened



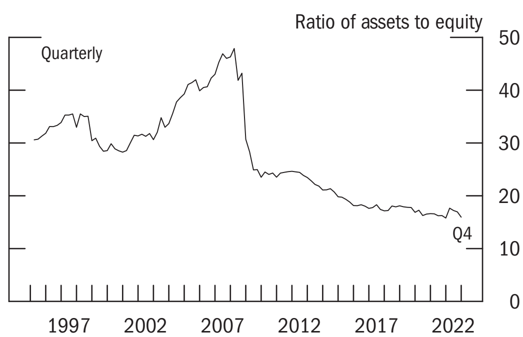
Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices; Federal Reserve Board staff calculations.

see also figure 1.16). At the same time, most banks reported weaker loan demand, especially in interest-rate-sensitive segments such as residential real estate and CRE. A material decrease in commercial property prices could lead to credit losses for banks with sizable CRE exposures (see the box "Financial Institutions' Exposure to Commercial Real Estate Debt"). Overall, bank profitability was below its 2021 level but close to its pre-pandemic average.

Leverage at broker-dealers remained low

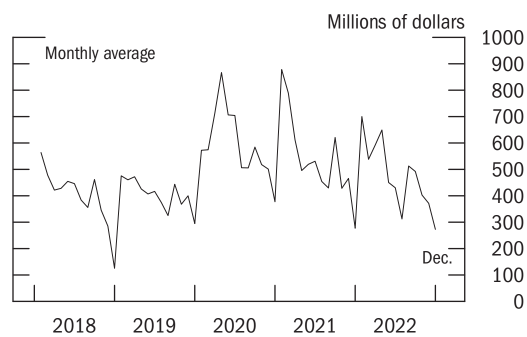
Broker-dealer leverage ratios decreased slightly in 2022:Q4 and remained near their recent historically low levels (figure 3.7). Dealers' equity growth has generally kept up with the growth of their assets, boosted in part by trading profits that have remained strong despite seasonal declines in 2022:Q4 (figures 3.8 and 3.9). Net secured borrowing of primary dealers has increased since

Figure 3.7. Leverage at broker-dealers remained historically low



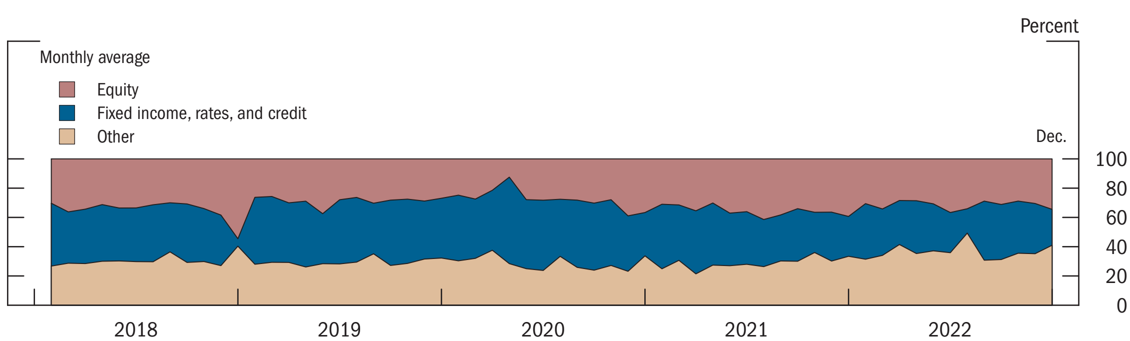
Source: Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States."

Figure 3.8. Trading profits decreased in 2022:Q4, consistent with seasonal patterns



Source: Federal Reserve Board, Reporting, Recordkeeping, and Disclosure Requirements Associated with Regulation VV (Proprietary Trading and Certain Interests in and Relationships with Covered Funds, 12 C.F.R. pt. 248).

Figure 3.9. Shares of trading profits by trading desks



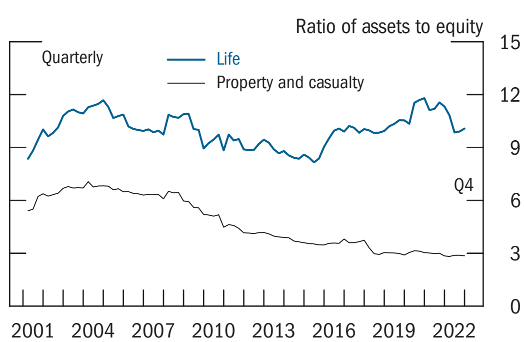
Source: Federal Reserve Board, Reporting, Recordkeeping, and Disclosure Requirements Associated with Regulation VV (Proprietary Trading and Certain Interests in and Relationships with Covered Funds, 12 C.F.R. pt. 248).

the November report but remained near its historical average, while gross financing and borrowing have increased. Primary dealer Treasury market activities, including market making and repo, increased since the November report but did not keep pace with the amount of Treasury securities available to investors. During the volatile period in mid-March, dealers faced elevated client flows that resulted in their inventories of Treasury securities increasing somewhat, suggesting that dealers continued to intermediate in Treasury markets.

In the March 2023 Senior Credit Officer Opinion Survey on Dealer Financing Terms (SCOOS), which covered the period between December 2022 and February 2023, dealers reported that they had, on net, tightened terms associated with securities financing and over-the-counter derivatives transactions offered to REITs and nonfinancial corporations.[12] Respondents also reported that liquidity and market functioning for non-agency residential mortgage-backed securities and consumer asset-backed securities (ABS) had improved. In response to a set of special questions about volatility products referencing interest rates, foreign exchange (FX), and credit spreads, respondents reported that, since January 2021, clients' interest in trading volatility products had increased, driven by increased demand for hedging volatility, and that market liquidity and functioning had improved for FX and credit spread volatility products.

Leverage at life insurers edged up but remained below its pandemic peak

Figure 3.10. Leverage at life insurance companies edged up but remained below its pandemic peak



Source: Generally accepted accounting principles data from 10-Q and 10-K filings accessed via S&P Global, Capital IQ Pro.

Leverage at life insurers increased slightly since the previous report, but it remained near the middle of its historical range and well below its pandemic peak. Meanwhile, leverage at property and casualty insurers stayed low relative to historical levels (figure 3.10). Life insurers continued to allocate a high percentage of assets to instruments with higher credit or liquidity risk, such as high-yield corporate bonds, privately placed corporate bonds, and alternative investments. These assets can suffer sudden increases in default risk, putting pressure on insurer capital positions. Rising interest rates have likely had a positive effect on the profitability of life insurers, as their liabilities generally had longer effective

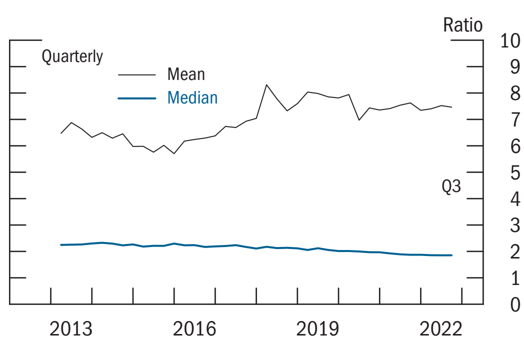
[12] The SCOOS is available on the Federal Reserve's website at https://www.federalreserve.gov/data/scoos.htm.

durations than their assets. However, an unexpected and sharp surge in interest rates may induce policyholders to surrender their contracts at a higher-than-expected rate, potentially causing some funding strains.

Hedge fund leverage remained somewhat elevated, especially at the largest funds

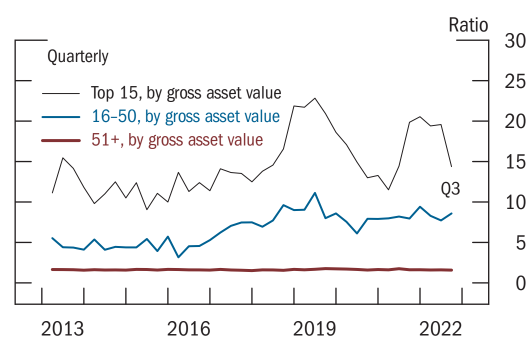
According to comprehensive data collected by the Securities and Exchange Commission (SEC), average on-balance-sheet leverage and average gross leverage of hedge funds, which includes off-balance-sheet derivatives exposures, remained above their historical averages in the third quarter of 2022 (figure 3.11). While average financial leverage was modest, leverage at the largest hedge funds was substantially higher. The average on-balance-sheet leverage of the top 15 hedge funds by gross asset value, which at times has exceeded 20-to-1, decreased in 2022:Q3 to about 14-to-1 (figure 3.12). These high levels of leverage are consistent with the low haircuts on Treasury collateral in the noncentrally cleared bilateral repo market.[13] More recent data from the March 2023 SCOOS suggested that the use of financial leverage by hedge funds had not changed, on net, between December 2022 and February 2023 amid unchanged price and nonprice borrowing terms (figure 3.13).

Figure 3.11. Leverage at hedge funds remained elevated



Source: Securities and Exchange Commission, Form PF, Reporting Form for Investment Advisers to Private Funds and Certain Commodity Pool Operators and Commodity Trading Advisors.

Figure 3.12. Leverage at the largest hedge funds decreased but remained high

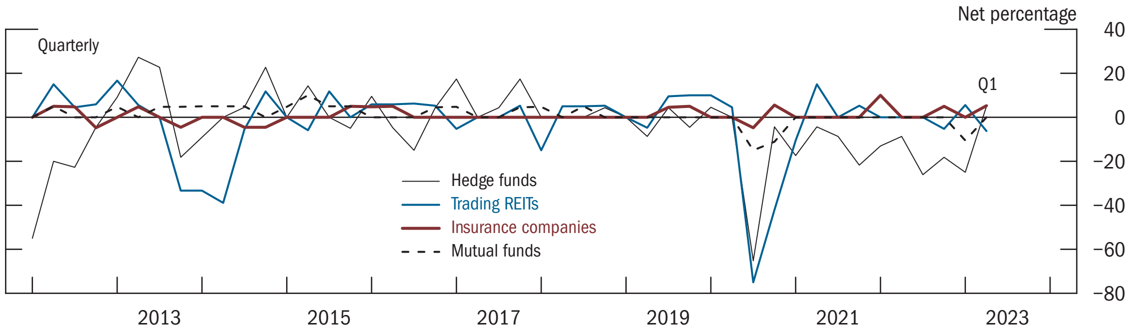


Source: Securities and Exchange Commission, Form PF, Reporting Form for Investment Advisers to Private Funds and Certain Commodity Pool Operators and Commodity Trading Advisors.

Data from the Commodity Futures Trading Commission Traders in Financial Futures report showed that, before the bank stresses of March 2023, leveraged funds' short Treasury futures positions had increased notably since the November report. In the past, high levels of short positions

[13] See Samuel J. Hempel, R. Jay Kahn, Robert Mann, and Mark Paddrik (2022), "OFR's Pilot Provides Unique Window into the Non-centrally Cleared Bilateral Repo Market," *The OFR Blog*, December 5, https://www.financialresearch.gov/the-ofr-blog/2022/12/05/fr-sheds-light-on-dark-corner-of-the-repo-market.

Figure 3.13. Dealers indicated that the use of leverage by hedge funds was unchanged recently



Source: Federal Reserve Board, Senior Credit Officer Opinion Survey on Dealer Financing Terms.

in Treasury futures held by leveraged funds coincided with hedge fund activities in Treasury cash-futures basis trades, and that trade may have gained in popularity recently as well. The basis trade is often highly leveraged and involves the sale of a Treasury futures and the purchase of a Treasury security deliverable into the futures contract, usually financed through repo.[14] Amid increased interest rate volatility following the SVB failure, some hedge funds that were short Treasury futures or were engaged in other bets that U.S. short-term rates would continue to rise faced margin calls and partially unwound those positions. The unwinds may have contributed to the large movements and increased volatility in short-term Treasury markets and to volatility in interest rate markets.

Like hedge funds, private credit funds are private pooled investment vehicles about which relatively little is known. The box "Financial Stability Risks from Private Credit Funds Appear Limited" assesses the vulnerabilities posed by private credit funds.

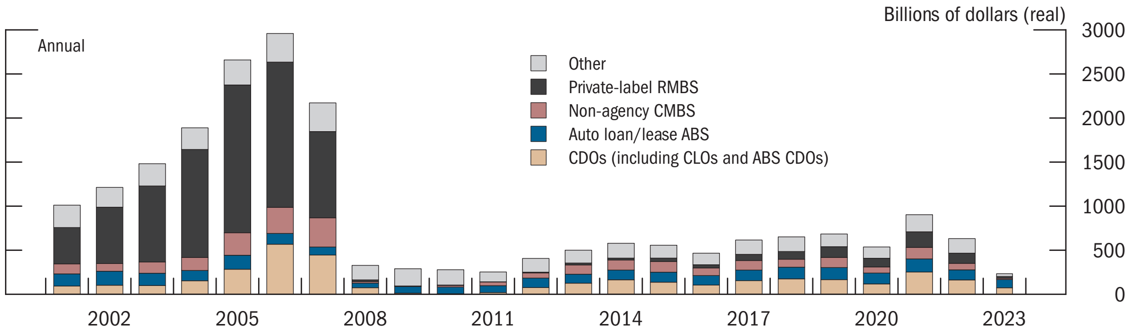
Issuance of non-agency securities by securitization vehicles has slowed

Non-agency securitization issuance—which increases the amount of leverage in the financial system—slowed significantly in 2022 and in the first quarter of 2023 (figure 3.14).[15] In particular,

[14] Between 2018 and March 2020, hedge funds built up large positions in the basis trade, which were then unwound, along with other Treasury trades, in March 2020 and reportedly contributed to Treasury market dislocations at that time. See Ayelen Banegas, Phillip J. Monin, and Lubomir Petrasek (2021), "Sizing Hedge Funds' Treasury Market Activities and Holdings," FEDS Notes (Washington: Board of Governors of the Federal Reserve System, October 6), https://doi.org/10.17016/2380-7172.2979.

[15] Securitization allows financial institutions to bundle loans or other financial assets and sell claims on the cash flows generated by these assets as tradable securities, much like bonds. By funding assets with debt issued by investment funds known as special purpose entities (SPEs), securitization can add leverage to the financial system, in part because SPEs are generally subject to regulatory regimes, such as risk retention rules, that are less stringent than banks' regulatory capital requirements. Examples of the resulting securities include collateralized loan obligations (predominantly backed by leveraged loans), ABS (often backed by credit card and auto debt), CMBS, and residential mortgage-backed securities.

Figure 3.14. Issuance of non-agency securitized products has slowed significantly since 2021



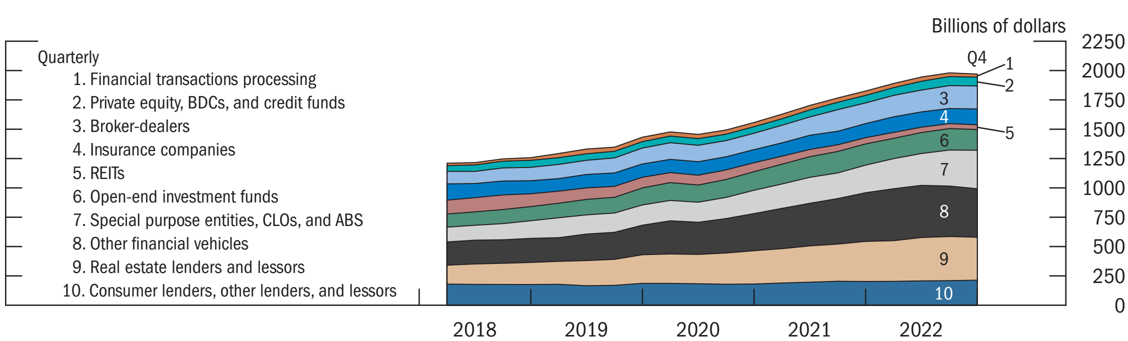
Source: Green Street, Commercial Mortgage Alert's CMBS Database and Asset-Backed Alert's ABS Database; consumer price index, Bureau of Labor Statistics via Haver Analytics.

non-agency CMBS issuance volumes were well below their five-year averages. Credit spreads of non-agency securitized products have narrowed since the November report. However, spreads between senior and junior tranches were higher, particularly for those deal types experiencing weakness in underlying credit, such as subprime consumer ABS deals and CMBS. Most securitization sectors exhibited relatively stable credit performance, indicated by low loan delinquency or default rates compared with historical long-term averages. However, delinquencies in non-agency CMBS backed by CRE remained relatively high.

Bank lending to nonbank financial institutions remained high

The growth in bank lending to NBFIs, which can be informative about the amount of leverage used by NBFIs and shed light on their interconnectedness with the rest of the financial system, slowed significantly since the November report. Banks' credit commitments to NBFIs grew rapidly in recent years and reached about \$2 trillion in the fourth quarter of 2022 (figure 3.15). The year-over-year growth rate in committed amounts to special purpose entities and securitization

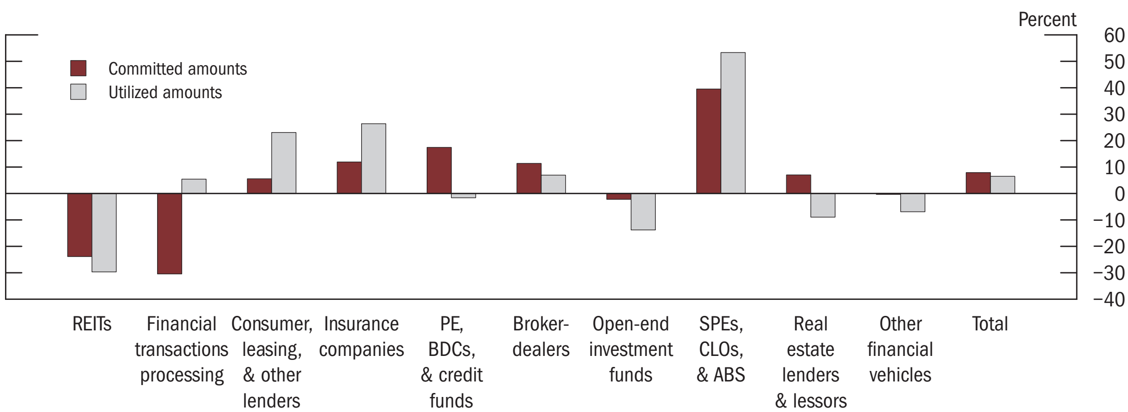
Figure 3.15. Bank credit commitments to nonbank financial institutions remained high



Source: Federal Reserve Board, Form FR Y-14Q (Schedule H.1), Capital Assessments and Stress Testing.

vehicles was about 40 percent at the end of last year, more than double its growth rate in 2021 (figure 3.16). Banks are also important creditors to nonbank mortgage companies. Nonbank mortgage companies' profitability has come under pressure as mortgage originations have declined; should mortgage delinquencies rise, some of these companies could become distressed and see a reduction in their access to credit. Utilization rates on credit lines to NBFIs remained steady and averaged about 50 percent of total committed amounts. Delinquency rates on banks' lending to NBFIs have been lower than delinquency rates for the nonfinancial business sector since the data became available in 2013. However, the limited information available on NBFIs' alternative funding sources, and the extent to which those sources may be fragile, could contribute to increased vulnerabilities in the financial sector.

Figure 3.16. Aggregate loan commitments and utilization rates of nonbank financial institutions increased during 2022 but varied across sectors



Source: Federal Reserve Board, Form FR Y-14Q (Schedule H.1), Capital Assessments and Stress Testing.

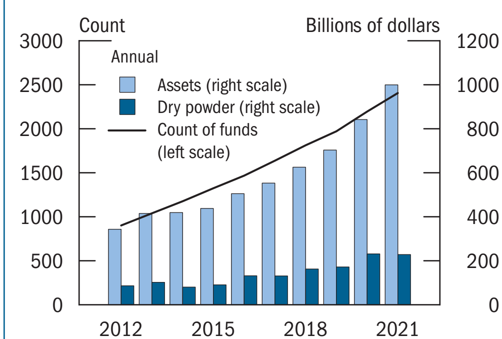
Box 3.2. Financial Stability Risks from Private Credit Funds Appear Limited

Private credit refers to direct lending to businesses by nonbank institutions and is distinct from bank loans, leveraged loans, or corporate bonds that involve lending by banks, by bank-led syndicates, or through public markets, respectively. Within the private credit market, private credit funds are the largest class of lenders and manage over five times more in assets than business development companies, the second-largest class of lenders. Private credit funds are pooled investment vehicles that originate or invest in loans to private—that is, not publicly traded—businesses. Only institutional investors or high-net-worth individuals are eligible to invest in such funds. Despite private credit funds' growing presence, available information about their activities and risks is limited. Using the SEC Form PF data, this discussion examines the financial stability risks that private credit funds can pose through their use of financial leverage or through liquidity transformation.[1] The analysis suggests that such risks are likely limited. While private credit funds have grown rapidly since the 2007–09 financial crisis and the assets they hold are mostly illiquid, the funds typically use little leverage, and investor redemption risks appear low. However, the sector remains opaque, and it is difficult to assess the default risk in private credit portfolios.

Since the 2007–09 financial crisis, private credit funds have experienced substantial growth, as the privately negotiated loans that they extend have become an increasingly important source of credit for some businesses, particularly middle-market companies.[2] As of 2021:Q4, their assets under management (AUM) stood at $1 trillion, and the estimated "dry powder" (committed but uncalled capital) amounted to $228 billion (figure A).[3] The industry grew further in 2022, according to private-sector estimates.[4] Over the past decade, private credit fund assets grew faster than leveraged loans (at annual rates of 13 percent and 10 percent, respectively) and as of 2021:Q4 were similar in size to the volume of outstanding leveraged loans and U.S. high-yield bonds (approximately $1.4 trillion and $1.5 trillion, respectively).

(continued)

Figure A. Private credit fund assets and dry powder



Source: Securities and Exchange Commission, Form PF, Reporting Form for Investment Advisers to Private Funds and Certain Commodity Pool Operators and Commodity Trading Advisors; Federal Reserve Board staff calculations.

[1] Private credit funds are structured as "private funds"—that is, issuers that would be investment companies according to the Investment Company Act of 1940 but for section 3(c)(1) or 3(c)(7) of that act. SEC-registered investment advisers with $150 million or more in regulatory assets under management in private funds provide information about their private funds on Form PF. Form PF does not break out private credit funds. To identify private credit funds in Form PF, Board staff (1) name-matched a sample of private credit funds from PitchBook; (2) searched fund names for terms commonly included in private credit fund names (for example, "senior credit" and "mezzanine"); (3) included funds filing as hedge funds on Form PF whose reported strategy allocations were mostly to private credit (based on a keyword search of strategy descriptions); and (4) removed collateralized loan obligations (CLOs), collateralized debt obligations (CDOs), and various types of other funds (for example, equity hedge funds) that were erroneously included in the previous steps. The sample does not include business development companies, CLOs or CDOs, registered investment companies pursuing private credit strategies, or private credit funds that are too small or are not required to file Form PF.

[2] Middle-market businesses are defined by the National Center for the Middle Market at Ohio State University's Fisher College of Business as businesses with annual revenues between $10 million and $1 billion.

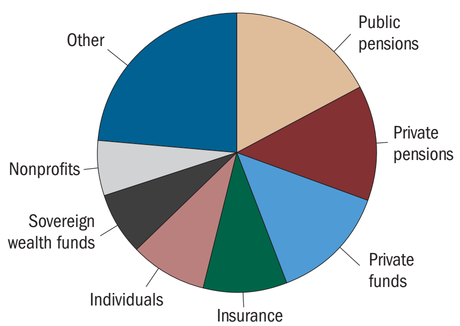
[3] For comparison, business development companies, the second-largest class of lenders, managed about $180 billion in assets.

[4] Preqin estimates that the industry's total AUM grew by 8.9 percent in 2022.

Box 3.2—*continued*

Private credit funds follow a diverse set of investment strategies and invest in loans with varying characteristics. Direct lending funds are the largest category of private credit funds in terms of assets. These funds hold senior secured, unrated, floating-rate loans to middle-market companies. Some private credit funds invest in loans that are categorized under a broad class of credit opportunities. For instance, distressed credit funds lend to businesses experiencing liquidity problems or invest in deeply discounted debt. Regardless of strategy, the loans held by private credit funds appear largely illiquid, with their valuations not based on prices readily available in active markets.[5]

Figure B. Shares of private credit fund assets held by different investors



Source: Securities and Exchange Commission, Form PF, Reporting Form for Investment Advisers to Private Funds and Certain Commodity Pool Operators and Commodity Trading Advisors; Federal Reserve Board staff calculations.

Investors in private credit funds are diversified institutional investors and high-net-worth individuals (figure B). Based on Form PF, as of 2021:Q4, public and private pension funds held about 31 percent ($307 billion) of aggregate private credit fund assets. Other private funds made up the second-largest cohort of investors at 14 percent ($136 billion) of assets, while insurance companies and individual investors each had about 9 percent ($92 billion). Given the rapid growth of private credit funds, these investors are increasingly indirectly exposed to the liquidity and credit risks of assets in private credit fund portfolios.

Financial stability risks associated with investor redemptions from private credit funds appear low. Most private credit funds have a closed-end fund structure and typically lock up the capital of their investors (that is, limited partners) for 5 to 10 years. Those funds that are structured as hedge funds routinely restrict share redemptions of their investors through redemption notice periods, lockups, and gates.[6] Thus, private credit funds engage in limited liquidity and maturity transformation.

Although private credit funds are not runnable themselves, they can pose liquidity demands on their investors in the form of capital calls, the timing of which investors do not control.[7] Generally, investors have 10-day notice periods to provide capital when called, though notice periods may differ across funds. Although most institutional investors would likely be able to manage such capital calls, unanticipated calls may pose a liquidity risk for some investors, potentially forcing them to sell other assets to raise liquidity.

Risks to financial stability from leverage at private credit funds appear low. Indeed, most private credit funds are unlevered, with no borrowings or derivative exposures. A minority of funds, however,

(continued)

5 The majority of private credit funds' assets rely on values quoted by market participants or estimated by valuation models rather than through real-time transactions; hence, they are classified as Level 2 or 3 under generally accepted accounting principles.

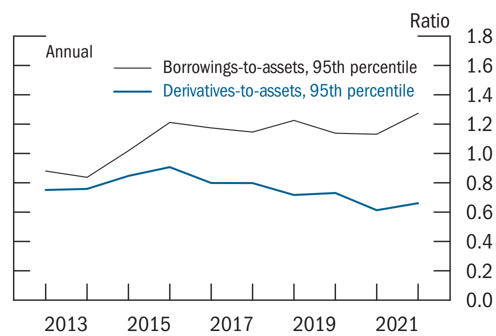
6 For the purposes of filing Form PF, a private equity fund is a private fund that does not offer investors redemption rights in the ordinary course and is not a hedge fund or one of the other types of funds defined in the form (liquidity fund, real estate fund, securitized asset fund, or venture capital fund). There is no requirement that a private equity fund conduct private equity transactions such as leveraged buyouts. On Form PF, a hedge fund is defined as a private fund whose adviser may be paid a performance fee, can take leverage, and can sell securities short; the definition does not mention investor share restrictions.

7 It is estimated that, as of 2021:Q4, pensions had $69 billion in uncalled capital commitments to private credit funds, while insurance companies had $23 billion. Uncalled capital (dry powder) is estimated as regulatory AUM (which includes uncalled capital commitments) minus total balance sheet assets.

Box 3.2—*continued*

use modest amounts of financial or synthetic leverage. Figure C shows that the most levered funds (those at the 95th percentile) have borrowings-to-assets ratios of about 1.27 and derivatives-to-assets ratios of about 0.66. In the aggregate, private credit funds borrowed about $200 billion in 2021:Q4, mainly from U.S. financial institutions, and held about $200 billion of derivative gross notional exposure.[8] Risks to lenders of private credit funds, typically banks, appear moderate due to the relatively modest amount of borrowings of private credit funds and their secured nature.

Figure C. Leverage ratios of private credit funds



Source: Securities and Exchange Commission, Form PF, Reporting Form for Investment Advisers to Private Funds and Certain Commodity Pool Operators and Commodity Trading Advisors; Federal Reserve Board staff calculations.

Overall, the financial stability vulnerabilities posed by private credit funds appear limited. Most private credit funds use little leverage and have low redemption risks, making it unlikely that these funds would amplify market stress through asset sales. However, a deterioration in credit quality and investor risk appetite could limit the capacity of private credit funds to provide new financing to firms that rely on private credit. Moreover, despite new insights from Form PF, visibility into the private credit space remains limited. Comprehensive data are lacking on the forms and terms of the financing extended by private credit funds or on the characteristics of their borrowers and the default risk in private credit portfolios.

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8 Form PF has detailed data on derivative exposures for only the relatively small subset of private credit funds filing as qualifying hedge funds. The derivatives exposures of these funds are concentrated in credit default swaps, FX derivatives, and interest rate derivatives.

4 | Funding Risks

Funding strains were notable for some banks, but overall funding risks across the banking system were low; meanwhile, structural vulnerabilities persisted in other sectors that engage in liquidity transformation

The failures of SVB and Signature Bank, along with strains at some other banks, highlighted vulnerabilities associated with high concentrations of uninsured deposits. Uninsured deposits are prone to runs, in part because they lack an explicit government guarantee. From the start of the pandemic in 2020 to the end of 2021—a period when interest rates remained low—banks received $3.7 trillion in domestic deposits, most of which were uninsured. As interest rates increased throughout 2022, bank deposits became less attractive for depositors and banks experienced outflows, led by uninsured deposits. As of the fourth quarter of 2022, aggregate uninsured deposits stood at $7.5 trillion. Although aggregate levels of uninsured deposits in the banking system were high, SVB and Signature Bank were outliers in terms of their heavy reliance on uninsured deposits, as most banks had a much more balanced mix of liabilities.

Overall, estimated runnable money-like financial liabilities decreased 1.6 percent to $19.6 trillion (75 percent of nominal GDP) over the past year. As a share of GDP, runnable liabilities continued their post-pandemic decline but remained above their historical median (table 4.1 and figure 4.1). Large banks that were subject to the liquidity coverage ratio (LCR) continued to maintain levels of high-quality liquid assets (HQLA) that suggested that their liquid resources would be sufficient to withstand expected short-term cash outflows.

Prime MMFs and other cash-investment vehicles remain vulnerable to runs and, hence, contribute to the fragility of short-term funding markets. In addition, some cash management vehicles, including retail prime MMFs, government MMFs, and short-term investment funds, maintain stable net asset values (NAVs) that make them susceptible to sharp increases in interest rates. The market capitalization of the stablecoin sector continued to decline, and the sector remains vulnerable to liquidity risks like those of cash-like vehicles. Some open-end bond mutual funds continued to be susceptible to large redemptions because they must allow shareholders to redeem every day even though the funds hold assets that can face losses and become illiquid amid stress. Liquidity risks at central counterparties (CCPs) remained low, while liquidity risks at life insurers appeared elevated.

Table 4.1. Size of selected instruments and institutions

Item	Outstanding/total assets (billions of dollars)	Growth, 2021:Q4–2022:Q4 (percent)	Average annual growth, 1997–2022:Q4 (percent)
Total runnable money-like liabilities*	19,627	−1.6	4.7
Uninsured deposits	7,506	−6.8	12.0
Domestic money market funds**	4,685	.9	5.4
Government	3,959	−3.6	15.3
Prime	616	37.7	−.7
Tax exempt	111	27.1	−2.2
Repurchase agreements	3,601	−1.6	4.9
Commercial paper	1,261	15.8	2.7
Securities lending***	805	2.8	7.1
Bond mutual funds	4,250	−20.4	8.5

Note: The data extend through 2022:Q4 unless otherwise noted. Outstanding amounts are in nominal terms. Growth rates are measured from Q4 of the year immediately preceding the period through Q4 of the final year of the period. Total runnable money-like liabilities exceed the sum of listed components. Unlisted components of runnable money-like liabilities include variable-rate demand obligations, federal funds, funding-agreement-backed securities, private liquidity funds, offshore money market funds, short-term investment funds, local government investment pools, and stablecoins.

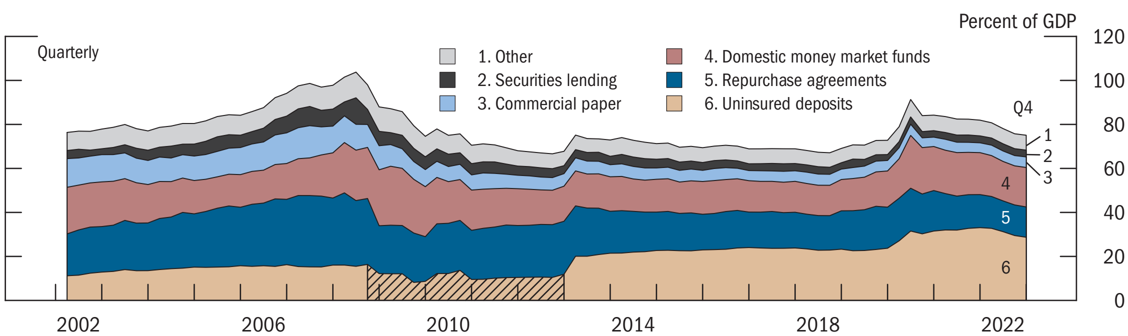
* Average annual growth is from 2003:Q1 to 2022:Q4.

** Average annual growth is from 2001:Q1 to 2022:Q4.

*** Average annual growth is from 2000:Q1 to 2022:Q3. Securities lending includes only lending collateralized by cash.

Source: Securities and Exchange Commission, Private Funds Statistics; iMoneyNet, Inc., Offshore Money Fund Analyzer; Bloomberg Finance L.P.; Securities Industry and Financial Markets Association: U.S. Municipal Variable-Rate Demand Obligation Update; Risk Management Association, Securities Lending Report; DTCC Solutions LLC, an affiliate of the Depository Trust & Clearing Corporation: commercial paper data; Federal Reserve Board staff calculations based on Investment Company Institute data; Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States"; Federal Financial Institutions Examination Council, Consolidated Reports of Condition and Income (Call Report); Morningstar, Inc., Morningstar Direct; DeFiLlama.

Figure 4.1. Ratios of runnable money-like liabilities to GDP edged down but remained above their historical medians

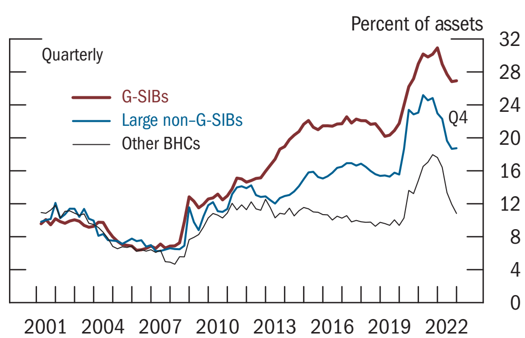


Source: Securities and Exchange Commission, Private Funds Statistics; iMoneyNet, Inc., Offshore Money Fund Analyzer; Bloomberg Finance L.P.; Securities Industry and Financial Markets Association: U.S. Municipal Variable-Rate Demand Obligation Update; Risk Management Association, Securities Lending Report; DTCC Solutions LLC, an affiliate of the Depository Trust & Clearing Corporation: commercial paper data; Federal Reserve Board staff calculations based on Investment Company Institute data; Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States"; Federal Financial Institutions Examination Council, Consolidated Reports of Condition and Income (Call Report); Bureau of Economic Analysis, gross domestic product via Haver Analytics; DeFiLlama.

The amount of high-quality liquid assets decreased for banks but remained high compared with pre-pandemic levels

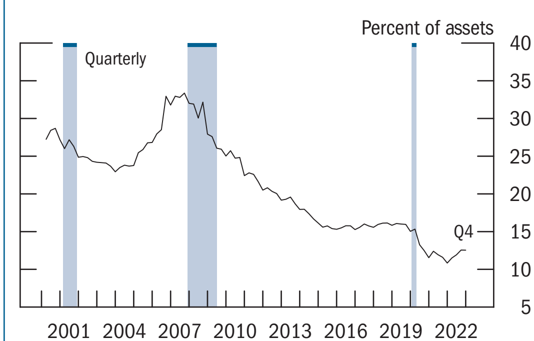
The amount of HQLA decreased across all types of banks over the past year, driven by decreases in reserves and reductions in market values of securities portfolios due to rising interest rates (figure 4.2). Nevertheless, aggregate bank reserves remained above $3 trillion, significantly higher than pre-pandemic levels. Throughout 2022, as interest rates increased, deposit outflows picked up, as higher-paying deposit alternatives became more attractive to businesses and households. Deposits declined in the fourth quarter of 2022 at a 7 percent annual rate, and the pace of outflows had increased somewhat in January and February before the banking sector stress in March 2023. Some banks increased their reliance on wholesale funding sources, though banks' overall reliance on short-term wholesale funding remained near historically low levels (figure 4.3). Even with the declines in HQLA, U.S. G-SIBs' LCRs—the requirement that banks must hold enough HQLA to fund estimated cash outflows during a hypothetical stress event for 30 days—remained well above requirements.

Figure 4.2. The amount of high-quality liquid assets held by banks decreased in 2022



Source: Federal Reserve Board, Form FR Y-9C, Consolidated Financial Statements for Holding Companies.

Figure 4.3. Banks' reliance on short-term wholesale funding remained low



Source: Federal Reserve Board, Form FR Y-9C, Consolidated Financial Statements for Holding Companies.

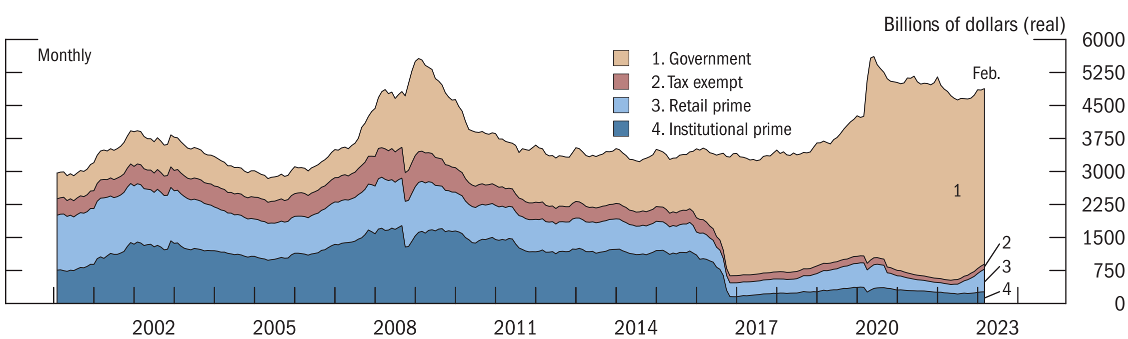
Some banks that relied heavily on uninsured deposits experienced notable funding strains

Aggregate liquidity in the banking system appeared ample; nonetheless, some banks experienced significant funding strains following the failures of SVB and Signature Bank (see the box "The Bank Stresses since March 2023"). These banks, including First Republic Bank, which subsequently failed, often shared similar weaknesses—notably, a combination of a heavy reliance on uninsured deposits and excessive exposure to interest rate risk. Data on bank assets and liabilities show that small domestic banks—defined as banks outside the top 25 in terms of domestic assets—initially experienced rapid deposit outflows in the wake of the SVB and Signature Bank failures. However, these outflows had slowed considerably by the end of March.[16] The Federal Reserve, together with the U.S. Department of the Treasury and the FDIC, took decisive actions to reduce funding strains in the banking system (see the box "The Federal Reserve's Actions to Protect Bank Depositors and Support the Flow of Credit to Households and Businesses"). Banks with funding needs increased borrowing from the Federal Reserve, including a notable increase in discount window borrowing and additional borrowing from the new Bank Term Funding Program (BTFP). In addition, Federal Home Loan Banks' total debt outstanding grew about $250 billion, to $1.5 trillion, during the week ending March 17, 2023, to meet a surge in demand for borrowing by their member banks.

Structural vulnerabilities remained at some money market funds and other cash-management vehicles

Prime MMFs remain a prominent vulnerability due to their susceptibility to large redemptions and the significant role they play in short-term funding markets. Since the November report, AUM in prime MMFs offered to the public increased $270 billion (53 percent), driven by $240 billion in inflows into retail prime funds (figure 4.4).

Figure 4.4. Growth in money market funds was concentrated in retail prime funds



Source: Federal Reserve Board staff calculations based on Investment Company Institute data; consumer price index, Bureau of Labor Statistics via Haver Analytics.

In the immediate aftermath of the failures of SVB and Signature Bank, government MMFs had a surge in inflows, but prime MMFs experienced a jump in redemptions. Although outflows from prime MMFs eased after a few days, the episode illustrated again that these funds continue to be at risk of large redemptions during episodes of financial stress.

[16] See Board of Governors of the Federal Reserve System (2023), Statistical Release H.8, "Assets and Liabilities of Commercial Banks in the United States," https://www.federalreserve.gov/releases/h8.

Box 4.1. The Federal Reserve's Actions to Protect Bank Depositors and Support the Flow of Credit to Households and Businesses

In March 2023, the domestic and global banking sector experienced acute stress, following a loss of confidence in SVB and Signature Bank. After experiencing bank runs of unprecedented speed, SVB and Signature Bank failed, and there were broader spillovers to the banking sector. Credit Suisse came under renewed pressure, leading to its acquisition by UBS in a deal that involved liquidity support and loss sharing from the Swiss government as well as the write-off of a certain type of contingent capital instruments (see the box "The Bank Stresses since March 2023"). The fast propagation of these stresses was compounded by novel factors. Social media and messaging apps facilitated the communication of perceived bank concerns among the network of uninsured depositors, and the availability of information technology facilitated the movement of deposits. In response, the Federal Reserve, together with the FDIC and the U.S. Department of the Treasury, took decisive actions to protect bank depositors and support the continued flow of credit to households and businesses. These actions reduced stress across the financial system, supporting financial stability and minimizing the effect on businesses, households, taxpayers, and the broader economy.

On Sunday, March 12, the Federal Reserve, together with the FDIC and the U.S. Department of the Treasury, announced two actions designed to support all bank depositors and the continued flow of credit to households and businesses. After receiving a recommendation from the boards of the FDIC and the Federal Reserve, and consulting with the President, the Treasury Secretary approved a systemic risk exception, enabling the FDIC to complete its resolution of SVB and Signature Bank in a manner that fully protects all depositors. Depositors were given full access to their accounts on the Monday following the announcement. In contrast to depositors, shareholders and certain unsecured debt holders were not protected, and senior management at these banks was removed. The losses associated with these actions, later estimated by the FDIC to be $22.5 billion, will not be borne by taxpayers and instead will be borne by the Deposit Insurance Fund, which will be replenished by special assessments on banks, as required by law.[1]

At the same time, on Sunday, March 12, with approval by the Treasury Secretary, the Federal Reserve Board announced the establishment of the BTFP, making available additional funding to eligible depository institutions. The BTFP offers loans of up to one year in length to federally insured banks, savings associations, and credit unions, and to U.S. branches and agencies of foreign banks. New loans can be requested under the BTFP until at least March 11, 2024. To borrow from the BTFP, eligible institutions can pledge any collateral eligible for purchase by the Federal Reserve in open market operations, such as U.S. Treasury securities, U.S. agency securities, and U.S. agency mortgage-backed securities. The BTFP extends loans against the par value of eligible collateral—that is, the face amount of the securities without giving effect to any declines in fair value. With approval of the Treasury Secretary, the U.S. Department of the Treasury has committed to make available up to $25 billion from the Exchange Stabilization Fund as a backstop for the BTFP. The Federal Reserve does not anticipate that it will be necessary to draw on these backstop funds.

The BTFP will be an additional source of borrowing for depository institutions against high-quality securities, which eliminates an institution's need to quickly sell those securities should a significant fraction

(continued)

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1 The exact cost of the resolution of SVB and Signature Bank will be determined when the FDIC terminates the receiverships. Current estimates from the FDIC about the cost to its Deposit Insurance Fund from the failure of SVB and Signature Bank are approximately $20 billion and $2.5 billion, respectively. See Federal Deposit Insurance Corporation (2023), "Subsidiary of New York Community Bancorp, Inc., to Assume Deposits of Signature Bridge Bank, N.A., from the FDIC," press release, March 19, https://www.fdic.gov/news/press-releases/2023/pr23021.html; and Federal Deposit Insurance Corporation (2023), "First–Citizens Bank & Trust Company, Raleigh, NC, to Assume All Deposits and Loans of Silicon Valley Bridge Bank, N.A., from the FDIC," press release, March 26, https://www.fdic.gov/news/press-releases/2023/pr23023.html.

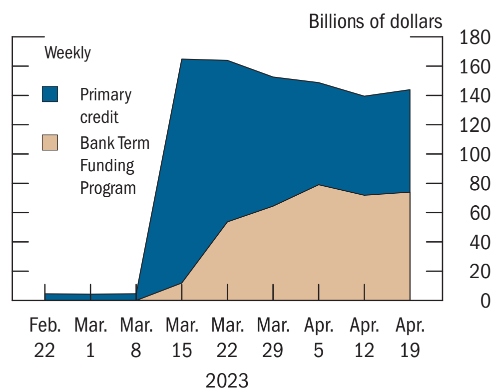
Box 4.1.—*continued*

of depositors withdraw their funding suddenly or the financial system curtail bank funding, helping assure depositors that banks have the ability to meet the needs of all their customers.

In addition, depository institutions may continue to obtain liquidity against a wide range of collateral through the discount window, which remains open and available. Moreover, at the same time as the BTFP was established, it was announced that the discount window will apply the same margins used for the securities eligible for the BTFP.

Following the acute banking stresses in early March and the announcements on March 12, primary credit extended through the discount window increased from less than $5 billion to more than $150 billion during the first week and quickly fell back to about $70 billion, whereas credit extended through the BTFP increased steadily by smaller increments and stabilized in a range between $70 billion and $80 billion (figure A).

Figure A. Outstanding balances of primary credit and Bank Term Funding Program



Source: Federal Reserve Board, Statistical Release H.4.1, "Factors Affecting Reserve Balances."

The Federal Reserve is prepared to address any liquidity pressures that may arise and is committed to ensuring that the U.S. banking system continues to perform its vital roles of ensuring that depositors' savings remain safe and providing access to credit to households and businesses in a manner that promotes strong and sustainable economic growth. These additional funding sources bolster the capacity of the banking system to safeguard deposits and ensure the ongoing provision of money and credit to the economy. The additional funding to eligible depository institutions will continue to serve as an important backstop against further bank stresses and support the flow of credit.

In international markets, Credit Suisse came under renewed pressure, and UBS agreed to merge with the firm on Sunday, March 19, in a deal that involved the write-off of a certain type of contingent convertible capital instruments as well as liquidity support and loss sharing from the Swiss government. On Sunday, March 19, the Federal Reserve, together with the Bank of Canada, the Bank of England, the Bank of Japan, the European Central Bank, and the Swiss National Bank, announced measures to mitigate the effects of strains on global funding markets via the standing U.S. dollar liquidity swap line arrangements. The network of swap lines among these central banks is a set of available standing facilities and serves as an important liquidity backstop to ease strains in global funding markets, thereby helping mitigate the effects of such strains on the supply of credit to U.S. households and businesses (see the box "Transmission of Stress Abroad to the U.S. Financial System"). To improve the swap lines' effectiveness in providing U.S. dollar funding, these central banks agreed to increase the frequency of seven-day maturity operations from weekly to daily and to continue at this frequency. These daily operations commenced on Monday, March 20. Following the announcement on March 19, demand for these swap lines ticked up by slightly over $100 million and then fell back to levels below $500 million observed before the announcement. These central banks announced on April 25 that the frequency of swap line operations will revert from daily back to once a week beginning on May 1.

Other cash-management vehicles, including dollar-denominated offshore MMFs and short-term investment funds, also invest in money market instruments, engage in liquidity transformation, and are vulnerable to runs. Since November, estimated aggregate AUM of these cash-management vehicles has edged up to about $1.7 trillion. Currently, between $600 billion and $1.5 trillion of these vehicles' AUM are in portfolios like those of U.S. prime MMFs, and large redemptions from these vehicles also have the potential to destabilize short-term funding markets.[17]

Many cash-management vehicles—including retail and government MMFs, offshore MMFs, and short-term investment funds—seek to maintain stable NAVs that are typically rounded to $1.00. When short-term interest rates rise sharply or portfolio assets lose value for other reasons, the market values of these funds may fall below their rounded share prices, which can put the funds under strain, particularly if they also have large redemptions.

The market value of many stablecoins declined, and they remain vulnerable to runs

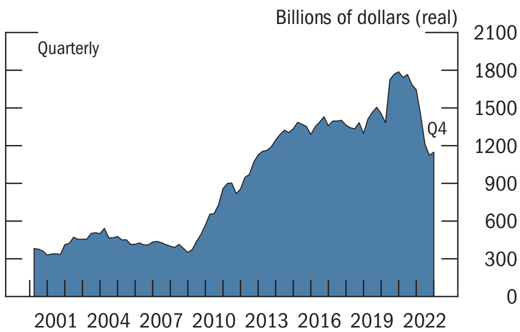
The total market capitalization of stablecoins, which are digital assets designed to maintain a stable value relative to a national currency or another reference asset, has fallen 21 percent since the beginning of 2022 to $130 billion. While not widely used as a cash-management vehicle by institutional and retail investors or for transactions for real economic activity, stablecoins are important for digital asset investors and remain structurally vulnerable to runs. On March 10, 2023, amid reports of large outflows of uninsured deposits at SVB, Circle Internet Financial, which operates the $31 billion stablecoin USD Coin (USDC), disclosed that it had $3.3 billion in dollar reserves held at SVB. This disclosure triggered large redemptions of USDC and caused it to drop temporarily below its target $1 value to as low as 87 cents. Following news of the government interventions assuring depositors of the safety of uninsured deposits at SVB and Signature Bank, USDC's price stabilized near $1.

Bond mutual funds experienced outflows and remained exposed to liquidity risks

Mutual funds that invest substantially in corporate bonds, municipal bonds, and bank loans may be particularly exposed to liquidity transformation risks, given the relative illiquidity of their assets and the requirement that these funds offer redemptions daily. The total outstanding amount of U.S. corporate bonds held by mutual funds fell to its lowest level since 2013 on an inflation-adjusted basis, primarily driven by a drop in valuations (figure 4.5). Mutual fund holdings at the end of 2022 were approximately 13 percent of all U.S. corporate bonds outstanding. Total AUM at high-yield bond and bank-loan mutual funds, which primarily hold riskier and less liquid assets,

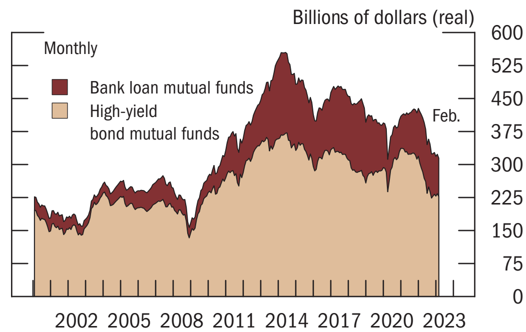
[17] Cash-management vehicles included in this total are dollar-denominated offshore MMFs, short-term investment funds, private liquidity funds, ultrashort bond mutual funds, and local government investment pools.

Figure 4.5. Corporate bonds held by bond mutual funds fell sharply



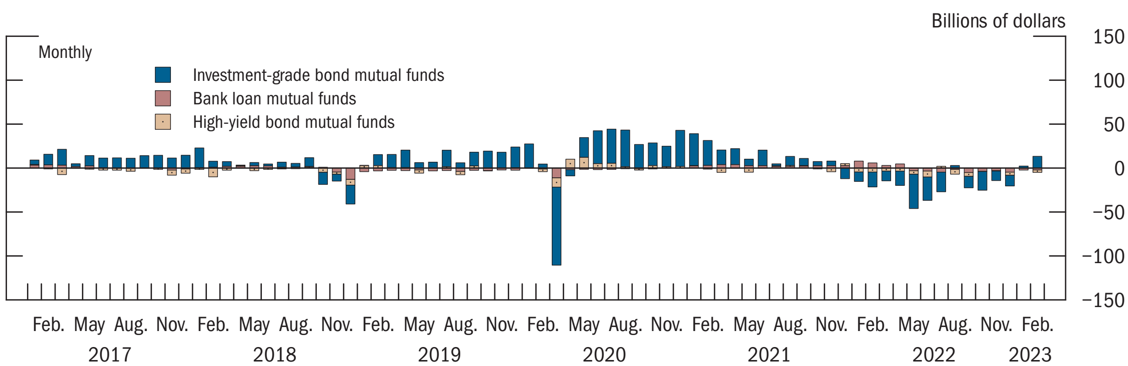
Source: Federal Reserve Board staff estimates based on Federal Reserve Board, Statistical Release Z.1, “Financial Accounts of the United States”; consumer price index, Bureau of Labor Statistics via Haver Analytics.

Figure 4.6. Assets held by high-yield and bank loan mutual funds decreased



Source: Investment Company Institute; consumer price index, Bureau of Labor Statistics via Haver Analytics.

Figure 4.7. Bond and bank loan mutual funds experienced notable outflows during most of the past year



Source: Investment Company Institute.

decreased sharply in real terms in 2022 (figure 4.6). Bond and loan mutual funds experienced negative returns and notable outflows during most of 2022 (figure 4.7).

On November 2, 2022, the SEC proposed reforms to the mutual fund sector. The proposed reforms include making swing pricing mandatory for open-end mutual funds. Swing pricing imposes costs arising from redemptions on the shareholders who redeem by reducing the NAV they receive on days when the mutual fund has net outflows. If properly calibrated, swing pricing could deter redemptions during a stressed market and lessen redeeming shareholders’ first-mover advantage. The SEC also proposed to enhance its 2016 liquidity risk-management rule for mutual funds and certain exchange-traded funds. These enhancements include a requirement that funds hold at least 10 percent of their portfolios in “highly liquid assets” as well as tightened liquidity classifications.

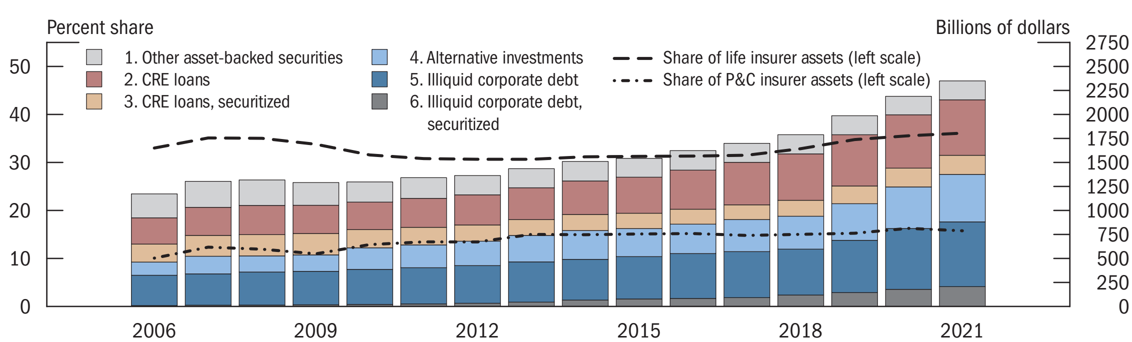
Liquidity risks at central counterparties remained low

Liquidity risks posed by CCPs to clearing members and market participants remained low. CCPs maintained elevated initial margin levels in the third quarter of 2022, the latest quarter for which data are available, even as volatility decreased in most cleared markets, with the notable exception of interest rate markets. In addition, their levels of prefunded resources were stable.[18] Those CCPs that focused on clearing interest rate products faced some difficulties adapting their margin models to the higher rate and volatility environment that began last year. During the second half of 2022, these CCPs experienced more frequent initial margin exceedances, in which some clearing members' mark-to-market losses exceeded their posted initial margin amounts. Large price moves and volatility in rates also resulted in large variation margin calls that were met by clearing members and clients. Finally, client clearing remained concentrated at the largest clearing members, which could make transferring client positions to other clearing members challenging if it were ever necessary.

Liquidity risks at life insurers remained elevated

Over the past decade, the liquidity of life insurers' assets steadily declined, and the liquidity of their liabilities slowly increased, potentially making it more difficult for life insurers to meet a sudden rise in withdrawals and other claims. Life insurers increased the share of illiquid assets—including CRE loans, less liquid corporate debt, and alternative investments—on their balance sheets (figure 4.8). In addition, they have continued to rely on nontraditional liabilities—including

Figure 4.8. Life insurers held more risky, illiquid assets on their balance sheets

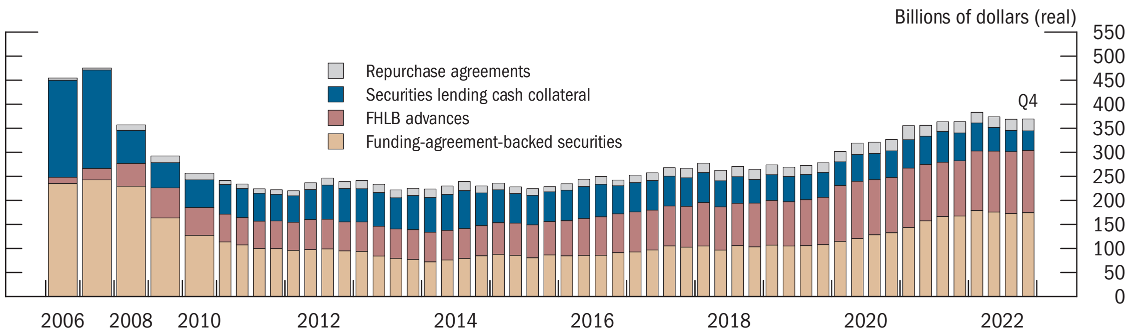


Source: Staff estimates based on data from Bloomberg Finance L.P. and National Association of Insurance Commissioners Annual Statutory Filings.

[18] Prefunded resources represent financial assets, including cash and securities, transferred by the clearing members to the CCP to cover that CCP's potential credit exposure in case of default by one or more clearing members. These prefunded resources are held as initial margin and prefunded mutualized resources.

funding-agreement-backed securities, Federal Home Loan Bank advances, and cash received through repos and securities lending transactions—which offer some investors the opportunity to withdraw funds on short notice (figure 4.9).

Figure 4.9. Life insurers continued to rely on nontraditional liabilities



Source: Consumer price index, Bureau of Labor Statistics via Haver Analytics; Moody's Analytics, Inc., CreditView, Asset-Backed Commercial Paper Program Index; Securities and Exchange Commission, Forms 10-Q and 10-K; National Association of Insurance Commissioners, quarterly and annual statutory filings accessed via S&P Global, Capital IQ Pro; Bloomberg Finance L.P.

5 | Near-Term Risks to the Financial System

The Federal Reserve routinely engages in discussions with domestic and international policymakers, academics, community groups, and others to gauge the issues of greatest concern to these groups. As noted in the box "Survey of Salient Risks to Financial Stability," in recent outreach, contacts were particularly focused on more restrictive policy to address persistent inflation, banking-sector stress, commercial and residential real estate, and geopolitical tensions.

The following discussion considers possible interactions of existing domestic vulnerabilities with several potential near-term risks, including international risks. The box "Transmission of Stress Abroad to the U.S. Financial System" discusses some transmission channels through which shocks originating abroad can transmit to the U.S. financial system.

Ongoing stresses in the banking system could lead to a broader contraction in credit, resulting in a marked slowdown in economic activity

Despite decisive actions by the Federal Reserve, the FDIC, and the U.S. Department of the Treasury, concerns about the economic outlook, credit quality, and funding liquidity could lead banks and other financial institutions to further contract the supply of credit to the economy. A sharp contraction in the availability of credit would drive up the cost of funding for businesses and households, potentially resulting in a slowdown in economic activity. With a decline in profits of nonfinancial businesses, financial stress and defaults at some firms could increase, especially in light of the generally high level of leverage in that sector. Additionally, an associated reduction in investor risk appetite could lead to significant declines in asset prices. Shocks are less likely to propagate to the financial system through the household sector because household borrowing is moderate relative to income, and the majority of household debt is owed by those with higher credit scores.

Further rate increases in the U.S. and other advanced economies could pose risks

If inflationary pressures prove to be more stubborn than anticipated, tighter-than-expected monetary policy could prompt sharp increases in longer-term interest rates and weaken economic growth worldwide. These developments could strain the debt service capacity of governments, households, and businesses abroad, including in emerging market economies (EMEs) that borrow externally. Most business loans and, in some countries, many residential mortgages have floating interest rates, implying that higher policy interest rates can quickly increase debt service requirements. Declines in property prices could strain the balance sheets of households and reduce recoveries on nonperforming loans backed by residential real estate and CRE. Bank funding costs are likely to increase as deposit rates continue to rise following earlier policy rate hikes and would continue to do so with any additional policy firming. While deposit rates are likely to remain lower than market interest rates, higher funding costs may pressure the profitability of banks with large portfolios of fixed-rate assets that were acquired when interest rates were much lower.

A sharp rise in interest rates could also lead to increased volatility in global financial markets, stresses to market liquidity, and a correction in asset prices. Liquidity pressures could subject banks to outflows of deposits and other forms of short-term funding. Higher rates and liquidity pressures could also lead to losses or liquidity strains for NBFIs that operate with high leverage or provide maturity transformation. Stress in foreign economies could transmit to the U.S. through disruptions in asset markets, reduced credit from foreign lenders to U.S. residents, and effects arising from U.S. financial institutions' interlinkages with foreign financial institutions, including in U.S. dollar funding markets (see the box "Transmission of Stress Abroad to the U.S. Financial System"). These interlinkages could further amplify stresses abroad.

A worsening of global geopolitical tensions could lead to commodity price inflation and broad adverse spillovers

The ongoing war in Ukraine is weighing on many countries in a variety of ways. Escalation of the war or a worsening in other geopolitical tensions could reduce economic activity and boost inflation worldwide. A resurgence in food and energy prices could, in turn, intensify stresses, especially in EMEs. Increased debt levels in some EMEs make these economies more vulnerable to shocks, potentially amplifying adverse effects. China continues to have very high levels of corporate debt, especially in the property sector, and local government debt has been increasing recently.[19] Stresses in China could spill over to other EMEs that rely on trade with China or credit from Chinese entities. Given the importance of EMEs, particularly China, to world trade and activity, stresses in EMEs could exacerbate adverse spillovers to global asset markets and economic activity, further affecting economic and financial conditions in the U.S.

[19] See the box "Stresses in China's Real Estate Sector" in Board of Governors of the Federal Reserve System (2022), *Financial Stability Report* (Washington: Board of Governors, May), pp. 58–60, https://www.federalreserve.gov/publications/files/financial-stability-report-20220509.pdf.

Box 5.1. Survey of Salient Risks to Financial Stability

As part of its market intelligence gathering, staff from the Federal Reserve Bank of New York solicited views from a wide range of contacts on risks to U.S. financial stability. From February to early April, the staff surveyed 25 contacts, including professionals at broker-dealers, investment funds, research and advisory organizations, and universities (figure A). The potential for persistent inflationary pressures to result in more restrictive monetary policy remained a top-cited risk, as it has been since the fall 2021 survey (figure B). Following the closure of SVB on March 10, a large majority of respondents highlighted the risk of additional banks coming under renewed stress. Many noted vulnerabilities in real estate markets, with some highlighting the potential for CRE exposures to trigger further banking sector concerns. Respondents also continued to focus on geopolitical risks, especially the possibility of heightened tensions between the U.S. and China and a further escalation of Russia's war in Ukraine. This discussion summarizes the most cited risks from this round of outreach.

Persistent inflation and monetary tightening

Concern over persistent inflationary pressures driving a highly restrictive monetary policy stance, particularly in the U.S., remained top of mind. Several contacts highlighted that labor and economic activity data remained robust despite the rapid rise in policy rates, suggesting global central banks may need to tighten further to fight inflation, risking a sharper economic slowdown and financial market instability. Some contacts noted that central bank balance sheet reductions in the U.S. and abroad could strain market functioning, particularly in sovereign bond markets.

Stress in the banking sector and nonbank financial institutions

Market participants highlighted the risk of stress in the banking sector, noting that higher funding costs and depressed profitability may render some banks vulnerable to deposit runs. Many respondents noted heightened market scrutiny over deposit stability and declines in fair value of legacy long-duration fixed-rate assets that could trigger further contagion and market volatility. Some contacts highlighted risks stemming from NBFIs in an environment of tightening monetary policy, such as that seen in the U.K. in September 2022.

Commercial real estate

Many contacts saw real estate as a possible trigger for systemic risk, particularly in the commercial sector, where respondents highlighted concerns over higher interest rates, valuations, and shifts in end-user demand. Some market participants associated risks in real estate with the emergence of banking-sector stress, noting some bank exposures to underperforming CRE assets could prompt instability.

Geopolitical risks

Many market participants cited a broad range of geopolitical risks, largely centered on the relationship between the U.S. and China. They noted rising tensions could cause a deterioration in trade and financial flows, with negative implications for global supply chains and investor sentiment. Some also cited the risk of military or political conflict between China and Taiwan, and any subsequent potential intervention by the U.S., as a possible flash point. Elsewhere, respondents highlighted the risk of an escalation of Russia's war in Ukraine as weighing on the economic outlook in Europe and driving higher commodity prices, with some noting that further escalation could increase risks of cyberwarfare.

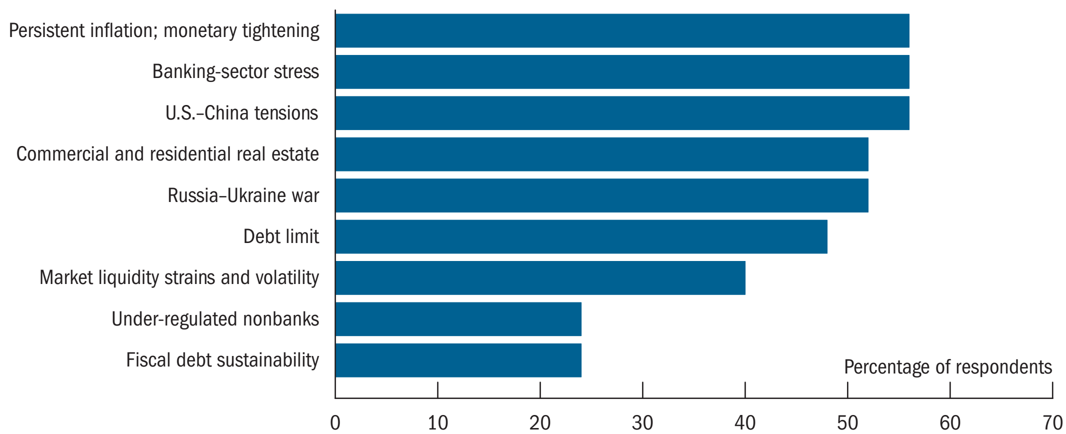
Debt limit

Respondents saw the potential for funding market disruptions and tighter financial conditions if the statutory debt limit is not raised in a timely manner, while noting the adverse ramifications of a technical or outright default, including a sharp rise in Treasury yields, an increase in corporate financing costs, and a deterioration in risk sentiment. Relatedly, some contacts noted the risk of higher government financing costs in an environment where monetary policy remains in restrictive territory for a protracted period.

(continued)

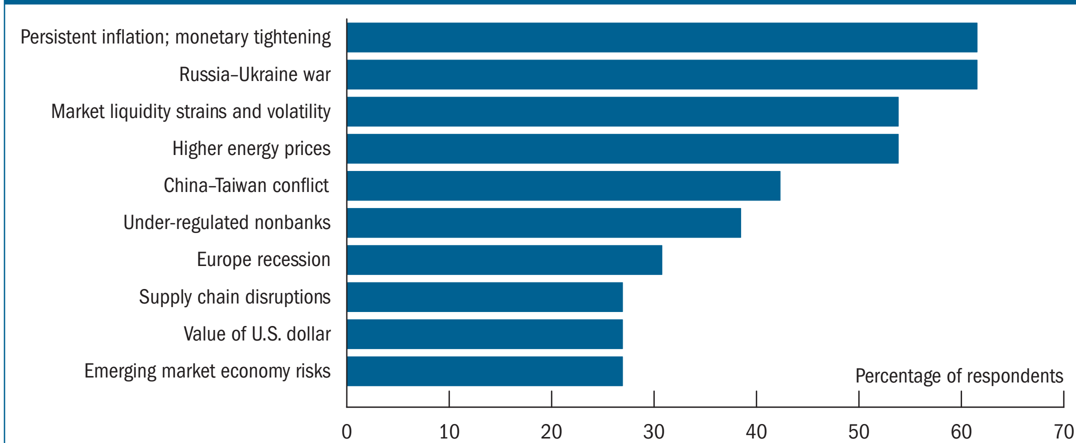
Box 5.1—*continued*

Figure A. Spring 2023: Most cited potential risks over the next 12 to 18 months



Source: Federal Reserve Bank of New York survey of 25 market contacts from February to April.

Figure B. Fall 2022: Most cited potential risks over the next 12 to 18 months



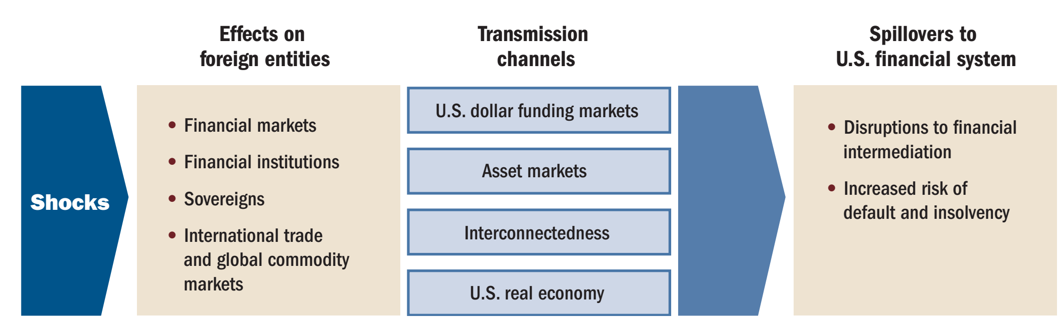
Source: Federal Reserve Bank of New York survey of 26 market contacts from August to October.

Box 5.2. Transmission of Stress Abroad to the U.S. Financial System

The U.S. financial system plays a central role in the global financial system, making it susceptible to spillovers from shocks abroad.[1] This discussion describes four important transmission channels: (1) U.S. dollar funding markets, (2) asset markets, (3) financial institution interconnectedness, and (4) the U.S. real economy.

As illustrated in figure A, shocks may generate stress for foreign financial markets, internationally active financial institutions, sovereigns, and international trade and commodity markets. This stress may be transmitted to the U.S. financial system through the four channels noted earlier, resulting in two types of spillovers: (1) disruptions to financial intermediation, which can reduce credit available to U.S. households and businesses; and (2) increased risks of default and insolvency due to losses on assets held by U.S. financial institutions. The strength of these spillovers largely depends on the extent of cross-border linkages and how existing vulnerabilities in the U.S. financial system interact with the foreign stress.

Figure A. Spillovers of foreign shocks to the U.S. financial system



U.S. dollar funding market channel

The U.S. dollar is the leading currency for global funding and investment—accounting for almost half of outstanding cross-border bank credit and international debt securities—and is widely used for trade and other international transactions.[2] U.S. and foreign financial intermediaries engage in dollar-denominated borrowing, lending, and investment activities within a complex and interconnected network of markets involving a broad set of financial instruments.[3] Disruptions in foreign institutions' ability to borrow U.S. dollars can transmit stress to the U.S. financial system in several ways, listed below.

(continued)

[1] Shocks from abroad can be geopolitical, sovereign, financial, or related to the real economy or other factors. Examples of foreign shocks include the war in Ukraine and the European sovereign debt crisis, as well as the COVID-19 pandemic, which was a global shock.

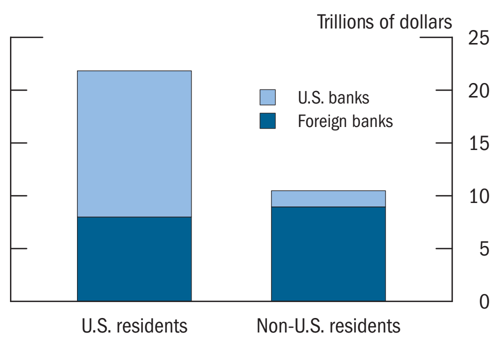
[2] See Bank for International Settlements (2022), BIS Statistics Explorer, Table A1-S: Summary of Locational Statistics, by Currency, Instrument and Residence and Sector of Counterparty, https://stats.bis.org/statx/srs/table/a1?m=S (accessed March 29, 2023); and Bank for International Settlements (2022), BIS Debt Securities Statistics, Table: Outstanding Stock of International Debt Securities by Currency of Denomination, https://www.bis.org/statistics/about_securities_stats.htm?m=6%7C33%7C638 (accessed March 29, 2023).

[3] The financial instruments used by foreign entities to obtain dollar funding include commercial paper, corporate and sovereign bonds, bank deposits, interbank loans, credit lines, FX swaps, repos, and leveraged loans.

Box 5.2—*continued*

Foreign institutions account for a significant share of borrowing in U.S. short-term wholesale funding markets, making up around half of all borrowing done through repos, and issue more than two-thirds of U.S. dollar-denominated commercial paper and negotiable certificates of deposit.[4] Concerns about the solvency or liquidity of foreign borrowers can induce sudden outflows from U.S.-based wholesale lenders, such as prime MMFs, that may then be forced to cut short-term funding provided to a broader set of borrowers that would have been otherwise unaffected by the foreign stress.[5] This could, in turn, reduce credit available for U.S. households and businesses.

Figure B. U.S. dollar-denominated bank claims on U.S. and non-U.S. residents as of 2022:Q3



Source: Bank for International Settlements, consolidated and locational banking statistics; Federal Reserve Board staff estimates.

Stress in U.S. dollar funding markets can also limit the ability of foreign banks to provide U.S. dollar-denominated credit to U.S. and foreign borrowers. Foreign banks supply around one-third of total bank credit to U.S. residents, especially to C&I borrowers, and most of the U.S. dollar-denominated lending to non-U.S. residents (figure B). U.S. branches and agencies of foreign banks tend to rely on short-term U.S. dollar wholesale funding, making their U.S. lending particularly sensitive to funding market disruptions.

Foreign banks are also important counterparties in U.S. dollar-denominated FX swaps, which many foreign NBFIs rely on as a source of U.S. dollars. If foreign banks are unable to borrow U.S. dollars in FX swap markets, other foreign financial institutions that use FX swaps will have limited ability to invest in U.S. markets and to lend to U.S. households and businesses and could be forced to liquidate U.S. assets. U.S. dollar liquidity swap line arrangements between the Federal Reserve and foreign central banks have played a critical role in alleviating U.S. dollar funding stresses when liquidity in private markets, such as the FX swap market, has dried up.[6]

Asset market channel

Stress abroad can cause rapid declines in the prices of both foreign and U.S. assets. When losses on equities and on other risk assets are severe and broad based, investors may respond by rebalancing their portfolios to low-risk assets such as U.S. Treasury securities, potentially triggering a cycle of deteriorating prices for higher-risk assets, heightened volatility and reduced market liquidity, margin calls, and forced asset sales. Spillovers to U.S. institutions may be amplified if substantial leverage is supporting stretched asset valuations.

(continued)

[4] See the box "Vulnerabilities in Global U.S. Dollar Funding Markets" in Board of Governors of the Federal Reserve System (2021), *Financial Stability Report* (Washington: Board of Governors, May), pp. 55–58, https://www.federalreserve.gov/publications/files/financial-stability-report-20210506.pdf.

[5] Just over half of all assets held by prime MMFs are claims on foreign entities as of January 31, 2023. See Board of Governors of the Federal Reserve System (2023), Money Market Funds: Investment Holdings Detail, Table 2: U.S. Money Market Fund Investment Holdings by Country of Issuance, Fund Type, Instrument, and Maturity, webpage, March 24, https://www.federalreserve.gov/releases/efa/efa-project-money-market-funds-investment-holdings-detail.htm.

[6] For a discussion of swap line use at the onset of the COVID-19 pandemic, see the box "Federal Reserve Tools to Lessen Strains in Global Dollar Funding Markets" in Board of Governors of the Federal Reserve System (2020), *Financial Stability Report* (Washington: Board of Governors, May), pp. 16–18, https://www.federalreserve.gov/publications/files/financial-stability-report-20200515.pdf.

Box 5.2—*continued*

U.S. Treasury securities are a unique type of asset critical to the functioning of the global financial system. Foreign holdings of U.S. Treasury securities totaled about $7 trillion as of December 31, 2022, or about 30 percent of outstanding marketable U.S. Treasury securities, with holdings split nearly equally between the foreign official—mostly central banks and sovereign wealth funds—and foreign private sectors. At the onset of the COVID-19 pandemic, foreign investors sought to sell U.S. Treasury securities because of an unprecedented surge in the demand for cash—in sharp contrast to typical market dynamics in previous periods of severe global financial stress—amplifying pressures on U.S. Treasury markets that resulted in significant dislocations and strained market functioning.[7] The FIMA (Foreign and International Monetary Authorities) Repo Facility broadens the reach of the Federal Reserve's provision of U.S. dollar liquidity overseas beyond its dollar swap lines. By reducing the incentive of foreign official investors to sell U.S. Treasury securities into stressed markets, the facility contributed to the stabilization of the U.S. Treasury market in the spring of 2020.[8]

Financial institution interconnectedness channel

Many U.S. financial institutions have client and counterparty relationships with foreign financial institutions, exposing them to losses from defaults and credit impairments on the one hand, and to loss of access to credit and important financial services on the other hand.[9] Moreover, a loss of confidence in a group of large foreign financial institutions could spread to large U.S. financial institutions, resulting in higher funding costs and the risk of broad-based pullbacks by depositors and other funding providers. This type of "contagion" is most likely to spread to U.S. institutions that have exposures to distressed foreign institutions or are considered to have similar business models. Regulatory changes following the 2007–09 financial crisis have markedly increased U.S. banks' capital and liquidity positions, providing additional resilience to various types of losses and reducing the likelihood of contagion.

U.S. real economy channel

Global economic shocks can trigger recessions abroad as well as commodity and trade market disruptions, which tend to transmit quickly through the asset market channel, as discussed earlier.[10] However, any effects on U.S. real economic activity—such as higher goods prices, unemployment, and reduced consumer demand and business investment—generally take longer to materialize and are unlikely to cause U.S. borrowers to default at a rate that would generate significant losses across the U.S. financial system.

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[7] See the box "The Role of Foreign Investors in the March 2020 Turmoil in the U.S. Treasury Market" in Board of Governors of the Federal Reserve System (2021), *Financial Stability Report,* (Washington: Board of Governors, November), pp. 22–25, https://www.federalreserve.gov/publications/files/financial-stability-report-20211108.pdf.

[8] A temporary facility was created in March 2020 and was made a standing facility in 2021. For additional details, see Mark Choi, Linda Goldberg, Robert Lerman, and Fabiola Ravazzolo (2022), "The Fed's Central Bank Swap Lines and FIMA Repo Facility," Federal Reserve Bank of New York, *Economic Policy Review,* vol. 28 (June), pp. 93–113, https://www.newyorkfed.org/medialibrary/media/research/epr/2022/epr_2022_fima-repo_choi.pdf.

[9] As of September 30, 2022, U.S. banks had claims on foreign banks and foreign NBFIs totaling $530 billion and $1.6 trillion, respectively, as well as an additional $373 billion in claims on foreign sectors through derivative contracts; see Bank for International Settlements (2023), BIS Statistics Explorer, Table B3-S: Summary of Foreign Claims and Other Potential Exposures (Guarantor Basis), by Nationality of Reporting Bank, https://stats.bis.org/statx/srs/table/b3?m=S&f=pdf (accessed March 29, 2023). U.S. corporations and financial institutions may also receive important financial services—directly or indirectly—from foreign banks, including investment banking, derivatives dealing, and market making, as well as securities clearing and other financial market infrastructure access.

[10] Foreign shocks can also create economic uncertainty, which has been shown to transmit across countries. See Juan M. Londono, Sai Ma, and Beth Anne Wilson (2021), "The Global Transmission of Real Economic Uncertainty," International Finance Discussion Papers 1317 (Washington: Board of Governors of the Federal Reserve System, April), https://doi.org/10.17016/IFDP.2021.1317.

Appendix | Figure Notes

Figure 1.1. Nominal Treasury yields fell in March and April

The 2-year and 10-year Treasury rates are the monthly average of the constant-maturity yields based on the most actively traded securities.

Figure 1.2. An estimate of the nominal Treasury term premium remained low

Term premiums are estimated from a 3-factor term structure model using Treasury yields and Blue Chip interest rate forecasts.

Figure 1.3. Interest rate volatility remained above its long-term median

The data begin in April 2005. Implied volatility on the 10-year swap rate, 1 month ahead, is derived from swaptions. The median value is 78.93 basis points.

Figure 1.4. The price-to-earnings ratio of S&P 500 firms continued to be above its historical median

The figure shows the aggregate forward price-to-earnings ratio of S&P 500 firms, based on expected earnings for 12 months ahead. The median value is 15.5.

Figure 1.5. An estimate of the equity premium fell below its historical median

The figure shows the difference between the aggregate forward earnings-to-price ratio of S&P 500 firms and the expected real Treasury yields, based on expected earnings for 12 months ahead. Expected real Treasury yields are calculated from the 10-year consumer price index inflation forecast, and the smoothed nominal yield curve is estimated from off-the-run securities. The median value is 4.78 percentage points.

Figure 1.6. Volatility in equity markets remained elevated

Realized volatility is computed from an exponentially weighted moving average of 5-minute daily realized variances with 75 percent of weight distributed over the past 20 business days.

Figure 1.7. Treasury market depth remained below historical norms

Market depth is defined as the average top 3 bid and ask quote sizes for on-the-run Treasury securities.

Figure 1.8. On-the-run market depth worsened in March then recovered

The data show the time-weighted average market depth at the best quoted prices to buy and sell, for 2-year and 10-year Treasury notes. OTR is on-the-run.

Figure 1.9. A measure of liquidity in equity markets fell sharply in March

The data show the depth at the best quoted prices to buy and sell, defined as the ask size plus the bid size divided by 2, for E-mini S&P 500 futures.

Figure 1.10. Corporate bond yields fell to near their historical averages

The triple-B series reflects the effective yield of the ICE Bank of America Merrill Lynch (BofAML) triple-B U.S. Corporate Index (C0A4), and the high-yield series reflects the effective yield of the ICE BofAML U.S. High Yield Index (H0A0).

Figure 1.11. Spreads to similar-maturity Treasury securities edged down

The triple-B series reflects the option-adjusted spread of the ICE Bank of America Merrill Lynch (BofAML) triple-B U.S. Corporate Index (C0A4), and the high-yield series reflects the option-adjusted spread of the ICE BofAML U.S. High Yield Index (H0A0).

Figure 1.12. The excess bond premium stayed near its historical average

The data begin in January 1997. The excess bond premium (EBP) is a measure of bond market investors' risk sentiment. It is derived as the residual of a regression that models corporate bond spreads after controlling for expected default losses. By construction, its historical mean is zero. Positive (negative) EBP values indicate that investors' risk appetite is below (above) its historical mean.

Figure 1.13. Spreads in the leveraged loan market fell modestly

The data show secondary-market discounted spreads to maturity. Spreads are the constant spread used to equate discounted loan cash flows to the current market price. B-rated spreads begin in July 1997. The line break represents the data transitioning from monthly to weekly in November 2013.

Figure 1.14. Commercial real estate prices, adjusted for inflation, declined

The data are deflated using the consumer price index and are seasonally adjusted by Federal Reserve Board staff.

Figure 1.15. Income of commercial properties relative to prices turned up but remained near historically low levels

The data are a 12-month moving average of weighted capitalization rates in the industrial, retail, office, and multifamily sectors, based on national square footage in 2009.

Figure 1.16. Banks reported tightening lending standards in commercial real estate loans

Banks' responses are weighted by their commercial real estate loan market shares. The shaded bars with top caps indicate periods of business recession as defined by the National Bureau of Economic Research: March 2001–November 2001, December 2007–June 2009, and February 2020–April 2020. Survey respondents to the Senior Loan Officer Opinion Survey on Bank Lending Practices are asked about the changes over the quarter.

Figure 1.17. Farmland prices reached near historical highs

The data for the U.S. begin in 1997. Midwest index is a weighted average of Corn Belt and Great Plains states derived from staff calculations. Values are given in real terms. The data are annual as of July. The median value is $3,308.32.

Figure 1.18. Farmland prices grew faster than rents

The data for the U.S. begin in 1998. Midwest index is a weighted average of Corn Belt and Great Plains states derived from staff calculations. The data are annual as of July. The median value is 18.1.

Figure 1.19. House price growth decelerated sharply

The Zillow and CoreLogic data extend through February 2023, and the Case-Shiller data extend through January 2023.

Figure 1.20. Model-based measures of house price valuations remained historically high

The owners' equivalent rent value for 2023:Q1 is based on monthly data through February 2023. The data for the market-based rents model begin in 2004:Q1 and extend through 2023:Q1. The value for 2023:Q1 is based on monthly data through January 2023. Valuation is measured as the deviation from the long-run relationship between the price-to-rent ratio and the real 10-year Treasury yield.

Figure 1.21. House price-to-rent ratios remained elevated across geographic areas

The data are seasonally adjusted. Percentiles are based on 19 large metropolitan statistical areas.

Figure 2.1. The total debt of households and businesses relative to GDP declined further

The shaded bars with top caps indicate periods of business recession as defined by the National Bureau of Economic Research: January 1980–July 1980, July 1981–November 1982, July 1990–March 1991, March 2001–November 2001, December 2007–June 2009, and February 2020–April 2020. GDP is gross domestic product.

Figure 2.2. Both business and household debt-to-GDP ratios edged down

The shaded bars with top caps indicate periods of business recession as defined by the National Bureau of Economic Research: January 1980–July 1980, July 1981–November 1982, July 1990–March 1991, March 2001–November 2001, December 2007–June 2009, and February 2020–April 2020. GDP is gross domestic product.

Figure 2.3. Business debt adjusted for inflation declined modestly

Nominal debt growth is seasonally adjusted and is translated into real terms after subtracting the growth rate of the price deflator for the core personal consumption expenditures price index.

Figure 2.4. Net issuance of risky debt remained subdued

The data begin in 2004:Q2. Institutional leveraged loans generally exclude loan commitments held by banks. The key identifies bars in order from top to bottom (except for some bars with at least one negative value).

Figure 2.5. Gross leverage of large businesses remained at high levels

Gross leverage is an asset-weighted average of the ratio of firms' book value of total debt to book value of total assets. The 75th percentile is calculated from a sample of the 2,500 largest firms by assets. The dashed sections of the lines in the first quarter of 2019 reflect the structural break in the series due to the 2019 compliance deadline for Financial Accounting Standards Board rule Accounting Standards Update 2016-02. The accounting standard requires operating leases, previously considered off-balance-sheet activities, to be included in measures of debt and assets.

Figure 2.6. Firms' ability to service their debt, as measured by the interest coverage ratio, was strong

The interest coverage ratio is earnings before interest and taxes divided by interest payments. Firms with leverage less than 5 percent and interest payments less than $500,000 are excluded.

Figure 2.7. Default rates on leveraged loans inched up from historically low levels

The data begin in December 1998. The default rate is calculated as the amount in default over the past 12 months divided by the total outstanding volume at the beginning of the 12-month period. The shaded bars with top caps indicate periods of business recession as defined by the National Bureau of Economic Research: March 2001–November 2001, December 2007–June 2009, and February 2020–April 2020.

Figure 2.8. The majority of new leveraged loans last year have debt multiples greater than 5

Volumes are for large corporations with earnings before interest, taxes, depreciation, and amortization (EBITDA) greater than $50 million and exclude existing tranches of add-ons and amendments as well as restatements with no new money. The key identifies bars in order from top to bottom.

Figure 2.9. Real household debt edged up

Subprime are those with an Equifax Risk Score below 620; near prime are from 620 to 719; prime are greater than 719. Scores are measured contemporaneously. Student loan balances before 2004 are estimated using average growth from 2004 to 2007, by risk score. The data are converted to constant 2022 dollars using the consumer price index.

Figure 2.10. A model-based estimate of housing leverage was flat

Housing leverage is estimated as the ratio of the average outstanding mortgage loan balance for owner-occupied homes with a mortgage to (1) current home values using the Zillow national house price index and (2) model-implied house prices estimated by a staff model based on rents, interest rates, and a time trend.

Figure 2.11. Mortgage delinquency rates remained at historically low levels

Loss mitigation includes tradelines that have a narrative code of forbearance, natural disaster, payment deferral (including partial), loan modification (including federal government plans), or loans with no scheduled payment and a nonzero balance. Delinquent includes loans reported to the credit bureau as at least 30 days past due.

Figure 2.13. New mortgage extensions to nonprime borrowers have been subdued

Year-over-year change in balances for the second quarter of each year among those households whose balance increased over this window. Subprime are those with an Equifax Risk Score below 620; near prime are from 620 to 719; prime are greater than 719. Scores were measured 1 year ago. The data are converted to constant 2022 dollars using the consumer price index. The key identifies bars in order from left to right.

Figure 2.14. Real consumer credit edged up in the second half of 2022

The data are converted to constant 2022 dollars using the consumer price index. Student loan data begin in 2005.

Figure 2.15. Real auto loans outstanding ticked up

Subprime are those with an Equifax Risk Score below 620; near prime are from 620 to 719; prime are greater than 719. Scores are measured contemporaneously. The data are converted to constant 2022 dollars using the consumer price index.

Figure 2.16. Auto loan delinquencies moved up in 2022 but still remained at modest levels

Loss mitigation includes tradelines that have a narrative code of forbearance, natural disaster, payment deferral (including partial), loan modification (including federal government plans), or loans with no scheduled payment and a nonzero balance. Delinquent includes loans reported to the credit bureau as at least 30 days past due. The data for auto loans are reported semiannually by the Risk Assessment, Data Analysis, and Research Data Warehouse until 2017, after which they are reported quarterly. The data for delinquent/loss mitigation begin in the first quarter of 2001.

Figure 2.17. Real credit card balances have increased in 2022, partially reversing earlier declines

Subprime are those with an Equifax Risk Score below 620; near prime are from 620 to 719; prime are greater than 719. Scores are measured contemporaneously. The data are converted to constant 2022 dollars using the consumer price index.

Figure 2.18. Credit card delinquencies increased but remained at low levels

Delinquency measures the fraction of balances that are at least 30 days past due, excluding severe derogatory loans.The data are seasonally adjusted.

Figure 3.1. Banks' average interest rate on interest-earning assets and average expense rate on liabilities increased

Average interest rate on interest-earning assets is total interest income divided by total interest-earning assets. Average interest expense rate on liabilities is total interest expense divided by total liabilities. The data for average interest expense rate begin in 2014:Q2. The shaded bar with a top cap indicates a period of business recession as defined by the National Bureau of Economic Research: February 2020–April 2020.

Figure 3.2. The fair values of banks' securities portfolios declined in 2022 as interest rates rose

The figure plots the difference between the fair and amortized cost values of the securities. Sample consists of all bank holding companies and commercial banks.

Figure 3.3. Banks' risk-based capital ratio remained near the median level since the 2007–09 financial crisis

The data are seasonally adjusted by Federal Reserve Board staff. Sample consists of domestic bank holding companies (BHCs) and intermediate holding companies (IHCs) with a substantial U.S. commercial banking presence. G-SIBs are global systemically important banks. Large non–G-SIBs are BHCs and IHCs with greater than $100 billion in total assets that are not G-SIBs. Before 2014:Q1 (advanced-approaches BHCs) or before 2015:Q1 (non-advanced-approaches BHCs), the numerator of the common equity Tier 1 ratio is Tier 1 common capital. Afterward, the numerator is common equity Tier 1 capital. The denominator is risk-weighted assets. The shaded bars with top caps indicate periods of business recession as defined by the National

Bureau of Economic Research: March 2001–November 2001, December 2007–June 2009, and February 2020–April 2020.

Figure 3.4. The ratio of tangible common equity to tangible assets increased for global systemically important banks but decreased for other banks

The data are seasonally adjusted by Federal Reserve Board staff. Sample consists of domestic bank holding companies (BHCs), intermediate holding companies (IHCs) with a substantial U.S. commercial banking presence, and commercial banks. G-SIBs are global systemically important banks. Large non–G-SIBs are BHCs and IHCs with greater than $100 billion in total assets that are not G-SIBs. Bank equity is total equity capital net of preferred equity and intangible assets. Bank assets are total assets net of intangible assets. The shaded bars with top caps indicate periods of business recession as defined by the National Bureau of Economic Research: July 1990–March 1991, March 2001–November 2001, December 2007–June 2009, and February 2020–April 2020.

Figure 3.5. Borrower leverage for bank commercial and industrial loans continued to decrease

The figure shows the weighted median leverage of nonfinancial firms that borrow using commercial and industrial loans from the 24 banks that have filed in every quarter since 2013:Q1. Leverage is measured as the ratio of the book value of total debt to the book value of total assets of the borrower, as reported by the lender, and the median is weighted by committed amounts.

Figure 3.6. Lending standards for bank commercial and industrial loans have tightened

Banks' responses are weighted by their commercial and industrial loan market shares. Survey respondents to the Senior Loan Officer Opinion Survey on Bank Lending Practices are asked about the changes over the quarter. Results are shown for loans to large and medium-sized firms. The shaded bars with top caps indicate periods of business recession as defined by the National Bureau of Economic Research: March 2001–November 2001, December 2007–June 2009, and February 2020–April 2020.

Figure 3.7. Leverage at broker-dealers remained historically low

Leverage is calculated by dividing total assets by equity.

Figure 3.8. Trading profits decreased in 2022:Q4, consistent with seasonal patterns

Sample includes all trading desks of bank holding companies subject to the Volcker rule reporting requirement.

Figure 3.9. Shares of trading profits by trading desks

Sample includes all trading desks of bank holding companies subject to the Volcker rule reporting requirement. The "other" category comprises desks trading in municipal securities, foreign exchange, and commodities, as well as any unclassified desks. The key identifies series in order from top to bottom.

Figure 3.10. Leverage at life insurance companies edged up but remained below its pandemic peak

Ratio is calculated as (total assets – separate account assets)/(total capital – accumulated other comprehensive income) using generally accepted accounting principles. The largest 10 publicly traded life and property and casualty insurers are represented.

Figure 3.11. Leverage at hedge funds remained elevated

Leverage is computed as the ratio of hedge funds' gross notional exposure to net asset value. Gross notional exposure includes the nominal value of all long and short positions and both on-balance-sheet and off-balance-sheet derivative notional exposures. Options are delta adjusted, and interest rate derivatives are reported at 10-year bond equivalents. The mean is weighted by net asset value. The data are reported on a 2-quarter lag beginning in the first quarter of 2013.

Figure 3.12. Leverage at the largest hedge funds decreased but remained high

Leverage is measured by gross asset value (GAV) divided by net asset value (NAV). Funds are sorted into cohorts based on GAV. Average leverage is computed as the NAV-weighted mean.

Figure 3.13. Dealers indicated that the use of leverage by hedge funds was unchanged recently

Net percentage equals the percentage of institutions that reported increased use of financial leverage over the past 3 months minus the percentage of institutions that reported decreased use of financial leverage over the past 3 months. REIT is real estate investment trust.

Figure 3.14. Issuance of non-agency securitized products has slowed significantly since 2021

The data from the first quarter of 2023 are annualized to create the 2023 bar. CMBS is commercial mortgage-backed securities; CDO is collateralized debt obligation; RMBS is residential mortgage-backed securities; CLO is collateralized loan obligation. The "other" category consists of other asset-backed securities (ABS) backed by credit card debt, student loans, equipment, floor plans, and miscellaneous receivables; resecuritized real estate mortgage investment conduit (Re-REMIC) RMBS; and Re-REMIC CMBS. The data are converted to constant 2023 dollars using the consumer price index. The key identifies bars in order from top to bottom.

Figure 3.15. Bank credit commitments to nonbank financial institutions remained high

Committed amounts on credit lines and term loans extended to nonbank financial institutions by a balanced panel of 24 bank holding companies that have filed Form FR Y-14Q in every quarter since 2018:Q1. Nonbank financial institutions are identified based on reported North American Industry Classification System (NAICS) codes. In addition to NAICS codes, a name-matching algorithm is applied to identify specific entities such as real estate investment trusts (REITs), special purpose entities, collateralized loan obligations (CLOs), and asset-backed securities (ABS). BDC is business development company. REITs incorporate both mortgage (trading) REITs and equity REITs. Broker-dealers also include commodity contracts dealers and brokerages and other securities and commodity exchanges. Other financial vehicles include closed-end investment and mutual funds.

Figure 3.16. Aggregate loan commitments and utilization rates of nonbank financial institutions increased during 2022 but varied across sectors

2022:Q4-over-2021:Q4 growth rates as of the end of the fourth quarter of 2022. REIT is real estate investment trust; PE is private equity; BDC is business development company; SPE is special purpose entity; CLO is collateralized loan obligation; ABS is asset-backed securities. The key identifies bars in order from left to right.

Box 3.1. The Bank Stresses since March 2023

Figure A. Bank stock prices and stock indexes

Stock prices are not reported on or after the day of bank failure.

Figure B. Peak 1-day withdrawal rates for runs on the largest banks, by inflation-adjusted total assets

Banks are sorted by inflation-adjusted total assets from left to right.

Box 3.2. Financial Stability Risks from Private Credit Funds Appear Limited

Figure A. Private credit fund assets and dry powder

Dry powder is estimated by subtracting balance sheet assets from regulatory assets under management, which include uncalled capital commitments.

Figure B. Shares of private credit fund assets held by different investors

The data are as of 2021:Q4. The “other” category consists of banks, broker-dealers, registered investment companies, government entities (excluding pensions), non-U.S. investors of unknown type, and a residual category that is responsible for most of the reported assets.

Figure 4.1. Ratios of runnable money-like liabilities to GDP edged down but remained above their historical medians

The black striped area denotes the period from 2008:Q4 to 2012:Q4, when insured deposits increased because of the Transaction Account Guarantee program. The “other” category consists of variable-rate demand obligations (VRDOs), federal funds, funding-agreement-backed securities, private liquidity funds, offshore money market funds, short-term investment funds, local government investment pools, and stablecoins. Securities lending includes only lending collateralized by cash. GDP is gross domestic product. Values for VRDOs come from Bloomberg beginning in 2019:Q1. See Jack Bao, Josh David, and Song Han (2015), “The Runnables,” FEDS Notes (Washington: Board of Governors of the Federal Reserve System, September 3), https://www.federalreserve.gov/econresdata/notes/feds-notes/2015/the-runnables-20150903.html.

Figure 4.2. The amount of high-quality liquid assets held by banks decreased in 2022

Sample consists of domestic bank holding companies (BHCs) and intermediate holding companies (IHCs) with a substantial U.S. commercial banking presence. G-SIBs are global systemically important banks. Large non–G-SIBs are BHCs and IHCs with greater than $100 billion in total assets that are not G-SIBs. Liquid assets are cash plus estimates of securities that qualify as high-quality liquid assets as defined by the Liquidity Coverage Ratio requirement. Accordingly, Level 1 assets and discounts and restrictions on Level 2 assets are incorporated into the estimate.

Figure 4.3. Banks' reliance on short-term wholesale funding remained low

Short-term wholesale funding is defined as the sum of large time deposits with maturity less than 1 year, federal funds purchased and securities sold under agreements to repurchase, deposits in foreign offices with maturity less than 1 year, trading liabilities (excluding revaluation losses on derivatives), and other borrowed money with maturity less than 1 year. The shaded bars with top caps indicate periods of business recession as defined by the National Bureau of Economic Research: March 2001–November 2001, December 2007–June 2009, and February 2020–April 2020.

Figure 4.4. Growth in money market funds was concentrated in retail prime funds

The data are converted to constant 2023 dollars using the consumer price index.

Figure 4.5. Corporate bonds held by bond mutual funds fell sharply

The data show holdings of all U.S. corporate bonds by all U.S.-domiciled mutual funds (holdings of foreign bonds are excluded). The data are converted to constant 2022 dollars using the consumer price index.

Figure 4.6. Assets held by high-yield and bank loan mutual funds decreased

The data are converted to constant 2023 dollars using the consumer price index. The key identifies series in order from top to bottom.

Figure 4.7. Bond and bank loan mutual funds experienced notable outflows during most of the past year

Mutual fund assets under management as of February 2023 included $2,173 billion in investment-grade bond mutual funds, $227 billion in high-yield bond mutual funds, and $87 billion in bank loan mutual funds. Bank loan mutual funds, also known as floating-rate bond funds, are excluded from high-yield bond mutual funds.

Figure 4.8. Life insurers held more risky, illiquid assets on their balance sheets

Securitized products include collateralized loan obligations for corporate debt, private-label commercial mortgage-backed securities for commercial real estate (CRE), and private-label residential mortgage-backed securities and asset-backed securities (ABS) backed by autos, credit cards, consumer loans, and student loans for other ABS. Illiquid corporate debt includes private placements, bank and syndicated loans, and high-yield bonds. Alternative investments include assets filed under Schedule BA. P&C is property and casualty. The key identifies bars in order from top to bottom.

Figure 4.9. Life insurers continued to rely on nontraditional liabilities

The data are converted to constant 2022 dollars using the consumer price index. FHLB is Federal Home Loan Bank. The data are annual from 2006 to 2010 and quarterly thereafter. The key identifies bars in order from top to bottom.

Box 5.1. Survey of Salient Risks to Financial Stability

Figure A. Spring 2023: Most cited potential risks over the next 12 to 18 months

Responses are to the following question: "Over the next 12–18 months, which shocks, if realized, do you think would have the greatest negative effect on the functioning of the U.S. financial system?"

Figure B. Fall 2022: Most cited potential risks over the next 12 to 18 months

Responses are to the following question: "Over the next 12–18 months, which shocks, if realized, do you think would have the greatest negative effect on the functioning of the U.S. financial system?"

Box 5.2. Transmission of Stress Abroad to the U.S. Financial System

Figure B. U.S. dollar-denominated bank claims on U.S. and non-U.S. residents as of 2022:Q3

The data exclude intragroup claims.

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Q2 2023

US
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Methodology change update:

In connection with our previously communicated methodology change, we will discontinue estimating future restatements in deal value. Since adopting our new methodology of including announced deals in addition to completed deals, the restatement of deal value has diminished greatly and as such estimates based on historic activity are no longer warranted. This change will apply to deal value only. We will continue to estimate expected revisions in deal count, as that has remained fairly consistent with prior observed activity. This change will apply to this and all future PE- and M&A-related reports and harmonizes with the methodology already in use for VC-related reports.

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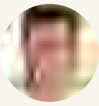
Dylan Cox, CFA Head of Private Markets Research

Institutional Research Group

Analysis



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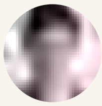

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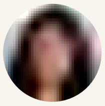

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Published on July 11, 2023

Click here for PitchBook's report methodologies.

EXECUTIVE SUMMARY

Halfway home

The first half of 2023 has played out in similar fashion to the back half of 2022 for US PE on many fronts. The industry continues to battle through a stubbornly high interest-rate environment that makes the cost of borrowing and servicing floating-rate debt prohibitively expensive for deals that would otherwise get done. Deployment remains down by 49.2% from the quarterly peak reached in Q4 2021, and realizations are down by 67.6% from the Q2 2021 peak. Fund performance, while still handily ahead of most asset classes and strategies on a 10-year basis, has fallen to the middle of the pack on a one-year horizon basis. As a result, fundraising continues to be more difficult and is tracking 15%-25% below 2022's first half, although other strategies such as venture and real assets have fallen more precipitously.

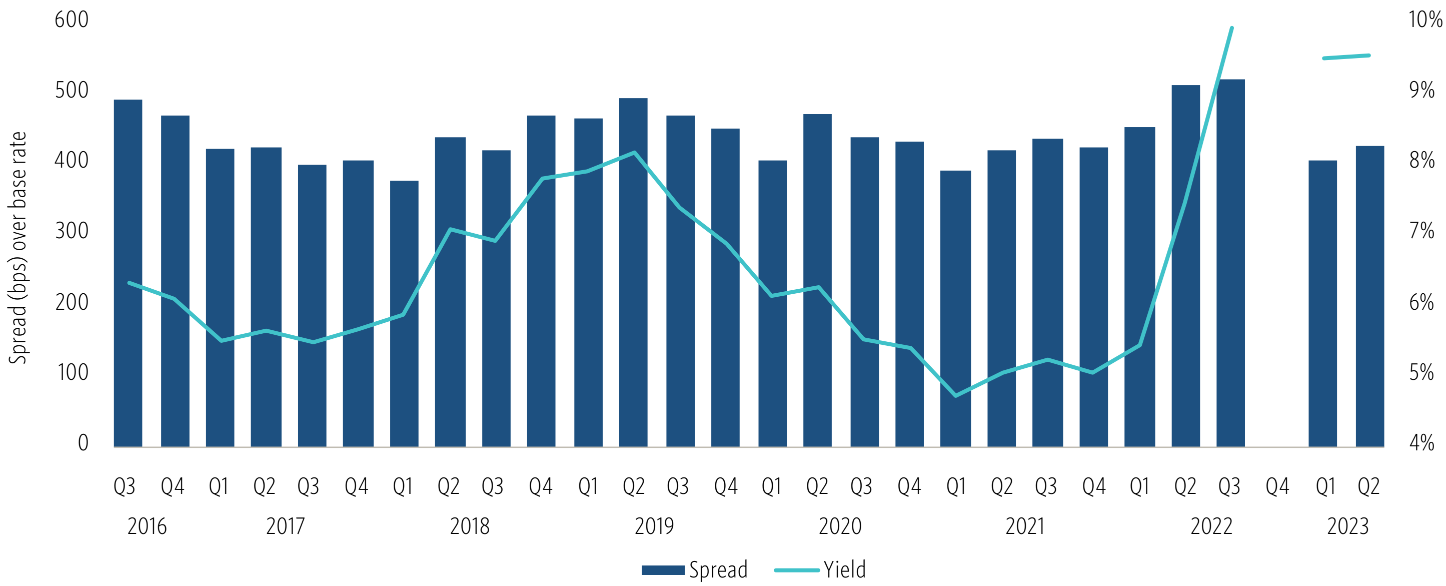
The seminal event so far this year, of course, was the Silicon Valley Bank failure and the mini-bank crisis that followed. PE escaped relatively unscathed, with four large take-privates announced in the two weeks surrounding that event. Indirectly, however, it created a more risk-averse environment among lenders and kept the lid on leverage ratios. The average share of debt to enterprise value on LBO deals has fallen to 43.3% so far in 2023, a lockstep change from 2022's average of 50.8% and the five-year average of 52.2%. Meanwhile the yield-to-maturity on new-issue leverage loan deals backing LBOs averaged 9.47% in Q2, little changed from nine months ago.

Also on the worry list is the continued anemic level of exit activity. The number of exits dropped by another 22.2% from Q1 and is now consistently below pre-COVID levels. Investments have outnumbered exits by three-to-one, even after excluding add-ons, and this imbalance needs to be cured to avoid a pile up further down the road when big funds face big maturity dates. There were some green shoots as the quarter closed with two large PE exits via M&A (Adenza for $10.5 billion and Apptio for $4.6 billion) and two via public listings (the $2.9 billion IPO of Savers Value Village and the $1.2 billion IPO of Kodiak Gas Services). The M&A exits were especially encouraging as they validate PE's furious "build-and-buy" playbook, which pushes platforms to reach critical mass quickly in order to attract much larger suitors, in this case Nasdaq and IBM. The multiples paid were also encouraging, to say the least, estimated at 20.2x TTM revenue for Adenza and 12.5x for Apptio.

While many of 2022's trends carried into 2023, there are some notable differences. Public markets have rebounded: As of June 30, the S&P 500 was up by 17.6% on a one-year basis, in stark contrast to the 18.1% one-year negative return just six months prior. The negative denominator effect is not as pronounced, and allocators have some breathing room to allocate more to PE or stay the course. Another noteworthy change is that big banks have slowly waded back into the leveraged buyout (LBO) market. After taking an eight-month sabbatical on making any new commitments to large take-privates, a trickle of new leveraged loan deals was announced in February and picked up steam in March. Private credit funds continued to lend all along and were the main reason the LBO market and PE deal flow, in general, did not collapse coming out of the steepest rate hikes in more than 40 years. Instead, the industry has maintained pre-COVID-19 levels of deal activity, which used to be considered strong years before the 2020 to 2021 frenzy set the bar impossibly high.

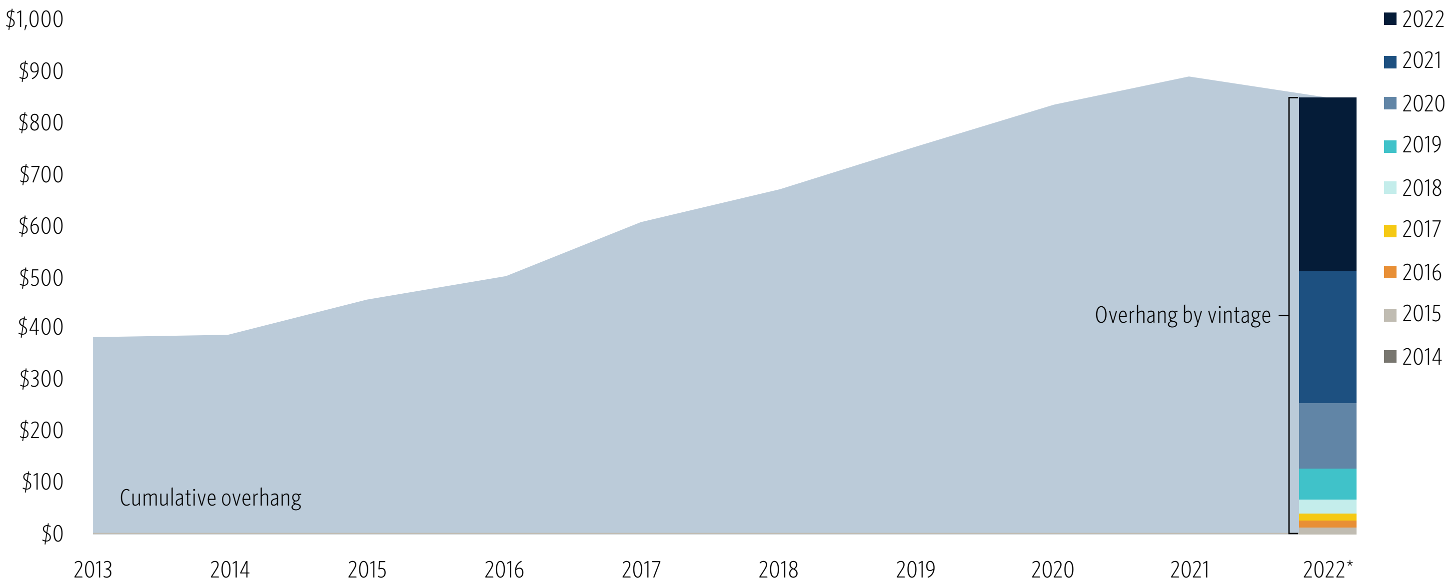
We suspect the second half of 2023 will provide its own twists and turns and will render a verdict as to whether higher interest rates are here to stay or the industry's journey to a friendlier LBO backdrop is finally complete.

New issue spread and yield-to-maturity on debt-backing LBO deals



Source: PitchBook | LCD • **Geography:** US
**Note: As of June 27, 2023. Lack of observations in Q4 2022 to provide meaningful averages.*

US PE dry powder ($B) by vintage



Source: PitchBook • **Geography:** US
*As of December 31, 2022

A WORD FROM STOUT
The state of dealmaking in a down market

Ted Speyer

Managing Director - Investment Banking
Stout

As a Managing Director in the Financial Sponsors Group at Stout, Ted covers a robust network of premier middle-market private equity clients. Throughout his 12-plus years in investment banking, he has executed a broad range of M&A engagements and diverse capital markets transactions in the public equity, private equity, and leveraged finance markets.

Bartley O'Dwyer

Managing Director - Private Equity Business Development
Stout

As Head of Private Equity Business Development at Stout, Bartley is leading teams in cultivating extensive relationships across the private equity market and with senior executives in technology, consumer, industrials, healthcare, energy infrastructure, and financial services. He has over 20 years of experience working with private equity sponsors, venture capital firms, investment managers, hedge fund managers, family offices, credit investors, business development companies, and lenders.

1. Markets remain uneasy for a multitude of factors. Which factors are you watching most closely, and why?

Ted: It has been a difficult year for private equity dealmaking. The Fed rate cycle continues to dominate the macro landscape. Rising rates, inflation, and uncertainty have negatively impacted M&A conditions. Many industries have seen rapid shifts in valuation, portfolio company performance has slowed, and financing costs have increased. That said, the Fed has followed a reasonably predictable and well-communicated path, so there have been few surprises, and firms have adjusted expectations accordingly. Notably, while geopolitical events always impact markets, the war in Europe and the pandemic are no longer having a significant effect on the appetite for dealmaking

We started to see some green shoots of increased M&A market activity in late Q1, but they were mostly quashed by the liquidity crisis in US regional banks, which culminated in the failure of SVB and others. This summer has seen a similar mini spike in new launches, as some sellers try to get transactions done by year's end. Overall, most of our clients are seeing deal flow down 25% to 40% YoY, resulting in far fewer opportunities to deploy capital.

Today, we are mostly focused on the long process of buyers and sellers realigning on value. There is no real catalyst other than time to truly reignite deal activity. The exact timing remains difficult to predict. For much of the last year, we have been hearing the return of active market conditions is three to four months out. The pressure for private equity funds to deploy capital is intense and building, so we anticipate a significant spike in activity when markets return to something like what we saw in early 2021 after the pandemic-driven slowdown.

2. Sponsor M&A activity has been quiet this year, and competition for attractive assets remains significant. Where are you seeing pockets of activity?

Ted: Overall, sponsor-backed deal flow in the middle market is materially down as market volatility makes aligning buyer and seller valuation expectations more difficult. As a result, many sponsors are not even considering selling portfolio companies until 2024.

However, the drivers of activity in the lower middle market (particularly for founder/family-owned businesses) are less dependent on financing, cycle, and valuation than other areas. Stout has been very active with platform and add-on deals under $25 million of EBITDA backed by founders, and we continue to be busy pitching and executing in this space. Many sponsors have been playing down the market to take advantage of this flow, especially in situations wherein continued consolidation opportunities allow further deployment of capital.

Certain sectors are healthier than others. We see activity in services broadly, healthcare services (especially non-reimbursement risk plays), and less cyclical Industrials. Meanwhile, consumer/retail has been weaker overall, and growth tech has been challenging. However, our tech bankers are busy working on old-line industry tech enablement, which remains a huge opportunity.

3. How can sponsors play this market?

Ted: Firms are more actively considering minority and structured deals through their main funds or dedicated pools of capital. Sellers, particularly those attempting to fundraise in a tough environment, are also more open to these transactions, as they can provide a valuation mark for a current portfolio company and some return of capital. Continuation funds remain popular as a way to record a valuation mark while holding an asset longer through a cycle.

In this environment of limited supply, competition for quality assets that hit the market is fierce. We are seeing numerous attempts to preempt processes, and speed to close is a real advantage.

4. With deal flow down, how are investment professionals and operating teams spending their time?

Bartley: Many are taking this slowdown as an opportunity to get the house in order at portfolio companies across the obvious pillars of people, process, and technology. This includes downsizing and businesses not replacing headcount lost through the ordinary course of business attrition.

Additionally, the role of the operating partner has changed. Previously, the operating partner was a C-suite executive ready to parachute in, but more and more (even with middle-market and lower-middle-market sponsors), there is a greater emphasis on deep functional skills (go-to-market, finance, and supply chain, for example) and a direct remit to drive EBITDA. Firms that shifted to this model will likely fare better through this slowdown.

Sponsors with platforms that have been highly acquisitive over the past 24 months are slowing the add-on pace and are taking a deeper look at back-end integration and efficiencies, with a focus on driving more top-of-funnel demand and sales efficiencies so that they are poised for growth when the economy improves. Companies are also focusing on fixing processes within the cash conversion cycle, such as order-to-cash and procure-to-pay, as well as faster invoicing, collections, and cash management. Healthy portfolio companies are upgrading key parts of the application stack like enterprise resource planning (ERP) and enterprise performance management (EPM) solutions.

5. How are valuation processes and terms and conditions evolving in the current milieu? How do they vary on the sell side versus the buy side?

Ted: In the current environment of diminished deal flow, sponsors have been aggressive on deals for quality assets. We have seen more attempts to preempt sell-side processes in the past year, and the trend is continuing. Several clients have found it difficult to compete if they are not on a highly accelerated timetable.

This dynamic has several implications for launching sale processes. For example, as speed is paramount, we have seen more prevalent equity backstops and/or over-equitizing for sponsors, especially for the A/A+ assets.

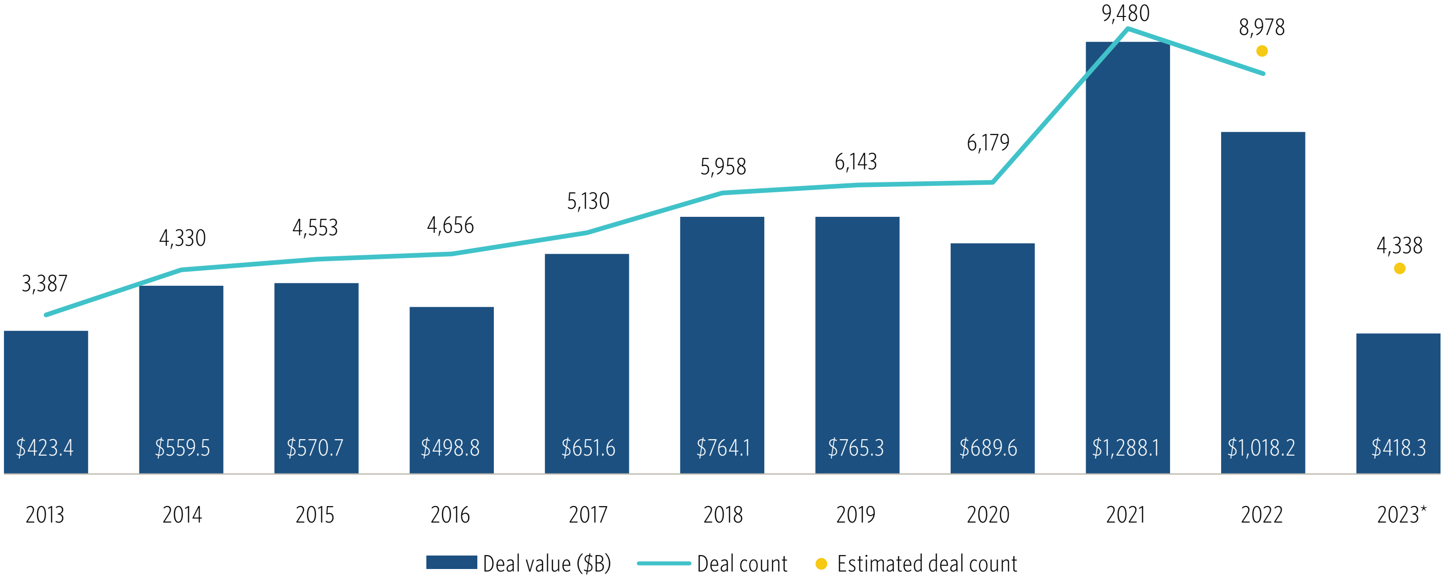
There has also been more caution around broad marketing launches. We have seen some sellers speaking to a small subset of buyers to see if a preemptive bid is possible, and then waiting for better market conditions if there isn't enough interest.

Getting an advance view on leverage before launching a process is increasingly important from the sell-side perspective. As available leverage levels have dropped and cost of debt has risen, valuation has come down modestly for assets that are more sponsor oriented. We have seen less of an impact in strategic-focused deals.

Another continued trend is the increasing use of buy-side advisors with material fees in situations wherein banks bring real access and origination on deals. Most of our middle-market clients now recognize the importance of rewarding advisory partners for differentiated advice and idea flow.

Deals

PE deal activity



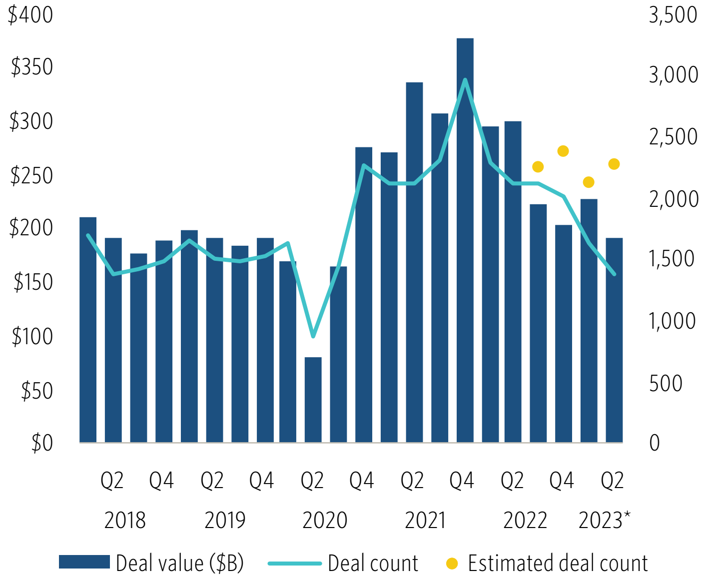
Source: PitchBook • **Geography:** US
*As of June 30, 2023

Overview

US PE dealmaking delivered another mixed quarter in Q2 with deal count slightly up and value declining by 15.8% from Q1. Dealmaking has declined in four of the last six quarters and has yet to stabilize. Since peaking in Q4 2021, quarterly volumes are now down 24.0% by deal count and 49.2% by deal value. Deal count is still solidly ahead of pre-COVID levels by 56.3% but only marginally so by dollar value.

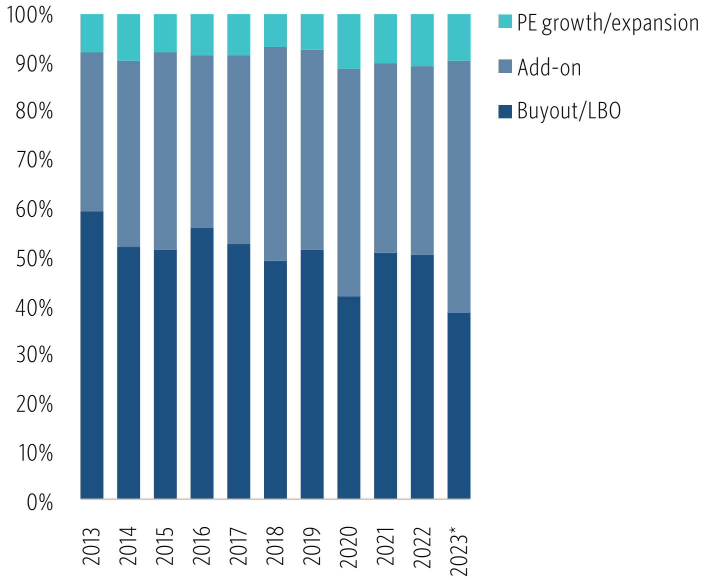
PE managers have had to adjust to make deals happen and keep the sputtering LBO machine from stalling. Deals have gotten smaller, making them more digestible and easier to finance. Many are add-ons, which have taken on outsized importance in the current environment for reasons described below, and now account for nearly eight out of every 10 buyouts. The leveraged loan market is still open for sponsor-backed companies wanting to do add-ons, and many have old facilities locked into place. Another source of credit for add-ons is net asset value (NAV) financing. Instead of using an individual company as collateral, these lenders use the NAV across a portfolio of companies held by a fund. This further

PE deal activity by quarter



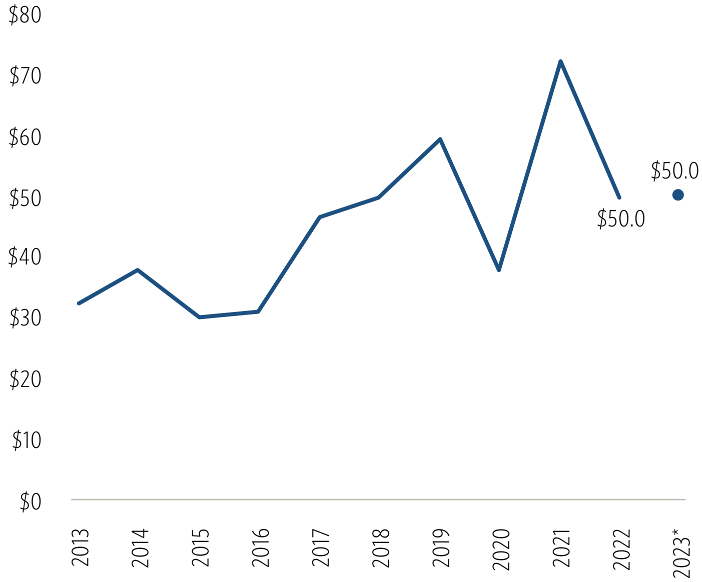
Source: PitchBook • **Geography:** US
*As of June 30, 2023

Share of PE deal value by type



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Median PE deal value ($M)



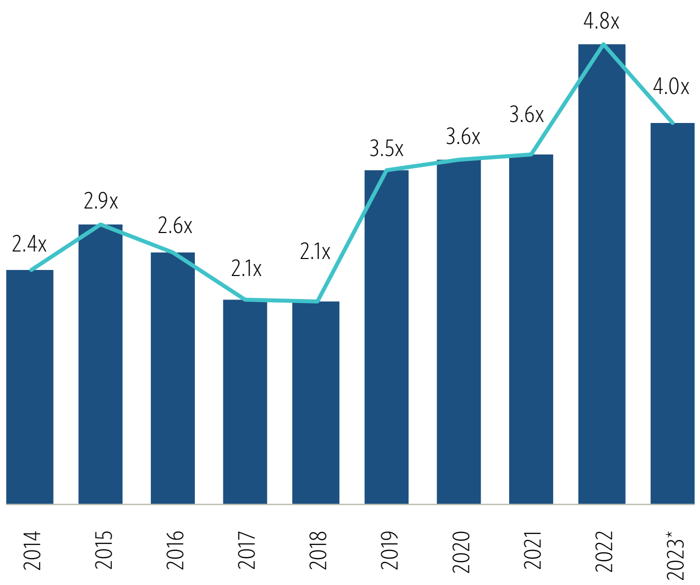
Source: PitchBook • **Geography:** US
*As of June 30, 2023

explains why add-on dealmaking is so frenzied, as it is seen by sponsors as a way to fix up portfolios in advance of selling these platform companies further down the road, and every bit of leverage counts. The NAV finance market is estimated to have grown by 50% in 2022.[1]

Growth equity deals, which are smaller deals and normally do not rely on debt, depend instead on a PE firm's ability to apply active management to augment company growth and boost returns via operational leverage in lieu of financial leverage. This continues to see increased deal activity. Corporate divestitures are another variation of the smaller deal theme. In recent months, buying smaller pieces of larger companies has seen a resurgence and is poised to push above a 10% share of all buyouts for the first time in more than a year. Lastly, even take-privates are smaller. Normally a bastion of large LBOs, more than half of all take-privates this year have been below $1 billion in size. As the target market for take-privates has broadened into the domain of middle markets, it has maintained the same brisk pace as the first half of last year when 43 take-privates were announced. This marks a re-acceleration from the second half of 2022 when it looked like take-privates had paused, only to be re-booted at the beginning of 2023. These are all examples of how PE has adapted to a rising rate environment: keeping deal sizes small or finding other sources of capital to fill gaps.

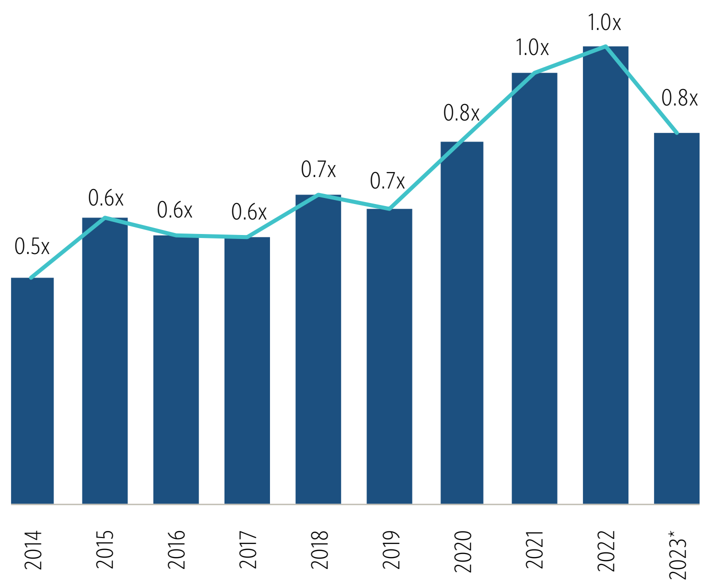
1: "Interviews," 17Capital, Robert de Caorainville and Greg Hardiman, March 22, 2023.

Median EV/revenue multiples on deals $2.5B+



Source: PitchBook • **Geography:** North America and Europe
*As of June 30, 2023

Median EV/revenue multiples on deals below $25M



Source: PitchBook • **Geography:** North America and Europe
*As of June 30, 2023

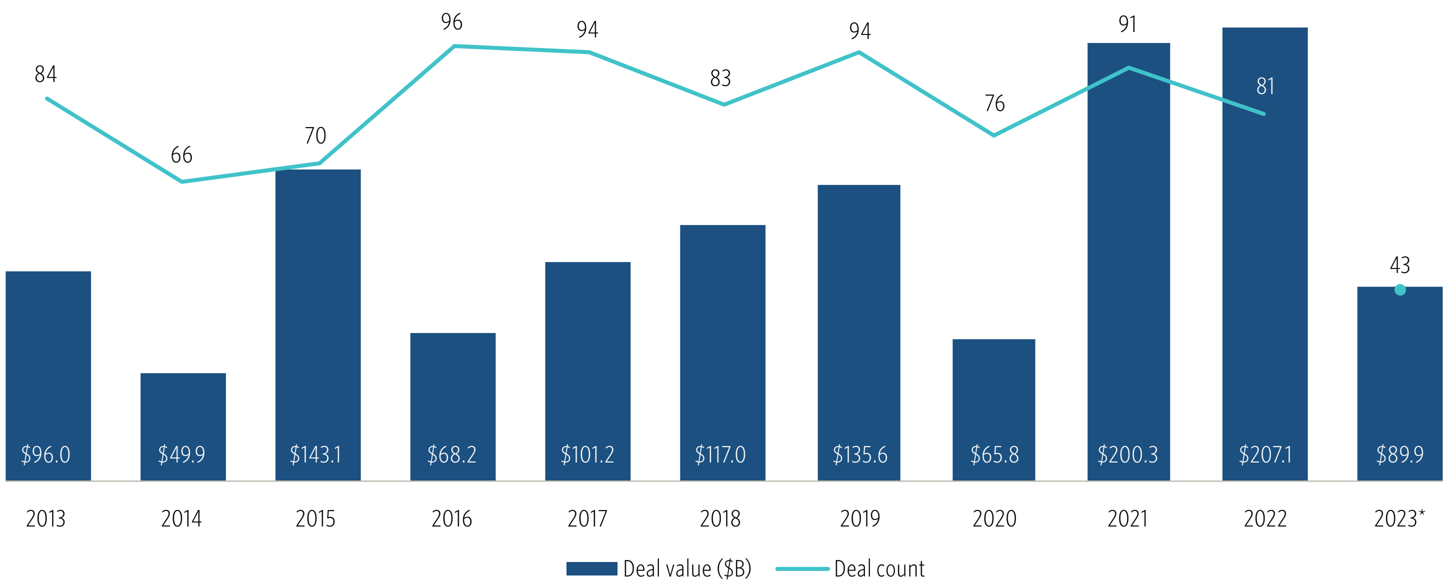
Valuations

Prices paid on PE buyouts are in full correction mode. Using enterprise value (EV) to EBITDA as a metric, multiples remained in a tight band of between 11.5x and 12.4x in the four years ending 2022 before collapsing by 18.5% this year. The median EV to EBITDA multiple now stands at 10.5x for the 12 months ended Q2 2023, down from 12.1x in 2022. EV to revenue multiples tell a similar story. After inching up to 2.2x in 2022, the median multiple has declined by a less-severe but still-significant 10%. EV to revenue is a broader yardstick of value as it captures a bigger sample size than EV to EBITDA, so it is less volatile. It also does a better job incorporating tech, which is littered with companies having little to no EBITDA but strong revenue growth. Likewise, revenue multiples are a better benchmark for financials where EBITDA is not necessarily relevant. The median EV to revenue multiple on PE buyouts now stands at 2.0x on a trailing 12-month basis, down from 2.2x at the beginning of the year. We pull in European multiples to further expand sample sizes as the US dataset is simply too thin and volatile due to low PE disclosure rates on private companies, especially on small to mid-sized companies. If one were to separate the two, it would show that prices paid by PE buyers for US companies skew higher by 25% to 30% owing to the concentration of large take-privates in the data. Combining the two better represents broader trends including the middle market. Both regional data sets are available for separate viewing in the Excel summary published with this report.

Drilling into the three distinct sectors toward which PE firms tend to gravitate —tech, healthcare, and financial—we see similar price weakness across the board with some variations. Financials are in full-scale retreat with revenue multiples below 2.0x from a median of 3.4x in 2022. Revenue multiples are holding up much better in healthcare and tech at 2.5x and 4.9x, respectively, but less so on an EBITDA basis where multiples have declined by 11.0% and 12.7%, respectively. We take that to mean PE buyers are still willing to pay up for revenues in these two secular growth industries—but only if they come with expanded EBITDA margins this year versus last year.

Drilling into size, just as we found in our Global M&A Report, which incorporates the corporate buyer in addition to the PE buyer, there is a clear relationship between purchase price multiples paid and size, with valuations stepping up to buy scale and stepping down for smaller companies and bolt-on deals. PE paid a median multiple of 4.0x revenue in megadeals of $2.5 billion or more in size, exactly twice the median multiple for all deals. While at first blush that may look like an enormous multiple and premium to pay, it was even higher last year at 4.8x and 117.2%, respectively, reflecting the fact that valuations have fallen harder in this segment of the PE deal market as leverage for large deals grew scarce. Looking at the other end of the size scale—companies and deals below $25 million in value—significant discounts emerge with a median revenue multiple at 0.8x, or 58.3% below the median multiple paid for deals of all sizes. Here too, multiples fell more steeply in the last year, down 20% from a median of 1.0x in 2022. Everything in the middle hewed closer to the 2.0x all-deals median and 10% average decline.

Take-private activity



Source: PitchBook • **Geography:** North America and Europe
*As of June 15, 2023

Take-privates

Taking public companies private continues to be a highly popular strategy for PE. A total of 43 take-privates have been announced or completed so far in 2023, identical to last year, which went on to record the highest take-private deal value in 15 years.

Deal sizes have contracted significantly due to the constrained lending environment for big LBOs. The median deal size of 2023's crop is $482.9 million, which compares with a median of $1.7 billion during the same span last year, dropping the combined value of take-private deals to $89.9 billion YTD versus $147.2 billion YTD in 2022. While down from H1 2022, this year's activity marks a re-acceleration from H2 2022 when take-privates slowed to just 32 deals and $44.8 billion in value.[2]

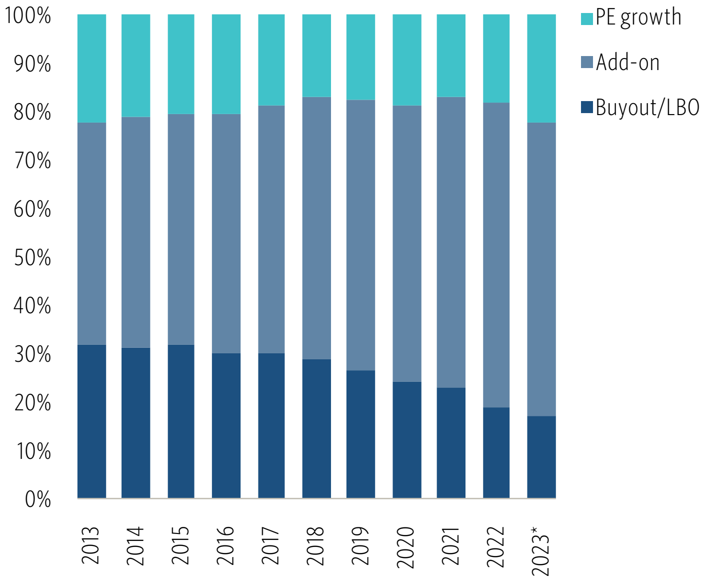
Of the 43 deals announced by PE firms this year, 23 were below $1 billion in size, up from 17 the prior year. This is consistent with our outlook expressed at the beginning of the year that take-privates would remain active but skew smaller. The $482.9 million median size of this year's deals was even smaller than we expected, and they came from an unexpected quarter. As it turns out, PE buyers went on a shopping spree in Europe where there is a long tail of sub-$1 billion public companies, and where the tender offer process allows for smaller stakes to gain full control. All but five of 2023's 23 sub-$1 billion take-private deals were European, a reversal from last year when the majority were North American.

"Boomerang" stocks—companies that succumbed to the take-public wave of 2020 to 2021 only to be become private again—are playing out, but in a different manner than we envisioned. Just under half, or 17 take-privates total, featured newly listed companies from the class of 2020 to 2021. While we expected these to hail from the 664 US IPOs and de-SPACs that started the year at less than $1 billion in market cap and down 76.5% in price, only four were taken from that cohort; another nine disappeared into the hands of public buyers, and nine went bankrupt. Instead, PE buyers mostly took aim at larger-cap boomerangs offering less steep discounts but greater quality and scale, as illustrated by the take-privates of public newcomers Qualtrics and Cvent.

Having a sub-$1 billion market cap is a tough road to hoe in public markets. The trading float is not sufficient to attract market makers, and that carries over to research coverage as well. Before long they end up being orphaned stocks with very little Wall Street support, and as a result, getting caught in a value trap. We still believe it's only a matter of time before many of these once promising new listings are taken private again or just fold. Their ranks have remained relatively static since the beginning of the year and valuations have drifted even lower. Take-over targets with high EBITDA margins and low or negative net debt levels are the ones going first in the present take-private market, as it takes the pressure off sponsors to line up debt in a leveraged-starved environment.

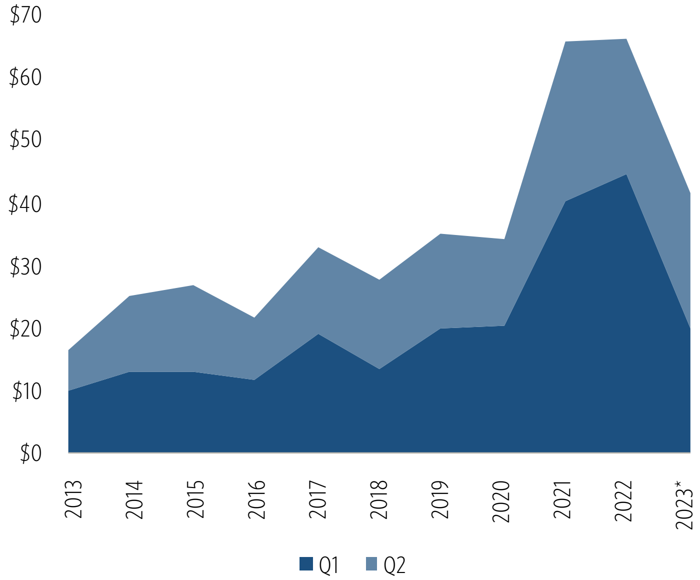
2: All values given are for North America and Europe

Share of PE deal count by type



Source: PitchBook • **Geography:** US
*As of June 30, 2023

H1 growth equity PE deal activity ($B)



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Growth Equity

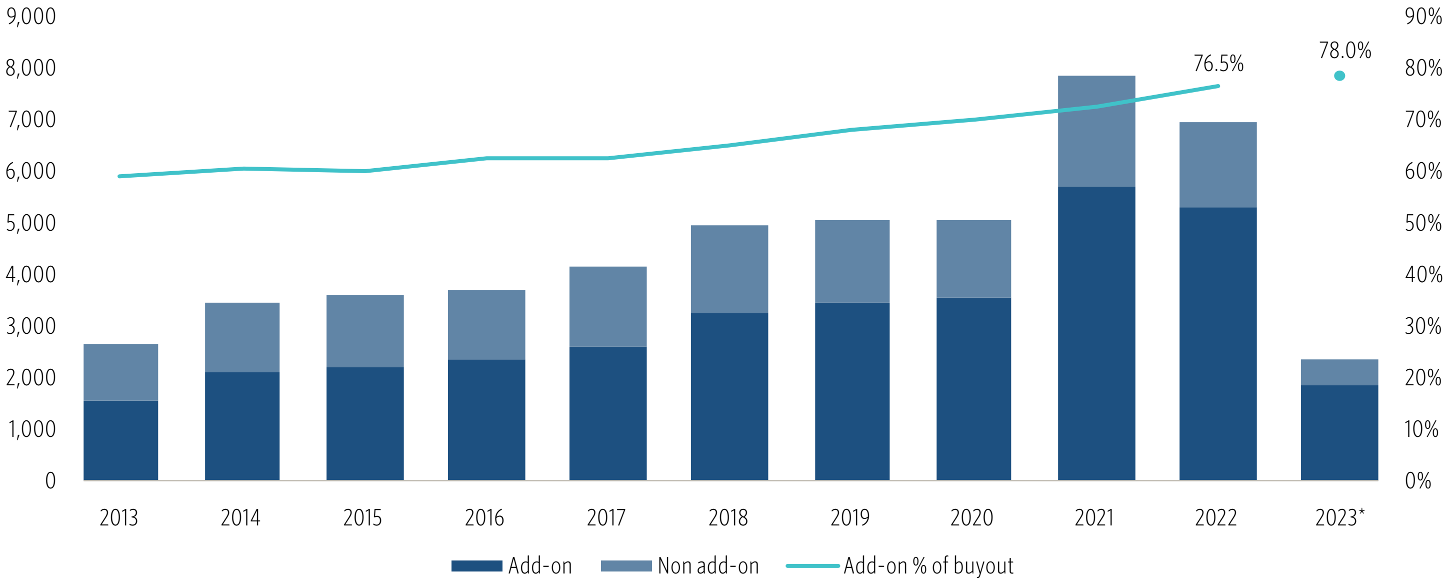
Growth equity is striding ahead on the deal front as it avoids the costly financing on which buyout strategies often rely. As a result, growth equity expanded its share of the total PE deal mix to 22.2% in H1 2023, up from 18.5% last year and within reach of the 10-year high watermark of 22.7% set in 2013. Additionally, growth equity is on pace for 2023 to be the first year in more than a decade where growth equity deals outnumber buyout deals.

Even if growth equity deal counts are down from the peaks of 2021-2022, the investment style exhibits resiliency. Its pace for deal volume in H1 2023 is tracking like 2019, with deal count up 9.3% YoY, while total deal value is up 19.5% YoY. This is a sharp contrast to the buyout category, where high rates are a headwind and activity is well below 2019 levels, with deal count down around 40% YoY, while deal value is down 24.0% YoY.

Growth equity aligns nicely with the current macro backdrop, as it involves minority investments with smaller check sizes and little or no debt financing. Additionally, with sellers anchoring their valuation expectations to the heydays of 2021-2022 and buyers expecting valuations marked-to-market for 2023, minority investments present an easier path to common ground on valuation, especially relative to a control buyout transaction. The value creation opportunity from incorporating the expertise of a PE firm can shift both parties to focus on the future upside after implementing best practices from industry mavens. PE firms are adept at scaling go-to-market, prioritizing growth investments, optimizing supply chains, and executing acquisitions (if advantageous). Pursuing this joint value-creation approach can increase competitive advantage as well as the likelihood of achieving financial goals for both parties.

Looking at the leaderboard, two of the largest growth equity deals of Q2 2023 were in the clean energy space. The largest was Chicago-based Invenergy, a developer and operator of sustainable energy generation and storage projects globally. In June the company received a $1 billion investment from Blackstone, bringing its total raised to $5.0 billion. The second largest was New York-based CleanCapital, which raised $500.0 million from Manulife Investment Management in May 2023. CleanCapital specializes in monitoring, identifying, and managing clean energy projects. This brings its total raised to $1.24 billion, and the company is believed to be a prime candidate for an IPO when the new equity issuance window eventually re-opens.

Add-ons as a share of all PE buyout activity



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Add-ons

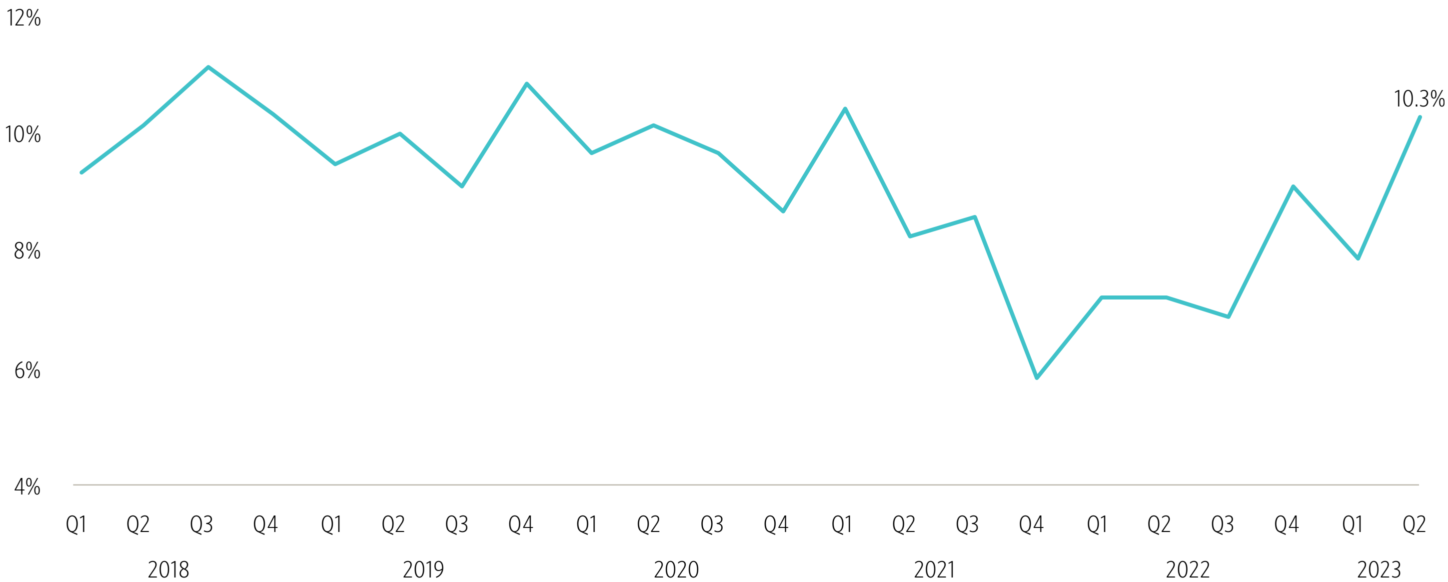
Add-ons are at the core of the PE buy-and-build playbook, and their share of all PE buyouts has risen steadily every year. Historically, that increase is one or two percentage points, but in 2022 and so far in 2023, growth has been off the charts. Add-ons as a share of all buyouts expanded by nearly four full percentage points in 2022 from 72.5% in 2021 to 76.5% before adding another point-and-a-half in the first six months of 2023 to stand at 78.0% currently.

Add-ons have been instrumental in keeping the PE flywheel spinning during this period of tight credit and market dislocation. They allow PE sponsors to continue deploying capital while taking down deal size and biding time until lending markets can support larger platform buyouts. A well-executed add-on can provide revenue and cost synergy that accelerates the top and bottom line for the acquiring platform company and creates value for the PE owner and potential buyer down the road. Add-ons have always been easier to finance, given their smaller size and ability to rely on the existing credit lines of their larger platform acquirer.

These credit facilities are locked into place shortly after a platform is created from a PE-backed LBO. That platform company will then tap the bank-led leveraged loan market, or increasingly, the private credit lending market, for a debt facility to back future M&A activity.

Since 2018, $326.8 billion in leveraged loan deals have been closed for M&A purposes by 479 unique PE-backed issuers. As these tend to be term loans with seven-year maturities, most of these facilities have yet to mature. Moreover, to the extent these older facilities have more advantageous base rates or other terms than what is available presently from M&A lenders, they become a valued source of inexpensive funding, which allows these PE platforms to continue intense dealmaking, albeit in smaller chunks that add-ons are known for. A good recent example of this is Hub International, a platform company owned by Helman & Friedman that is a leading consolidator of the highly fragmented 200,000-strong insurance agency business. The company tapped the leveraged loan market for $850.0 million in October of 2022 and has since completed 24 add-ons of insurance agencies and other related businesses, including 16 in Q2 of 2023 alone.

Carveouts/divestitures as a share of buyouts by quarter



Source: PitchBook • **Geography:** US
*As of June 30, 2023

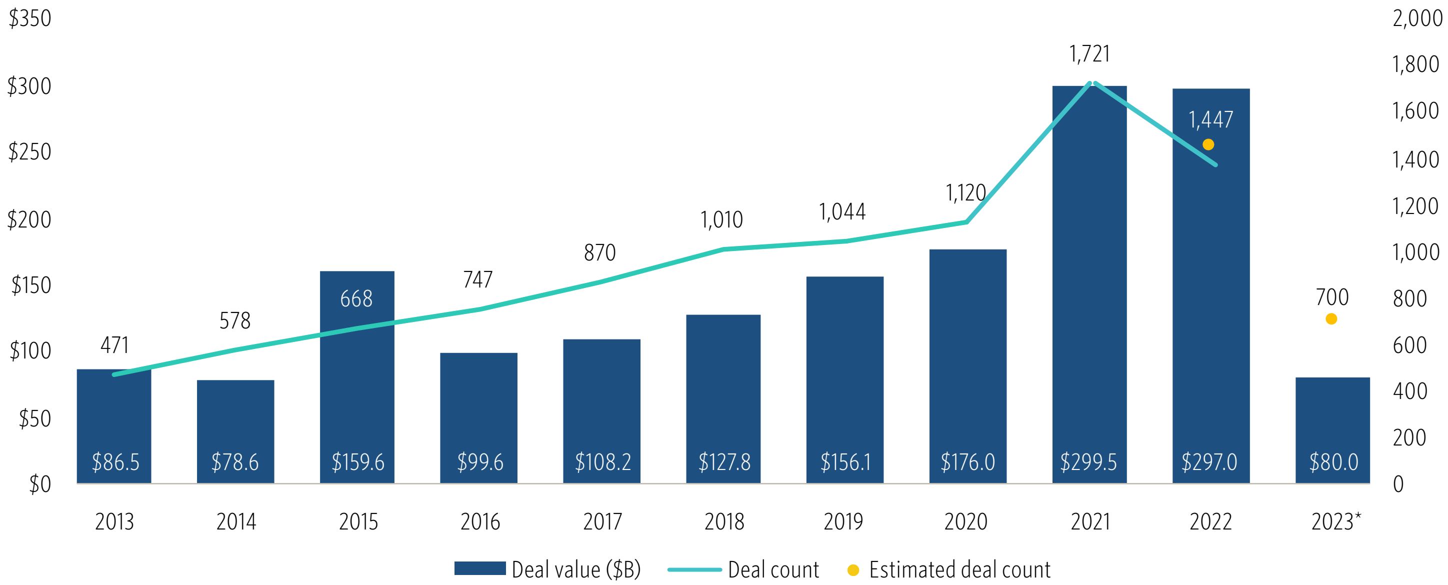
Carveouts and divestitures

In a market downturn, GPs are finding increasing deal opportunities in corporate carveouts and divestitures. Many companies are choosing to spin out noncore or nonperforming assets after reevaluating their businesses to better strengthen their balance sheets. At the same time, sponsors are readily available to pick up those deals thanks to their ample supply of dry powder. Carveouts can be more attractive for GPs during periods of rising interest rates and limited access to loans for leveraged buyouts because they allow GPs to acquire developed businesses at more digestible prices and with more seasoned operating histories that can be easier to bank and finance. Sponsors can use carveout strategies to either restore assets to health or bolster their growth prospects, often combining them with other portfolio companies to create synergies as a platform company. In Q2 2023, carveouts made up 7.8% of all US PE deals, the highest share in recent quarters. Of just buyout deals, carveouts made up 10.3% YTD, and accounted for 7.0% of all US PE activity, which is a slight uptick from 6.6% in 2021 and 6.2% in 2022, which were record lows for carveout activity due to the bull market. YTD carveout share of US PE is still below the last 10-year average. But as the slowed economic environment persists, carveout activity is likely to increase further as more corporates spin off assets and sponsors acquire them in a classic PE strategy of acquiring distressed assets for cheap and strengthening their growth.

While carveout deals can be smaller transactions, they can also be megadeals ($1 billion or greater) as corporations spin out well-established businesses during strategic restructuring. The largest carveout deal in Q2 was Baxter International's divestment of its BioPharma Solutions business, which is being acquired by Advent International and Warburg Pincus for $4.25 billion. Baxter, a medical device manufacturer, had been dealing with supply chain shortages and rising costs of raw materials and labor the last few years and sought to restructure its businesses to better align with the company's manufacturing footprint. Through the acquisition, the two PE firms will use their extensive experience investing in healthcare companies to accelerate BPS' growth as a standalone end-to-end CDMO (contract development and manufacturing organization). Thanks to this deal, healthcare made up the greatest share of carveout deal value YTD at 23.5%. Another sizable carveout was BPEA EQT's announced acquisition of Endeavor Group's IMG Academy for $1.25 billion in April. IMG Academy, a global sports education institution, plans to expand across markets in Asia and broaden its educational offering with the support of its new PE partner.[4]

3: "Baxter to Divest Biopharma Business for $4.25 Billion," Reuters, May 9, 2023.
4: "Endeavor Enters Agreement to Sell IMG Academy to BPEA EQT, in Partnership With Nord Anglia Education, for $1.25 Billion," Businesswire, April 25, 2023.

Technology PE deal activity



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Technology

Technology sector deals slowed in Q2 2023 following a busy Q1 that saw six software take-privates announced totaling more than $23.5 billion. Taken together, this makes for a decent H1 2023 with 700 PE deals in the tech space equating to $80.0 billion in total value. While this is well below the heydays of 2021-2022, it is consistent with H1 levels seen before the pandemic, such as in 2018-2019. Buyouts continue to be the preferred approach here, accounting for 76.0% of deals and similar to last year's 76.7%, with the balance comprising growth equity and a handful of platform creation deals.

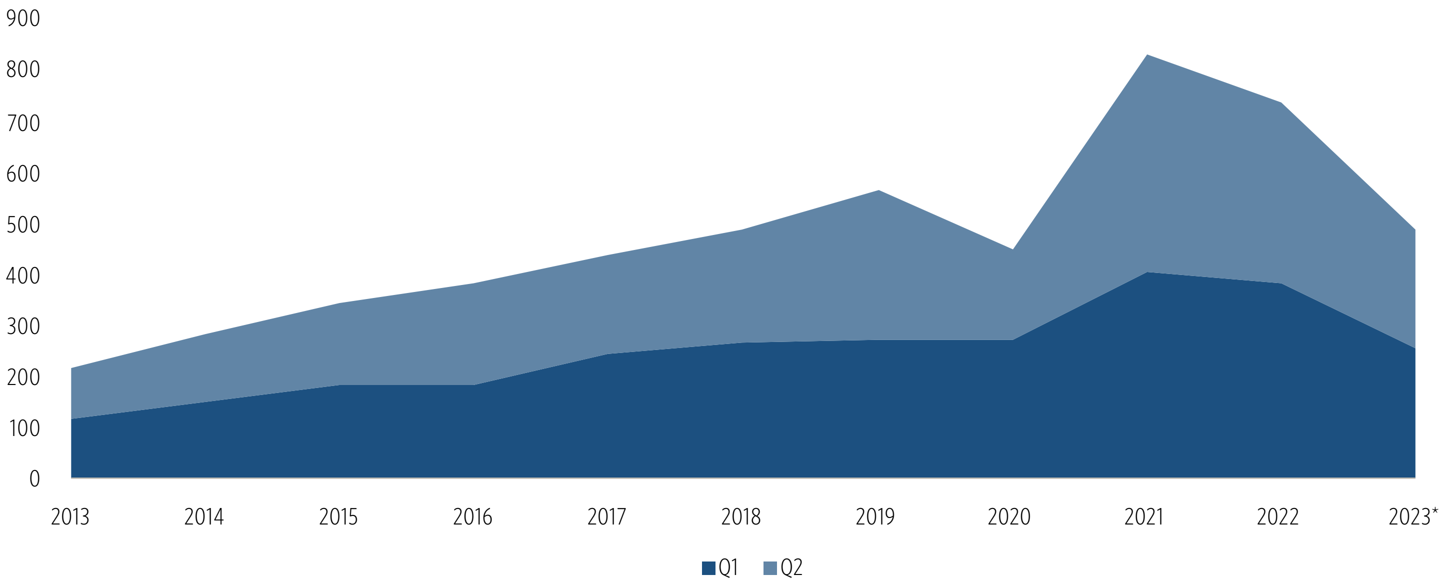
We see encouraging signs for continued strength in tech PE deals this year. Notably, banks are ramping up lending for LBO transactions after a pause in H2 2022 (see 2023 US Private Equity Outlook: H1 Follow-Up), PE firms hold ample dry powder, and valuation levels have reset from recent highs. LPs and specialized PE firms have an affinity for investing in the tech software vertical because the business model lends itself well to the transformation from unprofitable growth at all costs to a state of modest growth with robust profitability. Successful execution of this strategy often results in outsized returns.

The software model is advantageous because companies sell on a recurring model, often software-as-a-service (SaaS), a recurring license model, or a perpetual license coupled with a maintenance and support agreement. This means the business isn't at the mercy of its next sale for its profitability and viability because the recurring base gives stability during a recession. With B2B software, the customer generally derives significant economic advantage from the product through higher productivity and efficiency, meaning churn is often low.

Software companies in their early stages are often chasing 50+% YoY growth rates with high spending on marketing and sales, which often results in a large cash burn and an unprofitable business. When growth inevitably resets to a more sustainable single-digit pace, the management team may have the instinct to try investing in a new hit product, make a large acquisition, or hesitate to lower sales spending, blaming an exogenous factor for the slowdown. These situations often result in a sharp valuation reversal and create opportunities for PE buyers to step in to help these unprofitable software companies ditch the growth-at-all-cost strategy and transition to a new stable growth and high-profit model.

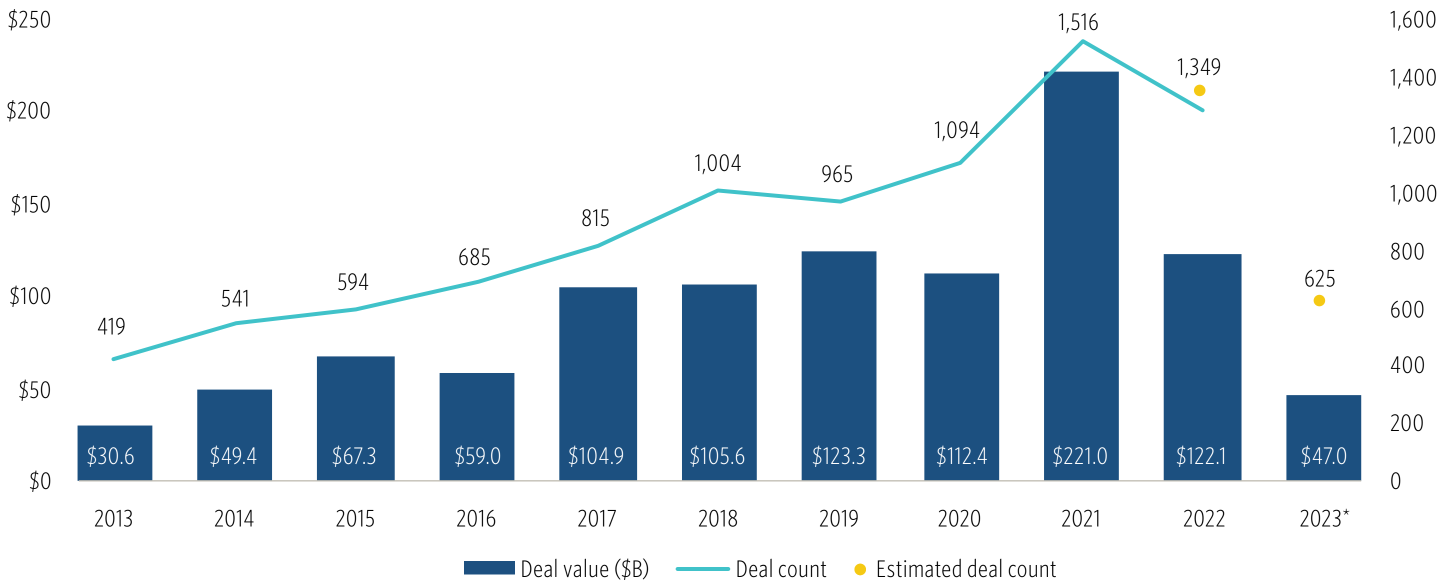
Notable technology deals announced in the IT space this quarter include two large software deals, Scopely, and Absolute Software. Scopely, based in Culver City, CA, offers a mobile-first digital entertainment platform that enables game design and development, live services, marketing, and analytics. On April 5, 2023, it agreed to be acquired in a $4.9 billion LBO by Savvy Gaming Group and Saudi Arabia's Public Investment Fund. Absolute Software, based in Vancouver, BC, offers a cloud-based endpoint visibility and control platform that provides management of and security for computing devices. The majority of its customers are based in the US, and key verticals include education, healthcare, government, and professional services. It agreed to be taken private in an $870.0 million LBO transaction by Crosspoint Capital Partners on May 11, 2023.

H1 technology PE deal count



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Healthcare PE deal activity



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Healthcare

Healthcare PE deal activity continues to lag other sectors, defying the common narrative of the industry's counter cyclicality. As of the end of Q2, 14.4% of US PE deals YTD have been in healthcare, down 1.8 percentage points from the five-year average. With a few noteworthy exceptions, sponsor-to-sponsor platform trades have been all but nonexistent so far in 2023. Buyer-seller price mismatches remain a key sticking point to some extent regarding multiples but more importantly regarding pro forma EBITDA adjustments.

Instead, GPs are deploying capital into small (one- or two-state) platform creations, carveouts, and take-privates. Advent International's announced a $4.25 billion carveout of Baxter's Biopharma Solutions business in May follows a wave of PE investment into pharma services as medtech giants rationalize their business lines. And Gurnet Point Capital and Novo Holdings, the investment arm of Novo Nordisk, together agreed to take struggling antibiotics manufacturer Paratek Pharmaceuticals private. In addition, many sponsors of mature platforms are bringing in new minority investors to either validate valuations, restructure, or fuel additional growth while the sponsor waits for a better exit opportunity.

According to a Coller Capital survey, 87% of LPs see healthcare as an attractive sector for investment over the next two years,[5] but healthcare specialist GPs will not be well positioned to take advantage of this sentiment if they cannot realize their current portfolios.

In 2022, the primary story in healthcare was cost inflation—principally labor, but also materials for some contract manufacturing platforms. We are finally seeing signs that the labor situation in healthcare services is stabilizing, albeit incrementally. This is a result both of efficiency gains at the company level—staffing has been the central preoccupation of most healthcare services operators over the past year and a half—and of reduced turnover in the labor pool. It is no coincidence that healthcare IT has seen steady PE investor interest over recent quarters. Some healthcare specialist firms that previously focused on healthcare services—and have seen first-hand the need for greater clinical efficiency and improved revenue cycles—have increasingly turned their attention to payer and provider software that addresses these challenges. For example, New Mountain Capital bought Apixio, an AI platform for value-based care, from Centene for $300.0 million in June.

5: "Global Private Equity Barometer," Coller Research Institute, 2023, accessed July 5, 2023.

If 2022 was the year of staffing pressures for healthcare platforms, 2023 is the year of debt burden. KKR's Envision Healthcare, which filed for Chapter 11 bankruptcy in May, and Blackstone's Team Health Holdings, which is exploring options to repay more than $1 billion in debt due next year, are the most extreme examples. The physician staffing companies fell prey to cuts in out-of-network reimbursement, first by payers directly, then via the No Surprises Act, as well as a protracted legal battle with UnitedHealth. Under heavy debt loads, the companies were both downgraded to CCC+ by S&P Global Ratings in the second half of 2022. Healthcare-focused sponsors have broadly moved away from businesses built on out-of-network reimbursement—including clinical staffing groups—for this reason. We have heard that many other healthcare platforms have seen growth slow significantly because debt service, combined with margin erosion, is eating into free cash flow. With the Federal Reserve expected to raise rates another 50 basis points, this pain will continue, and conservatively-leveraged platforms may have an opportunity to take additional market share as a result.

A WORD FROM WEST MONROE

Market downturn is driving evolved value-creation playbook for PE-backed SaaS companies

Continued macroeconomic headwinds have significantly impacted the software sector, with many software companies facing slower growth for the first time in several years and struggling to meet their earnings targets. This is causing companies to carefully manage expenses and private equity firms with dry powder to focus on improving EBITDA margins early in their hold periods.

At a high level, what are some key themes that you think are evolving in the PE environment over the first half of 2023?

Chris Stafford: This has been a very different year compared to the past decade. A fundamental slowdown in deal volume has impacted M&A and transaction opportunities for software companies. At the same time, they are also facing significant revenue challenges and rising costs. This is putting tremendous pressure on software management teams—pressure not seen in a decade—to properly focus on their bottom lines and ruthlessly prioritize their research & development (R&D) and M&A investments. A lot of value is placed on having the right leaders in the right functions who can make timely and often difficult decisions.

Dhaval Moogimane: It remains uncertain how long these market conditions will last, with some optimism for a rebound in H2 and early 2024. There is still significant dry powder that investors need to deploy, and the assets coming to market are still competitive. A more opportunistic theme that's getting significant attention is generative AI: The primary focus has been on software company leaders considering strategic uses for it within their products and to support operational efficiency. Furthermore, PE firms are discussing how to best apply it across the portfolio and advise their companies on embedding it in the most effective manner.

From the buy-side perspective, grappling with deal structuring—plus murky growth prospects for many sectors—is daunting enough. What other challenges are your clients seeing?

Chris Stafford: Challenges with revenue growth have made it difficult to pin down valuations and are making it more difficult to get buyers aligned with sellers. In some cases, diligence is uncovering slower revenue growth projections, lower pipeline volume, or greater retention risk than originally thought, which usually leads to valuation adjustments and can lead to buyers walking away from a deal. When growth projections are lower, these fluctuations are critical.

Developing a precise value-creation plan is another big factor. Investors are more focused than ever on executing operating-margin improvement initiatives very early in the hold period, partly driven by more tempered revenue growth projections. This requires additional scrutiny and intelligent, one-time investments to make the business more efficient and digitally enabled.

Dhaval Moogimane: Higher interest rates and the increasing cost of capital are forcing private equity firms to increase their upfront focus on value-creation plans across the full profit & loss (P&L)—from sales & marketing and revenue operations (RevOps) effectiveness, to R&D, cost of goods sold (COGS), and general & administrative (G&A) efficiency.

Dhaval Moogimane

Senior Partner, High-tech and Software

Dhaval Moogimane, a senior partner in our High-Tech and Software practice, excels in driving growth for software, technology, and IT services companies. With a focus on emerging trends, he collaborates with clients to develop and expand new products, solutions, and services. Dhaval maximizes value through M&A transactions, fosters customer retention, and enables profitable growth via digital transformation.

Chris Stafford

Partner, Mergers & Acquisitions

Chris Stafford is a partner in West Monroe's Mergers & Acquisitions practice, specializing in pre-close technology and operational transaction advisory, as well as post-close integration and separation leadership. A trusted advisor to many private equity firms and management teams, Chris has led more than 300 M&A transactions over the last decade.

Are publicly held companies currently a buying opportunity? What factors are at play? Are value-creation playbooks highly applicable?

Chris Stafford: Private equity investors have seen a significant buying opportunity for public companies, as many are not managed toward strong EBITDA margins. Value-creation playbooks are being realized and put to the test. Strong playbooks are being used in valuable and effective ways, but investors and companies without a clear or actionable approach are playing catch-up.

Dhaval Moogimane: An additional factor at play: Many private equity investors will try to get creative on their financing. In instances where valuations have come down, stock prices are fine, but price tags are still large. How can buyers finance these in an effective way? In some cases, we're seeing all-cash deals now with plans to finance later.

How are software management teams and private equity firms trading off between revenue growth and margins?

Chris Stafford: Software companies—and the sector as a whole—are in a pivotal moment. They simply must become more efficient. How do software-as-a-service (SaaS) companies optimize margins without sacrificing growth? It begins with proper portfolio management and making data-driven decisions regarding product/R&D investment. What does data indicate will drive growth across the customer base? For products at scale, how do you make them more efficient? For new products, how do you design them to have strong gross margins at scale? Oftentimes, we see poorly managed product roadmap priorities as a root cause of a variety of inefficiencies across the P&L.

Dhaval Moogimane: Fundamentally, good management teams and investors aren't trading off between revenue growth and profit margins; they are focused on both and are determining which specific investments can help to drive growth and optimize costs simultaneously. Companies with an increased focus on profitability are getting valued at higher multiples, but the Rule of 40 still holds in software.

What are the best options for software companies to reduce costs and improve profitability without sacrificing growth? How can software companies continue to increase their efficiency?

Chris Stafford: Every SaaS company is built on complex technology, and many are built on older technology that is no longer efficient. Part of becoming more efficient is sometimes taking a hard look at the core tech stack, which is a big lever in the R&D and COGS cost base. In the past, updating the tech stack in ways that reduced operating expenses over time was a "nice-to-have," but now, it is becoming a "must-do" in many situations.

Dhaval Moogimane: Many companies are rethinking their nearshore and offshore options for R&D, support, and services. We're also seeing a lot of interest in increasing efficiency and streamlining processes with automation. Companies are also harnessing more data—and using it in more impactful ways—for everything from predicting cross-sell and up-sell opportunities to reducing churn. AI will play a large role in this.

What are the top value drivers you are seeing within software companies today in relation to creating value through operational efficiency and innovation?

Chris Stafford: First is R&D efficiency: How product management and engineering operate day to day, how they generate revenue and improve customer experience (CX), and also the overall R&D cost base. As Dhaval mentioned, offshore and nearshore engineering is continuing to become a default operating norm for most SaaS companies.

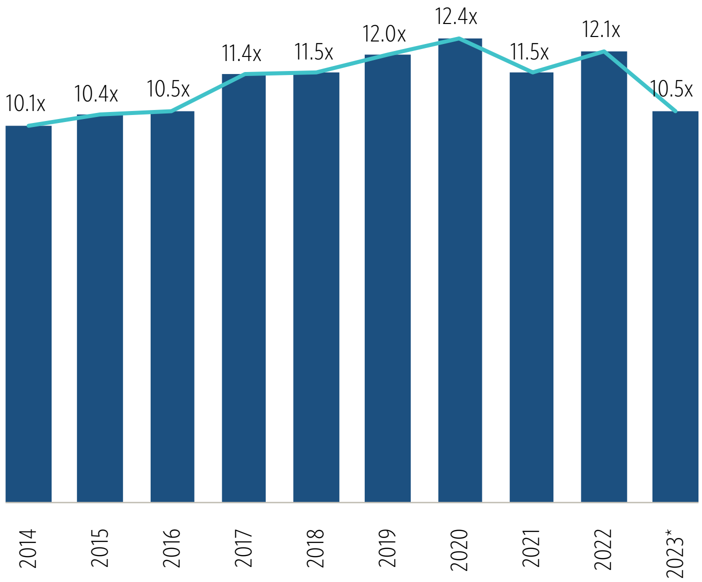
A second significant lever is cloud operations. For many SaaS companies, usage costs are not optimized, architectural designs are not conducive to efficient cloud consumption, and companies struggle to quickly reduce their cloud operating expenses and improve gross margin.

A third key driver is automation and AI. The surface is just getting scratched with generative AI and automation, but I think we'll see a lot of use cases for operational efficiency and innovation over the next several years.

Dhaval Moogimane: There is also innovation around the customer experience. What is the company's unique offering, and how could it be enhanced to drive increased usage and adoption? Plus, plugging more into customer sentiment to ensure ongoing satisfaction and retention is more critical than ever to drive net and gross retention.

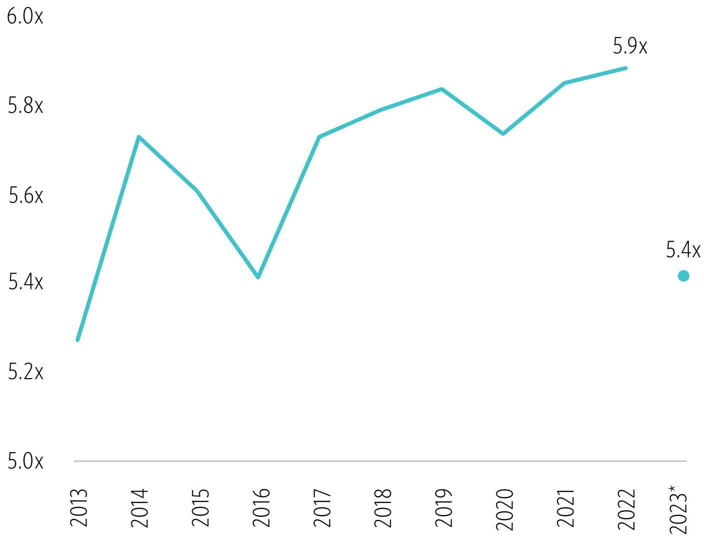
Deal valuation and debt metrics

Median PE EV/EBITDA multiples



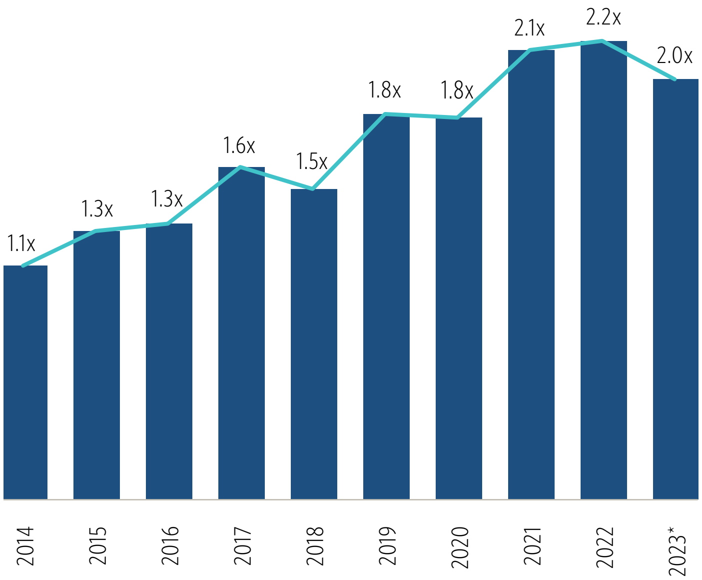
Source: PitchBook • **Geography:** North America and Europe
*As of June 30, 2023

Average PE debt/EBITDA multiples



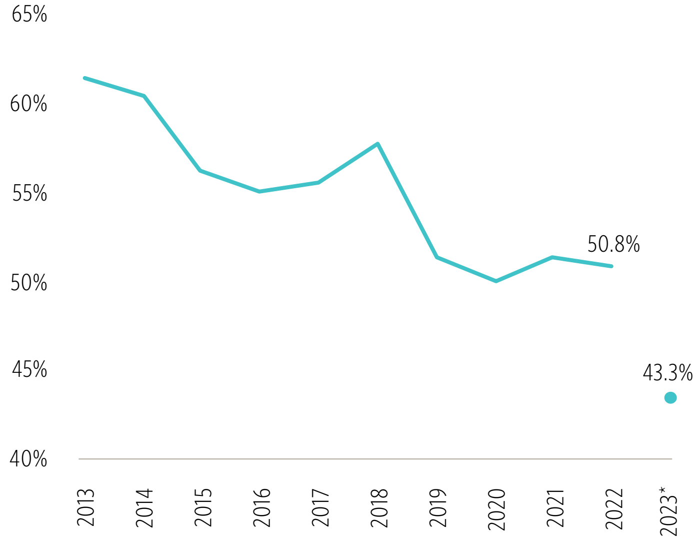
Source: PitchBook | LCD • **Geography:** US
*As of May 31, 2023

Median PE EV/revenue multiples



Source: PitchBook • **Geography:** North America and Europe
*As of June 30, 2023

Share of PE LBO debt to EV

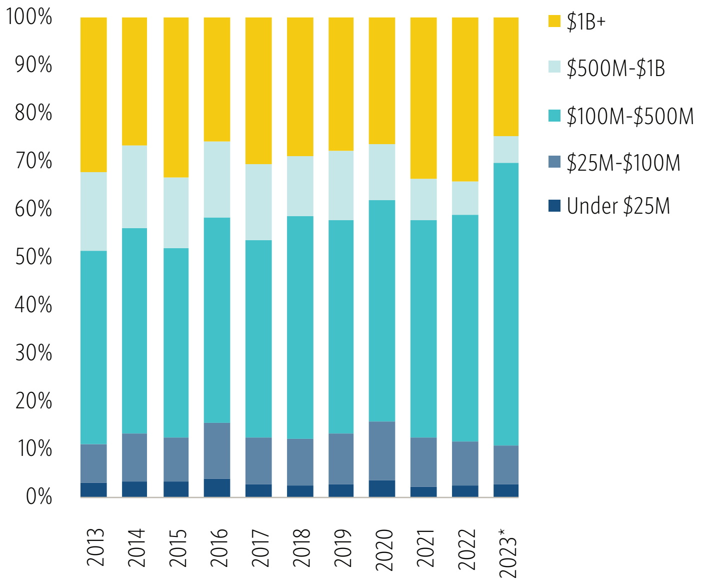


Source: PitchBook | LCD • **Geography:** US
*As of June 30, 2023

Sponsored by

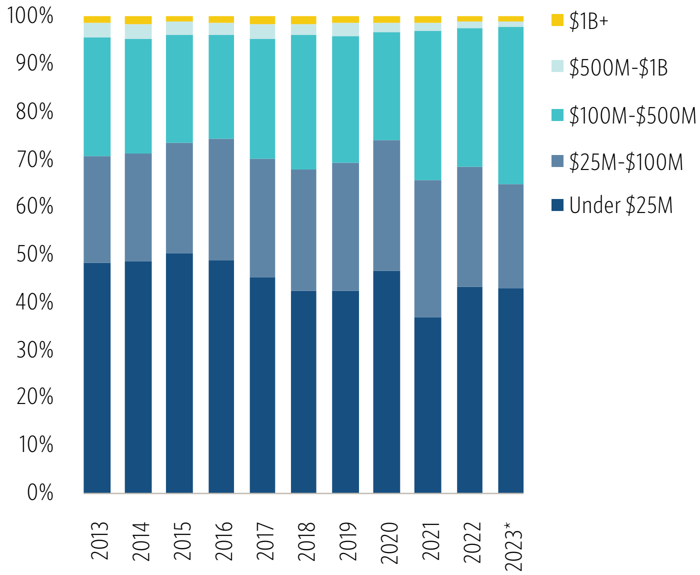
Deals by size and sector

Share of PE deal value by size



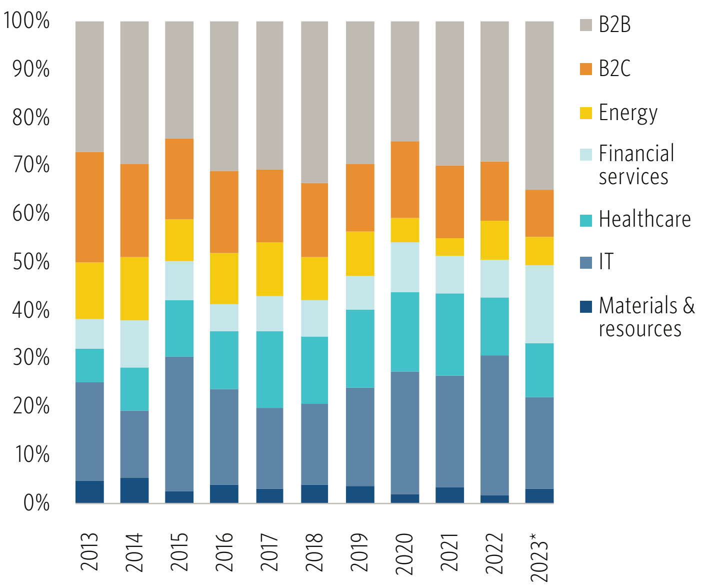
Source: PitchBook • **Geography:** US
*As of June 30, 2023

Share of PE deal count by size



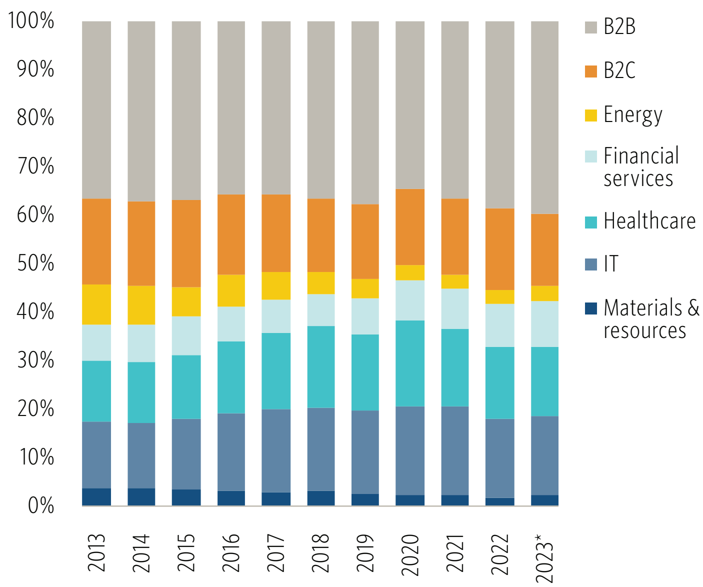
Source: PitchBook • **Geography:** US
*As of June 30, 2023

Share of PE deal value by sector



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Share of PE deal count by sector



Source: PitchBook • **Geography:** US
*As of June 30, 2023

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SPOTLIGHT

PE Exit Timelines and the Impending Maturity Wall

Note: This spotlight is excerpted from our analyst note, PE Exit Timelines and the Impending Maturity Wall. Please see the full report for additional analysis on PE fund timelines and maturities.

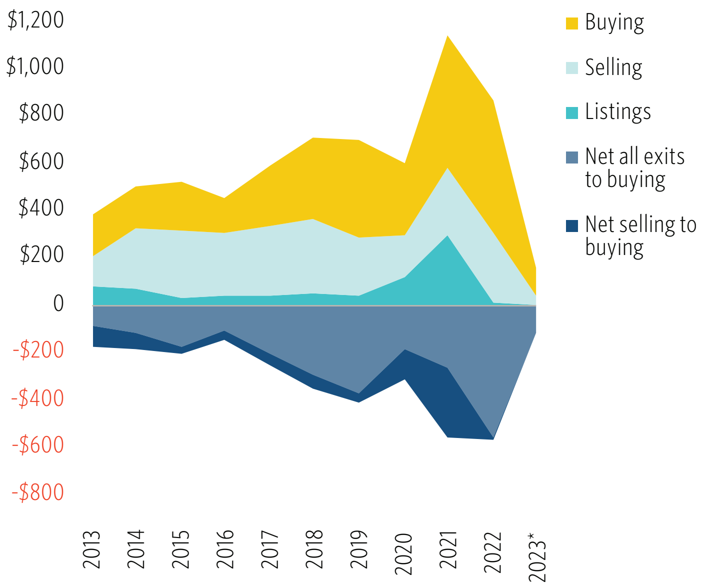
Key takeaways

Private markets have been enjoying an extended period of bullish economic conditions, setting new records in investment activity. After a blip during the pandemic, US PE activity flourished in the second half of 2020, thanks to cheap and abundant access to capital and investor interest in alternative assets. US PE set new records in 2021, as deal value soared by 86.6% to reach $1.3 trillion and deal count jumped by 53.1% to 9,286 deals.

While the bull market seemingly knew no bounds, markets tumbled shortly after as rising inflation and resulting interest rate hikes disrupted a golden period for PE. Deal activity fell from its peak but exits have dropped even more precipitously and have been suffering ever since. Quarterly exit value was flat to down for seven consecutive quarters starting in Q3 2021 and declined significantly throughout 2022, as sponsors continue to struggle against unfavorable valuation adjustments, an effectively closed IPO market, and an uncertain economic outlook. By the end of Q1 2023, quarterly exit value was down 75.1% from the peak in Q2 2021. Quarterly exit activity is now well below the pre-COVID (2017 to 2019) median with no signs of bottoming, which indicates to us that a new normal is firmly in place. Even if we assume a rebound to the pre-COVID norm, the industry is running out of time to complete an orderly disposition of portfolio holdings within the time frames initially allotted to its funds.

A typical buyout fund has a lifespan of approximately 10 years, with many PE funds starting to exit their successful assets earlier, around the five- or even three-year mark. On the other hand, buyout firms can extend their funds' lifespans for two one-year periods as needed to create more value for their assets. The current weakness in exit activity is creating

Exit versus investment gap ($B)



Source: PitchBook • **Geography:** US
*As of March 31, 2023

a gap between the two flows of capital: While deal activity soldiers on, exit pacing has slowed as GPs hold onto their portfolio companies longer to allow for valuations to recover to their liking or grow revenues and EBITDA to compensate for lower multiples.

The significantly fatigued exit market means an impending "maturity wall" looms in the PE industry for deals made five to seven years ago that are beginning to reach their natural exit timelines. With exit activity expected to remain stunted in the near future as investors continue to face macroeconomic headwinds, GPs will need to address the oncoming maturity wall of their existing investments. The investments made during the bullish deal environment of the last 10 years are now confronted with an economic downturn and will need to adjust to a much different exit environment.

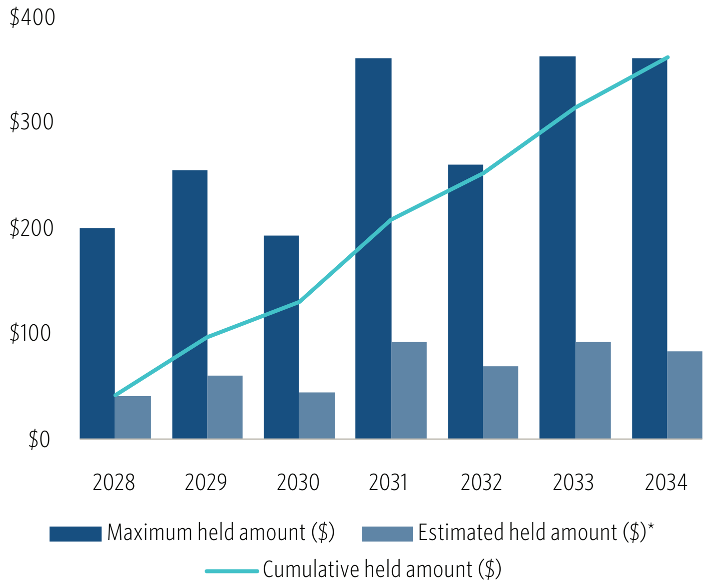
Maturity wall approaching for legacy PE funds

A way to discern the approaching maturity wall is to examine the capital raised by funds that are reaching the end of their 12-year term. Funds that closed in 2016 will hit their term in 2028, and the capital raised in 2016 that has yet to be distributed back to investors through exits will be the amount hitting the maturity wall, assuming no change in value. The chart above shows the set of funds and the value of capital raised between 2016 and 2022 with a 12-year shift—and the estimated remaining held amount at each juncture assuming a liquidation rate. In a hypothetical case in which nothing gets liquidated from this set of funds, the chart shows the maximum amount of capital that would hit the maturity wall at the 12-year mark, which equals the capital that had been initially raised by US PE funds. However, a portion of these funds has already had exits. Using a more realistic assumption, the chart presents the expected amount of the remaining capital that will hit the maturity wall at the end of the 12-year fund life using the incremental pace of exits seen through 2022, and then a slower 2022 exit rate thereafter for the remainder of the fund life cycle. This rough estimate, which combines the exit pace we have already seen and an adjusted exit pace, shows a reasonable expectation of how funds will wind down and the amount that will be liquidated, and shows how it will not be enough. Using this estimate, around 20% to 26% of the capital initially invested by funds is expected to hit the maturity wall. The cumulative held amount grows from $41.0 billion to $363.0 billion in the seven years beginning in 2028 as more fund vintages reach the maturity wall. PE investors would be faced with an enormous pileup of deals still held if the slowed exit activity were to continue.

Conclusion

The economic outlook has changed for PE: Exit activity has fallen 75% from peak to trough on a quarterly basis and shows no immediate signs of recovery to its previous heydays. Sponsors will need to adjust to this newly challenged exit environment, as the inventory of investments that are nearing their exit timelines either can't be sold or are being held for longer than expected because of their currently lower

Capital funds closed with 12-year shift



Source: PitchBook • **Geography:** US
**Note: Estimation using the observed exit rate for the six years ending 2022, and the TTM 2022 exit rate for all years thereafter.*

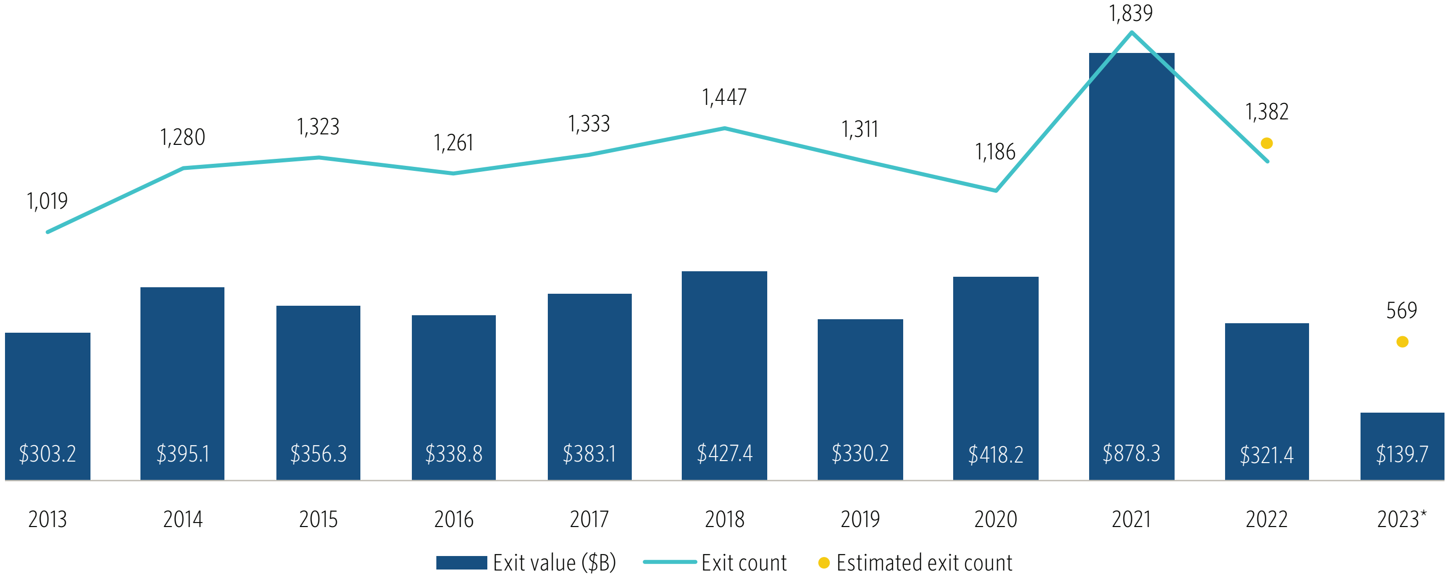
valuations. Even when we assume exit activity will revert to pre-COVID levels, PE firms are not out of the woods. A simple forecast using pre-COVID exit levels shows that investments entering their typical exit timelines will be slower to liquidate than previous investments.

Further extrapolation shows that the stunted exit pacing likely to pervade the PE industry's foreseeable future will push holding periods beyond the exit time frame that both GPs and LPs have been accustomed to. While the assets purchased five years or more ago are slightly ahead of the game, thanks to the impressive boost in exits seen in 2021, the industry now faces a growing maturity wall as exits have slowed to a crawl and funds draw closer to their end dates.

GPs, therefore, will need to find solutions to a rising liquidity concern, and it is likely more sponsors will turn to secondary sales, continuation funds, or NAV lending to placate capital needs to avoid becoming forced sellers in an unattractive exit market. The PE industry will have to innovate and do so quickly.

Exits

US PE exit activity

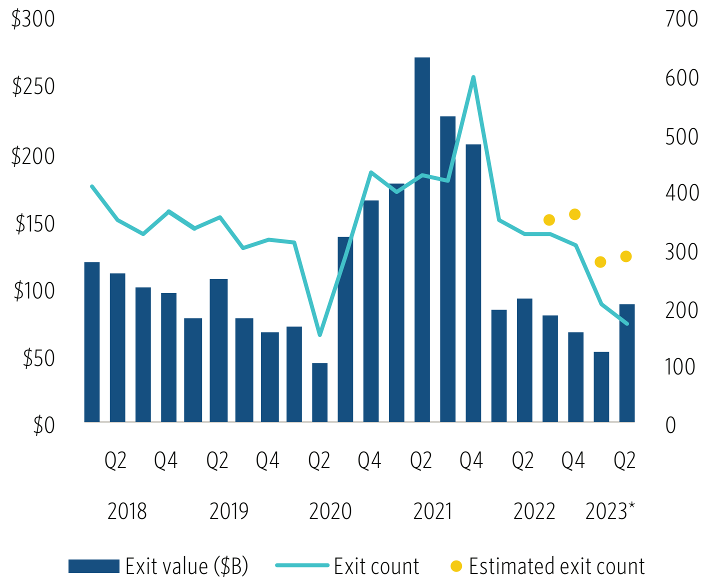


Source: PitchBook • **Geography:** US
*As of June 30, 2023

Overview

US PE exit activity lightly bounced back in Q2, a welcomed break from the three consecutive quarters of decline the industry experienced. 289 PE-backed companies exited with a cumulative exit value of $87.3 billion during Q2, increasing by 3.7% and 66.9% QoQ, respectively. Exit value experienced the first quarter of growth in the trailing 12 months (TTM). But this incremental jump in exit activity is not yet meaningful to the fatigued PE exit market, as both exit value and count remain below the pre-COVID-19 averages (2017-2019), and the quarter's exit value was boosted by a few mega-sized transactions. The exit-to-investment ratio dropped further to 0.32x by the end of Q2 2023 compared to 0.48x in 2021. Furthermore, YTD exit activity is less than half of that seen in 2022, projecting another year of stunted exits.

US PE exit activity by quarter



Source: PitchBook • **Geography:** US
*As of June 30, 2023

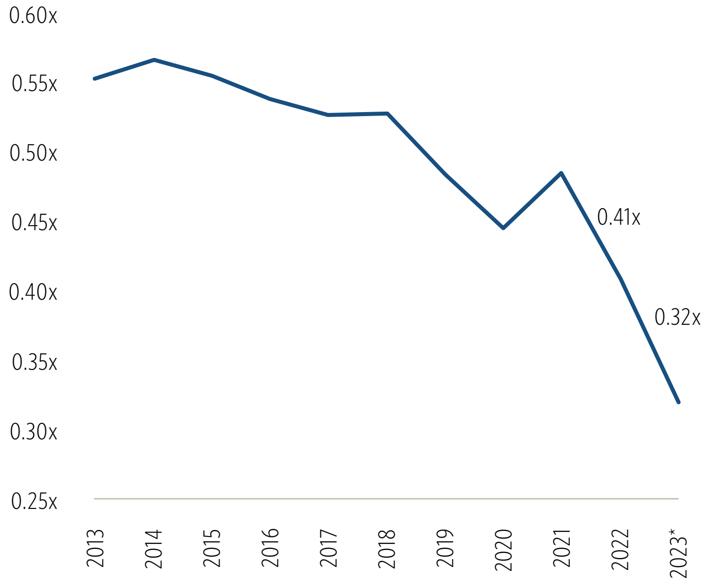
The current weakness in exit activity means that a "maturity wall" is fast approaching for the PE funds nearing the end of their term life to distribute their capital back to investors through exits. Because the new normal of slow exit activity is expected to continue in the near term, PE investors would be faced with an enormous pileup of deals that are either unable to sell or are being held for longer than expected because of lower valuations. Even when we assume exit activity to revert to pre-COVID-19 levels, which is not likely in the currently depressed market conditions, PE firms are expected to fall behind on their exit timelines. A simple forecast using pre-COVID-19 exit levels shows that investments that are entering their typical exit frames will be slower to liquidate than previous investments.[6] Further extrapolation shows that the stunted exit pacing that is likely to pervade the PE industry's foreseeable future will push holding periods beyond the exit time frame to which both GPs and LPs have been accustomed. The pressure is building for GPs to find solutions to a rising liquidity concern and to do so quickly.

Exits through public listings remained quiet for PE in Q2, although recent developments suggest there may be a long-awaited recovery of IPOs soon. Cava's successful IPO in June is a positive sign for those that had been reluctant to exit their investments at the risk of an unfavorable debut. EQT also bet on returning investor appetite for new offerings by listing Kodiak Gas Services, a natural gas compression services firm, during the last week of the quarter. EQT sought to raise $328.0 million at a $1.54 billion market cap but raised $256.0 million as stocks opened below range,[7] signaling a still-weak IPO market. On the same day, Ares Management also listed Savers Value Village, a thrift-store operator, on the New York Stock Exchange. The company received a warmer reception, fetching nearly $4 billion in market cap, which was above its target of $300.0 million at a $2.8 billion market cap. Ares will retain an 88% stake in Savers Value Village after the IPO.[8] While the IPO window seems to have cracked open a little, continued interest rate and valuation volatility is likely to keep PE investors cautious about potential exit routes.

Exits to corporates

Exits to corporates gained steam in Q2, accounting for a record 64.8% of total PE exit value. YTD, they are also tracking for the greatest share of PE exits annually at 61.9%. 85 companies exited in Q2 for an aggregate of $56.6 billion, showing an uptick in exit value but a third consecutive decline in quarterly exit count. In fact, exits to corporates marked the lowest count on an absolute basis amid anemic exit volume in the broad PE industry. Corporates with the ability and appetite to pursue

PE exit/investment ratio

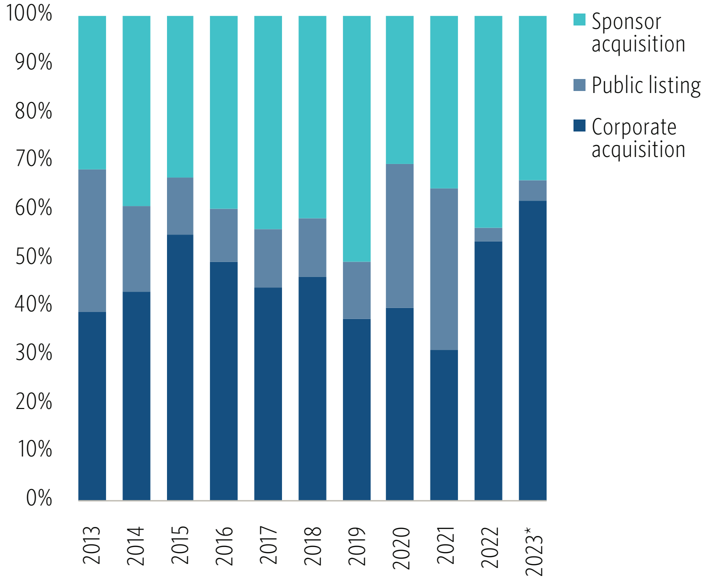


Source: PitchBook • **Geography:** US
*As of June 30, 2023

acquisitions are pursuing larger deals, as demonstrated by fewer exits resulting in higher exit volume and the increase in median exit size for exits to corporates. PE firms in the energy sector in particular saw sizable exits to corporates as industry actors continued to consolidate and the push towards energy transition drove investment activity. In May, ONEOK announced it would acquire PE-backed Magellan Midstream Partners for $18.8 billion. The merger would combine ONEOK's mainly natural gas liquids and natural gas business with Magellan's refined products and crude oil transportation business to form one of the biggest oil and gas infrastructure companies in North America and will enhance the company's presence in sustainable fuel and hydrogen corridors for further opportunities in energy transition.[9]

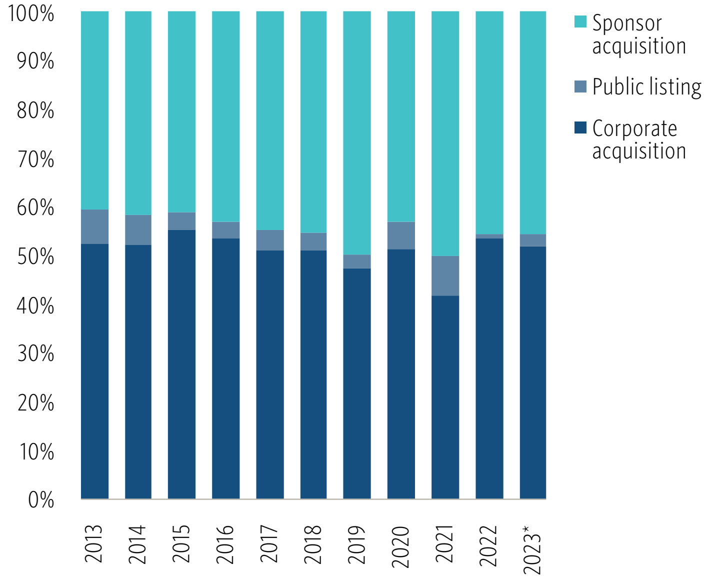
6: For more analysis, please refer to the Q2 2023 PitchBook Analyst Note: PE Exit Timelines and the Impending Maturity Wall.https://files.pitchbook.com/website/files/pdf/Q2_2023_PitchBook_Analyst_Note_PE_Exit_Timelines_and_the_Impending_Maturity_Wall.pdf
7:"The IPO Buzz: Kodiak Gas Services (KGS) Prices IPO at $16—Below Range," IPOScoop.com, Jan Paschal, June 28, 2023.
8: "Private Equity-Backed Savers Value Village Targets $2.7 Billion Valuation in US IPO," Reuters, Chibuike Oguh, June 21, 2023.
9: "US Midstream ONEOK to Acquire Magellan Midstream Partners in $18.8 Bil Deal," S&P Global, Rong wei Neo and Jeff Mower, May 15, 2023.

Share of PE exit value by type



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Share of PE exit count by type



Source: PitchBook • **Geography:** US
*As of June 30, 2023

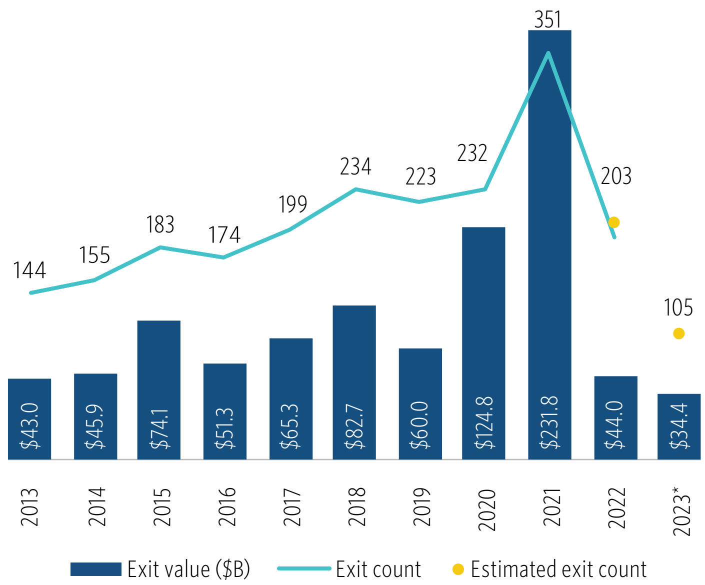
Sponsor-to-sponsor exits

On the other hand, sponsor-to-sponsor exit activity declined sharply because of compounding challenges: PE firms remained generally cautious in their dealmaking, which reduced transactions between sponsors, and disruptions in the lending market limited GPs' ability to absorb sizable deals and further slowed sponsor-to-sponsor exit activity. At the same time, those GPs that could finance larger deals have been increasingly focused on take-private opportunities as reduced valuations in the public market made for attractive acquisition targets. With $26.2 billion in quarterly value, sponsor-to-sponsor exits accounted for just 30.0% of Q2 exit value, declining from 40.5% in Q1. The number of exits to other sponsors fell in line with the broader market, with sponsor-to-sponsor exit count still accounting for a little less than half of Q2's total exits. Median size of sponsor-to-sponsor exits fell to $349.2 billion YTD compared to the $529.5 billion peak in 2021, reflecting the lower valuations at which sellers are able to exit their holdings.

Technology

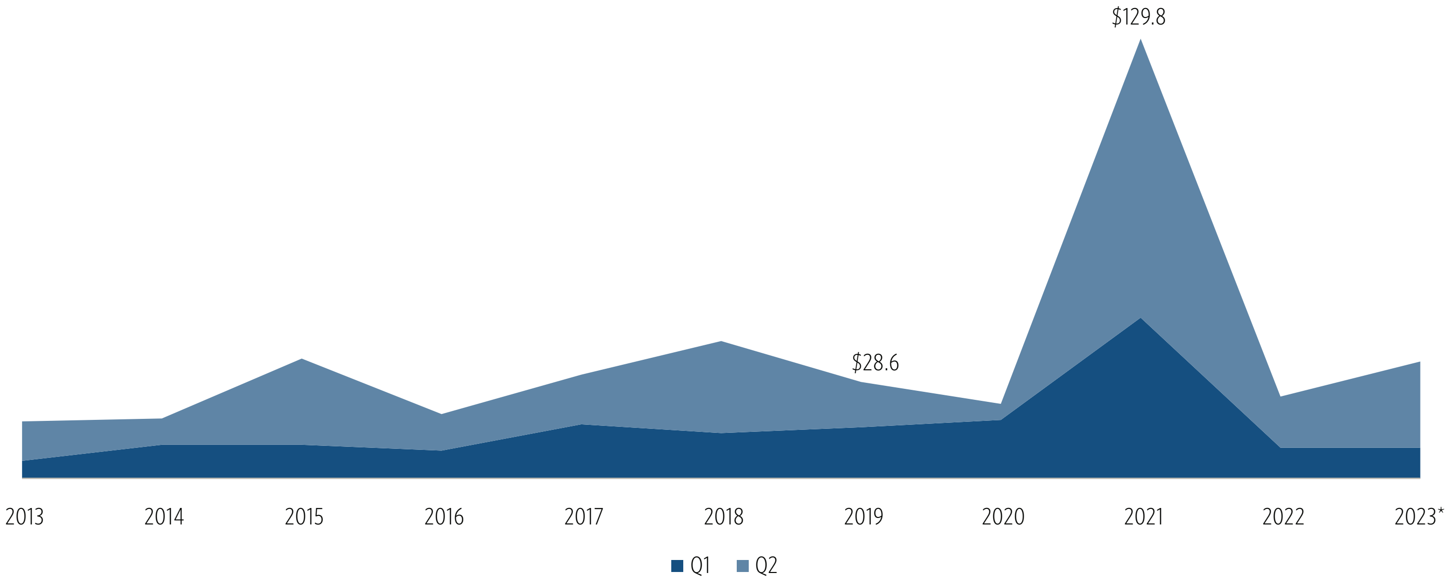
Technology exits accelerated in Q2 to $25.6 billion, up from $8.8 billion in Q1, a welcome sign for LPs and GPs alike as it demonstrates that buyers and sellers are converging on pricing and marking expectations to market amid higher rates.

Information technology exit activity



Source: PitchBook • **Geography:** US
*As of June 30, 2023

H1 IT PE exit value

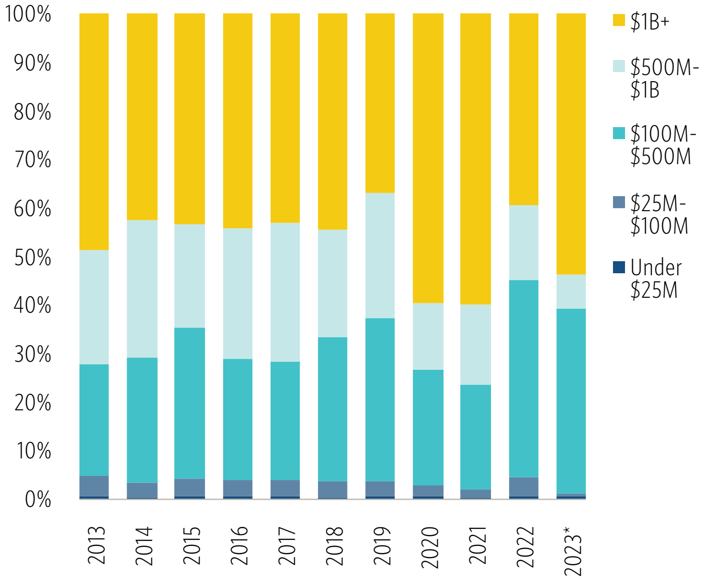


Source: PitchBook • **Geography:** US
*As of June 30, 2023

This brings H1 2023 tech exits to a total of $34.4 billion. While this H1 pace is below levels seen prior to the pandemic—and way off the peak of H1 2021 at $129.8 billion—we are optimistic that H2 2023 can beat the H1 watermark.

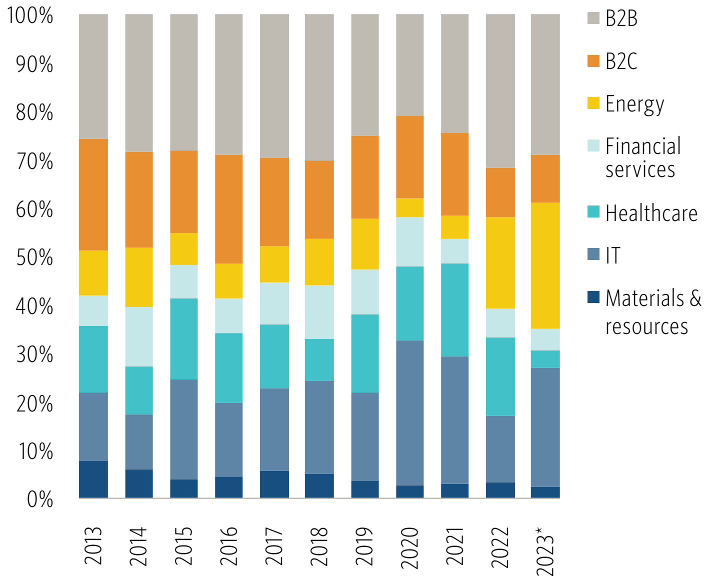
Software is leading the segment to better exit volumes, as mega deals are back on, bolstered by corporate buyers with strong balance sheets and ready access to capital. Two headline software exits were announced in June. Thoma Bravo will sell portfolio company Adenza, a provider of risk management and regulatory software to the financial services industry, to Nasdaq for $10.5 billion. Nasdaq seeks to increase its serviceable addressable market by $10.0 billion and expand its software solutions portfolio. The deal will be financed in part by a $5.9 billion debt offering, and Thoma Bravo's consideration will include a 14.9% stake in Nasdaq. Additionally, Vista Equity Partners announced it will sell Apptio to IBM for $4.6 billion in an all-cash deal as IBM seeks to increase its portfolio of hybrid cloud and automation tools. Notably, IBM has long-term debt at attractive rates and a strong balance sheet, making it uniquely positioned to capitalize on these market conditions.

Share of PE exit value by size



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Share of PE exit value by sector



Source: PitchBook • **Geography:** US
*As of June 30, 2023

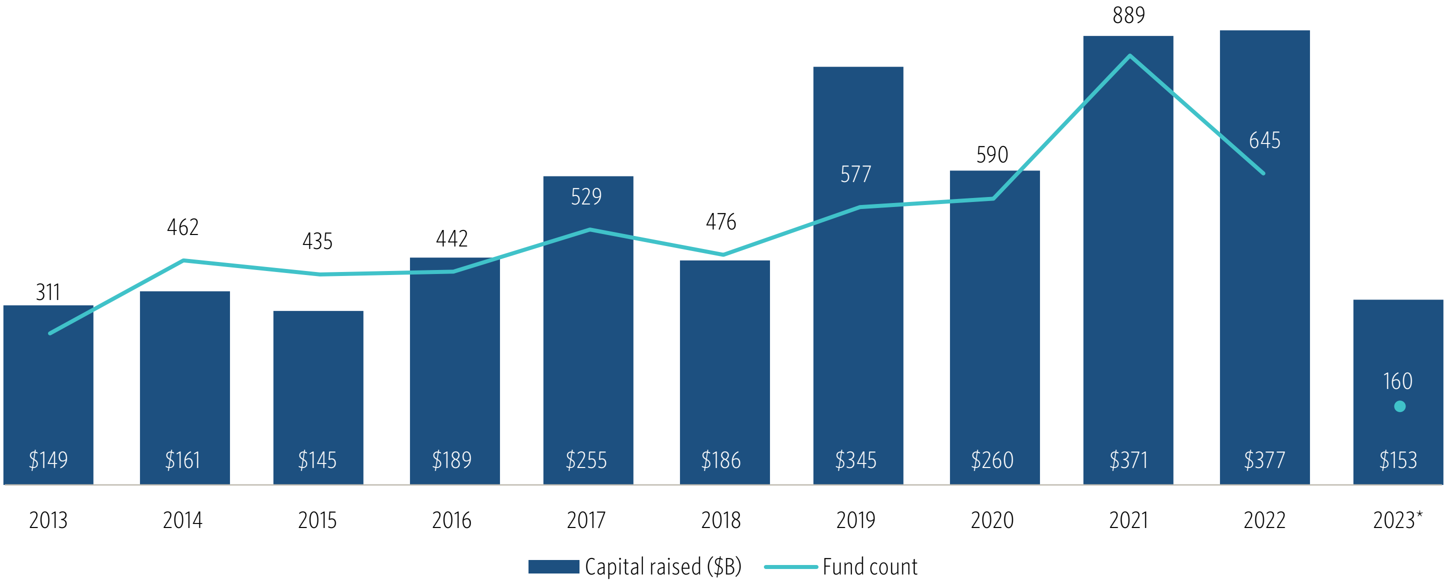
B2B

B2B exit activity faltered with 70 exits for an aggregate value of $17.6 billion, declining 24.2% QoQ in exit value. Although the sector's exit count and value are well below its quarterly averages of the last five years, the decline is in line with that of the broader PE exit landscape. In fact, B2B is performing well so far relative to other sectors; the sector's YTD share of total PE exit value is slightly above the average seen in the last five years. B2B captures a broad mix of primarily nontech and service-oriented businesses, and the exits that occurred in Q2 spanned various subsectors. For example, the largest exit during the quarter was Warburg Pincus' announced $2.05 billion sale of Wencor Group, a commercial and military aircraft aftermarket company, to HEICO, an aerospace and defense supplier. The transaction will be HEICO's largest-ever purchase and will provide complementary product sets and create synergies for its existing aircraft parts services business.[10] In industrials & manufacturing, Industrial Growth Partners sold ASPEQ Heating Group to SPX for $418.0 million in May. ASPEQ, which provides electrical heating solutions, will become part of SPX's HVAC Heating platform along with Marley Engineered Products.[11] Exits in B2B are expected to keep steady as potential buyers look for opportunities to increase capabilities, close strategic gaps, and scale their businesses.

10: "Heico Plans Wencor Acquisition," Aviation Week, Lindsay Bjerregaard, May 15, 2023.
11: "Exciting News! ASPEQ Has Joined SPX Technologies to Create Industry Leader in Commercial and Industrial Electric Heat," ASPEQ Heating Group, June 5, 2023.

Fundraising and performance

PE fundraising activity



Source: PitchBook • **Geography:** US
*As of June 30, 2023

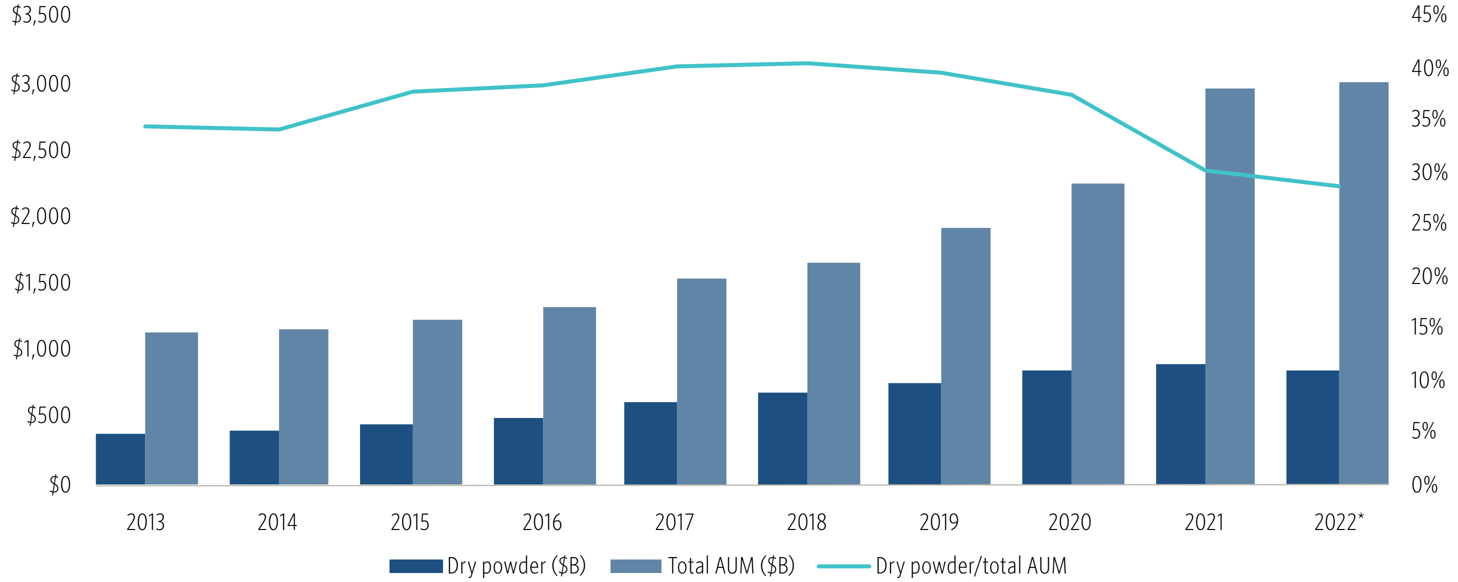
Overview

PE fundraising activity in H1 2023 is 15-25% slower than last year's pace based on the number of funds closed and final amounts of those closed funds. This slowdown was widely expected given that 2022 turned into another banner year with a record $377.0 billion raised for US based PE funds. The big surprise so far this year has been the turnaround in middle market PE fundraising. Middle market funds, which we define as between $100 million and $5 billion in size, have accounted for 57.4% of all PE fund value closed in 2023, up from a 15-year low of 47.4% last year and its best level since before the global pandemic. Numerically, the middle market's share of all PE fund closings has reached 60.5% so far in 2023, a record high. Granted we are only hallway into the year, but the reversal of fortune in fundraising by smaller buyout funds has been dramatic, nonetheless.

The strength in the sub-$5 billion fund segment masks the fact that a number of traditional players in the middle markets space are raising much larger funds to go after the middle market opportunity. These include TA Associates which raised $16.5 billion for its fifteenth buyout and growth equity fund; Genstar Capital which closed its eleventh flagship fund for $12.6 billion, and GTCR which closed on $11.5 billion for its fourteenth flagship fund.

Looking at fundraising by PE strategy, buyout funds dropped to 74.5% of the overall mix, slightly below 2022's 77.7%. This came at the benefit of growth equity funds, which increased to 25.4% of the mix, up from 22.2% last year. As LPs seek exposure to unique opportunities, specialist funds were popular in H1 2023 and reached a 19.4% share of total, up from 15.2% last year.

PE dry powder relative to AUM



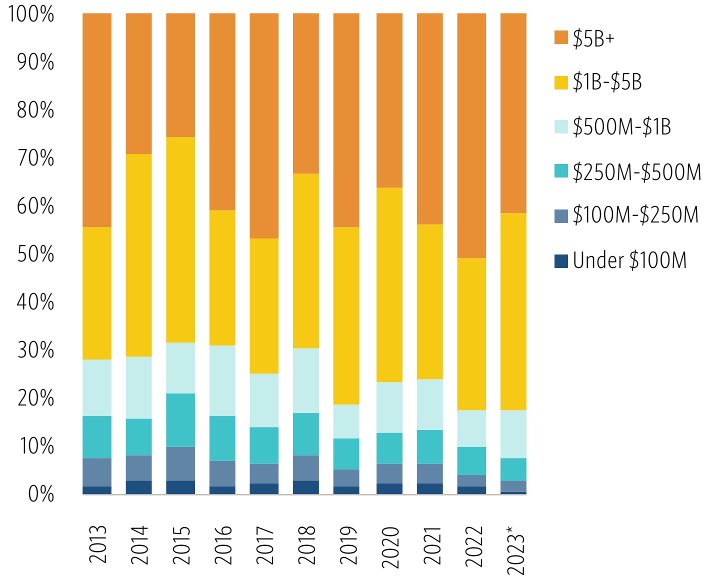
Source: PitchBook • **Geography:** US
*As of December 31, 2022

Megafunds

The first half of 2023 saw five megafunds (funds of $5 billion or more) close, down from seven in the first half of 2022. Over the past two years, megafunds have accounted for 47.2% of total fundraising. That share has dropped to 41.7% through the first half of 2023, but that downtrend is likely to reverse in the second half, as numerous large funds that have been kept open by mega sponsors are poised to close. Blackstone, Apollo, Carlyle, TPG, CDR Vista and Warburg all have flagship funds in the market that have been fundraising for a year or more and have collected close to $100 billion in investor capital. All but two of these seven flagship funds are likely to reach their targets, which total $146 billion in aggregate, and three have been open since 2021.

While megafunds are still raising capital, it is flowing in at a slower pace than in the past two years. This has led to some large sponsors to temper expectations.. On its first-quarter earnings call Blackstone announced that its ninth flagship buyout fund will likely be smaller than the $25.0 billion predecessor fund. Similarly, TPG announced on its Q1 earnings call that it is reducing the size of its flagship funds as the original targets were set under different market conditions. The same was echoed by Carlyle, which reduced its outlook for buyout fundraising while stating that it did not expect the current vintage of corporate buyout funds to be the same size as its predecessors.

Share of PE capital raised by size



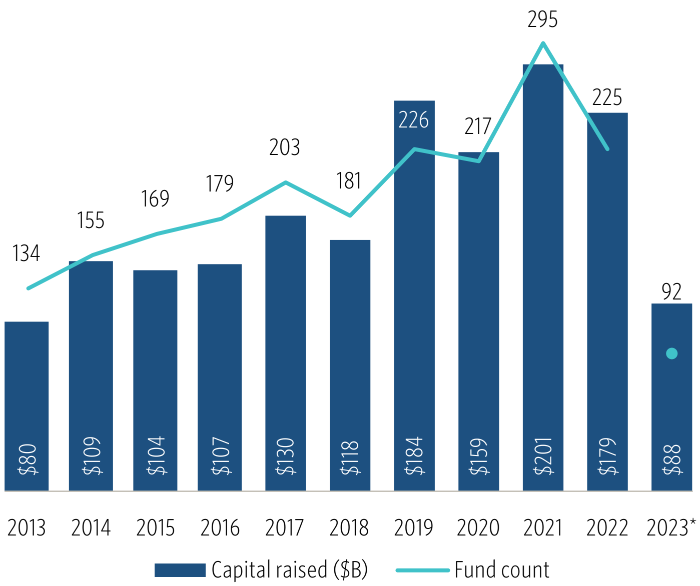
Source: PitchBook • **Geography:** US
*As of June 30, 2023

Notable open funds

Investor name	Fund name	Fund type	Fund size ($M)
Silver Lake	Silver Lake Partners VII	Buyout	$19,158
Apollo Global Management	Apollo Investment Fund X	Buyout	$16,000
Blackstone	Blackstone Capital Partners IX	Buyout	$15,547
Warburg Pincus	Warburg Pincus Global Growth XIV	PE growth-expansion	$15,364
The Carlyle Group	Carlyle Partners VIII	Buyout	$14,405
Clayton, Dubilier & Rice	Clayton, Dubilier & Rice Fund XII	Buyout	$13,704
BDT & Company	BDT Capital Partners Fund 4	Buyout	$10,382
TPG	TPG Partners IX	Buyout	$9,265
Audax Group	Audax Private Equity Fund VII	Buyout	$5,004
L Catterton	L Catterton X	Buyout	$4,346

Source: PitchBook • **Geography:** US
*As of June 30, 2023

Middle-market fundraising activity



Source: PitchBook • **Geography:** US
*As of June 30, 2023

Middle-market funds

Middle-market funds are in the midst of a strong run. They are outpacing their megafund counterparts in both fundraising and performance. Middle-market funds are vehicles that raise between $100 million and $5 billion. Through the first half of the year, 92 middle market funds have closed with an aggregate value of $87.9 billion, putting it on track for its best fundraising year since the peak in 2019. Big fund fatigue has clearly set in, and investors are gravitating toward smaller funds doing smaller deals that are easier to close and finance in the current macro backdrop. Deal valuations are also cheaper in this size range, making it easier to compensate for the lack of leverage and higher borrowing costs. Lastly, these funds are known to target non-backed companies. As highlighted in our recent analyst note, non-backed companies tend to have less flexibility to wait out an economic downturn, creating an opportunity for funds that can acquire them at attractive values and closer to a turn in the business cycle. Due to these factors, the fundraising environment favors middle-market funds for the foreseeable future.

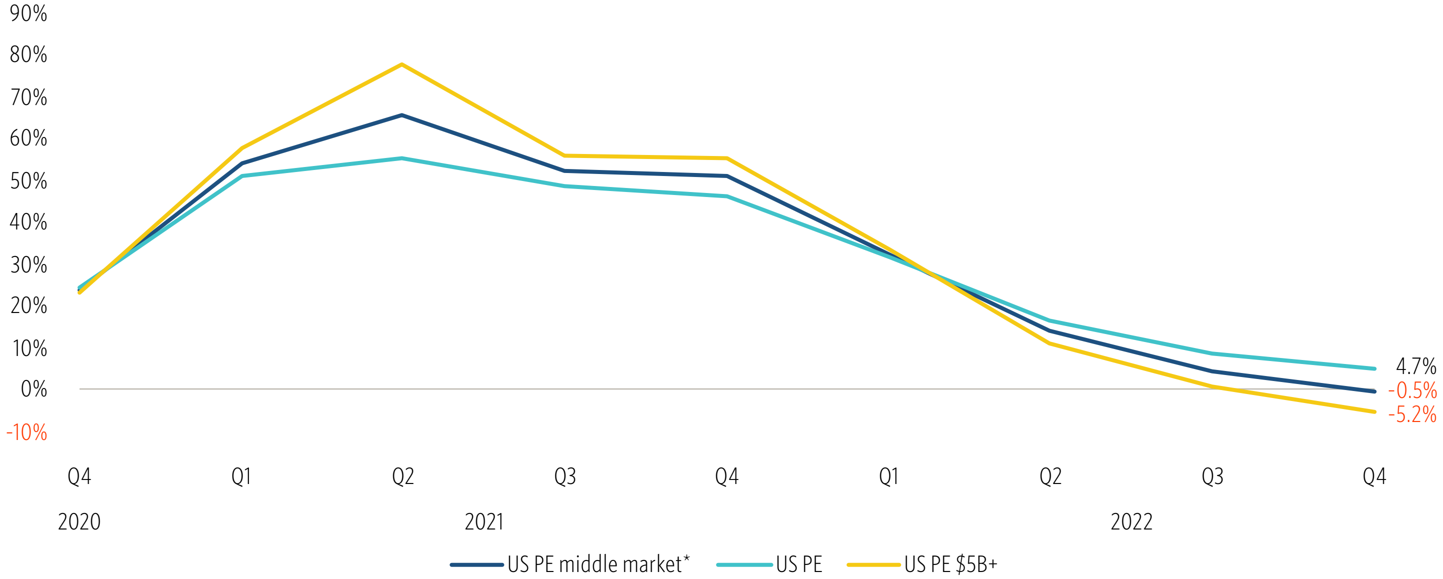
New sources of fundraising

Traditional LPs in North America remain constrained in their PE allocations, prompting GPs to explore other regions such as the Middle East and Asia have fewer headwinds. These LPs continue to commit capital and are attracted to PE as an asset class to diversify away from US public markets and local markets that are tied to other non-correlated assets such as energy. Increasingly, GPs are also seeing these major LPs from these regions seek out co-investment opportunities on specific investments, allowing GPs to tap another funding source when financing is tight. For example, French PE firm Ardian is raising its latest secondary fund, and the Abu Dhabi Investment Authority (ADIA) has agreed to invest $6.0 billion in the fund and provide co-investments in its deals.[12] Fellow Abu Dhabi sovereign wealth fund Mubadala and Singapore's GIC are also active in the co-investment space. In June, Denver-based KSL Partners and GIC made a joint £4.0 billion bid for UK holiday resort company Center Parcs in the sovereign wealth funds' latest co-investment endeavor. ADIA itself participated in three of the largest LBOs so far this year including the $4.6 billion take-private of Cvent, the $8.1 billion take-private of Univar, and the $5.5 billion take-private of Dechra Pharmaceuticals.

The under-penetrated market of retail investors has become a new avenue for fundraising. More vehicles are being launched with each passing quarter. These take a variety of forms including non-traded BDCs, trusts, interval funds and private placements, Most of these vehicles are tied to other asset classes such as real estate or private credit, but they are slowly creeping into corporate buyout strategies. For the time being they are limited to secondary strategies such as Ares' private market fund series

12: "Ardian Raises $20bn to Buy Stakes in Buyout Funds," Financial Times, Will Louch, June 25, 2023.

US PE rolling one-year performance by size



Source: PitchBook • **Geography:** US
*As of December 31, 2022

or private equity substitution strategies such as Apollo's AAA series, but over time they will pervade PE fundraising just as they have in other more income-oriented private market strategies.

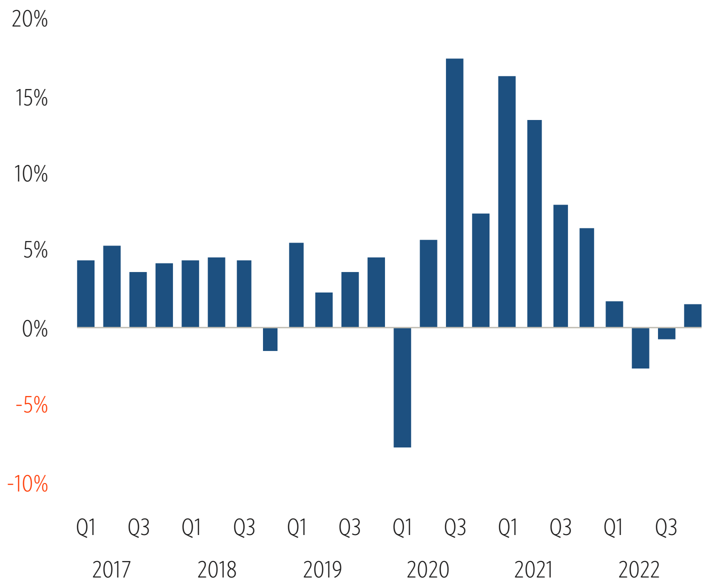
Asset gathering through acquisition

Large PE managers continue to seek ways to expand their product set, with private credit attracting significant demand. In May, TPG announced the $2.7 billion acquisition of private credit and real estate manager Angelo Gordon. This will bring $73.0 billion in AUM to TPG, including $55.0 billion in private credit strategies. This will fill a gap left after its separation from Sixth Street Partners in 2020. In March, First Sentier Investors announced it will acquire a majority stake in European credit lender AlbaCore Capital Group for $763.4 million. The acquisition of AlbaCore enables First Sentier to offer new asset classes and structures to clients, as well as unlock new channels, regions, and products to meet growing investor demand in the private credit sector.[13]

Performance

Final data collected by PitchBook points to a return of 1.5% for US PE funds in Q4 2022, following two negative quarters. For the year, US PE funds recorded an average return of -0.5%. This is in stark contrast to 2021's average return of 50.8%, but nowhere near as bad as the 18.3% decline in the S&P 500.

PE funds IRR by quarter

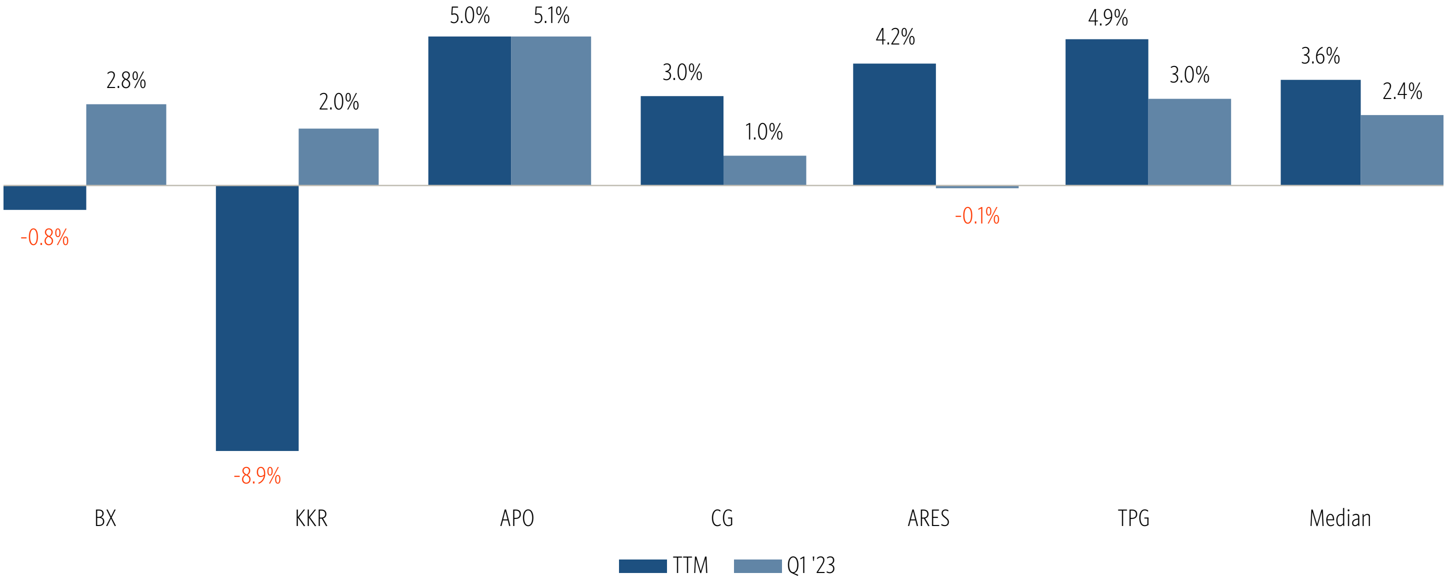


Source: PitchBook • **Geography:** US
*As of December 31, 2022

For the third quarter in a row, smaller PE funds have outperformed larger funds. The rolling one-year IRR on middle market funds stood at 4.7% in Q4 2022 versus a decline of -5.2% on megafunds, or 989 basis points of outperformance.

13: "First Sentier Investors announces strategic partnership with AlbaCore Capital Group," Cision PR Newswire, March 20, 2023.

Gross PE returns/appreciation by manager



Source: Company reports • **Geography:** Global
*As of March 31, 2023

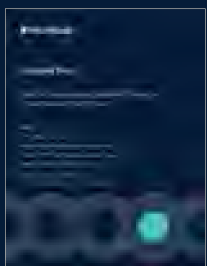
That's the largest gap in favor of middle markets since 2016. Investors were early to recognize the better set-up for smaller buyout funds in the current macro backdrop, resulting in better fundraising for middle market funds so far this year, and the outperformance of the last three quarters has only reinforced that view.

As expected, PE funds slowly marked down portfolio valuations in the second half of 2022. The markdowns were small, however, compared to the extreme valuation markups that preceded it. In the nine quarters ending Q2 2022, fund NAVs increased by an average of 7.9% per quarter and accounted for the vast majority of reported performance with very little coming from cash distributions. Historically, this figure has averaged just 2.5%. Even with a flat 2022, US buyout funds gained 81.4% in the three years ending 2022 versus a return of 25.6% on the S&P 500 index.

Looking forward into 2023, we use PE returns reported by the big six publicly traded PE managers as a lead indicator for the rest of the industry which tends to report on a six-month lag. Not including fees, the median Q1 return reported by these managers improved to 2.4%, while lagging the S&P 500 return of 7.5%. Given the large cumulative performance gap that remained at the end of 2022, we expect further underperformance from PE funds relative to public equities, and as a result, another year of flattish absolute returns. That said, the rally in public markets is a welcome change; it allows PE managers to mark down portfolios less severely given that comparable valuations have improved.

Additional research

Private equity



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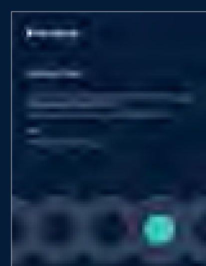

PE Exit Timelines and the Impending Maturity Wall

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Does Private Equity Over-Lever Portfolio Companies?

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Does Private Equity Over-Lever Portfolio Companies? *

Sharjil M. Haque †

This Version: November 2022

Abstract

Detractors have warned that Private Equity (PE) funds tend to over-lever their portfolio companies because of an option-like payoff, building up default risk and debt overhang. This paper argues PE-ownership leads to substantially higher levels of *optimal* (value-maximizing) leverage, by reducing the expected cost of financial distress. Using data from a large sample of PE buyouts, I estimate a dynamic trade-off model where leverage is chosen by the PE investor. The model is able to explain both the level and change in leverage documented empirically following buyouts. The increase in optimal leverage is driven primarily by a reduction in the portfolio company's asset volatility and, to a lesser extent, an increase in asset return. Counterfactual analysis shows significant loss in firm value if PE sub-optimally chose lower leverage. Consistent with lower asset volatility, additional tests show PE-backed firms experience lower volatility of sales and receive greater equity injections for distress resolution, compared to non PE-backed firms. Overall, my findings broaden our understanding of factors that drive buyout leverage.

Keywords: Private Equity; Capital Structure; Default Risk; Trade-off Theory

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*The views expressed in this paper are those of the author and do not necessarily represent the views of the Federal Reserve Board or the Federal Reserve System. Bureau van Dijk's Orbis and Zephyr data, and Compustat Global/North America data were obtained by the author prior to employment at the Federal Reserve Board, while he was a Ph.D. candidate at the University of North Carolina at Chapel Hilll. I am indebted to Greg Brown and Anusha Chari for their outstanding support and guidance. I would also like to thank Gustavo Cortes, Abed Farroukh, Mark Humphery-Jenner and Simon Schmickler (discussants). Many helpful comments and suggestions were received from Oleg Gredil, Ivan Ivanov, Anil K. Jain, Young Soo Jang, Tim Jenkinson, Christian Lundblad, Doriana Ruffino, Jacob Sagi, Elena Simintzi as well as seminar and conference participants at the Annual Private Equity Research Conference (PERC), Fed Board, Richmond Fed, Princeton's Young Economist Symposium, 2021 FMA Annual Meeting, Australasian Finance & Banking Conference, Society for Nonlinear Dynamics and Econometrics, Southern Methodist University and UNC Chapel Hill.

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1 Introduction

It is well-known that Private Equity (PE) funds acquire companies in leveraged buyouts (LBO) using substantial amount of debt (Kaplan and Stromberg, 2009). The sharp increase in portfolio company leverage following a PE-sponsored buyout has generated conflicting views.[1] One well-known view is that PE fund managers over-leverage their portfolio companies (Kaplan and Stein, 1990; Andrade and Kaplan, 1998), and buyout capital structure is primarily driven by credit market conditions instead of debt capacity of a given firm (Axelson, Jenkinson, Strömberg, and Weisbach, 2013). The alternate view is that high leverage is efficient since PE leads to lower debt-equity conflicts for a given debt ratio relative to public firms (Malenko and Malenko, 2015), thereby allowing PE-backed firms to trade off the benefits of higher debt against potentially lower expected cost of financial distress. Which effect dominates is thus an empirical question.

In this paper, I examine if PE investors systematically over-lever portfolio companies and estimate the *optimal* (value-maximizing) leverage of PE-backed firms. If PE sponsors over-leverage and overpay for deals as suggested by Axelson et al. (2013) and Axelson, Strömberg, and Weisbach (2009), we would expect optimal leverage of portfolio firms to be meaningfully lower than what we see in the data, which can lead to significant aggregate costs (Faria-e Castro, Paul, and Sánchez, 2021).

Examining this mechanism is challenging since we do not readily observe optimal leverage. Existing papers empirically examining leverage in PE rely on standard regressions of leverage on a number of factors that proxy costs and benefits of debt.[2] However, this approach cannot detect if firms have too much debt or too little debt on average and implicitly assumes firms are always optimally levered (Korteweg, 2010). Moreover, it cannot incorporate the endogeneity of the bankruptcy decision, which is jointly determined with leverage. The alternate approach is to structurally estimate optimal leverage.

[1] Throughout the text, I use the terms PE-backed, PE-sponsored, and PE-owned interchangeably to refer to portfolio firms.

[2] See for example Axelson et al. (2013); Guo, Hotchkiss, and Song (2011); Kaplan and Stein (1993).

As Ivashina and Kovner (2011) suggest, PE managers are effectively shadow-borrowers since they control the borrower's equity, management, capital structure and strategic direction. Consistent with this observation, if we relabel the PE General Partner (GP) as a CEO who chooses capital structure to maximize equity value taking into consideration a potentially different expected cost of financial distress, then a standard trade-off model with endogenous leverage could explain high buyout debt. Consequently, I estimate a dynamic trade-off model using data from a large, international sample of PE-owned portfolio companies covering pre- (post-) buyout financial information. Since the data allows me to estimate optimal pre- (post-) buyout leverage ratios, I can identify the underlying mechanism that explains a change in the optimal leverage. Additionally, the model allows me to examine tax benefits of debt and default risk following PE-intervention.

Using the post-buyout sample, I begin with my benchmark case and estimate the Leland (1994) structural model that considers trade-off theory with endogenous debt and default. However, a key hurdle I encounter is the need for market prices of PE-backed firms since estimation of Leland-type models involves recovering a firm's unobserved asset value and volatility such that they deliver its empirically observed equity value and volatility (Elkamhi, Ericsson, and Parsons, 2012; Bharath and Shumway, 2008; Nagel and Purnanandam, 2020). Given the absence of equity prices of private companies, I design a similar yet even more conservative matching methodology relative to Bernstein, Lerner, and Mezzanotti (2019) to identify nearly-identical public companies. Specifically, I match each PE-backed firm in my sample to public companies in terms of profitability, leverage, total assets and volatility of return on assets in the same country-industry-year. These variables are chosen to condition on factors that typically differentiate PE-backed firms from public companies.

My key finding is that private equity leads to substantially higher levels of optimal leverage. The estimation predicts mean and median post-buyout leverage ratios of 47.7 and 52.6 percent respectively, which matches the data quite well. Specifically, mean and median leverage in the data is around 50 percent, consistent with previous studies (Brown, 2021;

Gornall, Gredil, Howell, Liu, and Sockin, 2021). Re-estimating the model with pre-buyout data generates much lower optimal leverage ratio of around 33 percent, which is also close to pre-buyout levels. The model thus explains both the level and *change* in post-buyout leverage. In a counterfactual exercise, I find that the median firm in my sample stands to lose approximately 4.0 percent of value if they chose to stay at debt levels close to what is observed pre-buyout. The model predicts substantial cross-sectional heterogeneity in the cost of sub-optimal leverage with an inter-quartile range of 2.4 to 5.7 percent of value.

Next, I inspect the channel driving the results. The primary reason for the increase in optimal leverage is a sizeable reduction in estimated asset volatility, and to a lesser extent, an increase in asset return. I find that mean asset volatility declines from 0.309 pre-buyout to 0.177 post-buyout. Lower asset volatility reduces the firm's time-weighted probability of default and, by extension, the expected present value of bankruptcy costs (for a given default cost), thus raising optimal leverage.[3] The benchmark finding is consistent with the theory proposed by Malenko and Malenko (2015), who argue risk-shifting incentives are lower under PE-ownership in a setting where debt brings the standard tax and agency benefits as well as bankruptcy costs.

To support this finding, I also provide reduced-form evidence consistent with lower asset risk. I provide evidence on two (not necessarily mutually exclusive) channels: operational engineering and financial distress resolution through equity injections (Gompers, Kaplan, and Mukharlyamov, 2022a; Gryglewicz and Mayer, 2020). Using a matched difference-in-differences strategy with firm and year fixed effects to alleviate concerns related to selection, unobserved firm-specific factors and aggregate credit conditions, I uncover two key empirical facts. First, PE-firms receive greater equity infusion when default risk is high, relative to matched public companies consistent with Bernstein et al. (2019), Hotchkiss, Smith, and Strömberg (2021) and Haque, Jang, and Mayer (2022). This capital infusion comes from

[3]Prior research shows that in endogenous default models, the higher volatility and resulting lower-coupon effect dominates the opposing effect of higher coupon due to the likelihood of a firm finding itself in a very good state when it raises risk. See for example, Strebulaev, Whited, et al. (2012).

sponsoring funds with so-called dry powder since committed capital is typically invested over a series of years, rather than all at once. The key implication is that equity injection reduces distress risk, hence diminishes incentives to shift risk to lenders. This is the distress resolution channel.

Second, I show that PE-sponsored firms experience a reduction in the volatility of sales following PE-takeover: the operational engineering channel. Lower volatility in sales is consistent with findings in Fracassi, Previtero, and Sheen (2022), who use granular store-level data to show firms diversify both their product basket as well as geographic product market after PE-takeover, thus lowering risk. One concern with this finding, may be that PE managers may be manipulating accounting data to maximize fund-level risk-adjusted return, consistent with findings from Brown, Gredil, and Kaplan (2019). To alleviate this concern I show that my results are unchanged with a restricted sample of just a few advanced European countries where firms are required to disclose their financial statements and have them regularly audited (unlike firms in the US).

For completeness and robustness purposes, I extend the standard model in three additional directions to capture issues often associated with PE. First, Hotchkiss et al. (2021) show that PE-backed firms tend to negotiate out-of-court with lenders more often that similar non-PE firms, if they are in distress. Following Strebulaev et al. (2012), I estimate a simple version of a trade-off model where firms issue private bank debt and can negotiate its coupon payments in low-profitability states of the world instead of filing for a relatively more traditional chapter 11 bankruptcy. Second, PE-backed firms have also been accused of so-called asset-stripping (e.g. Reuters, 2010; The Gaurdian, 2021). The Leland (1994) model can capture liquidation of assets to fund higher payouts, allowing me to compute optimal leverage at different liquidation rates as a share of asset value. Third, as Ivashina and Kovner (2011) suggest, close relationships between banks and PE funds may loosen covenant violation thresholds, allowing for higher leverage. I introduce an Interest Coverage covenant in a parsimonious manner into the Leland (1994) model to examine this channel. In general, I find that these extensions are not as successful in explaining post-buyout leverage ratios as the benchmark model, indicating these factors may not be the primary driver of higher optimal leverage.

Finally, one might worry that higher optimal leverage arises from PE sponsor reputation (Ivashina and Kovner, 2011). The benchmark model can capture this effect through changes in loss given default. For example, higher PE sponsor reputation could potentially reduce loss of customers or limit fire sales in highly levered firms or firms with high default risk. In a comparative static exercise, I show that changes in dead-weight default costs do not generate the substantial change in leverage as the change in asset volatility does, and thus cannot explain the observed change in the data.

Related Literature. This paper contributes to a large literature on debt and leverage in private equity-sponsored leveraged buyouts. The extant literature on capital structure in PE has primarily focused on the role of aggregate market conditions (Malenko and Malenko, 2015; Bernstein et al., 2019; Axelson et al., 2013), reputational concerns (Malenko and Malenko, 2015; Huang, Ritter, and Zhang, 2016), deal returns (Brown et al., 2019; Brown, 2021), mechanisms in the initial year of operation (Robb and Robinson, 2014), agency conflicts between general and limited partners (Axelson et al., 2009; Gryglewicz and Mayer, 2020), and PE sponsor-lender relationships (Ivashina and Kovner, 2011; Jang, 2022). My paper is conceptually closest to Hotchkiss et al. (2021) who argue the expected cost of financial distress under PE-ownership is lower, given the standard trade-offs associated with choosing leverage. My paper differs from these by proposing and directly estimating the *optimal* leverage in buyouts, while previous papers have primarily theorized that optimal leverage could be different under PE, such as Malenko and Malenko (2015). To the best of my knowledge, this is the first paper to quantitatively examine optimal leverage in PE taking into account the endogenous nature of default and corporate debt policy.

I also contribute to the large literature on the effects of private equity buyouts. As suggested by Kaplan and Stromberg (2009), recent theories (Malenko and Malenko, 2015;

Gryglewicz and Mayer, 2020) or survey evidence (Gompers et al., 2022a), PE owners affect firm value and outcomes through operational, governance, and financial engineering. In this context, several papers study whether and how PE owners affect firm outcomes, managerial incentives, stakeholders, and/or create value (see, among others, Boucly, Sraer, and Thesmar (2011); Cronqvist and Fahlenbrach (2013); Cohn, Mills, and Towery (2014); Bernstein and Sheen (2016); Antoni, Maug, and Obernberger (2019); Gupta, Howell, Yannelis, and Gupta (2021); Gornall et al. (2021); Cassel (2021); Ewens, Gupta, and Howell (2022); Fracassi et al. (2022); Cohn, Hotchkiss, and Towery (2022); Haque et al. (2022)).I complement these efforts by empirically examining the effect of PE-ownership on underlying asset volatility, default risk as well as the tax and incentive benefits of debt.

Finally, this paper also contributes to the structural corporate finance literature. Prior studies which estimated structural leverage models have focused on cost of default (Glover, 2016), pre-default costs (Elkamhi et al., 2012; Elkamhi and Salerno, 2020), the effect of changes in tax rates on small firms (Ivanov, Pettit, and Whited, 2020) and collateral (Li, Whited, and Wu, 2016). Unlike these papers, I provide an examination of the quantitative effect of changes in asset volatility on capital structure, as well as the (counterfactual) effect choosing lower leverage. Unlike papers which have typically calibrated Leland-type models, I structurally estimate the model for proper inference.

2 Structural Model of Optimal Leverage

The key assumption I make in this paper is that the PE manager behaves similar to a profit-maximizing equity-holder. This is a reasonable assumption as Jensen (1986), and more recently Ivashina and Kovner (2011) and Gompers, Kaplan, and Mukharlyamov (2022b) argue, PE managers usually own a majority of the equity in the companies within their portfolio, take active roles in governance and operations, and seek to maximize the value of their investments because they are usually compensated with a large share of the profits of these investments. In this section, I begin by outlining a model of the leveraged firm following Leland (1994). Since the model is well known, I do not repeat detailed theoretical derivations here and only present key equations.[4]

Consider a firm in a continuous-time infinite horizon framework, whose manager maximizes shareholder value. At all times in which the firm is operating, its assets in place produce cash flows at a rate of δ_t, implying cash flows of $\delta_t dt$ are produced in each time interval $[t, t + dt]$. Assume there exists a risk-neutral measure with risk-free rate r under which cash flow rate follows a geometric brownian motion

$$d\delta_t = \delta_t \mu dt + \delta_t \sigma dB_t \tag{1}$$

where $\mu < r$, $\sigma > 0$ are constants representing risk-neutral drift and volatility of δ_t. In Eq. (1), B_t is a standard Brownian motion, which we can think of as random shocks to a firm's fundamental value. Since all value is generated by assets in place in perpetuity, and assuming the firm's capital structure only consists of equity, we can write the value of the unlevered firm as:

$$E_U(\delta) = \mathbb{E}\Big(\int_t^{\infty} e^{-r(s-t)}\delta_s ds\Big) = \frac{(1-\tau)\delta_t}{r-\mu} \tag{2}$$

where τ represents a constant proportional corporate tax rate.[5]

Now suppose the firm issues debt to take advantage of tax shields. Debt takes the form of a consol bond with constant coupon rate C. I follow the literature in assuming a full loss offset provision, so the firm subsequently pays taxes $\tau(\delta_t - C)dt$ per unit in time.[6]

[4]Readers interested in the theory can also see Leland and Toft (1996), Leland (1998), He (2011), Strebulaev et al. (2012) and Glover (2016), among others.

[5]One concern could be that the model cannot capture time-varying macroeconomic risk. Recall that the goal of this paper is to explain leverage ratios in the cross-section pre-(post-) buyout, as opposed to the time-series. Thus time-varying credit conditions should be less of a concern, however, I also provide tests in Section 6 that tackle this issue directly.

[6]Strebulaev et al. (2012) argue taxes are asymmetric in the real world, so that profits are taxed at a higher rate than losses. While I abstract away from this for simplicity in the benchmark model, unreported results confirm carry-forward or carry-back provisions of tax code does not change the main result of this paper.

2.1 Equity Value and Endogenous Default

Now, I outline the value process for the equity-holder's payoffs. In the context of this paper, I assume the PE fund manager acts as the owner-manager or equivalently is the equity-holder following an LBO. Equity value can be computed through the following ordinary differential equation that equates the required rate of return for the equity-holder with the expected rate of return on equity, which is the sum of the terms on the right hand side.

$$rE(\delta) = \delta_t - (1-\tau)C + \mu\delta\frac{\partial E}{\partial \delta} + \frac{1}{2}\sigma^2\delta^2\frac{\partial^2 E(\delta, t)}{\partial \delta^2} \tag{3}$$

The left hand side is the required equity return. The first term on the right-hand side captures the cash flow generated by the firm per unit of time. The second term is the after-tax coupon payment per unit of time. The third and fourth term capture the expected change in equity value caused by a fluctuation in the firm's asset value. Following a series of unexpected negative shocks that deteriorates the firm's financial status, the equity-holder may choose to default. Standard smooth-pasting condition yields the endogenous default-triggering asset level

$$\delta_B = (1-\tau)C\frac{r-\mu}{r}\frac{\gamma}{1+\gamma} \tag{4}$$

where γ is the root of the fundamental quadratic equation, defined below.

$$\gamma = -\frac{\mu - 0.5\sigma + \sqrt{(0.5\sigma^2 - \mu)^2 + 2\sigma r}}{\sigma^2} \tag{5}$$

2.2 Debt Value and Optimal Leverage

The value of debt is given by Eq. (6) below. The first term on the right-hand side is the constant coupon flow to debt-holders if the firm is solvent. The second term is equal to 0 since debt takes the form of a perpetual bond, thus time-independent. The last two terms on the right hand side are defined similar to the equity-holder's value.

$$rD(\delta) = c - \frac{\partial D(\delta)}{\partial t} + (\mu)\delta_t \frac{\partial D(\delta)}{\partial \delta} + \frac{1}{2}\sigma^2 \delta_t^2 \frac{\partial^2 D(\delta)}{\partial \delta^2} \tag{6}$$

The value of the leveraged firm is the sum of debt and equity values. Simplification yields the following standard equation which effectively is the sum of the value of the unlevered firm, the tax benefits of debt less bankruptcy costs, thus capturing trade-off theory.

$$V_L(\delta) = \frac{\delta_0}{r-\mu} + \frac{\tau C}{r}\Big(1 - (\frac{\delta}{\delta_B})^{-\gamma}\Big) - \frac{\alpha \delta_B}{r-\mu}(\frac{\delta}{\delta_B})^{-\gamma} \tag{7}$$

We obtain the optimal coupon C^* by maximizing the levered firm value in Eq. (7). This is then used to compute optimal leverage shown in Eq. (8).

$$L_i = \frac{D(\delta, \delta_B, C^*)}{D(\delta, \delta_B, C^*) + E(\delta, \delta_B, C^*)} \tag{8}$$

3 Estimation Method

To find out if a trade-off model of optimal leverage can, on average, explain leverage ratios we see in PE-backed firms, I now estimate the model with empirical data from a large sample of PE firms. In this section, I describe the empirical strategy and sample construction.

3.1 Estimation

To estimate the model, I first set some parameters to typical values seen in the literature. Specifically, I set the risk-free rate to 5 percent Strebulaev et al. (2012). Following Leland (1998), Strebulaev et al. (2012) and He (2011), I set the corporate tax rate to 20 percent, which is appropriate given the international nature of the sample, described subsequently. Bankruptcy cost is set to 23 percent following Andrade and Kaplan (1998).

Estimation strategy is standard. The advantage of the Leland (1994) model is that it provides closed-form solutions for debt value, equity values and volatilities. The two key inputs to the model - asset value (δ_t) and asset volatility (σ) - cannot be observed. Instead they are inferred by requiring the model to fit observable data. Specifically, I calibrate the model for each firm-quarter by simultaneously solving Eq. (9) and (10) for δ_t and σ that deliver the observed values of a firm's quarterly equity and stock return volatility. This procedure has been widely used in prior research (Nagel and Purnanandam, 2020; Elkamhi et al., 2012; Bharath and Shumway, 2008; Vassalou and Xing, 2004).

$$E_{mkt} = E_{mod}(\delta_t; \sigma) \tag{9}$$

$$\sigma_e = \frac{\delta_t}{E_{mod}(\delta_t; \sigma)} \frac{\partial E_{mod}(\delta_t; \sigma)}{\partial \delta_t} \sigma \tag{10}$$

In Eq. (9) and Eq. (10), *mod* and *mkt* denote model and market values respectively. I estimate δ and σ using straightforward numerical solution, and compute bootstrap standard errors using 5,000 replications.[7]

The necessity of market prices presents a challenge unique to this paper since we are examining private firms. In an ideal experiment, one would proxy for market prices using identical public companies. My empirical design follows similar thinking. I develop a more conservative matching procedure relative to Bernstein et al. (2019) and estimate the model using market price of this sample of matched public companies. As I will argue below, selection on unobservable dimensions is likely less of a concern given my choice of matching covariates and the conservative nature of my match.

3.2 Data

The data collection process is divided into three parts. First, I collect private equity deal-level data from Bureau Van Dijk's (BvD) Zephyr database. Zephyr has been increasingly

[7] I use Matlab's built-in Levenberg–Marquardt algorithm to iteratively solve the model, using a convergence tolerance criterion of 10^{-3}. Computation of bootstrapped standard errors is carried out through a Linux-based computing system, which substantially reduces estimation time.

utilized among PE researchers and has been verified as a comprehensive and representative sample of PE transactions compared with other PE databases (Jenkinson and Stucke, 2011; Bansraj, Smit, and Volosovych, 2020). Zephyr includes information on deal confirmation date, industry classification, country of the portfolio company and sponsoring fund.[8] I retrieve all Private Equity transactions labelled Institutional Buyout or deals where financing is labelled Leveraged Buyout or Private Equity from 2000 to 2019. In doing so, I exluded all Growth Capital and Venture Capital deals.

Second, I match target firms with their annual company-level accounting data from Orbis, which has also been used in previous studies such as Bernstein et al. (2019). One advantage of Orbis relative to other firm-level BvD datasets (e.g. Amadeus) is that Orbis does not remove firms from the sample after a few years of inactivity. This is important since it minimizes selection concerns arising from a substantial number of firms exiting after the financial crisis. I use information on deal-confirmation date from Zephyr to identify the pre-buyout and post-buyout years. I exclude firms in the utilities, financials and public sectors. I restrict the sample to firms with data on book assets, short-term debt, long-term debt, sales and cash and cash-like assets for the sample period. In addition, I require firms to have accounting data in at least the two years immediately preceding a buyout. Excluding firms that did not meet this minimum data criterion led to an initial sample of 1,383 PE-backed firms in the post-buyout sample. Next, I exclude firms that does not meet the requirements for the matching algorithm described below, leading to a final sample of 731 firms. As will be described below, variations in the matching criterion lead to higher or lower samples but does not change the main results of this paper.

All variables are defined in Table A1 in the Appendix. To minimize the effect of outliers, all variables are winsorized at the 1 and 99 percent level. Table A2 in the Appendix shows key moments such as asset value, net leverage and industry composition are quite comparable in the full and the matched sample. I focus on net leverage (henceforth, leverage) in this

[8] When sponsoring fund information is missing, Zephyr includes the name of the acquiring company which I use to pin down the sponsoring fund from public sources.

paper because PE buyout managers typically consider debt minus cash and cash-like assets when considering companies for leveraged buyout targets.

I also verify that key moments are comparable to other studies. For example, Brown (2021) report net leverage, measured as debt minus cash and cash-like assets over enterprise value, of 51 percent immediately following a buyout. First, as Table A2 shows, leverage ratio in my sample is quite similar and stands at 49.2 and 49.5 percent respectively in the full and matched samples respectively. Second, The sample is also consistent with the literature in the time series. Brown (2021) document that leverage nearly doubles following a buyout. As Figure 1 shows, leverage in this sample displays a similar pattern in the year following a buyout.

[Insert Figure 1 Here]

A key part of the empirical strategy relies on data of comparable (matched) public companies that have observable market prices. Hence in the third step, I retrieve financial data on non-PE backed public companies from Compustat (North America and Global). I restrict the Compustat data to the same sample period and data availability requirements mentioned above for the PE-backed firms. Since my PE-sample is at the firm-year level, I obtain accounting data for public companies at the annual frequency. However, for equity price and shares outstanding, I retrieve daily data. Further details on non-PE companies are provided below in section 3.3.

3.3 Matching Procedure and Sample Characteristics

PE-backed companies are not a random sample of the population. For instance, they are like to be larger and more leveraged than the average firm. Following Bernstein et al. (2019), I find a suitable sample of comparable public companies using a matching algorithm. For each year a firm is under PE-ownership, I find at most 5 non-PE owned public companies, if available, in Compustat that (a) was in the same country, (b) belonged to the same

2-digit NAICS industry, (c) had return on asset (ROA), leverage, total book assets and volatility of ROA within a *10* percent bracket around a PE firm-year. The key difference from Bernstein et al. (2019) is that I include the volatility (standard deviation) of profits as a matching covariate and I require a much tighter match relative to their 30 percent bracket. Reasonable variations of this matching procedure with fewer or additional variables leads to moderate changes in matched sample size, but does not change the key result of the paper.[9]

The key concern with using market prices of the matched sample is selection of PE-backed firms based on dimensions we cannot observe in the data. For example, the traded price of a PE-backed company may be influenced by whether or not it is backed by a reputed private equity sponsor.[10] Demiroglu and James (2010) suggest reputation can be proxied by performance, which in this context is captured by ROA. Specifically, since performance is persistent in PE (Kaplan and Schoar, 2005), firms backed by more reputable sponsors are likely to be relatively more profitable. Similarly differences in risk-shifting or incentives due to PE-ownership is likely to be captured by matching on volatility of ROA.[11] Nevertheless, in section 6, I provide reduced-form evidence using PE-firm data consistent with the main mechanism that will drive the key result in my benchmark structural estimation.

[Insert Table 1 here]

Table 1 compares firms backed by PE and matched non-PE backed public firms. My matching algorithm leads to a match of 731 PE-owned firms with around 2,900 firm-year observations for key matching covariates in the post-buyout sample. The matched public firm sample has around 6,500 firm-year observations. We can see that the matching is quite effective in ensuring the two samples are very similar. There is no statistically significant difference in means across the two samples, and standardized percentage bias is less than or

[9]For instance, I introduced sales growth as a matching covariate which decreased our matched sample, but left our main results unchanged.

[10]In other words, investors may value a firm owned by Kohlberg Kravis Roberts Co. more highly than an identical firm owned by a less reputable sponsor.

[11]It is also plausible that any remaining confounding effect that is not captured by any of the four matching covariates are likely to have relatively smaller effect on equity prices since investors are likely to put more weight on observable financial data when determining market price.

equal to 5 percent for all matching covariates. Further inspection shows mean leverage ratio for the two samples is around 48 percent. This is also consistent with prior literature.[12]

We can also see both the median and standard deviations of matching covariates in the public company sample are quite similar. For example, median ROA volatility in the PE and matched samples are 0.055 and 0.054 respectively. Mean leverage ratios are quite close as well. Mean ROA is 3.4 and 3.2 percent for the PE and matched public sample, while the median ROA is somewhat higher for the matched public firms.

How does the matched PE sample used in the analysis compare with the unmatched full sample? Table A2 in the Appendix shows the samples are quite comparable both in terms of portfolio company characteristics and industry characteristics. For example both book assets and leverage ratios are quite similar. Manufacturing companies dominate both samples, although they are somewhat more frequent in the sample used in the analysis. Overall, the sectoral composition is qualitatively similar across both samples.

4 Benchmark Results

Because we are primarily interested in deriving an optimal leverage value consistent with trade-off theory, we need only two model inputs: market value and volatility of equity. Armed with the matched sample of public firms, I estimate the model for each firm-quarter by matching model-implied equity value and volatility with the observed market capitalization and historical equity volatility of the matched sample. Market capitalization is simply share price times number of shares outstanding while equity volatility is the standard deviation of daily (historical) price return. I set the drift rate, μ=1.78%, which is estimated directly from the data using mean historical equity return.

[12]For example, Gornall et al. (2021) use data from Stepstone SPI and Pitchbook respectively and find their sample has leverage ratio of approximately 50 percent, where leverage ratios are defined similarly.

4.1 Post-Buyout Optimal Leverage

Table 2 reports benchmark estimation results using over 32,000 firm-quarter observations. First, Panel A reports model inputs. The median equity value is USD 68.5 mn while the mean is USD 235 mn. Median equity volatility is estimated at 18.5 percent while the mean is higher at 26.2 percent.

[Place Table 2 Here]

Panel B reports my key results. I begin by tabulating the estimated mean, median, 25th and 75th percentile asset volatility, along with bootstrapped standard errors. The recovered asset volatility moments are marginally lower than their respective equity volatility. For example, mean asset volatility is 23.8 percent while the median is 18.4 percent. Using estimated asset volatility I derive model-implied optimal leverage using an initial asset value of 100. It is worth recalling the the Leland (1994) model is scale invariant so initial asset value choice does not affect leverage ratios.

Row 2 in Table 2 reports mean, median, 25th and 75th percentiles of optimal leverage. For example, using the median estimated asset volatility, the model predicts optimal leverage ratio of 50 percent. Similarly, using the 75th percentile estimated asset volatility, I find a much lower optimal leverage ratio of 32.2 percent. The 25th percentile asset volatility predicts a much higher optimal leverage ratio of 59.4 percent. The negative relationship between asset volatility and optimal leverage is well-known in the literature, but the key question is how these predicted leverage moments match with the real data. Row 3 tabulates mean, median, 25th and 75th percentiles of leverage ratios in the actual post-buyout sample. As can be seen, the model is quite consistent with the data. Median leverage ratio in the post-buyout data is 49.6 percent, while the mean is 47.8 percent. The model also is consistent with the first and third quartile predicted leverage ratios. For example, the 25th percentile leverage ratio in the data is 32.4 compared to 32.2 predicted by the model. Mean leverage in the data and the model are also quite comparable.

The next row reports the ratio of the default boundary to the cash flow generated in each time period, $\frac{\delta_B}{\delta_t}$. We can see the mean boundary to value ratio is 0.361, which is quite comparable to Elkamhi et al. (2012) who estimate the Leland and Toft (1996) model and find a mean ratio of 0.29. That being said, I find the median boundary to value ratio is much higher compared to their estimation, reflecting the skewed nature of the asset value distribution and higher leverage in PE-backed firms. Next, median and mean distance-to-default, computed following Bharath and Shumway (2008), is 2.2 and 2.5 respectively. A natural question is if distance-to-default is exceptionally low for firms closer to the tail of the distribution. To shed light on this question, I plot distance to default for the entire sample in Figure 3. I do not find evidence of a non-trivial share of firms with distance to default lower than 1.

[Insert Figure 3 Here]

Finally, I compute the tax benefit of debt scaled by the un-levered value of the firm as follows:

$$Tax\ Benefit = \frac{\frac{\tau C}{r}\left(1 - (\frac{\delta}{\delta_B})^{-\gamma}\right)}{\delta_t/(r-\mu)} \tag{11}$$

where the numerator is simply the variables which capture discounted tax benefits of the levered firm value from Eq. (6). The model predicts high leverage ratios do indeed generate significant tax benefits. Median and mean tax benefit of debt is approximately 20 percent of unlevered value.

As will be shown subsequently, changes in asset volatility and resulting optimal leverage effectively capture agency benefits of debt as well. While the Leland (1994) model does not explicitly model agency costs, subsequent analysis in this paper using the pre-buyout sample will reveal part of the value from debt is consistent with agency benefits Jensen (1986), in addition to tax benefits.

4.1.1 Parameter Sensitivity

One concern with the benchmark estimation is choice of value of calibrated parameters, which were set according to the literature. Since researchers have used a range of values in the past, it is worth examining how sensitive optimal leverage ratios are to the choice of r, τ, and α which were not estimated (unlike δ and σ). In addition, since the previous literature has used several proxies to approximate μ, I also check the robustness of the result with respect to changes in mean drift. In this section, I examine the change in optimal leverage ratio due to a 20 percent increase in one of these four parameters, while setting the remaining parameters to values used in the benchmark estimation. Since the effects on leverage could be asymmetric, given the highly non-linear nature of the model, I also repeat the exercise using a 20 percent decrease.

[Insert Table 3 Here]

Table 3 reports these results. Overall, the directional change is consistent with Leland (1994). Increase in risk-free rates raises the tax benefits of debt. However, if we examine the first row we can see that the effect of a 20 percent increase in risk-free rate on optimal leverage is quite small, given the estimated asset volatility and asset value. The median leverage in this case is 54.1 percent relative to 50 percent in the benchmark case. We note similar patterns in the first and third quartiles. Similarly, the effect of different choice of bankruptcy cost value is also relatively small. The model's predictions on asymmetric effect of an increase relative to a decrease in parameter value is also quite small. Change in μ also does not change optimal leverage drastically. A 20 percent increase in mean estimated drift leads to only a 1.5 percent point increase in leverage (at the median) as shown in row 3. In an additional exercise, I ask what level of drift would be required to lower model-implied leverage closer to standard public company debt levels, conditional on the estimated volatility level. Figure A1 in the Appendix reports results from this exercise through a scatter plot of asset return and leverage. We find at the estimated asset volatility level, drift would have to be significantly negative to match public company leverage ratio.

Relative to risk-free rates, tax rates tend to have a larger effect on optimal leverage. Median optimal leverage rises to 57.7 percent following a 20 percent increase in tax rate, and declines to 47.7 percent following an equivalent decrease in the tax rate, as presented in the last row of Table 3. Nevertheless, these changes are not significantly different from the benchmark model predictions and the overall takeaway from this exercise is that the choice of calibrated parameter values cannot explain the large change in leverage we observe in the data following buyouts.

4.2 Pre-Buyout Optimal Leverage

In this section, I investigate if the benchmark results documented thus far are due to selection effects, that is PE funds select companies with relatively higher levels of optimal leverage, or due to changes brought about by PE-ownership. Two key parameters can significantly shift optimal leverage when asset value follows the standard log-normal diffusion process: (i) asset return/drift, and (ii) asset volatility. On drift rate, there is extensive literature that shows PE-owned firms are more efficient and profitable given better management and more aligned incentives (Bernstein and Sheen, 2016; Davis, Haltiwanger, Handley, Jarmin, Lerner, and Miranda, 2014). On asset risk, Malenko and Malenko (2015) show that for a given leverage ratio, debt-equity conflicts could be less severe when a firm is owned by a PE sponsor relative to a non-PE owned public company with dispersed shareholders. They argue because PE-owned firms borrow against both its own assets and the sponsor's reputational capital, debt-equity conflicts stemming from risk-shifting are lower relative to non-PE or independent firms with similar leverage ratios. Their theory is consistent with Ivashina and Kovner (2011) who find PE investors have close relationships with banks and lenders. It follows that PE-backed firms experienced a reduction in asset volatility from risk-shifting activities following an LBO.

Using the benchmark model and pre-buyout financial data, I estimate asset volatility, drift and corresponding optimal leverage *before* companies in my sample are taken over by PE funds. My estimation strategy is the same as that described in the previous section. I find similar matched public companies and draw on equity value and volatility from the pre-buyout matched sample to estimate the model. I restrict the match to years $t-1$ and $t-2$ where t is the year that a company undergoes an LBO. Table A3 in the Appendix provides descriptive statistics of the PE-backed firms and their matched counterparts in the two years before buyout. First, as can be seen from examining the mean and median of the treated and control group, both samples are quite comparable. For instance, the mean leverage ratio in the PE-owned firms before the buyout is 29.9 percent and 28.7 percent in the matched group. The standard deviations are also quite comparable.

Crucially, we also note that median profitability and profit volatility are markedly differently in the pre-buyout sample. Comparing with corresponding moments in Table 1, we observe the median pre-buyout firm's ROA is approximately 2 percentage points lower than the median post-buyout firm, while volatility of ROA is higher. While, these univariate figures cannot be used to interpret any PE-effect, they are qualitatively both consistent with the literature on private equity's effect on value and risk as well as indicative of the underlying mechanism at play in the benchmark model.

4.2.1 Results and Discussion

The results of the pre-buyout estimation are reported in Table 4. Using over 9,000 firm-quarter observations, I estimate asset volatility and bootstrapped standard errors using 5,000 re-samplings.[13] I find the Leland (1994) model predicts substantially higher asset volatility distribution for the pre-buyout sample. For example, median and mean recovered asset volatility stands at 0.309 and 0.303, which is approximately 50 percent higher than the estimated σ_v post-buyout. Using these estimated asset volatilities, I again generate a distribution of optimal leverage ratio. The model predicts median optimal leverage of 33

[13]The pre-buyout estimation sample is relatively smaller since I match on only the two years before buyout.

percent, which is nearly identical to the data as can be seen in Panel B. Mean predicted leverage ratio is also quite similar at just under 30 percent. Counterfactual analysis, discussed in Section 4.3, will show much of the increase in optimal leverage is driven by lower asset volatility.

[Insert Table 4 Here]

Looking at the $25th$ and $75th$ percentile, we find the model struggles somewhat to explain the data. One interpretation is that firms for example in the first quartile are systematically under-leveraged pre-buyout. Alternatively, one might infer that the Leland (1994) model is particularly successful in explaining PE leverage ratios in the sample median (mean). Not surprisingly, we find the boundary-to-value ratio is much lower pre-buyout given less debt. On the other hand, the tax benefit of debt as a consequence of lower leverage is also lower: mean tax benefit to unlevered value is approximately half of what we observed in the post-buyout sample.

The reduction in asset volatility is consistent with the theory proposed by Malenko and Malenko (2015) and empirical evidence shown by Haque et al. (2022) on lower earnings volatility in a large sample of bank-dependant U.S. PE-backed firms. PE managers have lower incentive to shift risk to debt-holders relative to managers in a public firm due to repeated deals and, consequently, greater reliance on lenders for continued deal flow. Another, not necessarily mutually exclusive view is that higher risk pre-buyout is driven by inefficient management of free cash flows, first proposed by Jensen (1986). While the model is not intended to differentiate between these mechanisms, my estimation strategy uncovers a change in asset volatility consistent with these views. Moreover, Section 6 provides reduced-form empirical evidence consistent with the reduction in σ_v. A key implication is that, by reducing underlying risk, PE managers reduce the chances of bankruptcy which reduces the expected cost of financial distress consistent with trade-off theory.

4.3 Counterfactual Analysis

Since much of the criticism of PE centers around high leverage ratios, a natural counterfactual analysis is to quantify the difference in firm value if firms deviated from optimal leverage. In particular, I examine the cost of choosing sub-optimal leverage. Specifically, I examine the loss in leveraged firm value if a PE-backed firm chose lower leverage despite lower asset volatility and higher asset return post-buyout. Put differently, what is the cost to the firm if it does not behave according to the trade-off theory?

I proceed by re-running the model such that each PE firm chooses half the amount of the optimal model-implied coupon, given their estimated asset volatility and asset return. While at first pass this coupon choice may appear arbitrary, it mirrors the typical difference in leverage between PE-backed and public companies. For each firm, I estimate levered firm value V_L^{sub} corresponding to this sub-optimal leverage ratio. Letting, V_L^* denote levered firm value at the PE firm's optimal leverage ratio given the estimated asset volatility, I compute cost of deviating from optimal leverage as the difference between V_L^* and V_L^{sub}.

[Insert Figure 2 Here]

The results are plotted in Figure 2. The blue bar quantifies levered firm value when the firm chooses half the model predicted optimal coupon. The red bar reports levered firm value at the optimal coupon. All parameterizations are otherwise identical to the baseline post-buyout estimation. Thus, I interpret the difference as the cost of choosing optimal leverage. Not surprisingly, I find there is indeed a cost of deviating from optimal leverage. Beginning with the bars on the extreme left which reports the levered firm value given the $75th$ percentile asset volatility estimate post-buyout, we note firms stand to gain by reaching the higher optimal leverage. We also note that the cost of deviating from optimal leverage rises as asset volatility declines. For example, difference in levered firm value at the $75th$ percentile (estimated from asset volatility at the $25th$ percentile) is higher relative to the estimates at the median. While this is not particularly surprisingly given that Leland-type models predict higher value from lower volatility on average, the question worth examining is how large is this cost.

[Insert Table 5 Here]

Table 5 reports the difference in the two values as percentage of the sub-optimal leveraged firm value. We find the cost is non-trivial. For firms in the median of the cost distribution, deviating from optimal leverage can cost up to 4.0 percent of value, and can go upto 5.7 percent for those in the lower end of the risk distribution. In other words, for firms that achieve substantial reductions in risk, choosing lower leverage is much more costly than those with higher risk. It is interesting to note that the cost of deviation estimated from the model is quite comparable to the literature. Specifically, Korteweg (2010) finds that the net benefits to leverage is approximately 5.5 percent for a representative firm.

5 Model Extensions

Thus far, we have shown optimal leverage ratios estimated from a trade-off model is, on average, consistent with PE-firm leverage. In this section, I study simple extensions to the standard trade-off model to examine two issues often associated with PE-sponsored buyouts.

5.1 Debt Covenant

One alternate explanation behind high buyout leverage could be a weaker covenant setting due to close relationships between lenders and private equity sponsors (Ivashina and Kovner, 2011; Achleitner, Braun, Hinterramskogler, and Tappeiner, 2012; Demiroglu and James, 2010). For instance, it could be that banks set looser covenant violation thresholds for PE-sponsored deals, thus raising covenant slack relative to public firms and allowing higher leverage. We would thus expect a trade-off model with covenants to explain the data. To examine this possibility, I extend the Leland (1994) framework to incorporate covenants and re-estimate the model.

Specifically, I model an interest coverage threshold which the literature has shown is one of the most prevalent types of covenants (Greenwald et al., 2019). For parsimony, I follow Strebulaev et al. (2012) who propose simple extensions to the Leland (1994) model to capture an exogenous default threshold because the firm violates a net-worth covenant. The starting point is the observation that $\frac{\delta_t}{C}$ effectively captures a coverage ratio (EBITDA/Interest Expense) and thus replacing the optimal default barrier with a covenant violation threshold can incorporate coverage ratio covenants in a simple and parsimonious way.

$$\delta_t = \theta C \tag{12}$$

Setting $\theta C = \delta_B$, I derive the optimal coupon by maximizing Eq. (7). Details of the derivation are presented in Appendix A9. I re-estimate post-buyout asset volatility and leverage similar to the baseline. All calibrated parameters are the same as before except I need to set a value for the covenant violation threshold, θ. I set $\theta = 2.63$ following findings in Bräuning, Ivashina, and Ozdagli (2022), whose sample of 119 maintenance covenants require borrowers to maintain the coverage ratio at that level.

[Insert Table 6 Here]

Table 6 presents results from this estimation. The asset volatility estimates are largely unchanged in the post-buyout sample. To wit, compared to our benchmark estimation, this version of the model predicts median asset volatility of 0.192, marginally higher than the 0.177 estimate reported in Table 2. However, when I estimate optimal leverage with this new asset volatility, the model does a below par job of matching the data. Median leverage predicted by the model post-buyout is less than 10 percent, given the calibrated value of θ and other parameters.

Why is optimal leverage so low with interest coverage covenants? The key reason is that setting an exogenous default threshold which is equivalent to relaxing the deep-pockets assumption leads the agent to declare default much earlier and lowers optimal leverage. As long as $\theta < 1$, the agent can inject equity. The greater the default threshold in a covenant, the earlier an agent declares default. In this case, we set $\theta = 2.63$, thus forcing default much earlier.

In the context of the key hypothesis motivating this exercise - PE sponsorship can loosen covenant threshold - we can now use this version of the model to ask what level of violation threshold would lead to observed PE leverage, conditional on the estimated asset volatility levels? This question is plausible since the Bräuning et al. (2022) sample likely captures both sponsored and non-sponsored firms. In other words, would a much lower covenant violation threshold lead to observed PE buyout leverage?

[Insert Figure 4 Here]

We plot the sensitivity of optimal leverage to covenant violation threshold, θ, in Figure 4. We observe a highly non-linear relationship between θ and optimal leverage. θ close to 1 leads to leverage ratios around 20 percent, which is somewhat comparable to many public company leverage ratios. On the other hand, we note that it would require violation thresholds significantly lower than 1 to match observed PE leverage, given all other parameter values. This would imply equity issuance cost for PE-backed firms is lower than public firms, which is plausible given PE funds' deep-pockets (Bernstein et al., 2019; Hotchkiss et al., 2021). Crucially, at $\theta < 0.4$, this version of the trade-off model also does a reasonable job of matching buyout leverage, conditional on the estimated asset volatility parameter.

5.2 Renegotiable Bank Debt

Second, previous studies have shown that PE-backed firms tend to avoid bankruptcy court more often, and liquidate less often compared to non-PE backed, highly leveraged firms experiencing financial distress (Hotchkiss et al., 2021). One potential explanation for why higher leverage is optimal in PE-backed firms could be PE sponsors' ability to negotiate out-of-court with lenders. However, a standard property of the Leland (1994) model, as well as its variants such as Leland and Toft (1996) or Leland (1998), is that debt-holders take control of the company if equity-holders default and crucially, there is no scope for renegotiation. Put differently, debt in the benchmark model is defaultable public debt and does not take into account private debt contracts, such as bank debt. In this section, I estimate a simple extension of the standard trade-off model with bank debt to examine if post-buyout leverage can be explained by the ability of borrowers to renegotiate debt.

To keep my analysis parsimonious, I follow Strebulaev et al. (2012) and assume the firm only has bank debt outstanding and has full bargaining power with the lender. Since the model is well-known, I only discuss its key features in this section and refer readers to Appendix A8 for further details. In this model without defaultable debt, the firm simply negotiates its coupon payments in low-profitability states of the world. This negotiation occurs at an asset level which the equity holder chooses by maximizing equity-value payoff, similar conceptually to the endogenous default point discussed earlier. Crucially, due to the assumption that the firm has full bargaining power, the firm renegotiates to keep the value of bank debt at its reservation value. The value of the leveraged firm is the sum of the unleveraged value in perpetuity and the tax benefits of debt. Similar to Leland (1994), the firm chooses an optimal coupon by maximizing levered firm value.

I report mean and various percentiles of leverage, keeping all the parameter values fixed at their benchmark quantities. I report the results in Figure 6 for two bankruptcy cost values: the baseline case of 0.23 and a lower bankruptcy cost of 0.1. My results indicate that the extended model with bank debt produces much lower leverage ratios when bankruptcy cost is held at the benchmark value. As can be seen from the bottom four rows in Figure 6, mean and median optimal leverage is much lower relative to the baseline estimation, and by extension, the data. One interpretation is that this model predicts PE-backed firms are over-levered. On the other hand, when I lower default cost to 10 percent, not implausible given the arguments in Hotchkiss et al. (2021), optimal leverage is much closer to the baseline.

5.3 Asset Liquidation and Dividend Payout

Third, in the main analysis, net cash outflows associated with the leverage decisions must be financed by selling additional equity, consistent with bond covenants restricting firms from selling assets. In other words, there are no net cash outflows resulting from payments to debt or equity-holders. However, PE investors are often accused of asset stripping, to the point where the EU has implemented a directive to stop this type of activity (e.g. Reuters, 2010; The Gaurdian, 2021). Asset stripping typically involves selling off individual assets to generate dividend payouts for investors.

To capture liquidation of assets to fund higher payouts, I follow Leland (1994) and consider the case of cash outflows that are proportional to asset value. This leads to a lower effective drift rate of $\mu^{'} = \mu - d$, where d is the payout rate as a share of asset value, δ. The only key change is that $\mu^{'}$ replaces μ in the root of the fundamental quadratic equation, γ outlined in Eq. (5). I consider two cases where $d = 0.01$, similar to Leland (1994), as well as $d = 0.02$. These liquidation rates are equivalent to approximately 2 percent and 4 percent payout on equity value respectively, based on the median leverage ratio predicted in the baseline case.

The rest of the estimation procedure is unchanged. I report the results in Figure 5 comparing optimal leverage ratios from the baseline post-buyout results with the extended version capturing asset liquidation in order to meet higher payouts. The top four moments capture the exercise where $d = 0.01$, and the bottom four moments are the ones with $d = 0.02$. Not surprisingly, we observe a decline in optimal leverage ratio in both cases and a higher decline when the asset liquidation rate is higher.

The key question is does asset liquidation substantially lower optimal leverage ratios? The answer appears to depend on what we consider as an appropriate liquidation rate. When the payout rate is 1 percent on asset value, consistent with Leland (1994), the change is quite small. For example, leverage ratios decline by approximately 2 percentage points at the mean and median. In fact, median leverage ratio of 50 percent with $d = 0.01$ is nearly identical to median leverage ratio in the data (49.8 percent) as reported in Table 1.

When I raise asset liquidation rate to 2 percent, median and mean optimal leverage ratio declines to 47.6 and 42.9 percent respectively. While the median is still quite close to the data, the mean optimal leverage is now much lower relative to mean leverage in the data. One interpretation of this result is that if PE investors exercise high asset liquidation rate in order to pay themselves dividend, then there is some moderate evidence of over-leveraging since actual mean leverage is higher. It is also worth observing that when $d = 0.02$, the disagreement between the baseline and the extended model appears to be more much pronounced at the first quartile, but is much smaller at the third quartile.

6 Reduced-form Evidence

The results so far are consistent with the idea that private equity can lower expected cost of financial distress by lowering underlying asset volatility of portfolio companies. Admittedly, one limitation of the benchmark model is that asset volatility is not endogenous.

In this section, I provide reduced-form evidence consistent with the idea that private equity can lower asset volatility. First, I show PE-ownership leads to a reduction in the volatility of sales consistent with an operational engineering channel (Gryglewicz and Mayer, 2020). Second, consistent with better distress resolution (Hotchkiss et al., 2021), I show PE-backed firms receive additional equity injection (relative to matched controls) whenever they are in financial distress. Equity injection during financial distress implies a reduction in incentives to engage in asset substitution or risk-shifting.

Operational Engineering Channel: Lower Sales Volatility. Fracassi et al. (2022) use store-level data to show PE-backed firms launch new products and expand their geographic reach relative to comparable controls. This diversification is consistent with a reduction in the volatility of sales and a reduction in volatility of the unlevered value of a firm in capital structure models. Thus, as a first exercise, I show the volatility of sales declines under PE-ownership relative to matched controls. I create a matched control group using the methodology described in Section 3.3, to address selection concerns, and run the following difference-in-differences regression specification.

$$Y_{it} = \alpha_i + \delta_t + Post_{it} + Post_t \times LBO_i + X_{it} + \epsilon_{it} \tag{13}$$

where the outcome variable is the *standard deviation* of a firm's Sales, scaled by Earnings Before and Interest Taxes, computed separately in the pre-(post-) buyout samples. LBO_i is a dummy taking value 1 if a company was ever owned by PE investors, and $Post$ is a dummy for the period following a PE-sponsored buyout. If the observation is a matched control firm, $Post_{it}$ equals 1 when the PE portfolio company matched to i has undergone an LBO, and 0 before. Furthermore I augment our specification with a set of firm covariates, firm (α_i) and year (δ_t) fixed effects. My estimation strategy thus controls for channels that have been documented as important drivers of buyout leverage: (i) economy-wide credit conditions (Axelson et al., 2013), the rise of structured credit (Shivdasani and Wang, 2011), (iii) fund managers non-randomly targeting specific firms and (iv) unobserved time-invariant factors.

[Insert Table 7a Here]

I report the results in Table 7a. We present results that iterate between various combinations of fixed effects and firm-controls. In column 1 for example, we include only firm fixed effects to capture time-invariant unobservable firm-level factors that can effect our outcome of interest. We observe a large and negative coefficient on the difference-in-differences estimator, $Post \times LBO$, indicating a reduction in sales volatility under PE-ownership. We also note that the $Post$ variable is positive and highly significant, suggesting these firms were on track to experience higher volatility but PE-ownership reduced this effect. In column (2) we drop firm fixed effects but include year fixed effects and immediately see a large drop in R^2, implying a lot of the variation does indeed come from time-invariant firm-level factors. Crucially, in column (3) we include both fixed effects and find that our coefficient of interest is still highly significant and negative. The estimate barely changes when we include time-varying firm-level controls including the natural log of total assets, leverage and ROA, signifying that the result is quite robust.

However, one concern with a reduction in sales volatility is a possibility that PE fund managers may manipulate accounting data to maximize risk-adjusted return at the fund-level, which in turn can lock-in greater capital from marginal investors in the future. Indeed, Brown et al. (2019) show PE fund managers can inflate fund returns during fund-raising, especially if the manager is under-performing. While my analysis is at the portfolio-company level, one could plausibly have similar concerns, since the location of private firms substantially affects its financial reporting environment. For example, private firms in the United States and Canada, are not required to make their financial reports public nor have them audited (Minnis and Shroff, 2017). On the other hand, most middle-market and larger European firms are required to both disclose their financial statements and have them regularly audited.

I thus repeat my analysis on sales volatility by restricting the estimation sample to the following European countries: Spain, Italy, France, Germany and UK. The rationale is that the need for auditing will lower systematic manipulation. Table A4a in the Appendix provides estimates with this sub-sample. As can be seen, although the estimates are somewhat smaller, they are still economically meaningful and highly significant. The only specification where the estimate is not significantly different from zero is where I do not include firm-level fixed effects or time fixed effects. Including firm and year FE, as well as firm-level time-varying control in column (4) yields an estimate of -0.308, which is significant at the 1 percent level.

Distress Resolution Channel: Equity Injection. One mechanism that can explain lower asset volatility and expected cost of financial distress is deployment of fresh capital into a distressed firm. Because PE groups raise funds that are drawn down and invested over multiple years—commitments that are very rarely abrogated—they may have "deep pockets" during downturns (Bernstein et al., 2019). These capital commitments may allow them to make equity investments in their firms when accessing other sources of equity, or financing in general, is challenging. Equity injection during financial distress can explain why debt overhang is less for a given leverage ratio, and reduces the equity-holder's incentive to shift risk to debt-holders when in financial distress. Put differently, capital infusion resolves financial distress more quickly and thus reduces a classic asset substitution problem at high leverage ratios.[14]

Following prior studies, I show that PE-backed firms in my sample receive greater capital injection relative to comparable non-PE companies. I proceed as follows. I define an indicator variable *Distress* as follows:

$$Distress = \begin{cases} 1 & \text{if Altman Z-Score} < x \\ 0 & \text{otherwise} \end{cases}$$

where the Altman Z-score is computed at the *company-year* level and x is a positive constant.[15] Using this *Distress* variable, I estimate Eq. (14) below where the dependant variable is Net Equity Contribution/Asset at the firm-year level. Equity Contribution is defined as the difference in total Book Equity over the past year, minus profit following Bernstein et al. (2019).[16] I introduce a triple interaction between *LBO*, *Post* and *Distress*. All second-order interactions are also included, unless they are absorbed by fixed effects. A positive coefficient is indicative of PE-backed firms receiving additional equity contribution compared to a matched control group when they are in financial distress. To summarize, I

[14] The literature argues the motivation to inject fresh equity comes from PE sponsors being repeat players in the buyout market; recurrent episodes of costly financial distress could harm reputations with lenders, fund investors, and other stakeholders

[15] Since I do not observe data on Retained Earnings, I proxy with Cash flows which Orbis (2007) defines as Profit for the Period plus Depreciation.

[16] For profit I proxy with Cash Flows in period t. I also verify that my results are not affected if I used other measures of Profit such as Profit Before Taxes. These are available upon request.

estimate variants of the following triple-interaction equation:

$$Y_{it} = \beta_1 Post_{it} + \beta_1 LBO_i \times Post_{it} + \beta_2 LBO_i \times Post_{it} \times Distress_{it} + \gamma^{'} \mathbf{X}_{it} + \alpha_i + \delta_t + \epsilon_{it} \quad (14)$$

[Insert Table 8a Here]

I report the results in Table 8a. The sample size is somewhat smaller relative to the regressions in Table 7a since our outcome variable is measured in changes. The key coefficient of interest is that on the triple interaction term $LBO \times Post \times Distress$. x is set to 1 in columns (1) and (2) and 1.5 in columns (3) and (4). In column (1) we include both firm and year fixed effects, thus our estimated coefficient is identified from within-firm variation over time.

We observe that the triple interaction coefficient is positive and highly significant. The estimate implies PE-backed firms receive 94.4 percent greater capital infusion relative to matched non-PE firms, conditional on severe financial distress. The estimate rises to 1.13 if we drop time fixed effects, as shown in column (2). In column (3) we use a higher threshold, which intuitively captures a relatively lower severity of financial distress. We find that our coefficient of interest is significant at the 10 percent level, and the point estimate is much smaller at 0.461. This is consistent with the idea that relatively greater financial distress leads to higher equity injection by sponsoring funds.

7 Conclusion

Private Equity is often accused of over-leveraging their investments. Prior studies argue PE sponsors primarily look at credit market conditions when choosing buyout debt, and buyout capital structure is unrelated with cross-sectional factors. This standard view implicitly assumes optimal leverage does not change post-buyout. However, we do not know whether higher buyout leverage is optimal without a structural model that endogenizes default, leverage and the key benefits and costs of debt. This paper argues a PE-manager behaves much like a standard equity-holder and chooses capital structure by balancing the benefits of debt with the expected cost of financial distress. The model's key result is that PE managers are able to achieve a higher level of optimal leverage, which are on average, consistent with the data. The model also predicts higher optimal leverage results from a significant reduction in asset risk, and to some extent, an increase in asset return. Consistent with higher optimal leverage, I show that PE's contribution to corporate distress and financial fragility is lower than previously argued.

To support results from the structural estimation, I provide additional empirical evidence consistent with key factors that drive higher optimal leverage. Specifically, using a set of matched difference-in-differences regressions, I show that PE backed firms reduce sales volatility and also receive greater equity injections when in financial distress relative to comparable non PE-backed companies. These mechanisms support the notion of lower agency costs and reduced incentives to shift risk to debt-holders, which reduces the expected present value of bankruptcy costs and raises the optimal level of leverage.

How can we reconcile the empirical evidence on credit market conditions and initial buyout structure, in prior studies? One possible explanation is prior studies primarily examine firm characteristics at deal entry, while my empirical strategy internalized the effects of post-buyout changes in the portfolio company's characteristics. Overall, this paper broadens our understanding of what drives buyout leverage, and highlights the need to examine the value-maximizing leverage ratio when firms are backed by financial sponsors.

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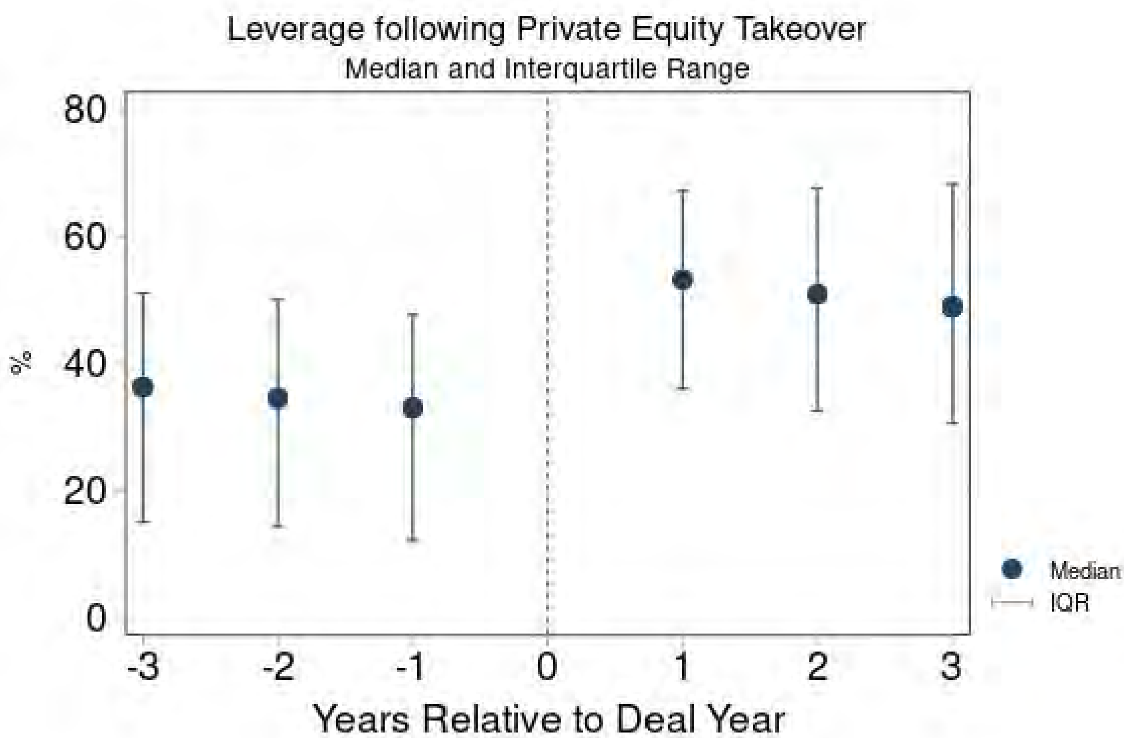
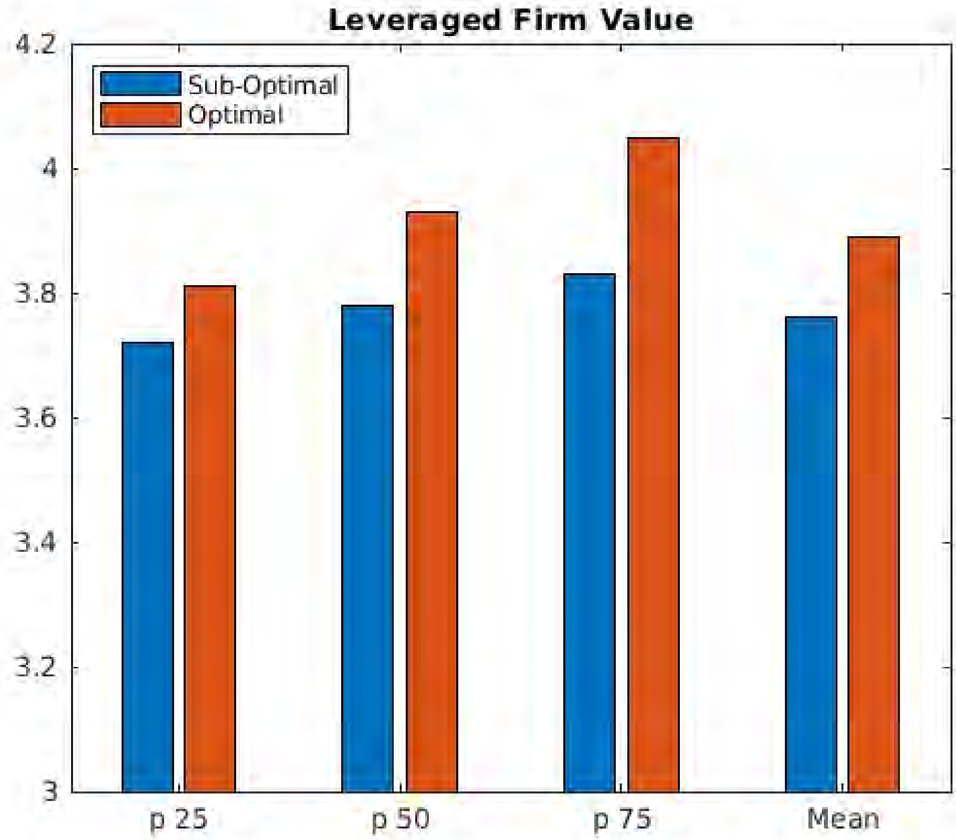
Figure 1: Leverage Dynamics



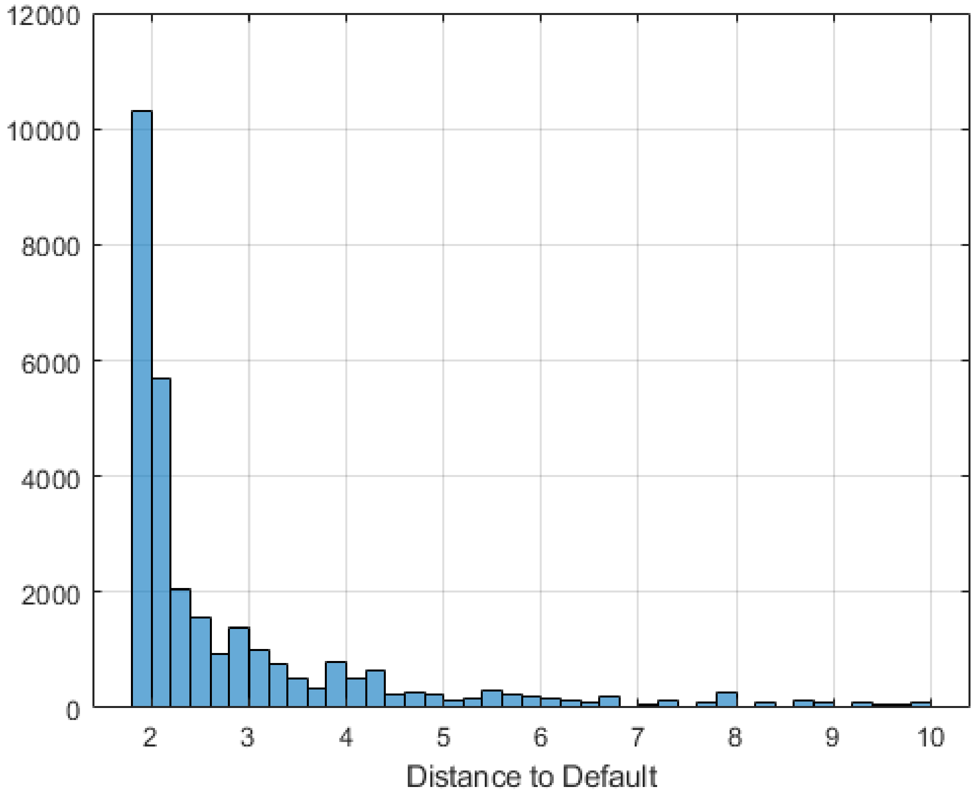
(a) *This chart plots leverage (Net Debt/Asset) in PE-backed firms in the pre-(post-) buyout periods. The x-axis plots years relative to the PE deal-year. The dot plots the median quantity, and the bands plot the interquartile range (IQR).*

Figure 2: Counterfactual Policy: Cost of Choosing Lower (sub-optimal) Leverage



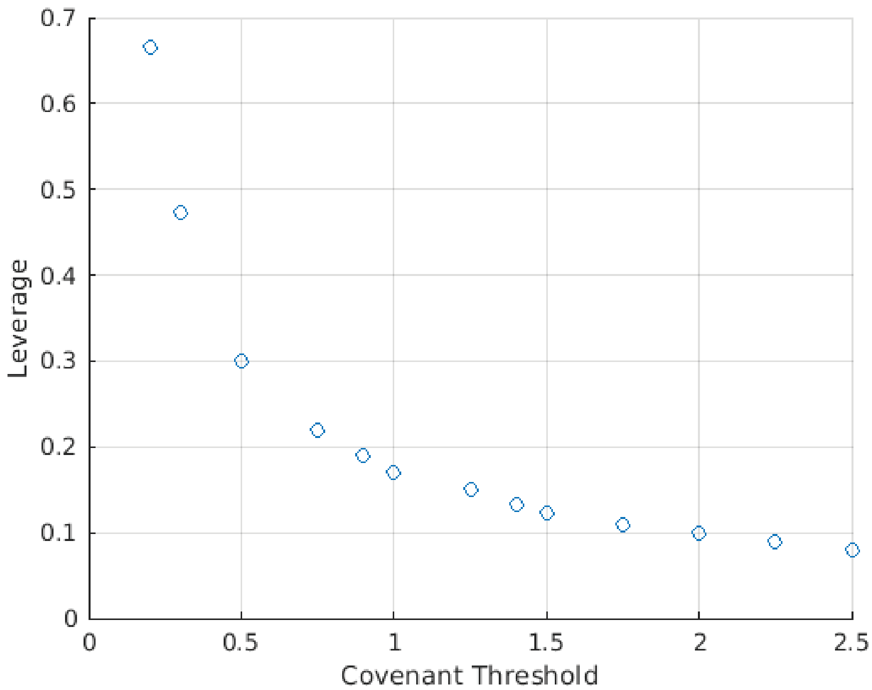
(a) *Notes: The chart above reports results from a counterfactual analysis on the cost of deviating from optimal leverage for a PE-backed company. The y-axis plots leveraged firm value and the difference between the two bars captures the cost of choosing sub-optimal leverage. Both charts plots the difference in firm value at the optimal* C^* *and a sub-optimal* C_{sub}*, where* $C_{sub} = 0.5 * C^*$*. This particular formulation of sub-optimal capital structure was chosen to match leverage ratios of standard non-PE companies.* δ_0 *value was set to 100. All values were multiplied by 0.001 to simplify visual exposition.*

Figure 3: Distance to Default Post-Buyout



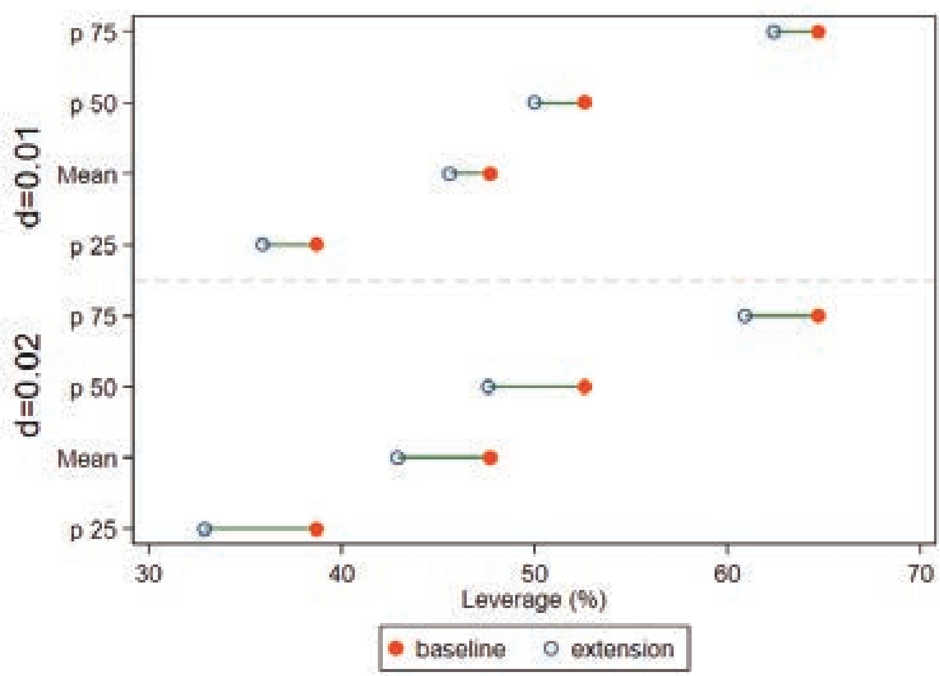
(a) *Notes: The chart above reports distance to default estimates from the benchmark Leland (1994) estimation. The model is estimated by solving for unobserved asset value and volatility that matches observed equity value and volatility. Market equity is computed as outlined in Section 3.3 and Equity volatility is computed as the standard deviation of (historical) daily stock price return for each firm and aggregated to the quarterly level to facilitate model calibration at the firm-quarter level. To calibrate the model, we set the risk-free rate to the drift rate,* $T = 1$ *and we approximate the default barrier with* V_B *which is derived endogenously.*

Figure 4: Model Extension: Optimal Leverage with Binding Covenant Threshold



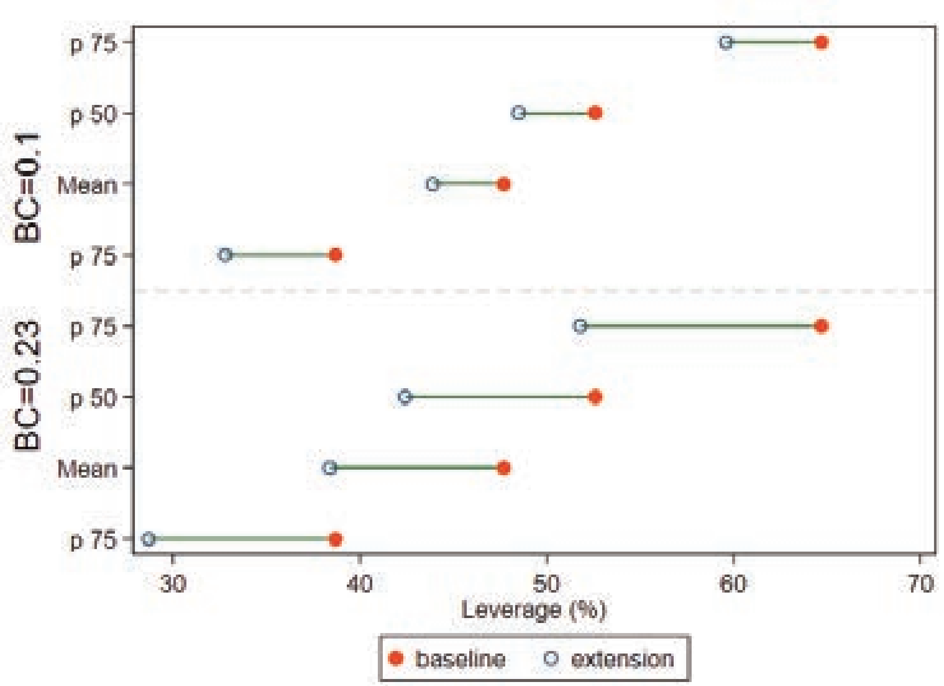
(a) *Notes: This chart reports leverage estimates from a trade-off model extended to capture an interest coverage covenant. The key difference of the model relative to the standard Leland (1994) model is explained in Section 5. Estimation methodology is described in Section 3.3. The x-axis plots θ, the covenant violation threshold, that links firm earnings to interest expenses and the y axis plots model predicted optimal leverage.*

Figure 5: Model Extension: Optimal Leverage under Asset Liquidation



(a) *Notes: This chart reports leverage estimates from a trade-off model extended to capture asset liquiditation. The key difference of the model relative to the standard Leland (1994) model is explained in Section 5. I use asset volatility quantities and all other calibrations from the benchmark estimation.*

Figure 6: Model Extension: Optimal Leverage under Bank Debt



(a) *Notes: This chart reports leverage estimates from a trade-off model extended to capture bank debt. The key difference of the model relative to the standard Leland (1994) model is explained in Section 5. I use asset volatility quantities and all other calibrations from the benchmark estimation. BC is abbreviation for bankruptcy cost. I use both the baseline bankruptcy cost as well as an alternative value of 0.1, presented in the top 4 rows.*

Table 1: Covariate Balance

Variable	PE Sample				Matched Sample					
	N	Mean	Median	SD	N	Mean	Median	SD	Mean diff.	%bias
Log Size	3020	18.2	17.89	1.57	6706	18.3	18.7	1.72	-0.1	-5.0
Leverage (%)	2875	48.8	49.8	28.9	6580	48.1	44.1	26.9	0.7	2.6
ROA (%)	3012	3.4	3.3	0.179	6585	3.2	4.2	0.07	0.2	1.7
Volatility	3028	0.091	0.055	0.34	6715	0.102	0.0539	0.32	-0.01	-3.0

(a) *Notes: This table reports summary statistics of sample firms across PE-backed and non-PE backed comparable public companies. The last column reports mean difference across the two groups.*

Table 2: Benchmark Results: Post-Buyout Leverage

A. Model Input	N	Q1	Q2	Q3	Mean
Market Equity ($ Mn)	32229	19.2	69.9	237	348
Equity Volatility	32229	0.135	0.191	0.357	0.242

B: Results	Q1	Q2 (Median)	Q3	Mean
Asset Volatility	0.122	0.177	0.277	0.203
	(0.054)	(0.046)	(0.032)	(0.058)
Leverage (Model)	38.7	52.6	64.7	47.7
Leverage (Data)	32.3	49.8	65.6	49.5
Boundary to Value ($\frac{\delta_B}{\delta_t}$)	0.188	0.331	0.475	0.361
Distance-to-Default	1.956	2.207	3.603	2.588
Tax/Unlevered Value	0.137	0.197	0.252	0.205

(a) *Notes: The columns are ordered by quartiles, after which the mean is reported.* δ_t *is recovered asset value in a firm-quarter,* δ_B *is the model-predicted endogenous default barrier. For the estimation, I set r=0.05,* τ*=0.2 and* α*=0.23.* μ*=0.0178, which is estimated directly from mean historical equity return data. See Appendix Table A5 for a summary of calibrated parameters and their sources. The formula for Tax Benefit to unlevered value is provided in Eq.* (10)*. Bootstrapped standard errors are reported in parenthesis computed from 5,000 re-samplings with replacement.*

Table 3: Sensitivity of Optimal Leverage to Calibrated Parameters

	Q2 (Median)	Q1	Q3
Benchmark Estimation	52.6	38.7	64.7
A. 20 % increase in calibrated parameter			
Risk-free rate, r	54.1	40.7	65.3
Bankruptcy cost, ρ	51.8	38.6	63.7
Drift, μ	54.1	39.6	66.0
Tax rate, τ	57.7	32.4	67.4
B. 20 % decrease in calibrated parameter			
Risk-free rate, r	50.7	36.4	62.9
Bankruptcy cost, ρ	53.4	38.9	64.8
Drift, μ	51.1	37.9	62.3
Tax rate, τ	47.7	44.5	60.3

(a) *Notes: This table reports sensitivity tests of model-implied optimal leverage with respect to the calibrated parameters, which were set according to previous studies. The benchmark estimation reports the same results from Table 2 as reference where leverage ratios are derived from estimated asset volatilities. For example, 'Q2 Median' in the first row reports the optimal leverage ratio at the median estimated asset volatility using the benchmark calibration. For each of the three calibrated parameters, Panel A reports optimal leverage from a 20 percent increase in the value of one calibrated parameter, while keeping the others at their benchmark value. Panel B reports the same for a 20 percent decrease.*

Table 4: Model Predicted Pre-Buyout Leverage

	N	Q1	Q2 (Median)	Q3	Mean
A. Model Inputs					
Market Equity ($ Mn)	9312	8.65	28.8	104	289
Equity Volatility	9312	0.329	0.424	0.924	1.3
B. Estimation Results					
Asset Volatility		0.272	0.331	0.406	0.320
		(0.003)	(0.01)	(0.006)	(0.002)
Leverage (Model)		25.3	29.1	33.0	22.2
Leverage (Data)		5.90	27.5	46.8	24.6
Boundary to Value		0.09	0.11	0.14	0.14
Distance-to-Default		2.22	2.57	2.91	2.56
Tax/Unlevered Value		0.04	0.04	0.051	0.049

(a) *Notes: The columns are ordered by quartiles, after which the mean is reported. δ_t is recovered asset value in a firm-quarter, δ_B is the model-predicted endogenous default barrier. For the estimation, I set r=0.05, τ=0.2 and α=0.23. μ=-0.013, which is estimated directly from mean historical equity return data for the pre-buyout sample. The formula for Tax Benefit to unlevered value is provided in Eq. (10). Bootstrapped standard errors are reported in parenthesis obtained from 5,000 re-samplings with replacement.*

Table 5: How Large is the Cost of Deviating from Optimal Leverage?

	p25	p50	p75	Mean
Levered Value: Sub-optimal	3.72	3.78	3.83	3.76
Levered Value: Optimal	3.81	3.93	4.05	3.89
Difference	0.09	0.15	0.22	0.13
Cost of Sub-Optimal Leverage	2.4%	4.0%	5.7%	3.5%

(a) *Notes: This table reports simulated cost of deviating from optimal leverage as outlined in Section 4.3. The columns are ordered by quartiles, after which the mean is reported. The first two rows report levered firm value (divded by 1000), given the estimated optimal leverage at different percentiles. All parameterizations are the same as the benchmark post-buyout. Sub-optimal firm value is estimated by setting optimal coupon to half of that predicted by the benchmark model. The last row reports the difference in two values as a percentage of the sub-optimal value, quantifying the cost of deviating from optimal leverage.*

Table 6: Extended Model with Debt Covenants

Results	Q1	Q2 (Median)	Q3	Mean
Asset Volatility	0.136***	0.192***	0.358***	0.244***
Leverage - Model (%)	11.68	8.3	2.61	6.1
Leverage - Data (%)	32.3	49.8	65.6	49.5
Boundary to Value ($\frac{\delta_B}{\delta_t}$)	0.074	0.296	0.443	0.28
Distance-to-Default	2.249	2.700	3.660	2.860
Tax/Unlevered Value	0.005	0.020	0.031	0.019

(a) *Notes: This table reports results of the benchmark model that incorporates coverage ratio covenant described in Section 5. The columns are ordered by quartiles, after which the mean is reported. δ_t is recovered asset value in a firm-quarter, δ_B is the model-predicted endogenous default barrier. For the estimation, I set r=0.05, τ=0.2 and α=0.23. μ=0.0178, which is estimated directly from mean historical equity return data. See Appendix Table A5 for a summary of calibrated parameters and their sources. The formula for Tax Benefit to unlevered value is provided in Eq. (10). For each asset volatility quartile estimate, bootstrapped standard errors are computed from 5,000 re-samplings with replacement.*

Table 7: Reduced Sales Volatility under PE-ownership

Y_{jt} : *Sales Volatility*	(1)	(2)	(3)	(4)
Post × *LBO*	-0.713***	-1.074***	-0.835***	-0.825***
	(0.182)	(0.405)	(0.191)	(0.202)
Post	0.682***	0.179	0.709***	0.710***
	(0.131)	(0.303)	(0.132)	(0.134)
R^2	0.931	0.010	0.932	0.929
Firm FE	Y	N	Y	Y
Year FE	N	Y	Y	Y
Controls	N	N	N	Y
N	2,538	2,537	2,537	2,465

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

(a) *Notes: This table reports difference-in-differences regression estimates at the firm-year level. The dependant variable is each firm's standard deviation of Sales, scaled by the firm's Earnings Before Interest and Taxes. Post takes value 1 for each year after a buyout, defined similarly for matched controls. LBO takes value 1 if a firm was actually acquired by a PE-sponsored leveraged buyout, 0 for matched controls. Controls include the log of book assets, leverage and return on assets. All variables are defined in Table A1 in the Appendix.*

Table 8: Equity Injection during Financial Distress

$Y:\ Equity\ Injection$	$Altman < 1$		$Altman < 1.5$	
	(1)	(2)	(3)	(4)
$Post \times Distress \times LBO$	0.944***	1.130**	0.461*	0.926***
	(0.211)	(0.462)	(0.229)	(0.207)
$Post \times Distress$	-1.241***	-1.207***	-0.622*	-0.803***
	(0.395)	(0.262)	(0.298)	(0.186)
R-squared	0.320	0.313	0.320	0.314
Firm FE	Y	Y	Y	Y
Year FE	Y	N	Y	N
Controls	Y	Y	Y	Y
N	1,965	1,965	1,965	1,965

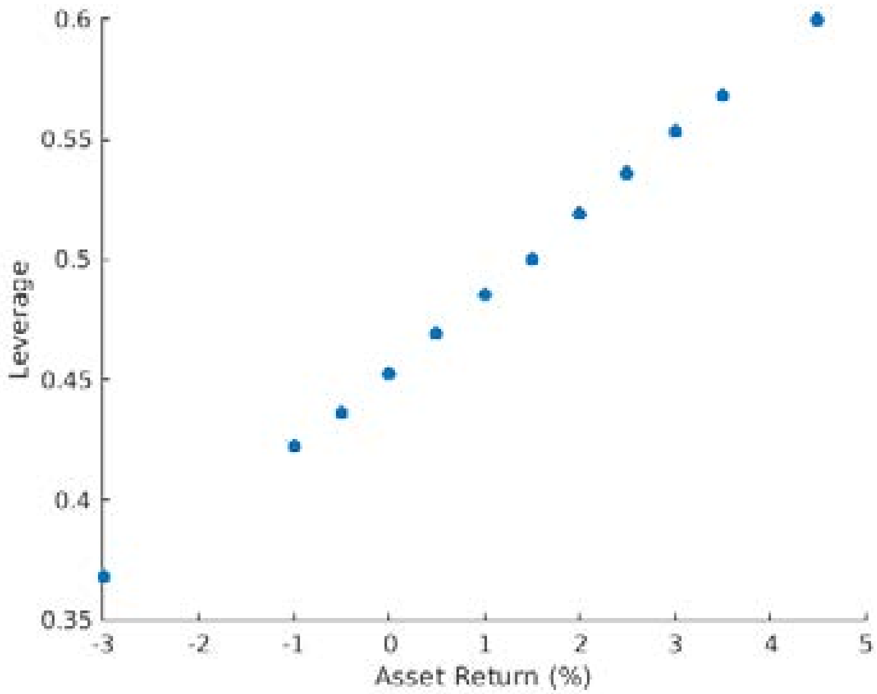
Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

(a) *Notes: This table reports results of matched difference-in-differences regressions of outcomes of PE-backed companies relative to public controls. Following Bernstein et al. (2019), Y_{jt} is Net Equity Contribution/Asset. Equity Contribution is measured as the difference in total equity (shareholder value) over the past year, minus profit. Specifications vary by fixed effects and definition of Distress. Post takes value 1 in years after a buyout. Distress takes value 1 if the computed Altman Z-score is less than 1 in a given company-year in Columns (1) and (2) and less than 1.5 in columns (3) and (4). I also control for confounding pairwise interactions if they are not absorbed by firm fixed effects.*

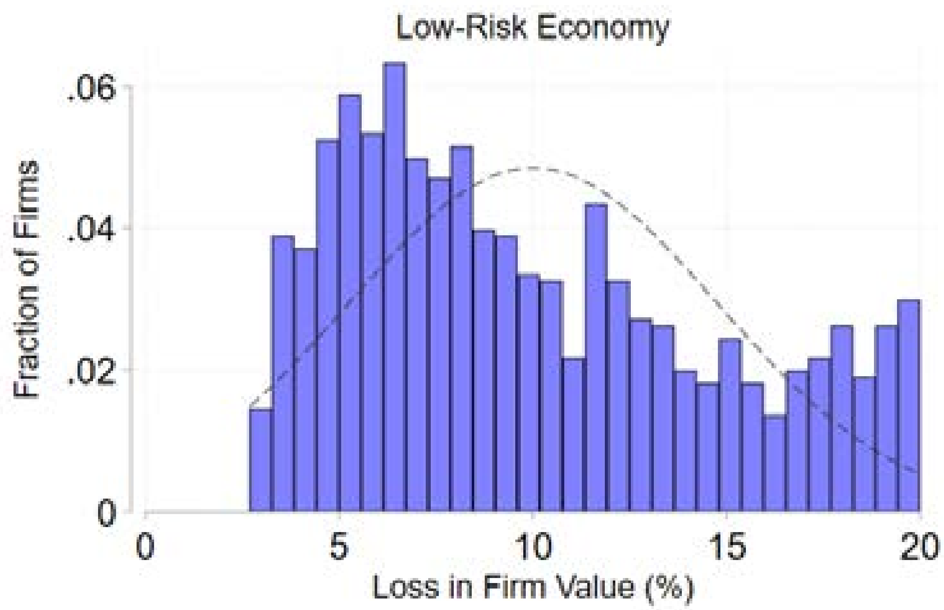
Internet Appendix

Figure A1: Sensitivity: Asset Return and Optimal Leverage



(a) *Notes: This chart reports leverage estimates from a trade-off model at different values of asset return, μ. σ_v is set to the value estimated from the benchmark analysis. All other parameter values are set to their benchmark calibrations.*

Figure A2: Counterfactual Policy: Sub-optimal Leverage and Low-risk economy



(a) *Notes: This chart reports the cost of choosing sub-optimal leverage in a low-risk economy using the benchmark estimation. To simulate a low-risk economy, I introduce a common (negative) shock of* $\sigma = 0.1$ *to the distribution of estimated firm risk.*

Table A1: Variable Definition

Variable	Description
Sales	Net Sales. BvD Code (TURN)
Size	Total Book Assets. BvD Code (TOAS)/Compustat Code (AT)
Debt	Total Book Debt. BvD Code (CULI -OCLI + LTDB); Compustat Code(dlc+dltt)
Cash and Cash Equivalents	Total Cash and Cash-like assets. BvD Code (Cash); Compustat Code (che)
Leverage	(Debt- Cash and Cash Equivalents)/Size
EBIT	Earnings Before Interest and Taxes. BvD Code (OPPL); Compustat ()
Return on Asset	EBIT/Size
Profit Volatility (Volatility)	Standard Deviation of EBIT
Sales Volatility	Standard deviation of (Sales/EBIT)
Shares Outstanding	Compustat (cshod)
Market Price	Compustat (prccd)
Net Equity Injection	Change in Book Equity (BvD Code SHFD)- Profit (PL)

Table A2: Sample Comparison

	All PE-backed Firms			PE Sample Used in Analysis		
	N	Mean	SD	N	Mean	SD
A. By Firm Characteristics						
Asset Size ($ Mn)	6576	18.3	1.6	3020	18.2	1.6
Leverage	6576	49.2	31.7	2875	49.5	28.9
		Share of Sample			Share of Sample	
B. By 1-digit NAICS Industry						
Agricultural, Forestry and Fisheries		0.8%			0.5%	
Mining, Utilities and Construction		6.1%			3.8%	
Manufacturing		42.8%			55.7%	
Wholesale and Retail Trade		13.1%			10.9%	
Information, Financials, Admins		32.9%			26.3%	
Other		4.2%			2.8%	

(a) *Notes: This table compares the PE sample retrieved from Orbis after standard cleaning procedures with the PE sample used in the analysis. The PE sample used in the analysis are those that could be matched to one or more comparable public companies using the methodology described in 3.3.*

Table A3: Matched Pre-Buyout Sample

A. Covariate Balance	PE Sample				Matched Sample				
	N	Mean	Median	SD	N	Mean	Median	SD	Mean diff.
Log Size	1551	18.79	18.6	1.586	9439	18.73	18.96	1.39	0.06
Leverage	1535	0.299	0.34	0.25	9389	0.287	0.25	0.25	0.012
Profitability	1552	0.011	0.01	0.6	9447	0.031	0.015	0.32	-0.02
Volatility	1539	0.31	0.29	0.13	9400	0..26	0..33	0.08	0.05

(a) *Notes: This table reports summary statistics of sample firms across PE-backed and non-PE backed comparable public companies using the pre-buyout sample only. The last column reports mean difference across the two groups.*

Table A4: Reduced Sales Volatility under PE-ownership: Restricted Sample

Y_{jt} : *Sales Volatility*	(1)	(2)	(3)	(4)
Post × *LBO*	-0.297***	-0.523	-0.316***	-0.308***
	(0.085)	(0.597)	(0.091)	(0.095)
Post	0.242***	-0.134	0.240***	0.242***
	(0.067)	(0.513)	(0.068)	(0.070)
R-squared	0.991	0.024	0.992	0.992
Firm FE	Y	N	Y	Y
Year FE	N	Y	Y	Y
Controls	N	N	N	Y
N	872	870	870	849

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

(a) *Notes: This table reports difference-in-differences regression estimates at the firm-year level; the estimation is restricted to 5 large european economies: UK, France, Italy, Spain and Germany. The dependant variable is each firm's standard deviation of Sales, scaled by the firm's Earnings Before Interest and Taxes and computed separately in the pre-(post-) buyout samples. Post takes value 1 for each year after a buyout, defined similarly for matched controls. LBO takes value 1 if a firm was actually acquired by a PE-sponsored leveraged buyout, 0 for matched controls. Controls include the log of book assets, leverage and return on assets. All variables are defined in Table A1 in the Appendix.*

Table A5: Model Parameters

Parameter	Value	Source
Risk-free rate	0.05	He (2011); Strebulaev and Whited (2012)
Tax Rate	0.2	Leland (1998); He (2011)
Bankruptcy Cost	0.23	Andrade and Kaplan (1998)
Drift, Post	0.017	Estimated
Drift, Pre	0.05	Estimated

(a) *Notes: This table reports key parameters required to initialize the benchmark model, and tabulates their sources. Drift is computed directly from historical (daily) equity return and aggregated to the quarterly level to facilitate the estimation.*

A8 Trade-off Model with Bank Debt

Trade-off model with Bank debt follows Strebulaev et al. (2012). I only outline the key equations and refer readers to the original paper for further details. The firm has only bank debt D_B outstanding, with a strong bargaining position with the bank. Thus, the firm can make a take-it-or-leave-it offer which the bank can reject. In that case the firm is liquidated. The bank's payoff can be denoted by:

$$R_B(\delta) = min\big[c_{bank}/r, (1-\alpha)(1-\tau)\frac{\delta}{r-\mu}\big] \tag{15}$$

where $\frac{c_{bank}}{r}$ is the promised coupon if the firm is solvent. Due to the firm's bargaining power, it will keep the bank debt at its reservation value if renegotiation were to occur, which we can denote as:

$$R_B(\delta) = (1-\alpha)(1-\tau)\frac{\delta}{r-\mu} \tag{16}$$

Importantly, total levered firm value is now the sum of only the un-levered value post-tax and tax benefits of (bank) debt, and can be given by the equation below.

$$V_L(\delta) = (1-\tau)\frac{\delta}{r-\mu} + \tau D_B(\delta) \tag{17}$$

The renegotiation point is conceptually similar to the default point in the standard model. Equity-holders maximize their payoff by choosing the renegotiation point. The mathematical derivations related to an optimal coupon are outlined in Strebulaev et al. (2012) and follow the same value-pasting strategy as Leland (1994).

A9 Optimal Coupon in Trade-off Model with Debt Covenant

As outlined in Section 5, I set the default barrier to a multiple of required coupon payment to capture an interest coverage covenant in a parsimonious manner. Thus, the borrower is forced to relinquish control to creditors if asset value falls to this exogenously specified level. Taking a derivative of the value of the levered firm in Eq. (7) with respect to C with $V_B = \theta C$ and setting the derivative equal to 0 yields the following expression:

$$\frac{\tau}{r} - (1+\gamma)\frac{\tau}{r}\theta C^{\gamma}\delta^{-\gamma} - (1+\gamma)\frac{\alpha}{r-\mu}\theta C^{\gamma}\delta^{\gamma} = 0 \tag{18}$$

Define:

$$X = (1+\gamma)\delta^{-\gamma}\left(\frac{\tau}{r} + \frac{\alpha}{r-\mu}\right) \tag{19}$$

Simplifying Eq. (18) using the definition in Eq. (19) yields:

$$C^{*} = \left(\frac{\tau}{r}\frac{1}{X}\right) * \frac{1}{\gamma} * \frac{1}{\theta} \tag{20}$$

Long-Term Private Equity Performance: 2000 to 2022[1]

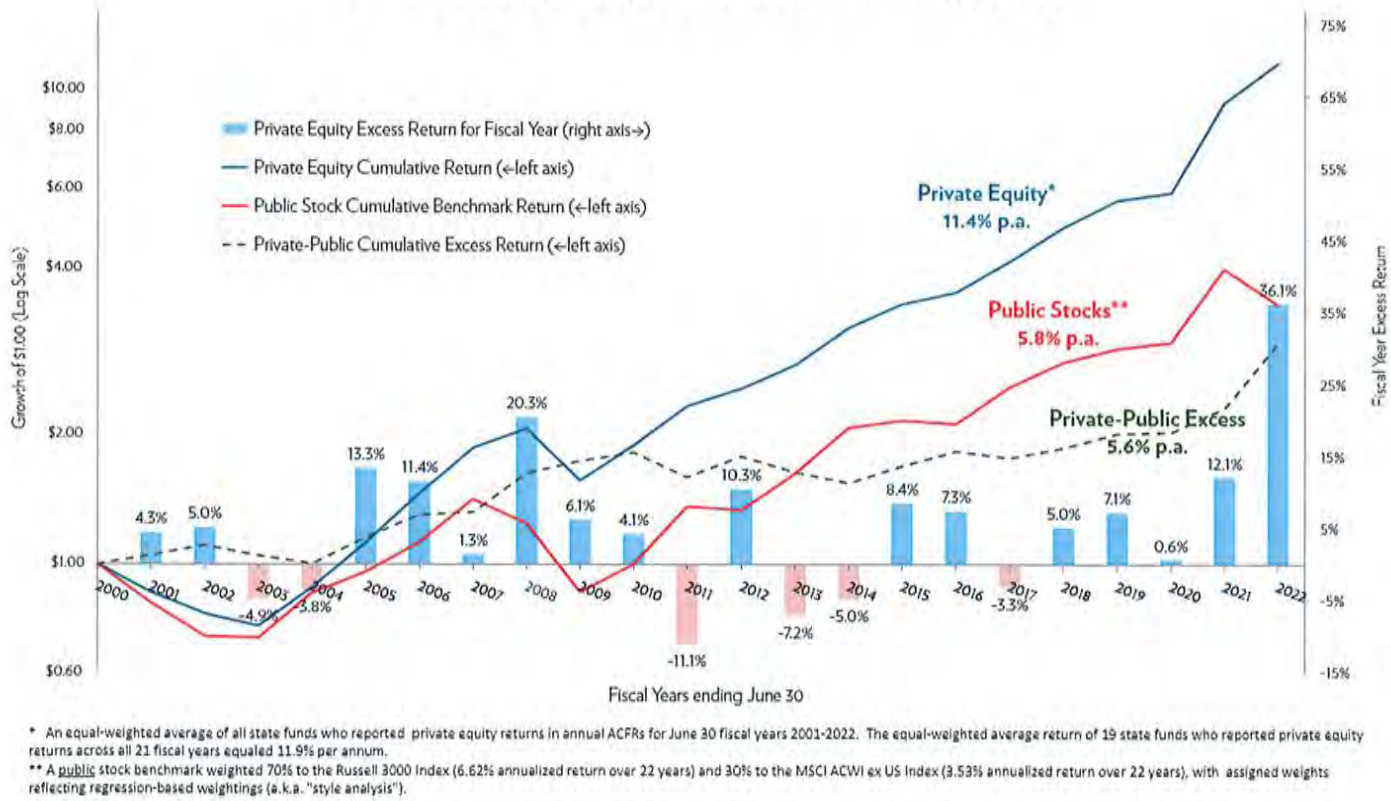
Updated February 28, 2023

Press coverage of private equity focuses almost exclusively on second order concerns over disclosure, fees, layoffs, debt, and an occasional scandal. Rarely is attention given to the first order benefit of high risk-adjusted returns.

Our annual performance study now includes 2022[2], a year that produced a 21% return for private equity, a record 36% better than the public stock markets. The 36% excess return is likely overstated to some degree by the timing of private equity valuations at June 30, 2022, and will be adjusted when 2023 returns are reported. Nonetheless, ***over a 22-year time period ending June 30, 2022, private equity allocations by state pensions produced a 11.4% net-of-fee annualized return, exceeding by 5.6% the 5.8% annualized return that otherwise would have been earned by investing in public stocks.***

The higher private equity returns did not come with higher volatility. The annualized standard deviation of returns for private equity equaled 15.8% for the 22-year period, compared to 17.5% for public stocks.

Exhibit 1: Composite <u>Private Equity</u> Performance across State Pensions:
Covering 22 Years starting June 30, 2000, and ending June 30, 2022
Growth of $1.00 (left axis) and Annual Excess Return (right axis)



* An equal-weighted average of all state funds who reported private equity returns in annual ACFRs for June 30 fiscal years 2001-2022. The equal-weighted average return of 19 state funds who reported private equity returns across all 21 fiscal years equaled 11.9% per annum.
** A <u>public</u> stock benchmark weighted 70% to the Russell 3000 Index (6.62% annualized return over 22 years) and 30% to the MSCI ACWI ex US Index (3.53% annualized return over 22 years), with assigned weights reflecting regression-based weightings (a.k.a. "style analysis").

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[1] This is the sixth edition of our private equity performance report, which was first printed in 2017.
[2] Fiscal year 2022 from June 30, 2021, to June 30, 2022.

Private Equity Performance

Exhibit 1 plots cumulative returns[3] for the Private Equity Composite, the Public Stock Benchmark, and the return difference (excess return) between private and public equities. Annualized returns for the entire 22-year period are reported. The 11.4% annualized return for private equity for the entire 22-year period is impressive compared to the 5.6% annualized return for the Public Stock Benchmark and the resulting 5.6% annualized return difference exceeds the 3% annual premium or excess return generally associated with return objectives for private equity. Also shown in Exhibit 1 are bars representing individual fiscal year return differences ("excess returns") between the Private Equity Composite and Public Stock Benchmark.

Study Data and Design

We draw our findings from data provided in Annual Comprehensive Financial Reports ("ACFRs") published by 94 state pension systems. We selected this data source because, unlike commonly used commercial universes, it is a closed group with no selection biases, and represents actual results achieved by large institutional investors. The list of 94 is narrowed to 65 state systems that use the same June 30 fiscal year-end date to achieve consistent performance measurement periods. The list is reduced again to 53 state systems that reported private equity returns for all or part of the study period. Nineteen (19) of the 53 state systems operated private equity portfolios for all 22 fiscal years.

The study period was selected partly for ease of data collection but also because it covers three full market cycles, encompassing three bear markets and three bull markets. We create a "Private Equity Composite" return series calculated by taking the average of all state systems reporting private equity portfolio returns for that fiscal year. The number of state systems included in the yearly average grew steadily over the study period from 19 to 61.

Most state systems have a private equity objective to outperform public equity by some percentage point amount, the most frequent amount being 300 basis points (3%), net of all fees. The 3% incremental return is intended to compensate investors for the loss of liquidity and complexity associated with private equity, but investors do differ on the appropriate return spread for private equity over public equity. The equity index used to represent public equity varies as well with some state systems targeting a U.S. benchmark like the S&P 500 or Russell 3000 Index and others using a global equity index like the MSCI ACWI Index.[4]

We create a "Public Stocks Benchmark" by calculating a weighted average of the Russell 3000 Index (70%) and the MSCI ACWI ex US Index (30%), rebalanced annually. The 70% and 30% weights are, in our judgment, reflective of the typical mix of U.S. and non-U.S. private equity investments in large, diversified portfolios. The weightings are confirmed through a statistical analysis of periodic state pension private equity returns as the dependent variable and the Russell 3000 and MSCI ACWI ex US index returns as independent variables. Regression coefficients on the Russell 3000 and MSCI ACWI ex US variables were found to be exactly 70% and 30%, respectively, indicating that our Public Stocks Benchmark best reflects the geographic risks found in private equity allocations.

The return calculations in this study follow the reporting practices of state pension systems as described in most ACFRs. Reported fiscal year private equity returns are typically *internal rates of return*, which are then linked in a *time-weighted* fashion to create multiperiod returns. The *internal rate of return* calculation is often used in measuring private equity performance in part because it represents a better measure of return when cash flows are very large in relation to portfolio values and because managers control the timing of cash flows. These two conditions are less relevant for state private equity portfolios that aggregate

[3] Cumulative returns are presented in Exhibit 1 using a "Growth of $1.00" scale, measuring how an initial $1.00 investment would have grown if it earned the average private equity return of reporting state systems or the Public Stocks Benchmark return.

[4] MSCI ACWI Index represents all global public equity markets. The MSCI ACWI ex US Index excludes the U.S. equity market. "ACWI" is an acronym for All Country World Index.

many underlying private equity funds. First, aggregated private equity cash flows (both inflows and outflows) tend to be modest relative to the size of the overall portfolio. Second, at the aggregate level the timing of cash flows is also controlled by the pension system itself through its "capital budgeting". For example, a fund manager's eagerness to distribute cash proceeds may be offset by increased new fund commitments by the pension system to preserve "vintage diversification".

Convergence

Not too long ago, a familiar narrative was that private equity returns were failing to deliver the excess return over public stocks compared to years past.[5] Our study finds no such evidence. Private equity returns are tested for convergence through a simple regression analysis that uses fiscal private equity excess returns reported in Exhibit 1 as the dependent variable and time as the independent variable. Last year (excluding 2022) the resultant coefficient on time (year) was virtually zero. With strong comparative private equity performance in 2022 the resultant coefficient on time is now +39 basis points per year, without statistical significance. Convergence may be a legitimate investor concern, but so far there has been no evidence of its presence.

Strong performance from private equity is expected. Private asset classes, including private equity, private debt and private real estate, should outperform their public equivalents as investors demand higher returns for loss of liquidity. This "illiquidity premium" has generally been estimated at two percentage points in extra return across private asset classes.[6]

Conclusion

Our updated study focuses on the private equity performance achieved by large state pension systems over a 22 fiscal year period from 2000 to 2022. This data is different from return universe data available on individual private equity funds which ignores selection, weighting, co-investment, and other decision factors that state pensions make in managing a private equity portfolio.

The study finds that private equity produced a meaningful 5.6% annualized excess return over public equity. We test for any diminution of excess return over time and find no evidence of private equity and public stock return convergence.

Private equity has consistently been one of the strongest performing asset classes within state pension portfolios.

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[5] A recent example is contained in the otherwise excellent *Bain Global Private Equity Report 2020*, recently reported on by *Pensions & Investments* under the headline "U.S. Private, Public Equity Returns Starting to Converge."
[6] See, for example, Private Debt: Yield, Safety and the Emergence of Alternative Lending, Stephen L. Nesbitt, John Wiley & Sons © 2023, Chapter 11, for illiquidity premiums in private direct loans.

FRANK HAWKINS KENAN INSTITUTE OF PRIVATE ENTERPRISE REPORT

APRIL 2019

Have Private Equity Returns Really Declined?

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ABSTRACT

In a recent paper, "Demystifying Illiquid Assets – Expected Returns for Private Equity," Ilmanen, Chandra and McQuinn (of AQR) give a perspective on the past, present, and expected future performance of private equity. They conclude that "private equity does not seem to offer as attractive a net-of-fee return edge over public market counterparts as it did 15-20 years ago from either a historical or forward-looking perspective." This analysis provides our perspective based on more recent and, we think, more reliable data and performance measures – the historical perspective is more positive than Ilmanen et al. portray.

INTRODUCTION

Over the past 20 years, as new and higher quality datasets have emerged, there has been a growing body of research on the performance of private equity funds. This research has studied the returns of the asset class in absolute terms and relative to public equity, its risk-adjusted returns, attempts to replicate returns with public equities, as well as the persistence of returns. Conclusions on the performance of private equity have differed by data source, by methodology and benchmark, and by author. In a recent paper, "Demystifying Illiquid Assets – Expected Returns for Private Equity," Ilmanen, Chandra and McQuinn (of AQR) give their perspective on the past, present, and expected future performance of private equity. They conclude that "private equity does not seem to offer as attractive a net-of-fee return edge over public market counterparts as it did 15-20 years ago from either a historical or forward-looking perspective." They also conjecture that the greater attraction to private equity is "investors' preference for the return-smoothing properties of illiquid assets in general."

In this analysis, we use high quality data from Burgiss to provide our perspective on these questions using up-to-date numbers on the historical absolute and relative returns of private equity. We then discuss the implications of different variables for future expected returns.

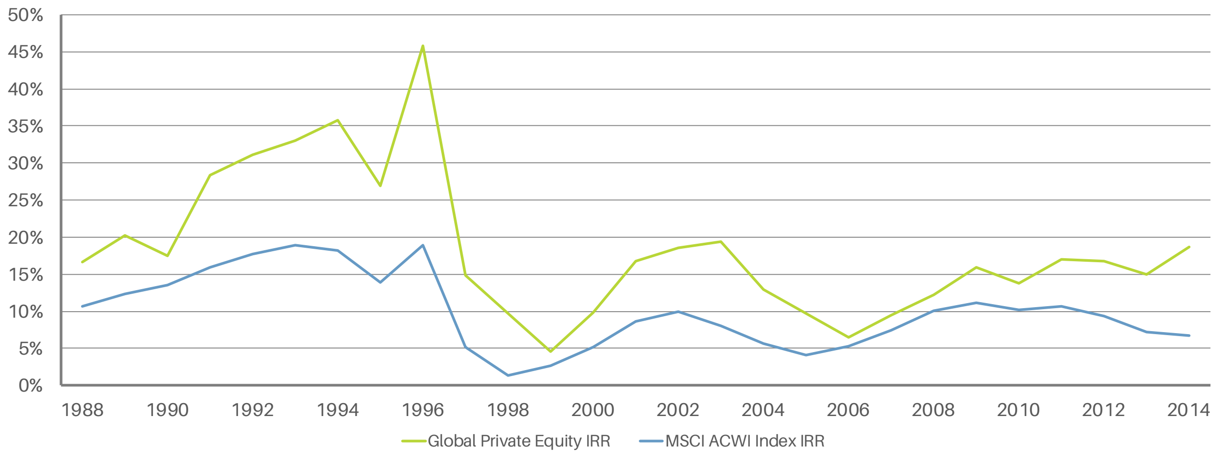
Exhibit 1A shows the annualized returns by vintage year and Exhibit 1B shows the Kaplan-Schoar (2005) public market equivalents (PMEs) by vintage year of global private equity funds against the contemporaneous total returns of the MSCI ACWI index. The exhibits use the most recent data from Burgiss. Burgiss sources its data directly from institutional limited partners (LPs), so the data are up to date and relatively free of selection bias. In these exhibits, we include in private equity the categories of buyout, venture, growth, and generalist private equity funds. In the rest of the paper, we focus on the largest category, U.S. buyout funds.

As can be seen, private equity returns have been higher than the MSCI in every single vintage year. The PMEs are greater than one for every single vintage year.[1] While one can debate, whether the MSCI ACWI is an appropriate benchmark for private equity, it is a reasonable place to start for the average institutional investor's public equity exposure.

While excess returns and PMEs have declined post-2005, they have still exceeded the returns to public markets. It seems likely that these persistent excess returns are the main reason for the past and current popularity of private equity. While it is probable that investors do not mind any perceived return smoothing that comes with illiquid assets, it seems unlikely that smoothing is a first order source of demand given the historical performance.

[1] Returns of private and public equities for less mature vintage years are still subject to change as portfolio investments are exited and valuation estimates are converted to cash returns.

Exhibit 1A: IRRs of Global Private Equity and the MSCI ACWI by Vintage Year



Source: Burgiss Private iQ, as of September 30, 2018. Global Private Equity includes buyout, venture, growth, and generalist private equity funds. Contemporaneous IRRs of the MSCI ACWI are derived via Direct Alphas as per Gredil, Griffiths, and Stucke (2014).

Exhibit 1B: PMEs of Global Private Equity against the MSCI ACWI by Vintage Year

Source: Burgiss Private iQ, as of September 30, 2018. Global Private Equity includes buyout, venture, growth, and generalist private equity funds. PMEs as per Kaplan and Schoar (2005).

THE PERFORMANCE OF U.S. BUYOUT FUNDS

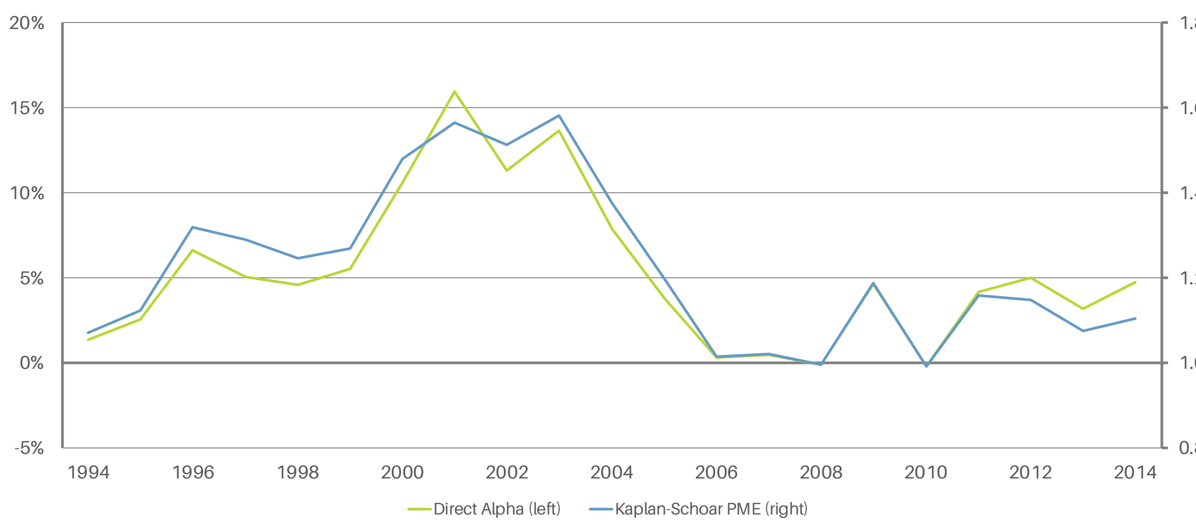
Ilmanen et al. (2019) focus on U.S. buyout funds, which represent the largest part of global private equity. Based on time-weighted returns back to 1986, they estimate an excess return over the S&P 500 of 2.3%.

This number appears low.[2] Using the latest fund cash flow data from Burgiss as of the third quarter of 2018, we calculate an average Direct Alpha of 4.8% and an average PME of 1.22 for 1986 to 2014 vintage years.[3] Accounting for the different amounts of capital in each vintage year leaves an excess return of 3.5% or 1.15. In other words, U.S. buyouts have historically outperformed the S&P 500 by a fairly wide margin.

Ilmanen et al. reference research by L'Her et al. (2016) who found that U.S. buyout fund returns for 2009 to 2014 vintage years were roughly equal to those of the S&P 500. As it turns out, this finding was probably driven in part by the immature nature of those more recent vintage years.[4] As of the third quarter of 2018, funds from 2009 to 2014 have generated an average Direct Alpha of 3.9% and a PME of 1.11. This is quite healthy performance and in line with expectations of returns that are 2% to 3% above public markets.

Exhibit 2 shows Direct Alphas and PMEs back to 1994.[5] Capital-weighted average excess returns over this period are 3.6% and the average PME is 1.15. The highest excess returns are for 2000 to 2004 vintages. The lowest are for the 2006 to 2008 vintages. The 2009 to 2014 vintages look most like the vintages of the mid- to late-1990s, albeit slightly lower. Note that the funds for more recent vintage years are not fully realized. PMEs will increase if funds continue to generate returns in excess of the S&P. (Of course, they will decrease if the reverse is true.)

Exhibit 2: Direct Alphas and PMEs of U.S. Buyout Funds against the S&P 500 by Vintage Year



Source: Burgiss Private iQ, as of September 30, 2018.

[2] See Harris, Jenkinson, and Kaplan (2014), and Higson and Stucke (2012).

[3] See Kaplan and Schoar (2005), and Gredil, Griffiths, and Stucke (2014) for a derivation of Direct Alpha.

[4] In their paper, the authors acknowledge the preliminary nature of the returns for more recent vintage years.

[5] Results for earlier vintage years are more volatile due to a much smaller number of funds in each vintage year. Capital-weighted average Direct Alphas and PMEs across 1980 to 1993 vintage years are 4.1% and 1.19, respectively.

SMART-BETA FACTORS AND U.S. BUYOUT FUNDS

It is no secret that buyouts use more leverage than and are smaller than the typical company in the S&P 500. There also is a perception that buyouts are more like value investments than growth investments. The question, then, is what is the appropriate benchmark to use for buyout fund investments.

One possibility is that the S&P 500 is just fine. Sorensen and Jagannathan (2015) show that this is a reasonable assumption if investors have log utility. And, of course, the primary objective of institutional investors is to generate returns in excess of their public equity portfolio.

An alternative is to try to adjust for leverage and the level of market risk (i.e., the CAPM beta). Ilmanen et al. assume that the market risk inherent in a portfolio of U.S. buyout funds is equivalent to having a beta of 1.2 and adjust accordingly. Because buyout funds are illiquid, it is difficult to estimate betas directly. The academic literature on this is inconclusive with betas typically ranging from 1.0 to 1.3.[6] In general, using a beta above 1.0 has the effect of lowering the PMEs and Direct Alphas of buyout funds because the stock market goes up on average. We note that, empirically, beta does not do a good job of explaining realized returns, i.e., a portfolio of higher beta public stocks does not perform much differently from a portfolio of low beta stocks. Evidence for this comes from Frazzini and Pedersen (2014). It is further not clear, to what extent risk measures based on volatility and covariance are particularly meaningful for illiquid investments, where cash flows are at the discretion of the fund manager.

Another alternative is to adjust for size. Portfolios of smaller capitalization stocks perform differently over different periods than portfolios of larger stocks. And buyout investments tend to be in companies that are more like smaller capitalization stocks.

A final alternative is to adjust for value as opposed to growth. Again, portfolios of value stocks and growth stocks perform differently over different periods. As with beta, it is difficult to know exactly what value adjustment to make for buyout funds.[7] While it is unclear which adjustments make the most sense, if any, we show the effects of making different adjustments. Exhibit 3 presents Direct Alphas using the S&P 500 index, the Russell 2000 and the Russell 2000 Value indices.

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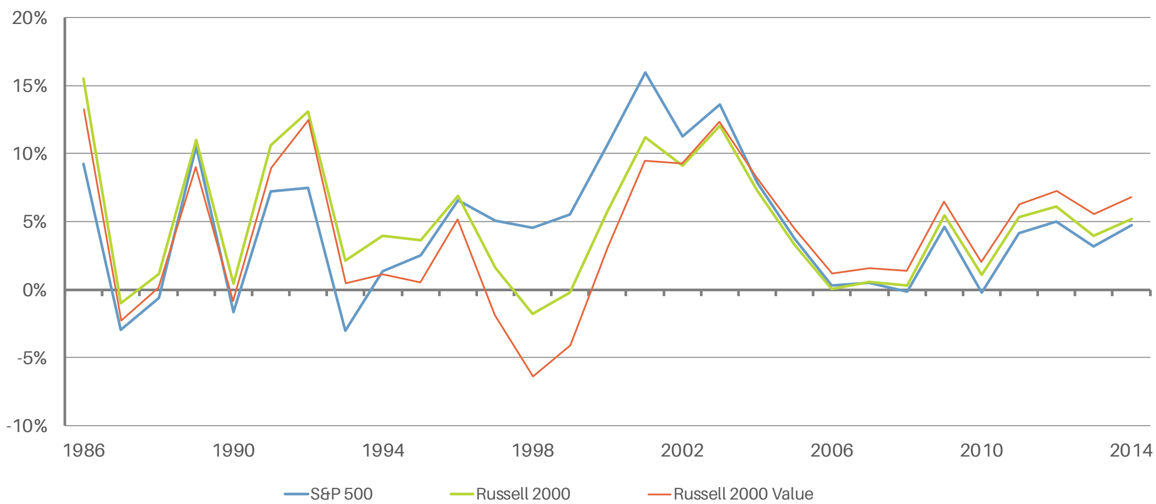
[6] See Kaplan and Sensoy (2015) and Korteweg (2018) for a survey of this and other evidence.

[7] Buyouts are priced at entry and exit because these valuations form the basis for eventual investment returns. For buyouts of privately-held companies, the valuation process usually starts with earnings multiples of a group of industry- and size-matched public peers as well as recent private equity or M&A transactions. A potential acquirer then determines a maximum bid based on its investment thesis (that includes operational improvements and strategic adjustments), the debt used to fund the transaction, the estimated cash flows and the valuation of the company at final exit. For buyouts of publicly-listed companies, the acquirer typically has to pay a premium of 20% to 40% to the selling shareholders. In summary, while buyout valuations are informed by recent valuations in the public market, those are only one part of the overall equation.

Exhibit 3: Direct Alphas – S&P 500 vs. Russell 2000 and Russell 2000 Value by Vintage Year



Source: Burgiss Private IQ, as of September 30, 2018.

If U.S. buyouts were indeed subject to a size and value premium in public equity markets, this should be accounted for when using the Russell 2000 indices as benchmarks. Since the 2008 vintage year, excess returns of U.S. buyout funds have been consistently higher against the Russell 2000 index than against the S&P 500. Since 2004, excess returns have been consistently higher against the Russell 2000 Value index. The advantage of small-cap value stocks over the S&P 500 is concentrated in the 1997 to 2001 vintages. This fact is typically ignored by research that attempts to replicate long-term buyout returns with small-cap value stocks. (That research also ignores potential capacity constraints in public markets – the market capitalization of the entire Russell 2000 Value index of about $1.5 trillion compares to uncalled capital by U.S. buyout funds of about $500 billion.)[8]

We also estimate the effects of assuming a beta of 1.2 using the S&P 500, the Russell 2000, and the Russell 2000 Value indices. Exhibit 4 presents the Direct Alphas and PMEs over different time periods. What is clear from these calculations is that buyout performance has exceeded the leveraged indices for the vintages from 1986 to 2014 and over the two more recent different sub-periods.

It is worth pointing out that outperformance has been the greatest against the Russell 2000 Value index for 2009 to 2014 vintage years and, inversely, it has been at the lower end against the Russell 2000 Value index in earlier periods, especially in the 1990s. This observation raises questions as to whether buyouts are at all subject to a small-cap and value premium as historically observed for public equities, particularly given the increased size and competitiveness of the buyout industry over the past 10-15 years.[9]

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[8] See Chingono and Rasmussen (2014), and Stafford (2017).

[9] Using a benchmark with a greater size and value tilt, such as customized Fama-French portfolios of small-cap value stocks also generates positive PMEs and Direct Alphas for post-2000 vintages.

Exhibit 4: Direct Alphas and PMEs against a simulated Beta of 1.2

	Direct Alpha				KS-PME			
From	1986	2000	2000	2009	1986	2000	2000	2009
To	2014	2014	2008	2014	2014	2014	2008	2014
S&P 500	2.1%	1.9%	2.0%	1.3%	1.09	1.07	1.09	1.04
Russell 2000	0.8%	1.0%	0.6%	2.4%	1.03	1.04	1.03	1.07
Russell 2000 Value	0.9%	1.8%	1.2%	3.9%	1.04	1.07	1.06	1.11

Source: Burgiss Private IQ, as of September 30, 2018. Direct Alphas and PMEs are calculated based on capital-weighted, vintage year concurrent cash flows.

EXPECTED OR FUTURE RETURNS FOR U.S. BUYOUT FUNDS?

Ilmanen et al. conclude their paper by attempting to estimate expected returns for buyout funds going forward. They conclude that the expected buyout fund returns relative to public markets are likely to be lower than the past – on the order of 80 basis points. They base this on several considerations.

First, they note that buyout fund returns appear to have declined post-2005 to almost equal public market returns. They also point out that this coincided with private market purchase multiples have been in line with public market multiples since 2006 (suggesting that there is no longer a valuation discount to buyouts). As we showed above, the conclusion that buyout fund returns equal public market returns for post-2008 vintages just does not hold using the most recent data. As an aside, by the same logic, one might conclude that the value premium is also a figment of the past as it has performed quite poorly the last decade.

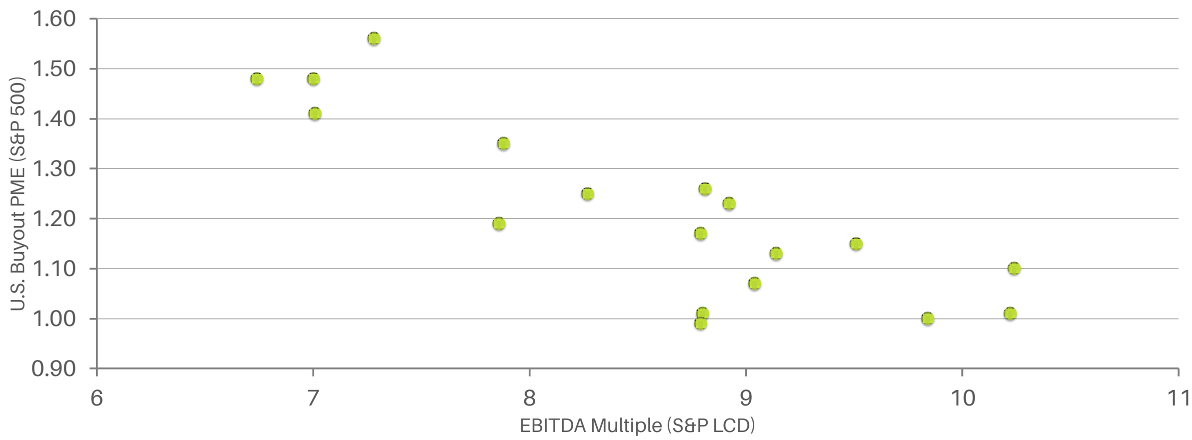
Second, they point out that buyout fundraising has been substantial over the last five years and that high fundraising has been associated with lower subsequent returns. We agree that this is, indeed, a concern. There is a negative correlation historically between PMEs and buyout fundraising. However, that correlation is to some extent backward looking. The correlation has been smaller in real time. See Brown et al. (2018).

Finally, they point out that buyout earnings yields are relatively low today. Under certain assumptions, that implies relatively low future returns. That is another way of saying that buyout multiples are historically high. On this, we agree. The high multiples being paid are a cause for concern.

Historically, higher multiples are associated with lower PMEs and Direct Alphas. Exhibits 5A and 5B show the relationship between PMEs and Direct Alphas (relative to the S&P 500) and EBITDA multiples paid in deals worth more than $500 million in enterprise value according to the S&P LCD. Consistent with this, a regression of EBITDA multiples on PMEs yields a negative and significant coefficient of -0.13.

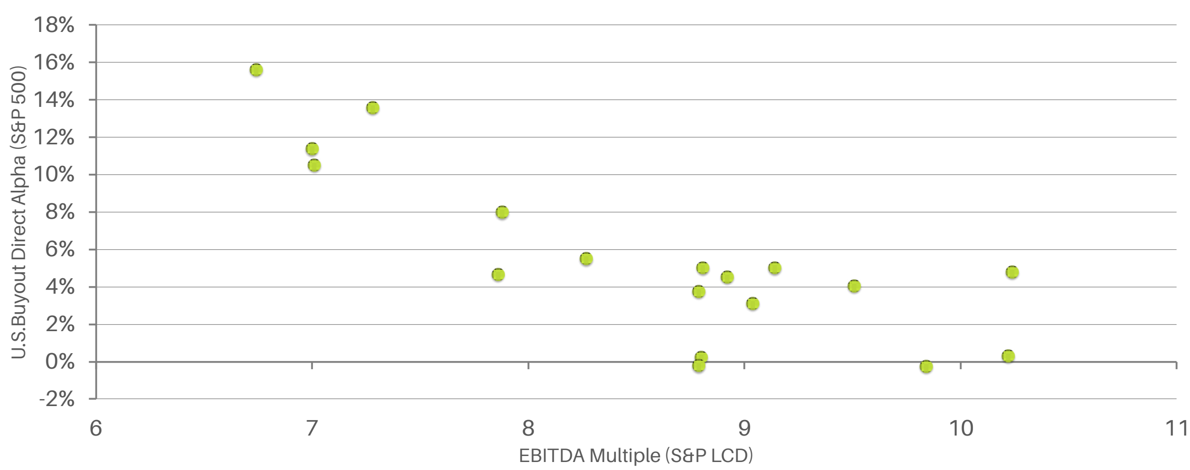
This correlation is concerning because EBITDA Multiples averaged 10.9 in 2017 and 2018. At those multiples, the regression coefficients imply performance for those vintages will be less than the S&P 500 with PMEs of 0.90. That said, EBITDA multiples have been above 10 for vintages since 2014. Despite that, the 2014 and 2015 vintages currently have PMEs above one and Direct Alphas well above zero.

Exhibit 5A: PMEs Versus EBITDA Multiples from 1997 to 2014



Source: Burgiss Private IQ, as of September 30, 2018. S&P LCD.

Exhibit 5B: Direct Alphas Versus EBITDA Multiples from 1997 to 2014



Source: Burgiss Private IQ, as of September 30, 2018. S&P LCD.

CONCLUSION

U.S. buyout funds have historically outperformed public market indices, even more recently. This remains true even after making reasonable adjustments for leverage (beta) and a potential small-cap and value premium.

That said, there are two forces that will make it more difficult for buyout firms to continue that performance. First, the amount of capital raised by buyout funds is at historically high levels. Second, purchase price multiples also are at historically high levels. In the past, realized buyout returns have been lower when capital and, particularly, multiples have been high.

While those two forces operate, buyout firms have faced similar headwinds in the past. Perhaps surprisingly, buyout firms have been able to offset those headwinds in every vintage year in the last twenty-five years, to perform at least as well as the S&P 500.

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Columbia Business School

Capital Structure and Leverage in Private Equity Buyouts

by Greg Brown, University of North Carolina at Chapel Hill; Robert Harris, University of Virginia; and Shawn Munday, University of North Carolina at Chapel Hill*

Private equity buyouts depend on debt financing. In fact, the practitioner and academic research literature generally refers to buyouts as *leveraged* buyouts, or LBOs, precisely because of the important role of debt in funding such transactions. But in contrast to the literally thousands of empirical studies over more than half a century that have focused on the capital structure of *public* companies, there are remarkably few large-scale empirical studies of the role that leverage plays in buyouts—its effects on the risk, returns, incentives, and other basic characteristics of LBOs. The relative scarcity of research on PE capital structure is attributable mainly to the lack of widely available financial data on buyout deals or other aspects of PE capital structures. The few studies that we now have rely mainly on comparatively small proprietary datasets or are limited to a subset of more transparent transactions, such as public-to-private buyouts or financings that include publicly traded bonds.

With this in mind, we recently conducted a study designed to shed light on the various kinds of debt now used to finance buyout transactions, and to provide some current insights on the profitability and leverage of such transactions using newly available data. In the pages that follow, we summarize the current state of knowledge on buyout financing from both a theoretical and empirical perspective with the aim of informing academics, practitioners, and policymakers.

We begin by providing an overview of the different ways that debt can enter into the financing of buyout transactions—not only at the level of the portfolio companies, but also at the level of the funds or investors in those funds. Then, following a brief discussion of capital structure theory, we use the existing literature to address several specific questions of importance to both practitioners and policymakers: What accounts for the cyclical nature of private equity? How does leverage affect the alignment of interests and incentives between the general partners (GPs) and the limited partners (LPs) who provide the bulk of the equity capital in buyouts? How has PE performed as an investment and how is that performance linked, if at all, to leverage? We close by presenting the findings of our recent analysis of new deal-level data.

Before turning to the detailed analysis, we provide a summary of our main conclusions:

• Debt enters into the PE buyout ecosystem in a variety of ways. Along with direct borrowing by the individual portfo-

*This paper draws heavily on a white paper, "Debt and Leverage in Private Equity: A Survey of Existing Results and New Findings," which is the result of a collaborative effort between the Private Equity Research Consortium and the Research Council of the Institute for Private Capital. Valuable contributions and comments were provided by James Bachman, Keith Crouch, Michael Del Giudice, Wendy Hu, Tim Jenkinson, Steve Kaplan, David Robinson, Christian Lundblad, Pierre-Yves Mathonet, Christopher Jones, Peter Cornelius, Andra Ghent, Paul Finlayson, Barry Griffiths, Tom Keck, Craig Nickels, Dominic Garcia, Ruediger Stucke, Jim Albertus, Matt Denes, Timothy Riddiough, Nick Crain, Lisa Larsson, Tyler Johnson, Sam Scherf, Tobias True, Avi Turetsky, Sarah Kenyon, Celine Fei, Dave Fisher, and Huan Lian. The authors especially thank Burgiss, StepStone, and an anonymous global investment bank for providing data.

lio company acquired in the buyout transaction, the buyout funds themselves are increasingly borrowing using either LP commitments or equity interests in the underlying companies as collateral. In addition to these borrowings, private equity GPs and LPs have been raising debt independent of the funds or portfolio companies. In this way, buyout capital structures have been evolving over time to incorporate incremental leverage as the debt markets and PE firms have created new ways to attract risk capital.

• Leverage decisions made as part of PE buyout deals depend, at least to some extent, on the characteristics of those deals. In particular, finance theory predicts that the deal partners (typically employed by the GP) will trade off the benefits of debt with the expected costs. Potential benefits include a greater debt tax shield and stronger management incentives to generate cash flow. Potential costs arise mainly from the increased financial risk, including the risk of and costs associated with bankruptcy, as well as other operating and financial frictions. The leverage-supporting characteristics of deals vary across industry and geography, and over different time periods, though to a lesser extent than both academics and practitioners appear to believe. All of which suggests that many of the same forces that shape capital structure in public companies are at work in PE buyouts.

• Leverage makes possible PE firms' concentration of ownership, which in turn is expected to improve monitoring of operating performance and managerial decision making. Along with more disciplined capital spending, a number of studies suggest that PE has a comparative advantage in managing high leverage and its potential costs—one that effectively enables PE-backed firms to take on higher levels of debt than comparable public companies.

• Although reducing potential agency conflicts between GPs and their operating managers and creditors, the typical PE investment structure introduces conflicts of interest and incentives between GPs and LPs that can, at least in part, be managed by contractual arrangements.

• The most recent and comprehensive research suggests that PE funds generate superior risk-adjusted returns compared to public equity investments. This implies that even after their fees, GPs have created value for LP investors through a number of interrelated sources including better governance, operational engineering, multiple expansion and leverage. While it is difficult to empirically characterize risks in private investments, studies suggest that PE firms have comparative advantages that allow them to mitigate the impact of leverage on financial risks faced by other investors.

• Studies of PE capital structures and return and risk outcomes continue to confirm the highly cyclical nature of private equity activity, suggesting that institutional features combined with macroeconomic cycles are to some degree hardwired into the industry.

• Using a new sample of thousands of individual PE buyouts transacted over more than three decades, we find that, in almost all sectors, the vast majority of deals were profitable when compared to public market returns. We also document that the relationship between leverage and returns depends on the way leverage is measured. When leverage is measured as the ratio of net debt to total enterprise value, we observe a strong positive relationship with returns, which is consistent with a risk-return trade-off. High debt-to-value deals tend to target larger, established companies with low growth rates that can provide predictable cash flows to service debt. Entry EBITDA multiples tend to be lower in such cases, and the companies pay down more debt than average. But when we measure leverage as net debt divided by EBITDA (typically referred to as "the leverage ratio"), we find a weakly *negative* relationship with returns. Deals with high leverage ratios tend to target companies with faster growing earnings and higher operating margins. Deals with high leverage ratios are associated with above-average entry EBITDA multiples, but do not appear to be riskier than deals with low leverage ratios.

"
PE firms have comparative advantages that allow them to mitigate the impact of leverage on financial risks faced by other investors.
"

Overview of Private Equity and the Use of Debt

PE funds are typically structured as closed-end private partnerships with a life span of ten or more years. The partnership is made up of limited partners (LPs) and general partners (GPs), each of which have rights and responsibilities as governed by their partnership agreement. The LPs are institutional and high-net-worth individual investors who provide the majority of the capital to the partnership. The GP manages the capital, deciding when it is called, what it is used for, and how and when it is returned to the LPs subject to provisions in the partnership agreement. The GPs typically charge a management fee on the committed or the invested capital and earn a share of the profits, known as "the carry," though typically only after a preferred return (or hurdle rate) is realized by the LPs. The LPs' liability risk is limited to the capital they contribute. The GP role is typically managed by professional PE fund managers. These managers protect themselves from liability, at least in part, by not serving directly as the GPs, but instead as shareholders of the corporation that serves as the GP.[1]

As the PE industry has evolved over the last half century, so too has the use of debt. Since the earliest days of leveraged buyouts, PE managers have used debt financing, "multiple arbitrage," and operational improvements combined with more effective governance as the primary drivers of value creation. PE typically targets gross equity returns in excess of 20%, which is higher than cost of equity capital for many strategic acquirers who compete with PE to own assets. LP suppliers of equity have illiquid claims and cede control to the GP when capital is called or returned. Moreover, the GP has a much higher concentration of ownership, and much of their annual compensation comes from the returns.[2] The resulting high cost of private equity, together with the perceived incentive benefits of concentrating ownership, pushes GPs to use as much leverage as they can confidently support, with the goal of minimizing their blended cost of capital, and so enabling them to compete more effectively for assets. Typical uses of debt proceeds by PE-backed companies are similar to those of public companies, including the funding of M&A transactions, the refinancing of existing debt, and the recapitalization of a company's balance sheet. Traditional PE financings have most frequently included issuances in both the syndicated bond and bank markets. However, as financing alternatives evolve, PE remains at the vanguard pursuing investment opportunities for which traditional sources of capital may have once been too expensive.

In the 1970s and 1980s, PE-backed companies were among the earliest and most frequent issuers of high-yield bonds, which were used mainly to fund their takeover efforts. To compensate investors for their higher chance of issuer default, high-yield bonds offer higher interest rates and sometimes investor-friendly structural features. Until the 1980s, traded high-yield bonds were simply the outstanding bonds of "fallen angels," once investment grade companies that had experienced credit rating downgrades. Drexel Burnham and other investment banks launched the modern high-yield market in the 1980s by selling new bonds from companies with non-investment grade ratings to fund mergers and leveraged buyouts.

Many of the issuers of high-yield bonds continue to be companies backed by private equity. Today's high-yield bonds typically take the role of junior debt capital—subordinate to senior secured loan debt but senior to the PE fund's equity investment. High-yield bond investors include mutual funds, pension funds, insurance companies and arrangers of instruments that pool debt securities (as in collateralized debt obligations, or CDOs). High-yield bonds offer investors the potential for diversification, higher current income, capital appreciation, and longer duration. The size of the global high-yield corporate bond market was estimated to be in excess of $2.8 trillion at the end of 2019, of which some $2.5 trillion had been issued by U.S. industrials.[3]

With the advent of "market flex" language in the syndicated loan market during the Russian debt crisis of the late 1990s, loan syndications emerged as a full-fledged capital markets alternative for PE financings.[4] Leveraged loans, which are loans with non-investment grade ratings, are typically senior secured debt instruments, either first or second lien. They also typically provide floating-rate coupons, may or may not have covenant provisions, and usually have shorter duration than bonds.

The syndicated leveraged loan market, which developed as an offshoot of the investment grade loan market, provides a way for borrowers to access banks and other institutional capital providers of loans in a less expensive and more efficient form than traditional bilateral credit lines. As a result, by the late 1990s many PE-backed companies were relying heavily on the leveraged loan market to fund their portfolio companies. Leveraged loan investors include banks, finance companies, institutional investors (typically using structured vehicles such as collateralized loan obligations, or CLOs), loan mutual funds, and ETFs. The Bank of England estimates the current size of the global leveraged loan market at more than $2 trillion, a rise of more than 100% since 2007. U.S. leveraged loans outstanding at the end of 2019 amounted to over $1.2 trillion, with the remainder mostly denominated in euros.[5]

Away from the syndicated loan markets, private credit alternatives expanded dramatically during the post-financial crisis period. In the wake of the financial crisis, many financial institutions faced the need to reduce leverage, thanks in part to higher capital reserve requirements and increased regulation that forced many banks to curtail traditional bank

1 See Josh Lerner, Ann Leamon, and Felda Hardymon, (2012), *Venture Capital, Private Equity, and the Financing of Entrepreneurship*, Wiley Press.

2 Anecdotal evidence suggests that while the gross internal rate of return private equity managers typically underwrite varies with changes in the market cycle and dynamics, typical estimates range from 15%-30%, with 20%-25% most frequently sighted. Managers have generally tended toward the lower end of the range in the post-financial crisis period.

3 "U.S. Corporate Debt Market: The State of Play in 2019," *S&P Global Market Intelligence*.

4 "Leveraged Commentary & Data (LCD): Leveraged Loan Primer," *S&P Market Intelligence*.

5 "U.S. Corporate Debt Market: The State of Play in 2019," *S&P Global Market Intelligence.*

loan lending. As a result, alternative sources for risk capital stepped into the void, developing a range of private credit structures to meet the growing capital needs of companies, particularly in the middle market. Faced with an historically low interest rate environment, institutional investors have increased allocations to private credit.[6] Private credit assets under management (AUM) exceeded $767 billion in 2018, more than three times the amount in 2008. Much of that expansion can be attributed to supply-side growth driven by PE-backed borrowers. While typically more expensive than a bank or syndicated loan alternative, private credit capital has certain advantages over traditional market alternatives. Notable among them are quick and efficient access for middle-market companies where banks are lending less; fewer counterparties; less regulation and potentially higher leverage levels; the tendency for lenders to hold the loans until maturity; and less public visibility. Despite the emergence and significant growth of private credit in the post-financial crisis decade, the syndicated bank and bond markets continue to be the largest sources of PE debt financing, particularly for the largest, most complex, and multinational financings in which the relative size, liquidity, and sophistication of the syndicated markets continue to be most important.

As the depth and breadth of credit markets have expanded with investor appetite, innovations have followed. Figure 1 depicts various layers of debt that have emerged and the Appendix provides more detail. The emergence of holding company debt in the early 2000s was one innovation. Holding company (HoldCo) debt, which is issued above the operating company (OpCo) level, is junior in priority of repayment, has a junior collateral claim to all debt at the OpCo, and is typically non-cash pay because it is subject to restricted payment provisions of OpCo debt. The primary role of HoldCo debt has been to provide a mechanism for adding incremental debt in a transaction beyond what is accessible at the OpCo.

From the "bottom-up" perspective of OpCo creditors, HoldCo debt behaves essentially as equity and has minimal impact on the cash flow and creditworthiness of the operating company. While holding company debt is generally riskier than operating company debt, often holding only a pledge against the underlying equity as collateral, it can be priced to meet investor demand for yield in robust markets. At the same time, from the "top-down" perspective of private equity, HoldCo debt behaves very similarly to OpCo debt; it can be used to reduce the size of the equity investment while increasing the risk of the residual equity. Although more expensive and riskier than OpCo debt, it is cheaper than equity capital. Not all market conditions support HoldCo debt financings; it becomes accessible only when investor risk appetites are high and credit markets are robust.

Securitized markets have also developed over the last two decades, spurring further innovation and access to capital for private equity.[7] Securitized debt is a form of financing commonly used by companies to raise debt proceeds with the backing of illiquid assets on their balance sheet. Securitized financing requires the creation of a special purpose vehicle (SPV). Effectively a trust that is separate from the operating company, the SPV provides legal isolation of the assets from the original holder of the assets. After receiving the assets from the operating company, the SPV then issues securities backed by the assets of the trust and delivers the proceeds to the operating company. The interest and principal on the securities are paid from the cash flows that arise from the trust assets; the operating company effectively "rents" the assets back from the SPV.

Because the debt issued by the SPV is nonrecourse to the originator, an important benefit of securitized debt is that the credit rating of the debt is based on the SPV's assets rather than the originator's cash flow and assets. The proceeds raised from the sale of the securitized assets are returned to the operating company, thereby enabling illiquid assets of the originator to be turned into cash.

Although securitized financings are commonplace for financial institutions—which use them to finance mortgages or credit card receivables—one of the first times it was used by private equity was during the buyout of Hertz in 2005 by The Carlyle Group. In the case of buyouts, the PE backer is able to raise more debt at lower cost than a traditional financing structure would allow. The concept of a SPV structure is frequently used in commercial mortgage-backed securitizations as well, and was also co-opted by private equity in the form of an OpCo/PropCo structure to finance buyouts of companies with substantial real estate assets on their balance sheets.[8] Whole business securitization structures have also been used by franchise businesses when financing PE-backed acquisitions.[9]

Fund-Level Debt. In a more recent development, the advent of *fund-level* debt has been adopted by private equity. In the case of fund-level debt, the lenders can look either to the

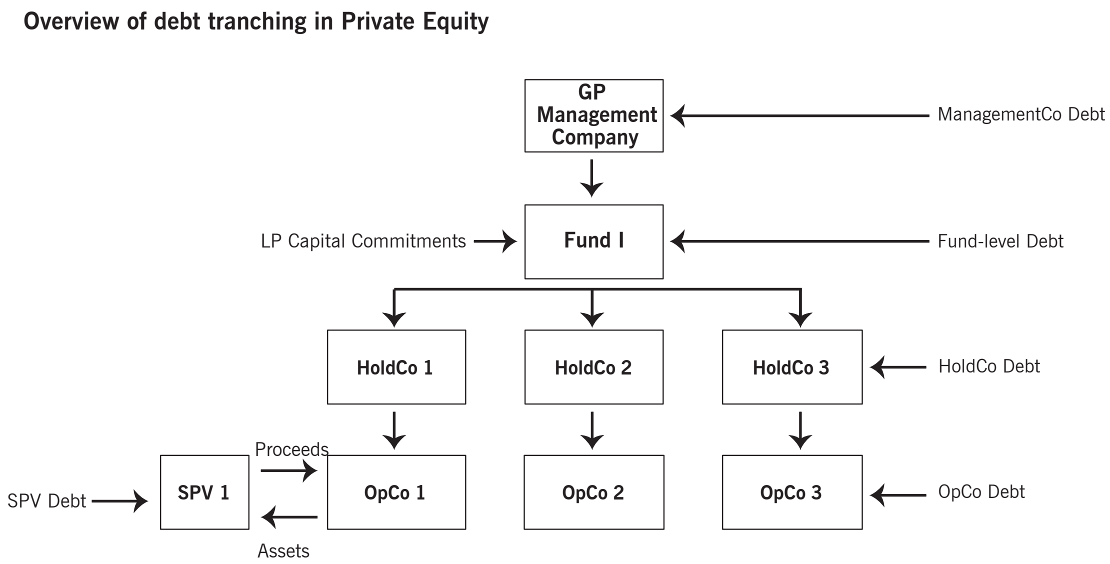
6 Shawn Munday, Wendy Hu, Tobias True, and Jian Zhang, (2018), "Performance of Private Credit Funds: A First Look," *The Journal of Alternative Investments*, 21(2), 31-51.

7 Anil Shivdasani and Yihui Wang, (2011), "Did Structured Credit Fuel the LBO Boom?" *Journal of Finance*, 66(4), 1291-1328.

8 For example, the Toys "R" Us LBO of 2006.

9 For example, the Dunkin' Donuts LBO, 2007.

Figure 1
Overview of Debt in Private Equity



unfunded capital commitments of the LPs or to the underlying equity collateral invested in companies across the fund's portfolio for collateral. In the case of unfunded capital commitment, lenders underwrite the LP credit risk, which in many cases is considered investment grade. In the case of fund-level loans with pledges of collateral from funded commitments, the risk of illiquid equity investments in private companies is often considered non-investment grade and is quite high.

While the adoption of fund-level debt is a relatively new phenomenon in private equity, it has long been used in private credit to enhance LP returns. Business Development Companies (BDCs) have for many years benefited from access to SBIC-guaranteed debt at the fundlevel. Other private credit funds have access to loans at the fund level, often in the form of subscription lines (also referred to as "capital-call" or "wireline" facilities). PE managers can use such subscription lines to facilitate less frequent capital calls from limited partners. These subscription lines typically have to be repaid somewhere in the 30-day to one-year timeframe but can be reborrowed.

Some PE fund managers use fund-level leverage to act as leverage above and beyond what may be efficient (or allowed) at the portfolio company, thereby increasing internal rates of return at the expense of a (modest) reduction in multiples of invested capital. While the effects of fund-level leverage are straightforward when fully disclosed, some ambiguity exists in reporting standards as a result of the less than consistent disclosure of fund-level returns on both a before- and after-fund-level leverage effects basis.[10]

Management Company-Level Debt. More recently, GPs have borrowed loans or issued bonds at the management company level to finance their operations. Management Company (ManagementCo) debt can be used to provide incremental leverage on underlying investments of the fund, seed/acquire new investment strategies, compensate employees, or achieve other general corporate purposes. Lenders and creditors often look to the cash flows of the ManagementCo or personal guarantees of the shareholders of the management company for credit support. Loans at the management company-level are traditionally rated investment grade and funded by large banks and financial institutions. Both secured and unsecured investment-grade bond issuances have been syndicated by the management companies as well. ManagementCo debt effectively acts like any other corporate debt of a financial services company.

A Brief Overview of Capital Structure Theory

The most basic question about leverage in private equity is this: Why do PE buyouts have substantially higher leverage than similar public companies? If the optimal, or value-maximizing, capital structure is indeed a higher level of debt, why

10 See James F. Albertus Matthew Denes (2020), "Private Equity Fund Debt: Capital Flows, Performance, and Agency Costs," SSRN working paper 3410076.

don't public companies operate with more debt? Alternatively, if public company capital structure is on average optimal, doesn't that imply that PE deals are overleveraged and excessively risky?

To provide a framework for answering these and other related questions, we start with an overview of capital structure theory based on the traditional literature that focuses on public companies. This overview will serve as a basis for understanding what may be relevant for private companies and, in particular, the PE buyout transactions that we focus on later. We end this section with an overview of capital structure theory that is related specifically to private equity.

Classic Theory

In the classic trade-off theory of capital structure, companies choose an optimal level of debt based on the tax shield provided by the deductibility of interest payments and the frictions associated with high levels of debt such as higher expected bankruptcy costs. The optimal capital structure is determined in a static equilibrium as the point where the tax benefits of higher debt are just offset by the marginal expected costs of greater frictions.[11]

The trade-off theory predicts that the optimal capital structure decision should be largely the same for private and public companies with similar firm characteristics and financial conditions. As a consequence, the trade-off theory can explain changes in optimal capital structure only to the extent that the difference in ownership structure between public and private companies affects either the tax shields or financial frictions associated with debt.

While higher debt levels result in a greater tax shield, PE-backed companies face much the same tax policies as public companies; and large public companies, thanks to their global operations, often have more sophisticated tax avoidance opportunities that may be unavailable to smaller private companies. If anything, then, corporate tax incentives are likely to work to promote the acquisition of small and mid-sized firms by larger public firms.

In short, even if taxes play an important role in determining optimal capital structure, they are likely to play a relatively modest role in explaining why PE buyouts have more debt. And so if the classic trade-off theory is to explain why buyout deals have high leverage, there must be differences in other frictions that are affected by debt financing. As we discuss later, PE-owned companies have reasons to operate with higher leverage as well as advantages over public companies in managing the expected costs of financial distress that have nothing to do with corporate taxes.

The strongest challenger to the static trade-off theory is the so-called "pecking order" theory, which predicts that companies will choose internal over external funds whenever possible; and when forced to raise outside capital, they will choose debt over equity to minimize the "information costs" arising from information asymmetries between managers and the market. In particular, outside investors in companies proposing new securities offerings worry about a "lemons problem" and price-protect themselves by reducing the value of the firm when the offerings are announced. Because the lemons problem is greater for shareholders than bondholders, issuing equity is generally the most costly and hence least desirable way to raise capital.

Other research has focused on the possible effects, negative as well as positive, of capital structure and leverage ratios on managerial incentives to maximize efficiency and value. Most important for our purposes is Michael Jensen and William Meckling's seminal paper[12] that presented the theory of "agency costs" associated with raising and operating with outside equity. More specifically, Jensen and Meckling showed how the combination of information asymmetry and agency conflicts between managers and outside shareholders over things like the optimal size and diversification of public companies effectively reduces their value. Heavy debt financing, as Jensen and Meckling noted at the end of their article, has significant potential to manage agency conflicts by concentrating ownership and minimizing the need to rely on outside capital.

The theory of agency costs sheds light on an important fundamental difference between private and public ownership. Whereas the PE buyout investors typically take a controlling interest in a company, giving them full control of the board and the power to hire and fire management—which they often exercise—the ability of public shareholders to reform companies that fail to serve their interests generally depends on costly interventions by the market for corporate control, with its threat of takeover, and other forms of shareholder activism.

What's more, especially in large, mature companies, shareholder activists often exert pressure to pay out excess (equity) capital and operate with higher leverage ratios, with the aim of discouraging corporate overinvestment. But in PE-controlled companies, as we just saw in highly lever-

11 Franco Modigliani and Merton H. Miller, (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment," *The American Economic Review*, 48(3), 261-297. See Stewart Myers, (2001), "Capital Structure," *The Journal of Economic Perspectives*, 15, 81-102, for a detailed discussion.

12 Michael C. Jensen and William H. Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics*, 3 (1976) 305-360, Q North-Holland Publishing Company.

aged public companies, the high leverage not only spurs the search for efficiencies and disciplines capital spending, but plays a perhaps still more important role: facilitating the concentration of ownership that enables PE companies to acquire and maintain full control over their portfolio companies.

Nevertheless, as we also discuss below, if this concentration of control in the hands of the firm's largest investor works to minimize the cost arising from the agency conflict between managers and owners, the structure of PE funds generates a new agency relationship between the GPs and their LPs that gives rise to new frictions.

Capital Structure Theory as Applied to Private Equity

In a much cited 1989 *Harvard Business Review* article called "Eclipse of the Public Corporation,"[13] Jensen viewed the rise of "LBO partnerships" like KKR and Clayton & Dubilier as a "new organizational form"—one that, in acquiring and operating companies across a broad range of industries, was competing directly with, and threatening to supplant, public conglomerates. As Jensen put it, "The LBO succeeded by substituting incentives held out by compensation and ownership plans for the direct monitoring and often centralized decision-making of the typical corporate bureaucracy."[14]

The heavy debt financing played a critically important role in consummating the deal we just noted—making possible the concentration of ownership and control by the PE sponsor. But it also played a valuable ongoing corporate governance function, providing what Jensen described as "an automatic internal monitoring-and-control system." That is, if problems were developing, top management would be forced by the pressure of the debt service to intervene quickly and decisively. By contrast, in a largely equity-financed company, management could allow much of the equity cushion to be eaten away before taking the necessary corrective action.

The crux of Jensen's argument, then, is that debt serves as a control mechanism to focus the efforts of managers and owners on increasing efficiency and value. But if this model was appropriate for mature companies with stable lines of business, it was not likely to work for companies requiring significant capital investment or in early stages of development, such as firms backed by venture capital. Nonetheless, venture capital is predicated on much the same concentrated ownership structure as PE buyouts, only for the most part without leverage (though as we will see below, some new forms of VC debt have emerged in recent years).

Viewed within the context of the pecking-order theory, the information gap between managers and shareholders that increases the costs of public companies operating with outside equity is effectively closed by the concentration of ownership and board participation of PE buyout (as well as VC) sponsors. And the potential information gap between lenders and managers in public companies could also be reduced by PE sponsors' greater interaction and pressure to remain on good terms with their bankers and other debt providers. Thanks to their more frequent dealings, greater two-way flow of information, and stronger relations with banks, the most reputable PE sponsors, as studies have reported, have been able to get better lending terms.[15] And to the extent the expected costs of financial distress are significantly lower for PE-backed companies—an argument we present more evidence for below—the classic trade-off theory would also predict much higher optimal levels of debt.

Agency Conflicts within PE: the GP-LP Relationship

But all this begs the question: What other information or agency problems could a private ownership structure create that are not present in a public ownership model? After all, although there are no public shareholders in the PE model, there are LPs who depend on fair treatment by GPs for their net returns in much the same fashion as shareholders depend on managers and boards. Hence there would appear to be similar potential for self-dealing and other abuses.

In a number of important respects, then, the principle-agent relationship between private equity GPs and LPs adds a layer of complexity and friction that could be important for understanding optimal capital structure in PE buyouts. The potential agency conflicts in question arise from the delegated asset management typical in PE fund structures, and the contracts that are designed to manage such conflicts.

As one example, a GP's limited liability and the option-like carried-interest provisions could provide GPs with incentives to invest in even overpriced and overleveraged deals. Recognizing these incentives, LPs presumably choose to invest with GPs that they feel are best suited to meet their investment goals. LPs also sometimes negotiate partnership agreement terms that are deemed to better align the GP's interests with those of the LP.

As another example, fund-level debt could benefit the GP in ways that provide no benefit to, and even additional costs

13 Michael Jensen, (1989), "Eclipse of the Public Corporation," *Harvard Business Review*, 67(5), 61-74.

14 Jensen, "Active Investors, LBOs, and the Privatization of Bankruptcy," cited earlier.

15 The theoretical framework provided by Malenko and Malenko (2015) highlights the impact of reputation in securing capital.

for, the LP. For example, many LPs are not taxable entities and thus derive no benefit from any sort of tax shield provided by borrowing at the fund level. In addition, many LPs have the ability to adjust their own effective fund leverage through their own borrowing (or lending), presumably at a lower cost.

But to come back to the possibility just mentioned, the agency conflict, or imperfect alignment of interests and incentives, between LPs and GPs could result in a predictable pattern of "procyclical" LBO leverage that takes the form of too many overpriced and overleveraged deals in robust economies and loose credit conditions—and to excessive cutbacks in prices, leverage, and LP commitments under recessionary conditions.[16] The excessive retrenchment of capital in such cases is attributable to the agency conflict—the temptation of GPs, when provided excessive capital, to invest even in bad deals. And the net effect of this GP-LP conflict is a predictable scarcity of LP and hence PE investment during economic downturns. The most visible sign of this conflict of incentives is a predictable plummeting of late-cycle returns stemming from the excess of overpriced deals transacted by GPs during boom times.

And like the conflict of incentives in the relationship between GPs and LPs, a similar agency problem is likely to complicate the relationship between banks (lenders) and GPs. During boom periods, the risk of overpriced deals is borne disproportionately by the banks with their fixed claims. This misalignment of interests and outcomes also contributes to the cyclicality of LBO leverage—tending to excess in good times, and too little in bad.

The Evidence on Debt and Leverage in LBO Transactions

We now summarize the findings of studies that bear on several fundamental questions about leverage in buyout transactions. Although we focus mostly on past empirical work, in the last portion of our discussion we supplement these findings with ongoing analysis using a new dataset on *individual portfolio companies*.

Why Is the Leveraged Buyout Market So Cyclical?

We start with one of the most basic questions about private equity and associated credit markets: What drives the historically pronounced cyclical behavior of LBOs? As the literature has expanded, several explanations for the procyclical pattern in LBO leverage levels have emerged. Chief among them are market timing, GP-LP agency conflicts, agency problems between banks and PE investors, fluctuations in aggregate risk premia, and the growing use of subscription lines of credit.

A number of studies have provided evidence that GP-LP agency conflicts play an important role in the procyclical pattern seen in LBO leverage levels. Specifically, the leverage of LBOs responds more to relaxations or contractions of credit market conditions than that of other companies. Since LBO leverage is procyclical, leverage peaks when debt is cheap during "hot" credit markets. In contrast, public companies generally respond to the same market conditions by reducing their *market* leverage and thus exhibiting a "countercyclical" leverage pattern. Pro-cyclical PE investment patterns and countercyclical investment performance have also been documented in venture capital as well as buyouts.[17]

Studies have also confirmed the ability of PE investors to time their debt market issuance in order to "arbitrage" the conditions between debt and equity markets by increasing the leverage of deals in response to cheap credit—and documented the significant contribution of such market timing to the pro-cyclical pattern of buyout activity. A study published in 2010 finds that the more reputable PE firms are less likely to participate in LBO transactions when credit risk spreads are narrow and lending standards relaxed.[18] A 2012 study finds that LBOs have higher leverage when debt market liquidity is high and credit and leveraged loan spreads are low.[19] And a 2019 study comparing PE to strategic buyers concludes that periods of overvalued credit markets lead to increases in the leverage of PE funds and the price-to-earnings ratios paid by strategic buyers.[20] None of these studies, however, finds that hot credit markets are associated with better PE fund performance.

Banks have a unique position as credit experts, providers of access to capital markets investors, and advisors on transac-

16 These and similar results are predicted by theoretical frameworks, including those formulated by Ulf Axelson, Tim Jenkinson, Per Strömberg, and Michael S. Weisbach, (2013), "Borrow Cheap, Buy High? The Determinants of Leverage and Pricing in Buyouts," *Journal of Finance*, 68(6), 2223-2267; and Alexander Ljungqvist, Matthew P. Richardson, and Daniel Wolfenzon, (2019), "The Investment Behavior of Buyout Funds: Theory and Evidence," *Financial Management*, 49(1), 3-32.

17 See Paul Gompers, Josh Lerner, Anna Kovner, and Daniel Scharfstein, 2008, "Venture Capital Investment Cycles: The Impact of Public Markets," *Journal of Financial Economics*, 87, 1-23; and Steven N. Kaplan, and Jeremy C Stein, (1993), "The Evolution of Buyout Pricing and Financial Structure in the 1980s," *Quarterly Journal of Economics* 108 (2): 313-357. Axelson, Jenkinson, Strömberg, and Weisbach (2013) find that debt market conditions predict LBO leverage. Ljungqvist, Richardson, and Wolfenzon (2019) find that PE funds accelerate their investment flows and earn higher returns when investment opportunities improve, competition for deal flow eases, and credit market conditions loosen.

18 Cem Demiroglu and Christopher M. James (2010), "The Role of Private Equity Group Reputation in LBO Financing," *Journal of Financial Economics*, 96(2), 306-330.

19 Wouter De Maeseneire and Samantha Brinkhuis, (2012), "What Drives Leverage in Leveraged Buyouts? An Analysis of European Leveraged Buyouts' Capital Structure," *Accounting & Finance*, 52, 155-182.

20 Marc Martos-Vila, Matthew Rhodes-Kropf, and Jarrad Harford, (2019), "Financial vs. Strategic Buyers," *Journal of Financial and Quantitative Analysis*, 54(6). 2635-2661.

tions. Additionally, banks are compensated on a transaction basis instead of on an hourly or "when value is created" basis. To the extent such banks are in a better position to observe deal prospects than the market as a whole, they are likely to allocate capital and services in a more pro-cyclical manner than other participants and so exacerbate PE credit cycles.

Since the mid-1980s, syndicated loans have been the primary structure for debt financing in PE deals. While these loans originate in a bank, a syndicate of lenders acts as the funders and the originating bank owns only a portion of the loan. A 2013 study[21] of syndicated lending in PE deals investigates the market-timing distortions that might be attributed to it.[22] In addition to the effects on cyclicality, the authors of this study find that banks are no better equity investors than other LPs. When compared to stand-alone, or "parent-financed" deals, bank-affiliated deals had worse financing terms for the borrowers and worse *ex post* outcomes—notably, more debt downgrades and fewer upgrades. At the same time, although parent-financed deals provided significantly better financing terms for borrowers, they failed to exhibit better *ex ante* credit characteristics or deliver better *ex post* outcomes.[23]

As the authors of this study also discuss, this relationship and the involvement of banks in private equity has sparked substantial debate, including the inclusion of the Volcker Rule in the U.S. Dodd-Frank Act of 2010.[24] Furthermore, parent-financing deals pose an additional market risk. Banks, which occupy a unique position as debt market intermediaries, are able to "originate and distribute the debt from their own risky deals during the peak of the market, thereby amplifying the cyclicality of investments and the credit market."[25]

Other studies have demonstrated effects of macroeconomic conditions on LBO leverage levels, as well as investors' demand for a higher liquidity premium during bust periods.[26] As one example, a 2017 study[27] that focuses on the effects of the risk premium finds that 30% of the total variation in PE buyout activity can be attributed to changes in the aggregate equity risk premium while only 10% can be attributed specifically to credit market conditions.[28] In addition, the authors note a number of firm-level differences, including the following: "(1) firms with high market beta or high idiosyncratic volatility (a higher cost of capital and greater illiquidity costs) are less likely to be targets and there are even fewer high-beta firms when the risk premium is high; (2) firms with poor corporate governance and in less competitive industries are more sensitive to changes in the risk premium; (3) more liquid industries (easier for acquirers to exit) are less sensitive to movements in the risk premium.

How Have Buyouts Performed, and How Has Leverage Affected Risk?

The most common way to measure the performance of buyouts in academic studies is to compare the returns of PE investments to comparable public market returns. Most analysis of buyout funds has been conducted at the fund level. For example, a 2016 study by L'Her et al.[29] found that PE buyout funds outperform public equities before making any adjustments for differences in risk, but that such outperformance becomes insignificant after adjusting the benchmark for the systematic risks of buyout portfolio companies.

But in a more recent comprehensive study of buyout fund returns, Steve Kaplan and one of the present authors found that PE returns have exceeded a wide range of public market indexes on average over a variety of horizons and using a number of benchmarks.[30] Reinforcing that finding, another 2019 study undertook an extensive review of risk and return estimates for buyout funds and concluded that, although estimates vary substantially by method, time period, and data source, the most recent and comprehensive studies appear to be converging on PE fund risk estimates that are slightly higher than public markets (beta of around 1.3), and historical risk-adjusted outperformance of around 3% per year.[31]

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21 Lily H. Fang, Victoria Ivashina, and Josh Lerner, (2013), "Combining Banking with Private Equity Investing," *Review of Financial Studies*, 26(9), 2139-2173.

22 Shleifer and Vishny (2010) find that during credit market booms, banks will fund more risky projects when debt securities are mispriced by outside investors and banks hold only a portion of the loan as they receive loan origination fees. This increases the cyclicality of the credit market.

23 "The superior nonpricing terms of parent-financed deals are concentrated entirely in credit market peaks when banks retain the least of the loans, which suggests that the superior financing terms result from favorable credit supply conditions. They also find that bank involvement in private equity—especially their role as lenders—generates significant cross-selling opportunities for banks, which enables them to capture more future revenues (while their risk exposures can be syndicated out)." See Fang, Ivashina, and Lerner (2013), p. 2144.

24 The basis for the Volcker rule is the belief that "equity investments by banks could reflect bank managers' incentives to grow revenues and maximize volatility, which can create systemic risks. Such incentives might arise because banks' own equity values increase with volatility, and large banks enjoy implicit bail-out guarantees". See Fang, Ivashina, and Lerner (2013), p. 2140.

25 Fang, Ivashina, and Lerner (2013), p. 2141.

26 See Francesco Franzoni, Eric Nowak, and Ludovic Phalippou, (2012), "Private Equity Performance and Liquidity Risk," *Journal of Finance*, 67(6), 2341-2373; and Valentin Haddad, Erik Loualiche, and Matthew Plosser, (2017), "Buyout Activity: The Impact of Aggregate Discount Rates," *The Journal of Finance*, 72(1), 371-414.

27 Haddad, Loualiche, and Plosser (2017). https://www.nber.org/system/files/working_papers/w22414/w22414.pdf.

28 Buyout activity is negatively related to the market-wide risk premium after controlling for credit market conditions.

29 Jean-Francois L'Her, Rossitsa Stoyanova, Kathryn Shaw, William Scott, and Charissa Lai, (2016), "A Bottom-Up Approach to the Risk-Adjusted Performance of the Buyout Fund Market," *Financial Analysts Journal*, 72(4), 36-48.

30 Gregory W. Brown and Steven N. Kaplan, (2019), "Have Private Equity Returns Really Declined?" *The Journal of Private Equity*, 22(4), 11-18. See also Robert Harris, Steven N. Kaplan and Tim Jenkinson, (2014), "What Do We Know about Private Equity Performance?" *Journal of Finance*, 69(5).

31 Arthur Korteweg, (2019), "Risk Adjustment in Private Equity Returns," *Annual*

What's more, as Will Goetzmann and colleagues[32] argued in a recent study, PE funds also appear to provide diversification benefits to LPs in the form of "priced risk factors" in illiquid markets that are only partly spanned by public factors.[33] By providing exposures somewhat different from those of public markets, PE markets are effectively providing investors with an additional source of "factor risk premia" and hence value-adding diversification.

While the fund-level analysis discussed above suggests that funds in aggregate generate superior risk-adjusted returns, it is difficult to accurately characterize risk in private investments. For example, one recent study[34] disputes the widespread belief that PE investments have higher volatility than public equity due to higher leverage. The study's results suggest that the volatility of private equity returns is not detectably higher than that of public equity, despite its higher leverage. The authors argue that buyout fund managers prefer to invest in companies whose underlying business activities are inherently less risky and can therefore bear higher leverage, which increases profits without the commensurate expected increase in overall volatility.

Another study[35] provides evidence of a negative relationship between deal leverage and return that is attributed to heightened competition among bidders during periods of easy credit. As an equilibrium outcome of the deal process, good credit market conditions are related to both larger amounts of debt and higher transaction prices. But the higher price translates to a lower deal return upon exiting, an effect that is especially notable for less reputable funds with poor interim performance.[36]

As noted earlier, hot credit markets can lead to high leverage, which could lead to higher default rates.[37] But it is hard to discern this relationship in the data, where estimates of the effects of leverage on the probability and cost of distress vary widely, especially between PE-backed private companies and public companies. For example, a 2010 study by the Private Equity Council concluded that PE-backed firms had a default rate of 2.8%, as compared to a rate of 6.2% for similar public companies during the 2008-2009 recession.[38] Another study published in the same year,[39] after examining over 2,000 public and private companies that obtained leveraged loan financing between 1997 and 2010, reported that PE-backed firms were no more likely to default than similar public companies with comparable leverage, and showed themselves better able to deal with financial distress. In the words of the authors, "When private equity-backed firms do become financially distressed, they are more likely to restructure out of court, take less time to complete a restructuring, and are more likely to survive as an independent going concern than financially distressed peers not backed by a private equity investor." As if to anticipate these findings, a study done 12 years earlier estimated the distress costs of a set of LBOs that entered bankruptcy in the 1990s. When the authors combined their estimates of 10%-20% of total enterprise values with (ex post unconditional) probabilities of bankruptcy for buyouts of around 5%, the expected financial distress costs for LBOs ended up averaging as low as 0.5% to 1% of firm value.[40]

Viewed together, the findings of these studies suggest that PE has a comparative advantage in managing high leverage—one that effectively enables PE-backed firms to take on higher levels of debt without incurring commensurate levels of financial risk that would otherwise reduce their values. Nevertheless, in a sign that public companies can also learn

Review of Financial Economics, 11, 131-152.

32 William N. Goetzmann, Elise Gourier, and Ludovic Phalippou, (2018), "How Alternative Are Private Markets?" SSRN Working Paper 3227020. https://doi.org/10.2139/ssrn.3227020.

33 Goetzmann et al. (2018) provide an eight-factor model that captures 57.2% of the total variance of private market returns. The eight factors are: all European private funds (except those focusing on Venture Capital), non-small (i.e., largest three quartiles) Venture Capital funds, U.S. non-small Real Estate funds, U.S. non-small Distressed Debt funds, energy (oil & oas) funds, funds with a low-risk profile, and the other two factors cannot be easily characterized. Four of their eight private factors are relatively well spanned by a five-factor model that includes the U.S. market equity factor, the size factor [SMB] of Eugene Fama and Ken French, (2015), "Five-Factor Asset Pricing Model," *Journal of Financial Economics*, 116(1), 1-22; the alternative value factor [HMLd] of Clifford S. Asness, Andrea Frazzini, (2013), "The Devil in HML's Details," *The Journal of Portfolio Management*, Volume 39, Number 4, the quality of earnings factor [QMJ] of Clifford S. Asness, Andrea Frazzini, and Lasse H. Pedersen, (2018), "Quality Minus Junk," *Review of Accounting Studies*, 24, 1-79; and the low-beta factor [BAB] of Andrea Frazzini and Lasse Heje Pedersen, (2014), "Betting Against Beta," *Journal of Financial Economics*, 111(1), 1-25.

34 Megan Czasonis, William B. Kinlaw, Mark Kritzman, and David Turkington, (2020), "Private Equity and the Leverage Myth," SSRN *Working Paper* 3540545.

35 Reiner Braun, Nicholas G. Crain, and Anna Gerl, (2017), "The Levered Returns of Leveraged Buyouts: The Impact of Competition," SSRN *Working Paper* 2667870.

36 See Marc Martos-Vila, Matthew Rhodes-Kropf, and Jarrad Harford, (2019), "Financial vs. Strategic Buyers," *Journal of Financial and Quantitative Analysis*, 54(6). 2635-2661; who find that as competition increases among PE funds, gains captured from the overvalued debt market may be captured by the target firms, and thus PE funds may experience lower returns. Two theoretical rationales, the co-insurance effect and the monitoring effect explain this behavior. The co-insurance effect derives from the fact that "strategic buyers are less able than financial buyers to exploit investors' misperceptions because strategic buyer combines projects and the valuation mistake partially offset each other." The monitoring effect derives from the fact that "overvaluation increases the moral hazard problem and enhances the importance of better governance to eliminate misbehavior, which are the strength of PE funds."

37 For supporting evidence, see Steven N. Kaplan, and Jeremy C. Stein, (1993), "The Evolution of Buyout Pricing and Financial Structure in the 1980s," *Quarterly Journal of Economics,* 108(2), 313-357; and Ulf Axelson, Tim Jenkinson, Per Strömberg, and Michael S. Weisbach, (2013), "Borrow Cheap, Buy High? The Determinants of Leverage and Pricing in Buyouts," *Journal of Finance*, 68(6), 2223-2267.

38 See Private Equity Council (2010).

39 Edie Hotchkiss, David C. Smith, and Per Strömberg, (2010), "Private Equity and the Resolution of Financial Distress," NBER Chapters, in *Market Institutions and Financial Market Risk, National Bureau of Economic Research, Inc*.

40 Gregor Andrade and Steven N. Kaplan, (1998), "How Costly is Financial (Not Economic) Distress? Evidence from Highly Leveraged Transactions That Become Distressed," *Journal of Finance,* 53, 1443-1493.

to use high leverage to their advantage (as Jensen suggested they would), Steve Kaplan and Jeremy Stein's 1993 study of large leveraged recaps of public companies in the late '80s provides evidence of management's ability to handle their debt loads by reducing their operating as well as financial risks.[41]

How Do PE Firms Add Value Through Leverage?

As discussed earlier, the potential gains from higher leverage are likely to come through several channels, but can be related back to a fundamental trade-off between the benefits coming from the tax shield and more efficient operations and the costs associated with a higher probability of financial distress. A 2011 study[42] finds that the estimated tax savings associated with the debt in public-to-private LBOs are positively related to acquisition premiums, but the fact that such premiums are roughly twice the size of the tax savings implies that the tax savings from increasing financial leverage effectively accrue to the selling public shareholders rather than the PE fund sponsoring the LBO.[43] On the other hand, a 2014[44] analysis of the confidential corporate tax returns in 317 public-to-private LBOs find more room for value creation from the debt tax shield. Specifically, the authors document that debt levels remain high for several years after acquisitions and that EBITDA growth makes the value of the tax shield more durable than assumed in other analyses. On the other hand, a recent study[45] of the corporate taxes and leverage of a large sample of U.S. public and private companies actually finds a negative relation between tax rates and leverage, which suggests that the tax shield is not a primary driver of leverage decisions.[46]

Public companies are acutely aware of the effects of financial distress and the importance of maintaining financial flexibility. For PE-backed companies, however, the PE sponsors' access to credit effectively works to "relax the financial constraints of portfolio companies."[47] And along with the strong ties between GPs and the banking industry that give PE investors preferred access to credit, their capital commitments by LPs with long-term holding periods provide PE investors with another source of capital during economic downturns. And as we mentioned earlier, buyouts sponsored by more reputable PEs with strong track records are less likely to experience financial distress during their operating lives.

Leverage trade-offs have been studied in other asset classes as well. For example, a 2011 study of the optimal fund-level leverage in real estate finds that the advantages include tax shield, ability to purchase more properties, liquidity and flexibility, and increase in return on invested equity.[48] Among the drawbacks of such fund-level leverage is loss of the benefits of the investor's bond exposure and incurring double transaction costs in the bond market, interest rate volatility risk, additional fees and management alignment difficulties, and high cost of distress.

In his 1989 *Harvard Business Review* article cited earlier, Jensen proclaimed the superiority of the corporate governance structure of PE-owned firms over that of public companies. Jensen argued that together "with active boards, high-powered management compensation, and concentrated ownership," the leverage component plays a critical role in the success of PE buyouts, first by making possible the concentration of equity ownership, and then by exerting pressure on management to operate more efficiently and pay out excess capital.

In support of Jensen's argument, a growing literature has investigated the effects of private equity ownership on firm productivity, product quality, employment, and related dimensions; and during normal times, these studies have found substantial positive effects on the operations of the firms in which they invest.[49] In addition to direct value creation,

41 Steven N. Kaplan and Jeremy C Stein, (1993), "The Evolution of Buyout Pricing and Financial Structure in the 1980s," *Quarterly Journal of Economics,* 108 (2): 313-357.

42 Tim Jenkinson and Rüdiger Stucke, (2011), "Who Benefits from the Leverage in LBOs?" SSRN Working Paper 1777266.

43 A result that is confirmed empirically by Braun, Crain, and Gerl (2017).

44 Jonathan B. Cohn, Lillian F. Mills, and Erin M. Towery (2014), "The Evolution of Capital Structure and Operating Performance after Leveraged Buyouts: Evidence from U.S. Corporate Tax Returns," *Journal of Financial Economics*, 111, 469-494.

45 Ivan Ivanov, Luke Pettit, and Toni M. Whited, "Taxes Depress Corporate Borrowing: Evidence from Private Firms," (September 18, 2020). Available at SSRN: https://ssrn.com/abstract=3694869 or http://dx.doi.org/10.2139/ssrn.3694869.

46 The effect is stronger for private companies. The authors show that the value benefits from a decline in credit spreads associated with lower taxes more than offset the decline in value of the tax shield. Consequently, lower taxes incentivize higher debt levels.

47 During the financial crisis, PE-backed companies decreased investments less than non-PE-backed companies. PE-backed companies have been less bound by financial constraints: higher debt issuance and equity issuance, a relative decrease in the cost of debt, greater growth in their stock of assets in the years after the crisis, increased their market share in the industry during the crisis, more likely to be sold through nondistressed merger and acquisition (M&A) transactions. See Shai Bernstein, Josh Lerner, and Filippo Mezzanotti, (2019), "Private Equity and Financial Fragility during the Crisis," *Review of Financial Studies*, 32(4), 1309-1373.

48 Maarten van der Spek, and Chris Hoorenman, (2011), "Leverage: Please Use Responsibly," *Journal of Real Estate Portfolio Management,* 17(2), 75-88.

49 See Greg Brown, Robert Harris, Tim Jenkinson, Steve Kaplan, and David Robinson, (2020a), "Private Equity: Accomplishments and Challenges" *Journal of Applied Corporate Finance*, 32(3). Examples include Shai Bernstein and Albert Sheen, (2016), "The Operational Consequences of Private Equity Buyouts: Evidence from the Restaurant Industry," *Review of Financial Studies*, 29, 2387-418; Shai Bernstein, Josh Lerner, Morten Sorensen, and Per Strömberg, (2016), "Private Equity and Industry Performance," *Management Science*, 63(4), 1198-213; Quentin Boucly, David Sraer, and David Thesmar, (2011), "Growth LBOs," *Journal of Financial Economics* 102, 432-453; Steven J. Davis, John Haltiwanger, Kyle Handley, Ron Jarmin, Josh Lerner, Javier Miranda, (2014), "Private Equity, Jobs, and Productivity," *American Economic Review*, 104(12), 3956-3990; Kose John, Larry Lang, and Jeffrey Netter, (1992), "The Voluntary Restructuring of Large Firms in Response to Performance Decline," *Journal of Finance* 47, 891-917; Steven Kaplan, S. (1989), "The effects of Management Buyouts on Operating Performance and Value," *Journal of Financial Economics*, 24(2), 217-254; Frank R. Lichtenberg and Donald Siegel, (1990), "The Effects of Leveraged Buyouts on

the anticipation of these improvements by itself allows for higher leverage at the time of the buyout, which in turn generates value from the debt tax shield. And consistent with this argument, a 2011 study has demonstrated a clear link between post-buyout performance and the level of bank financing.[50]

What Do Studies Tell Us About Collateralized Loan Obligations, Direct Lending, and Venture Debt?

Thus far we have focused on evidence from the perspective of the portfolio company, GP, or LP—that is, essentially from the borrower's perspective. Of course, for every borrower there is a lender, and a body of studies has examined the effects of such borrowing on the efficiency of debt markets that provide capital to the private equity industry.

After the global financial crisis, for example, several studies examined the market for collateralized loan obligations (CLOs), which are effectively collateralized debt obligations backed by corporate debt. A 2012 study[51] provides evidence that adverse selection is not, as many observers have assumed (because originators are not keeping the loans they originate), an inevitable consequence of the securitization of corporate loans.[52] The authors find no consistent evidence that securitized corporate loans are riskier than similar non-securitized loans, neither during the 2005-2007 period lead-up to the financial crisis nor for the subset of loans purchased by the CLO from its underwriters.[53] The authors argue that the larger loan size and the syndication process itself make corporate loans less vulnerable to adverse selection than the securitized mortgages to which they are regularly compared. Corporate loans, at origination, are funded by a group of banks and institutional investors whose concern about their reputations lead them to screen the quality of such loans.[54]

Productivity and Related Aspects of Firm Behavior," *Journal of Financial Economics*, 27(1), 165-194; and Erik Stafford, (2017), "Replicating Private Equity with Value Investing, Homemade Leverage, and Hold-to-Maturity Accounting," SSRN Working Paper 2720479.

50 Shourun Guo, Edie S. Hotchkiss, and Weihong Song, (2011), "Do Buyouts (Still) Create Value?" *Journal of Finance*, 66(2), 479-517.

51 Effi Benmelech, Jennifer Dlugosz, and Victoria Ivashina, (2012), "Securitization without Adverse Selection: The Case of CLOs," *Journal of Financial Economics*, 106(1), 91-113. https://doi.org/10.1016/j.jfineco.2012.05.006.

52 Several studies provide evidence that securitization resulted in lower lending standards, which led to adverse selection in the collateral pools underlying these products. See Benmelch et al. (2012) and Benjamin J. Keys, Tanmoy Mukherjee, Amit Seru, and Vikrant Vig, (2010), "Did Securitization Lead to Lax Screening? Evidence from Subprime Loans," *Quarterly Journal of Economics*, 125, 307-362.

53 Fundamental agency tensions can plague this subset. The CLO underwriter is typically a bank and is responsible for loan screening and interacting with the rating agencies. However, these underwriting banks "may use this channel to sell fractions of their own riskier loans to CLOs" (Benmelch et al. (2012).

54 "Fractions of the same underlying loan are simultaneously held by multiple CLOs as well as by other institutional investors and banks. In addition, the bank that originated the loan (the lead bank) typically retains a fraction of the loan on its balance sheet and each underlying loan is rated" (Benmelch et al. (2012). These all provide incentives of the investors for better screening process and risk retention by the originator.

Loan covenants also play a role in allocating control rights between PE-backed issuers and their investors. A 2016 study[55] investigates the possible negative effects of the rising number of covenant-light (cov-lite) leveraged loans, including the higher costs of resolving financial distress stemming from higher coordination costs borne by dispersed lender groups. Contrary to what their name might suggest, cov-lite loans do not have fewer covenants, but weaker enforcement mechanisms, which has at least the potential to make them riskier.

The increasing use of cov-lite loans is especially relevant for leveraged loans, since they are widely syndicated to a diverse group of institutional investors.[56] With the bulk of leveraged loans funded by CLOs, loan mutual funds, hedge funds, securities firms, insurance companies. and pension funds, any renegotiation triggered by financial covenants requires multiple-party coordination. But contradicting the widespread view that the rising use of cov-lite loans reflects the demands of the borrowing companies, the authors present evidence that as cov-lite volumes have expanded, the yields on cov-lite loans—and thus the effective cost of cov-lite financing for issuers—have actually fallen over time, reflecting increases in investor demand.[57]

Recently, academic interest has expanded to direct lending by nonbank creditors. In a 2018 study[58] that provided a first look at the risks and returns of private credit funds, the authors found positive returns for the top three quartiles in terms of IRR and excess returns relative to leveraged-loan, high-yield and BDC indexes. Direct lending funds, which undertake a "bilateral" origination of a loan between a single borrower and a small group of lenders, are shown to have a relatively low beta and positive alpha compared to the leveraged loan and high-yield indices, which is viewed as evidence of diversification benefits relative to other credit strategies.

A 2019 study[59] examined the effect of changes in bank regulatory capital positions on the entry of nonbank lenders. The study showed that undercapitalized banks were especially likely to remove loans with higher capital requirements from their balance sheets when bank capital is scarce, and that a significant portion of these loans was reallocated to

55 Bo Becker and Victoria Ivashina, (2016), "Covenant-Light Contracts and Creditor Coordination." https://www.hbs.edu/faculty/pages/item.aspx?num=50952.

56 Traditional lenders like banks and finance companies account for about 10%-15% of loan origination.

57 If the rising of cov-lite loans is driven by demand shock from the borrowers, the price would be expected to rise.

58 Shawn Munday, Wendy Hu, Tobias True, and Jian Zhang, (2018), "Performance of Private Credit Funds: A first look," *The Journal of Alternative Investments*, 21(2), 31-51.

59 Rustom M. Irani, Rajkamal Iyer, Ralf R. Meisenzahl, and Jose-Luis Peydro, (2020), "The Rise of Shadow Banking: Evidence from Capital Regulation," SSRN Working Paper 3166219.

nonbanks. Such credit reallocation was viewed as a capital market response to the negative impacts of the 2008 crisis, when loans funded by nonbanks experienced both a sizable reduction in credit availability and greater price volatility in the secondary market.

Another 2019 study[60] looked at the post-crisis lending of non-bank financial institutions, including finance companies (FCOs), private equity/venture capital (PE/VC) firms, hedge funds, bank-affiliated finance companies (bank FCOs), investment banks, insurance companies, business development companies (BDCs), and investment managers. While most studies examine a syndicate led by a commercial bank, this study focused on the direct negotiation process between non-bank financial institutions and borrowers. Based on a randomly collected sample of publicly traded middle-market firms during the post-crisis period (2010-2015), the authors find that non-bank lending was widespread—accounting for almost a third of the market—and that these institutions fund less profitable, more leveraged, and more risky and volatile firms. In particular, the study showed that PE (including venture capital) firms were especially likely to lend to faster growing, R&D-intensive firms.

What's more, to address the agency problem between the borrowers and lenders, non-bank lenders are less likely to monitor borrowers by including financial covenants, but more likely to align incentives using warrants and engage in more intensive ex-ante screening. The authors also find that nonbank loans have 1.9% higher interest rates, but that the difference between bank and non-bank loans are due to the market segmentation and differences in funding costs rather than difference in loan risks.

Yet another 2019 study[61] examines the growth in direct lending during the period 2003-2016, and the potential extent of adverse selection costs. The analysis documents how institutional investors have aggressively entered the market, accounting for about 80% of the direct loan volume in 2016. Direct lending tends to become more active when banks face tighter capital and regulatory constraints, and is more prevalent among borrowers with limited credit history. But even so, the study finds direct loans to be of similar credit quality to bank-originated loans. In addition, and more tellingly, direct loans issued by PE or investment management firms exhibit significantly better performance than other institutional loans.

Increasingly, young firms backed by venture capital are entering debt markets as a source of external capital. Because such firms are unlikely to possess tangible assets and positive cash flows, it is difficult for them to secure traditional bank lending. To fill the gap, so-called "venture debt" has become increasingly popular as start-up financing intended to "extend the runway" between venture rounds and reduce equity dilution.

A 2016 study[62] of venture debt financing that conducted a "discrete choice" experiment using 55 senior U.S. venture debt lenders concluded that (1) patents are as important as tangible assets as collateral to lenders; (2) venture debt lenders show a preference for start-ups that offer warrants that can help overcome the agency problems; and (3) VC backing can substitute for positive cash flow, but only for early-stage ventures. In addition, a 2018 study[63] also finds that venture debt can create firm value by reducing dilution, aligning the entrepreneur's incentives with the firm's, and inducing entrepreneur's risk-taking behavior.

New Evidence on Buyout Leverage (and Performance) at the Deal Level

As part of our ongoing research, we analyzed a new proprietary dataset that has leverage information for individual buyout deals provided by the StepStone Group. Our sample consisted of 6,248 buyout transactions from the period 1984 through 2020 with sufficient performance and financial accounting data for our analysis. Although this is only a subset of total transactions, they are among the largest and together represent about $1.3 trillion in combined equity investments and about 4.5 trillion in total enterprise value (TEV). By our estimates, these transactions cover about half of the value of all (global) historical buyouts with PE fund sponsors. As one would expect, most deals in the first half of the sample are fully exited, but as we move closer to the present, an increasing proportion are not fully exited. We now summarize the main results of the analysis (and refer the reader to the white paper for a more thorough presentation of the methods and results).[64]

The typical PE deal in our sample was held for 4.6 years and part of a fund with an average size of about $2.6 billion, though there is of course a wide range of fund sizes. Although the mean deal's TEV is $718 million, the median

60 Sergey Chernenko, Isil Erel, and Robert Prilmeier, (2019), "Nonbank Lending," National Bureau of Economic Research Working Paper, no. 26458. https://doi.org/10.3386/w26458.

61 Maria Loumioti, (2019), "Direct Lending: The Determinants, Characteristics and Performance of Direct Loans," SSRN Working Paper 3450841.

62 Gaétan de Rassenfosse and Timo Fischer, (2016), "Venture Debt Financing: Determinants of The Lending Decision," *Strategic Entrepreneurship Journal*, 10(3), 235-256.

63 Jesse Davis, Adair Morse, and Xinxin Wang, (2018), "The Leveraging of Silicon Valley: Venture Debt in the Innovation Economy," SSRN Working Paper 3222385.

64 The paper, "Debt and Leverage in Private Equity: A Survey of Existing Results and New Findings," can be downloaded from the Institute for Private Capital website.

TEV is only $195 million. Thus, as expected, the size of the deals is heavily skewed, with a relatively large number of small and mid-sized transactions, and a few much larger deals. Although deal size dropped during the global financial crisis of 2008-2009, it has grown significantly in the last decade to the point that by 2019 the median deal had returned to its previous peak reached in 2007. The mean entry EBITDA multiple paid by the PE sponsor was 10.8 times.

As measures of leverage, we use two metrics representing different ways of viewing capital structure at the deal level. One is a "flow" measure that can be used to assess debt-servicing capability, which is defined as entry Net Debt divided by entry EBITDA. The average leverage ratio was 4.2 times, with an interquartile range of 2.8 to 5.4. Over the life of a deal, the leverage ratio declined slightly for the typical firm, though more than a quarter of the firms experienced increasing leverage ratios.

The second measure of leverage is a "stock measure"—defined as entry Debt-to-TEV or (D/V)—which measures the fraction of total firm value financed with debt. The average D/V was 0.49, with an interquartile range of 0.37 to 0.62. D/V values tended to decline relatively more than the flow leverage ratios over the life of a deal—and rarely increased.

The large majority of firms increased in value while owned by PE firms, although such growth has proved very cyclical, with deals done in the 1997-2001 and 2006-2008 periods growing much less than average. Nevertheless, the growth in the TEV of buyouts has become much more pronounced since the GFC. Such TEV growth derives from two general sources: increases in operating performance and increases in valuation multiples. Annual growth rates in revenue and EBITDA, which both averaged about 12%, were considerably lower than the average TEV growth rate of 19%, which suggests that much of recent TEV growth is attributable to expanding valuation ratios as well as increased growth and profitability.[65] For the large majority of deals, we found that the EBITDA multiple not only increases, but that multiple expansion has reached a record high in recent years.

In sum, our findings show that PE buyouts in recent years have produced larger deals, and higher growth rates and enterprise values.

Our flow measures of leverage (Net Debt divided by EBITDA) at the deal level have exhibited considerable cyclicality, with values well above average during the years leading up to the GFC and then plummeting in 2008 and 2009. Nevertheless, by 2018, leverage ratios had returned to pre-GFC levels. Despite the cyclicality, there has generally been more variation within years than across years—and a wide range of values not only across industries, but even within every industry. What's more, regardless of deal year or industry, we find that leverage ratios decline on average during a deal's life; but there is a wide range of outcomes, and for more than a quarter of transactions, leverage ratios increase.

"For the large majority of deals, we found that the EBITDA multiple not only increases, but that multiple expansion has reached a record high in recent years."

But unlike leverage ratios based on EBITDA, we found that the average D/V ratio in PE buyouts declined sharply during the GFC and has not increased since then. During the financial crisis, moreover, the typical deal shifts from being financed with a majority of debt to a majority equity. And the average D/V ratio since 2015 has been lower than at any other time during our sample period. The average D/V ratio varies by industry, but the majority of transactions in recent years have been financed with 40% to 60% debt for all industries. And over the life of the deals, D/V declines significantly in the vast majority of cases.

In sum, the growth in leverage ratios and decline in D/V ratios post-GFC has been driven by a confluence of trends. First, higher expected revenue and profitability growth have attracted higher EBITDA multiples. Higher entry multiples, by definition, increase both the value of a transaction and the leverage ratio for a given level of debt. Nevertheless, a modest decline in D/V ratios post-GFC has tempered the increase in leverage ratios slightly. Realized high growth in EBITDA, combined with record multiple expansion, has resulted in more rapid declines in both the leverage ratio and D/V ratio over a typical deal's lifetime.

Buyout Performance Measured at the Portfolio Company Level

Measuring performance at the deal level is typically done on gross returns since fees and carry depend on the overall perfor-

65 See, for example, Figures 1.6 and 1.7 in Bain & Company's *Global Private Equity Report 2020*.

mance of a fund. A recent study using portfolio company data from Burgiss[66] shows that buyout deals are generally profitable in all time periods, across all industry sectors, and in all major geographies. Unfortunately, that study did not have detailed information on leverage.

When using the StepStone sample, we find similar, but somewhat stronger performance than in the Burgiss data. The median gross money multiple was 1.84 (as compared to 1.55 in the Burgiss data) with an interquartile range of 1.07 to 3.07. The median deal gross IRR was 21.0%, with an interquartile range of 4% to 43%. Median gross PMEs showed that deals typically outperformed public market returns, though the lowest quartile gross performance of buyout deals is generally inferior to market returns.

Gross deal-level performance has been quite cyclical, with high returns from deals closed in the mid-1990s, early 2000s, and post-GFC. Conversely, gross returns were relatively weak for deals closed in the late 1990s and leading up to the GFC. And when we examined deal returns by sector, we found remarkably consistent results, with surprisingly small differences across sectors. In almost all sectors, the vast majority of deals were profitable (before fees) on both an absolute and market-adjusted basis.

The StepStone data allowed us to look at the relationship between leverage and performance at the deal level. Summarized at a high level, the findings show that deals with high D/V ratios tend to be larger companies with lower EBITDA and TEV growth as well as lower operating margins than low D/V deals. In addition, high D/V deals have higher entry leverage ratios than low D/V deals, but over the life of the deal, high D/V deals experience significant drops in net debt outstanding accompanied by large declines in both D/V *and* leverage ratios. In contrast, low D/V deals experience substantial growth in net debt, no change in D/V ratios, and large increases in leverage ratios. Exit EBITDA multiples expand less in high D/V deals than in low D/V deals. In terms of deal performance, the top quartile of D/V deals generate much higher returns than the other three quartiles, though returns increase monotonically with D/V.

Like high D/V deals, deals with high leverage ratios are also larger and have lower TEV growth over the life of the deal. However, deals with high leverage ratios have higher operating margins and experience higher EBITDA growth. Perhaps the biggest contrast with high D/V deals is that the entry EBITDA multiples are much higher for deals with high leverage ratios than those with low leverage ratios. Over the life of the typical high leverage deal, net debt expands but both the leverage ratio and D/V contract. Upon exit, deals with high leverage ratios also experience weak multiple expansion and the variation in multiple expansion is much greater than for low leverage ratio deals—the opposite of what is observed for D/V.

Viewed together, our results suggest that deals with high leverage ratios are expected to grow revenues and profits to service the higher leverage. But in contrast to high D/V transactions, the performance of high leverage ratio deals is inferior to that of low leverage ratio deals. And regardless of the level of D/V, deals with high leverage ratios are larger, have higher entry EBITDA multiples, and less expansion in EBITDA multiples over the life of the deal. In contrast, there is a strong positive relation between D/V and performance regardless of the entry leverage ratio.

Overall, our findings echo the conclusions of others about the cyclicality of leverage found in other studies. Moreover, they show the deal performance is linked to the use of debt, but that such linkage depends on how leverage is measured relative to the cash flow and value of the underlying company.

Conclusions

Although private equity has grown dramatically as an asset class in the last few decades, there have been relatively few large-scale empirical studies of the role that leverage plays in buyouts—its effects on the risk, returns, incentives, and other basic characteristics of LBOs. In these pages, we provide an overview of the evolution of PE capital structures, the types of leverage used, the theories offered to explain capital structure choices, and the recent empirical studies that shed light on leverage in PE deals.

Buyout capital structures have evolved over time as the debt markets and PE firms have created and adopted new ways to attract debt capital. Debt enters into the PE buyout ecosystem in a variety of layers and structures. PE firms continue to use innovative capital structures, adding layers of debt at the fund and investor level on top of those at the portfolio company. Moreover, the forms and sources of debt vary, widely introducing an array of incentive and risk-sharing elements that are more complex than the simple, "stylized" view of leverage as borrowings that work to increase equity returns on an underlying asset with an exogenous set of operating returns and risks.

Leverage decisions in PE are shaped by many of the same forces and considerations that influence public companies. That said, a number of studies suggest that PE has a comparative advantage in managing high leverage and its potential

66 Gregory W. Brown, Robert S. Harris, Wendy Hu, Tim Jenkinson, Steven N. Kaplan, and David Robinson, (2020b), "Private Equity Portfolio Companies: A First Look at Burgiss Holdings Data," SSRN Working Paper 3532444.

costs—one that effectively enables PE-backed firms to take on higher levels of debt than comparable public companies. Leverage also plays a role in facilitating the concentrated ownership of firms (by a PE fund), which itself is expected to lead to better governance, and increases in the operating efficiency and value of the business. And consistent with this thinking, research continues to show PE buyouts providing net returns to LPs that exceed the returns to public market investors. But on the negative side, the structure of PE deals also continues to raise concerns about possible conflicts of interests and incentives between GPs and their LPs and creditors that may be managed only with partial success by PE's contractual arrangements.

The capital structure decisions in PE vary considerably across the cycle, with rises and falls in leverage with fluctuations in credit market conditions and PE investment and returns. A number of studies offer explanations of the highly cyclical nature of private equity activity, suggesting that institutional features combined with macroeconomic cycles are to some degree hardwired into the industry. Several explanations for the procyclical pattern in LBO leverage levels have emerged, including market timing, GP-LP agency conflicts, agency problems between banks and PE investors, fluctuations in aggregate risk premia, and the growing use of subscription lines of credit.

Finally, our exploration of individual buyouts using a new large dataset provides more evidence of PE outperformance. It also shows that the relationship between debt and performance depends on how leverage is measured. When debt is measured as a percentage of deal value, we find the expected positive relationship with average returns—consistent with a simple model of financial leverage generating a risk-return trade-off. But when leverage is measured as a multiple of EBITDA, we find only a weak negative relationship with performance. The data suggest that firms with high debt-to-value ratios are more likely to be mature "value" firms whereas firms with high leverage ratios tilt towards growth—and these differences explain the results related to performance.

Looking forward, there is of course much more to learn about the effects of PE leverage and capital structure choices. It is difficult to measure and characterize the risk of PE investments and how it is affected by leverage. In fact, even the choice of an appropriate measure of leverage—whether in relation to value or operating cash flow—is important for understanding the links between leverage and PE investments. The rich field for research is increasingly fueled by new innovations in financing as investors are exposed to risks stemming from debt of many forms and at many layers in PE structures. We look forward to considerable progress in our understanding of these issues as more comprehensive, including portfolio company, data become available to researchers.

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Appendix I: A Brief Summary of the Structural Variations and Uses of PE-Related Debt:

Management Company Debt: Debt issued or borrowed at the management company level backed by the partners' interest in the management company and/or personal guarantees. This can be either secured or unsecured and can be in the form of a loan or bond. Large global PEs (several of which are publicly listed) have borrowed in the form of term loans and issued bonds. The term loans have been senior secured first lien, typically with 7-year tenors. The bonds have been both secured and unsecured obligations with long-dated maturities (including 30 years). Most of these issuances have been investment grade rated with effective yields in the low single digits. Use of proceeds includes M&A, seed new business lines, fund dividends to partners, and general corporate purposes

Fund-Level Debt: Debt borrowed at the fund-level, backed by undrawn LP capital commitments and/or pledges of equity collateral of the underlying portfolio companies (HoldCo's and OpCo's).

- **Subscription Lines:** One common form of fund-level debt is typically referred to as a "wire line" facility or "subscription line." These instruments enable the borrower to use proceeds instead of LP capital to make early investments or pay fees and expenses. Typical features include:
  - limited as a percentage of the LPs' capital commitments (commitments from the most creditworthy LPs earn a 90% advance rate, and commitments from lesser credits earn lower advance rates or, in some cases, zero),
  - are secured by the LPs' capital commitments,
  - generally must be repaid in the early or middle part of the fund's life (unless extended), although terms are beginning to lengthen.

Because subscription lines are backed by either undrawn capital commitments or a pledge of underlying illiquid equity collateral, they do not lever funds in the sense of allowing funds to invest more than committed capital.

- **SBIC Loan:** SBA-guaranteed debt provided at the fund level to private capital funds that are designated participants in the SBIC program. Features include:
  - leverage at 2:1 debt/equity up to a cap of $175mm,
  - senior in right of repayment to all other LP & GP capital,
  - act as a form of low-cost incremental capital to invest in small businesses,
  - typically priced in the very low single digits.

SBIC loans effectively allow funds to invest more than LP committed capital at a specified 2:1 ratio up to a size constraint.

- **"Other" Fund-Level Debt**: There are a variety of other sources of debt that can provide incremental leverage at the fund level to meet borrowers' needs. Often these facilities are structured to meet fund investment needs that are constrained by the operating agreement or LPA. For example, a fund past its draw-down period may seek to invest incremental capital into a portfolio company to preserve or enhance value of the investment. The loan could be collateralized at a low LTV via a pledge of the underlying illiquid equity investments across the existing portfolio. The lender is effectively stepping in front of the LPs and GPs in right of repayment. These loans are typically priced in the mid-to-high teens or higher. Another example includes combination facilities that include characteristics of a subscription facility with a loan backed by portfolio company equity pledges.

Holding Company (HoldCo) Debt: Debt issued or borrowed at the holding company level that is structurally subordinate to all claims at the OpCo level. The debt is typically backed by a pledge of the equity collateral in the underlying portfolio company and guaranteed by relevant subsidiaries. Holding company debt is utilized to provide incremental leverage in a transaction when existing debt covenants preclude the addition of incremental debt at the operating company level. When viewed at the operating company level, all debt above the operating company is junior in all respects; effectively, ManagementCo/Fund-level/HoldCo debt behaves as if it were equity from the perspective of OpCo lenders. Pricing is typically in the very high single digits to double-digit range.

Operating Company (OpCo) Debt: Debt issued or borrowed at the operating company level. It can be structured as senior or junior, secured or unsecured, loan or bond, etc. What is typically recognized as the LBO debt in a leveraged buyout.

SPV Debt: Some operating companies will utilize SPV structures to finance their operations. These structures typically involve creating a SPV then transferring a specified set of collateral to the SPV, which is then borrowed against by the SPV. The OpCo makes a recurring "rent" payment to the SPV in exchange for use of the underlying collateral. The SPV structure is used to achieve more efficient forms of financing for the company in lieu of traditional OpCo financing structures. Examples include airlines, rental car companies, finance companies, etc.

Many of the specific channels for debt financing remain hard to study because of a lack of transparency, but a comprehensive knowledge of the landscape facilitates an understanding of how various stakeholders are impacted by leverage.

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The (Heterogenous) Economic Effects of Private Equity Buyouts

Steven J. Davis, John Haltiwanger, Kyle Handley, Ben Lipsius, Josh Lerner, and Javier Miranda[1]

8 July 2021

Abstract: The effects of private equity buyouts on employment, productivity, and job reallocation vary tremendously with macroeconomic and credit conditions, across private equity groups, and by type of buyout. We reach this conclusion by examining the most extensive database of U.S. buyouts ever compiled, encompassing thousands of buyout targets from 1980 to 2013 and millions of control firms. Employment shrinks 13% over two years after buyouts of publicly listed firms – on average, and relative to control firms – but expands 13% after buyouts of privately held firms. Post-buyout productivity gains at target firms are large on average and much larger yet for deals executed amidst tight credit conditions. A post-buyout tightening of credit conditions or slowing of GDP growth curtails employment growth and intra-firm job reallocation at target firms. We also show that buyout effects differ across the private equity groups that sponsor buyouts, and these differences persist over time at the group level. Rapid upscaling in deal flow at the group level brings lower employment growth at target firms.

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This paper develops evidence of a remarkable heterogeneity in the economic effects of private equity (PE) buyouts. Specifically, the effects on employment, job reallocation, and productivity differ markedly by type of buyout, with credit conditions that prevail when the buyout closes, with the evolution of macroeconomic and credit conditions after the buyout, and across the PE groups that sponsor buyouts. To carry out our study, we tap multiple sources to identify and characterize about 9,800 PE buyouts of U.S. firms from 1980 to 2013. For roughly 6,000, we successfully merge information about the buyout with comprehensive Census micro data on firm-level and establishment-level outcomes. Armed with this database, we estimate the effects of buyouts on target firms relative to contemporaneous developments at comparable firms not backed by private equity. We focus on outcomes over the first two years after the buyout.

Our large sample, long time period, high-quality data, and ability to track firms and establishments enable a careful look at heterogeneity in the real-side effects of buyouts. We can, for example, investigate how buyout effects on independent, privately held firms compare to those of publicly listed firms. Because our sample period encompasses huge swings in credit market tightness and macroeconomic performance, we can address recurring questions about how these external conditions affect the relative performance of target firms. By tracking individual PE groups over time, we can assess whether they differ in their impact on target firms, and whether and how much those differences persist over time.

Our chief findings include the following:

- Post-buyout labor productivity gains at target firms are large relative to contemporaneous outcomes at control firms, and much larger yet for deals executed in tight credit conditions.
- Relative employment at targets rises 13 percent, on average, in firms previously under private ownership, whereas it falls 13 percent in buyouts of publicly listed firms.

- A post-buyout widening of credit spreads, or a slowdown in GDP growth, lowers employment growth and intra-firm job reallocation at targets (again, relative to controls).
- The mix of buyout types and PE sponsor characteristics varies over time, but there is little evidence that changes in this mix drive the sensitivity of buyout effects to market conditions.
- Buyout effects on employment differ among the PE groups that sponsor buyouts, and these differences persist over time at the group level.[2]
- Rapid upscaling in deal flow at the PE group level brings weaker post-buyout employment performance at target firms, conditional on the group's performance history, time effects, and a battery of other controls.

In short, the real-side effects of buyouts on target firms are more complex and varied than either PE champions or detractors claim. Indeed, the effects are highly circumstance-specific in a manner, we argue, that aligns well with financial theory and with evidence on the financial performance of PE buyouts.

Our study builds on and draws inspiration from many previous works. Early studies on the real-side outcomes associated with PE buyouts include Kaplan (1989) and Lichtenberg and Siegel (1990). More recent research considers larger samples, often by exploiting a combination of proprietary and government data sources. Examples include Boucly, Sraer, and Thesmar (2011), Cohn, Mills, and Towery (2014), Davis et al. (2014), Farcassi, Previtero, and Sheen (2018), and Cohn, Nestoriak, and Wardlaw (2019). Beginning with Bernstein and Sheen (2016), many recent studies consider the impact of private equity in particular industry settings. Relative to Davis et al.

[2] Echoing persistent financial performance differences at the group level (e.g., Kaplan and Schoar, 2005, and Harris et al., 2020). Unlike the case of financial performance, however, we see no evidence of a weakening over time in the group-level persistence of real-side effects.

(2014), we improve on their empirical methods, extend their sample period to cover the financial crisis and its aftermath, draw on previous research to explain why we anticipate heterogeneity in the real-side effects of PE buyouts, and provide a rich set of new findings on how buyout effects vary with macroeconomic and credit conditions, by type of buyout, across the PE groups that sponsor buyouts, and with the scale of buyout activity at the group level. Below, we offer many additional remarks about how our study and findings relate to previous research.

The next section reviews theoretical perspectives and prior empirical research that help understand the heterogenous effects of PE buyouts. Section II discusses the creation of our database. Section III sets forth our empirical approach and describes our results. Section IV concludes the paper. Appendices provide additional information about our data and empirical methods and additional results.

I. Sources of Heterogeneity in the Effects of Private Equity Buyouts

There are several theoretical reasons to anticipate heterogeneity in the real-side economic impact of various buyouts.[3] This section reviews some of the key literature to help frame the analyses that follow.

A. Differences across Buyout Types

There is little theoretical work on the heterogeneous effects of PE buyouts *per se*, but the tradeoffs between publicly traded and privately held ownership are the subject of an extensive literature. Among the hypothesized advantages of public ownership are lower equity costs, higher firm values, and relaxed capital constraints. Zingales (1995), for instance, hypothesizes that public listings put firms "on the radar screen" of potential acquirers and, under certain conditions,

[3] The main text focuses on productivity, employment and job reallocation effects. Appendix D also presents estimated buyout effects on firm-level mean wages, which appear to be heavily influenced by buyout-related shifts in management compensation.

maximize firm value. Pagano et al. (1998) argue that access to public equity markets reduces the cost of credit by giving firms more bargaining power with their banks, thereby maximizing capital availability and enhancing firm value. Chemmanur and Fulghieri (1999) suggest that private investors may demand a risk premium, and value firms accordingly. Brau et al. (2003) argue that IPOs create publicly traded shares that a firm can use as "currency" when acquiring other companies. Maksimovic and Pichler (2001) model firms that conduct IPOs to increase publicity or reputation value, thereby improving capital market access and raising firm value.

Being publicly traded also comes at a cost. The vulnerability of publicly traded firms to agency problems has been understood since Jensen and Meckling (1976). Due to weaknesses in the market for corporate control, difficulties in monitoring by dispersed shareholders, problematic incentives of corporate directors, compensation schemes that reward empire building and myriad other reasons, publicly traded firms can be especially prone to value-destroying activities. Jensen (1989) proposed that buyouts are optimized to resolve these problems. Axelson et al. (2013) report that buyouts of publicly traded firms are more associated with high debt burdens, which Jensen hypothesized create pressure on management to take cost-cutting steps they might otherwise resist.

These arguments and observations suggest that the consequences of PE buyouts differ between publicly traded and privately held targets. For targets that trade publicly before the buyout, PE groups may focus on tackling the agency problems sketched above – whether manifested as excess headcounts, wasteful perquisites, or value-destroying "pet projects."[4] For

[4] Job losses after public-to-private and divisional buyouts could also be interpreted along the lines of the workforce re-contracting hypothesis that Shleifer and Summers (1988) advance in the context of hostile corporate takeovers. They stress the role of implicit long-term contracts in fostering relationship-specific investments by the firm's stakeholders. According to the re-contracting hypothesis, takeovers that break implicit contracts can be profitable for shareholders, at least in the short run.

privately held targets that face fewer agency problems but find it harder to access capital markets, it makes sense for PE groups to devote greater attention to investments that drive growth. Insofar as PE buyouts lead to productivity gains at target firms, these observations also suggest that the mechanisms at work may be quite different for publicly listed and privately held targets.

Case evidence illustrates some of these points. In late 1987, Berkshire Partners bought out the Lake States Transportation division of the Soo Line (the U.S. subsidiary of the publicly traded Canadian Pacific), renaming it Wisconsin Central. The new management cut operating employees per train from 4.8 to 2.2 and cut wages by 15%.[5] As a result, labor costs dropped from the historical 50% of revenue to 32% in 1988. In later years, Wisconsin Central continued to improve labor productivity through the application of better information technology and tight management, with revenue ton-miles per workhour rising 54% from 1989 to 1995 (Jensen, Burkhardt and Barry, 1989, and SEC filings).[6] In another case, Brazos Partners acquired 80% of privately held Cheddar's Restaurants in 2003, buying out many "friends and family" investors who were reluctant to put additional capital into the firm. Brazos' own funds, its banking connections, and its industry relationships enabled the firm to greatly accelerate its pace of restaurant openings, bring in new managers to rationalize the practices of an extremely informal organization, and develop new chain concepts. The founder, having liquidated much of his equity in the firm and diversifying his asset holdings, still retained a significant equity stake but nonetheless became more willing to pursue high-risk, high expected-return strategies (Hardymon and Leamon, 2006).

Existing empirical work also finds evidence consistent with these hypotheses. For instance, Boucly, Sraer, and Thesmar (2011) analyze a sample of largely private-to-private buyouts of

[5] Most of the division's employees opted to remain with Soo Line, as the new owners made clear that transferred employees would lose seniority rights and work in a non-union environment.
[6] Jensen, Burkhardt, and Barry (1989) and SEC filings.

French firms. They conclude that these buyouts eased financing constraints at target firms, enabling their expansion. Large productivity gains fit well with evidence in Bloom, Sadun, and van Reenen (2015), who survey a sample of buyouts of middle-market firms, where private-to-private deals predominated. They find that these PE deals led to investments that resulted in better management practices. Hellman and Puri (2002) provide evidence that venture capital helped drive the professionalization of recruitment, human resource policies, marketing, and the use of stock options in high-tech start-up firms. Similarly, private equity may drive professionalization in the buyouts of privately held firms in particular, especially when sales growth or market conditions have outpaced legacy management structures and processes.

B. Differences over the Economic Cycle

Axelson, Stromberg, and Weisbach (2007) offer a useful framework for understanding why the consequences of buyouts may vary over the economic cycle.[7] In their setting, privately-informed firms (e.g., the general partners of PE groups) raise funds from less-informed investors. Informational asymmetries create a temptation on the part of general partners to overstate the potential of their investments. Axelson et al. show that the (second-best) solution ties the compensation of PE investors to the collective performance of a fund, rather than that of individual

[7] More generally, fluctuations in credit availability have long pre-occupied economists (e.g., Kindleberger, 1978). One concern involves the incentives that drive credit decisions. In Rajan's (1994) model, for example, the desire to manage short-term earnings drives bankers to make value-destroying loans in good times and curtail lending abruptly in bad times. A second concern involves the banking system's capacity to supply credit. Bernanke and Gertler (1987) develop a theory in which negative shocks to bank capital cause them to forego value-creating loans. A third set of concerns surrounds the effects of credit availability on the broader economy. According to the "financial accelerator" mechanism in leading macro models (e.g., Bernanke, Gertler and Gilchrist, 1999), endogenous swings in credit availability amplify and propagate the effects of shocks to the macroeconomy. Credit availability and debt levels are also a key focus in many post mortems of economic crises (e.g., Reinhart and Rogoff, 2009; Campello, Graham, and Harvey, 2010; and Schularick and Taylor, 2012) and a first-order concern for central bankers.

buyouts. In this way, the general partners have less incentive to invest in bad deals. Moreover, it makes sense for fund managers to invest equity alongside outside debt raised on a deal-by-deal basis, thus providing a further check on the temptation to do lower-quality deals with funds raised.

Even when employing this optimal financing structure, however, Axelson et al. show that PE groups are tempted to overinvest during hot markets. Conversely, during recessions, value-creating projects may languish unfinanced. These distortions amplify the normal ebb and flow of the business cycle, resulting in an intense pro-cyclicality of PE deal-making activity.

This theoretical work focuses on the cyclicality of PE activity and the financial returns to buyouts, but it has implications as well for their real-side consequences. In particular, deals done when financing is plentiful may end up underperforming for two reasons. First, due to overfunding, PE groups may move "down their own demand curve" when financing is easy, selecting inferior deals with less scope for value creation in the form of operational improvements. Second, if the supply of experienced PE managers is not fully elastic in the short term, a larger deal flow may dilute the attention paid to any given portfolio company. Both reasons lead to weaker post-buyout operating performance for deals executed amidst easy-credit conditions. While we cannot pin down which of these two reasons (or both) might be at work, this line of thinking says that the marginal benefits of PE buyouts in the form of productivity gains are countercyclical.

The post-buyout evolution of macroeconomic and credit conditions is also likely to affect the performance of target firms. As Appendix Table D.4 shows, firms backed by private equity are far more likely to engage in acquisitions than their peers. To the extent that market conditions influence the ability of target firms to undertake post-buyout acquisitions and divestitures, a deterioration in macroeconomic or credit conditions can affect overall employment growth and reallocation in target firms, although not necessarily the organic parts.

There is also previous empirical research on the relationship between buyouts and credit cycles. Pioneering work by Kaplan and Stein (1993) presents evidence that fits "a specific version of the overheated buyout market hypothesis… [that] the buyouts of the later 1980s [were] both more aggressively priced and more susceptible to costly financial distress." Twenty-five of 66 deals in their sample executed during the easy-credit period from 1986 to 1988 later underwent a debt default, an attempt to restructure debt, or a Chapter 11 bankruptcy filing. In glaring contrast, only one of 41 deals executed from 1980 to 1984, when credit conditions were much tighter, experienced one of these forms of financial distress. Axelson et al. (2013) look at a broader sample of deals and show that credit market conditions drove leverage in buyouts far more than in publicly listed firms. Kaplan and Schoar (2005), among others, find that easier credit conditions bring greater inflows into buyout funds and lower fund-level returns.[8] In short, the literature suggests that when economic growth booms and credit spreads narrow, PE funds attract larger inflows, their deals involve more leverage and higher valuations, and investors ultimately receive lower returns. We investigate the impact of these forces on the real-side outcomes at target firms, which has received little attention to date.[9]

Much less is written, from either a theoretical or empirical perspective, about the *interaction* of buyout type and economic cycles: whether the sensitivity of buyouts to external conditions differs by type of buyout. Nonetheless, we hypothesize that productivity gains and the pace of reallocation are more procyclical in public-to-private than private-to-private deals. Public-

[8] Other papers that touch in various ways on market cycles and private equity include Ivashina and Kovner (2011), Hotchkiss, Strömberg, and Smith (2014), Harris, Jenkinson, and Kaplan (2016), and Bernstein, Lerner, and Mezzanotti (2019).

[9] One exception is the survey data in Bernstein, Lerner, and Mezzanotti (2019), which provide evidence that PE groups devoted more attention to the operating performance and strategic decision making of their portfolio companies during the financial crisis of 2008-09.

to-private deals are both more leveraged (Axelson et al. 2013) and more likely to encounter financial distress (Stromberg, 2008). Thus, tight financial conditions during downturns may divert the attention of management at the target firm and the PE group itself away from operating performance. In addition, insofar as the typically larger buyouts of publicly listed firms are more dependent on continuing capital market access (e.g., to finance ongoing acquisitions and divestitures that reshape the firm), economic downturns may especially impair restructuring and performance in public-to-private buyouts.

C. Differences across Private Equity Groups

Economists have become increasingly attuned to the role of persistent organization-specific attributes that affect productivity. Syverson (2011) provides an overview of many key studies, and Autor et al. (2020) examine a related phenomenon. Many differences in firm performance reflect heterogeneity in management practices (Bloom and van Reenen, 2007). Bertrand and Schoar (2003) show that top executives influence firm performance and key strategic choices, an effect that holds even when focusing on switchers who move from one firm to the next.

These differences can manifest across PE groups as well. Practitioner accounts (e.g., Bain, 2020) suggest that PE groups often have well-defined specializations, not just in regard to industry (e.g., the focus of ABRY on telecommunications or Vista on software), but in their approaches to value creation. One frequently encounters claims that some PE groups place greater emphasis on value creation through operational improvements while others stress financial engineering. Anecdotal accounts suggest that PE groups have "playbooks" and shared-value systems, which they apply to their investments in buyout after buyout (Lerner, Tagade, and Shu, 2018, and Wulf and Waggoner, 2010). PE groups are also remarkably stable in terms of their key senior management (Lerner and Noble, 2021), which may drive persistence in their approaches.

In line with these remarks, Kaplan and Schoar (2005) and Harris et al. (2020) find strong persistence in the financial performance of buyout groups, at least for funds formed through 2000. Thus, in addition to the effects of market cycles and buyout types, we hypothesize the presence of PE group-specific differences in their effects on portfolio firms.

II. Creating the Leveraged Buyout Sample

A. Identifying Private Equity Buyouts

Our study builds on the data work and analysis in Davis et al. (2014) to consider transactions involving later-stage companies with changes in ownership and control, executed and partly financed by PE firms. In these deals, the (lead) PE firm acquires a controlling equity stake in the target firm and retains significant oversight until it exits by selling its stake. The buyout typically involves a shift toward greater leverage in the capital structure of the target firm and, sometimes, a change in its management. Bank loans are key sources of the credit that facilitate the leveraged nature of PE buyouts.

We made major efforts to construct our sample of buyouts and ensure its integrity, expending thousands of research assistant hours. The specific process is described in Appendix A. The resulting sample contains 9,794 PE-led leveraged buyouts of U.S. companies from January 1, 1980 to December 31, 2013. We sort the sample buyouts into four main deal types based on descriptions in CapitalIQ and our reviews of other databases, press accounts, and securities filings.

Figure 1 displays quarterly counts of PE-sponsored buyouts in our sample for the four deal types.[10] As noted in other studies, PE buyout activity grew enormously in recent decades. The

[10] Appendix Table D.1 reports average quarterly counts before, during and after the financial crisis. Because we lack non-Census data on deal size for much of our sample, especially in more recent years, we cannot construct a size-weighted version of Figure 1 without matching to Census micro data. Once we match, however, we become subject to Census disclosure rules that preclude a granular depiction of deal flow as in Figure 1.

expansion is especially striking for private-to-private buyouts, which saw a huge increase in deal flow over time. The flow of new PE buyouts crashed during the financial crisis, as credit conditions tightened and the economy contracted. Interestingly, the flow of new public-to-private buyouts dropped off well before the onset of the financial crisis, and remained at modest levels through the end of our sample. Counts for private-to-private and secondary (where PE groups are on both sides of the buyout) transactions rebounded sharply as the economy recovered from the 2008-09 recession and maintained a robust pace until the end of our sample in 2013.

To set the stage for the analysis below, Table 1 presents evidence on how deal flow relates to economic and credit conditions. Specifically, we regress the natural log of quarterly buyout counts on buyout type indicators, a linear time trend, and the deal-type indicators interacted with market conditions. We consider conditions when the buyout closed (top panel) and changes over the next two years (bottom panel). We use real GDP growth to characterize economic conditions and the yield spread between below-investment-grade corporate bonds and one-month LIBOR for credit conditions. (See Section III.D for precise definitions.)

The results are striking. The top panel says that deal volumes are higher when real GDP growth is above its sample median and credit spreads are narrower than the median. Buyout counts are 28 log points (32%) higher for private-to-private deals, 66 log points (93%) higher for public-to-private deals, and 41 log points (51%) higher for divisional sales in periods with above-average GDP growth, conditional on the credit-spread interaction variables and the controls. Buyout counts are 18-27 log points lower when credit spreads are wider than average, conditional on the other regressors. The credit spread results are considerably stronger when using an upper tercile split. (See Appendix Table D.2.) Axelson et al. (2013), among others, also document the relationship of credit spreads to buyout activity and to the extent of leverage and valuations.

The bottom panel in Table 1 says that periods with high buyout volume are associated with rising credit spreads over the next two years and, except for secondary sales, higher than average GDP growth over the next two years. Again, the associations are large in magnitude. For example, buyout counts are 20-68 log points higher in periods that precede above-average increases in credit spreads. This pattern – most pronounced for public-to-private buyouts – says that target firms often face a tightening of credit conditions after the buyout, an issue that we explore below.

Appendix Table D.3 shows how the industry mix of PE buyouts differs by deal type. For instance, public-to-private deals are relatively prevalent in Consumer Staples (e.g., food and household products) and Healthcare, while divisional deals are relatively prevalent in Information Technology and Utilities. A Pearson chi-squared test rejects the hypothesis that the industry distribution of buyouts is independent of deal type. The distributions of PE buyouts by industry, firm size, and firm age also differ greatly from the corresponding distributions of private sector employment (Davis et al., 2014). Given these patterns, our econometric investigations below compare buyout targets to control firms within cells defined by the full cross product of industry, firm size categories, firm age categories, multi-unit status, and buyout year.

B. Matching Private Equity Buyouts to Census Micro Data

The Longitudinal Business Database (LBD) is a longitudinal version of the Census Bureau's comprehensive Business Register (BR), which contains annual data on U.S. businesses with paid employees. The LBD covers the entire nonfarm private sector and, in recent years, has roughly 7 million establishment records and 5 million firm records per year.[11] It draws on a wide range of administrative records and survey sources for data inputs. Firms are defined based on

[11] An establishment is a physical location where economic activity occurs. A firm is a legal entity that owns and operates one or more establishments.

operational control, and all establishments majority owned by a parent firm are included in the parent's activity measures. Core data items include employment, payroll, four-digit Standard Industrial Classification (SIC) or six-digit North American Industrial Classification (NAICS) codes, employer identification numbers, business names, and location information.

To merge our buyout data to Census data on firms and establishments, we match business name and address information for the buyout targets to the name and address records in the BR. Table 2 summarizes our sample of PE buyouts matched to Census micro data. Panel A reports the number of establishments operated by our 6,000 matched target firms and their employment, with breakdowns by deal type. Panel B considers the 5,100 matched buyouts that closed from 1980 to 2011. Compared to the 1980-2003 sample in Davis et al. (2014), our new 1980-2011 analysis sample has 2.3 times as many matched targets, reflecting high deal flow after 2003. Private-to-private deals account for about half of our 1980-2011 sample, as in our earlier work. The 22% share of secondary sales is nearly twice as large as in our earlier work, reflecting the large flow of these deals in recent years. The share of divisional buyouts is somewhat smaller in our new sample.

In our econometric analysis below, we limit attention to matched buyouts that closed from 1980 to 2011, so we can track their outcomes through 2013 in the LBD. We also drop target firms that we match to Census micro data using only taxpayer EINs (and not other firm IDs). As explained in Appendix A, we are not confident we can identify all establishments operated by the target firm in these EIN cases. Finally, we restrict our regression analysis to firms that we confidently track for two years post buyout. That leaves roughly 3,600 target firms in our regression analyses below, identified as "Two-year continuers" in Panel B of Table 2. Private-to-private deals account for 29% of target employment as of the buyout year in this sample, public-to-private deals account for 36%, divisional deals account for 11%, secondary sales account for 19%, and buyouts of unknown type for the rest.

Panel C compares matched buyouts in our new sample to those in Davis et al. (2014) for their 1980-2003 analysis period. Our new sample has about 20% fewer buyouts in the overlapping period, which reflects the more rigorous matching criteria that we now apply. Our new sample of two-year continuer targets (excluding EIN cases) has 10% fewer matched buyouts. The mix of buyout types in our new 1980-2003 sample is similar to the one in our earlier work.

III. Empirical Results

A. *Regression Specification, Weighting, and Identification*

We estimate firm-level regressions of the following form by least squares

$$Y_{i,t+2} = \alpha + \sum_c D_{cit}\theta_c + \lambda_1 LEST_{it} + \lambda_2 LFIRM_{it} + \gamma PE_{it} + \varepsilon_{it}, \quad (1)$$

where $Y_{i,t+2}$ is the change in the outcome variable of interest from buyout year *t* to two years later for firm *i*.[12] The D_{cit} are cell-level dummy variables defined on the full cross product of buyout year *t*, the firm's three-digit NAICS, its size category, its age category, and an indicator for whether it owns multiple establishments. $LEST_{it}$ and $LFIRM_{it}$ are controls for the firm's pre-buyout growth history. To construct $LEST_{it}$, we consider the set of establishments owned by firm *i* in buyout year *t* and compute their employment growth rate from $t-3$ to $t-1$. To construct $LFIRM_{it}$, we consider the parent firm that owned these establishments in $t-3$ and compute its growth rate from $t-3$ to $t-1$. If ownership was split across multiple firms in $t-3$, we select the firm with the

[12] It is often impossible to track target firms over several years post buyout. However, Davis et al. (2014) track employment at target and control *establishments* for five years after buyout events. They find that establishment-level buyout effects over five years are about 90 percent larger than over two years, which suggests that results based on (1) understate the cumulative impact of buyout events on firm-level outcomes over several years.

largest share of employment among these establishments. Often, but not always, these two control variables take on the same value. PE_{it} is a dummy variable equal to 1 for a target firm.

Buyout effects can vary with firm characteristics and economic conditions and by industry, deal type, and time period. However, there is surely more heterogeneity in treatment effects than we can estimate with precision. Faced with this heterogeneity, our goal is to obtain a consistent estimate for the activity-weighted mean treatment effect on treated units (i.e., buyout targets) under the under assumptions of conditional mean independence (CMI) and stable unit treatment value (SUTVA). To do so, we weight each target firm by its share of aggregate target activity, where "aggregate" refers to the sum over all buyouts in the regression sample. We weight each control unit in proportion to its employment share in its control cell, and rescale to equate the sum of weights on control units in a cell to the sum of weights on targets in the same cell. See Appendix B for additional discussion.

Our rich set of controls lends greater plausibility to the CMI assumption than in most previous work on PE buyouts. Even if CMI fails, our results provide useful evidence for formulating and evaluating theoretical models of PE behavior and its effects. The SUTVA assumption could fail if treatment effects on targets alter product demand and factor supply conditions facing controls, or if they exert competitive pressures that drive higher productivity at controls. Since targets typically account for modest activity levels relative to controls, these effects are likely to be quite small in our setting. Another possibility is that buyout targets implement superior technologies or business strategies that controls then emulate. The scope for such imitation effects also seems quite small within our two-year post-buyout time frame.

B. *The Average Economic Effects of Private Equity Buyouts*

Table 3 reports the estimated γ coefficients and associated standard errors for regressions of the form (1). Coefficients are approximate percentage point changes from the buyout year t to t+2. The "All Buyouts" column covers firms that underwent buyouts from 1980 to 2011 and matched control firms in the same cells. There are about 3,600 targets and 6.4 million total firm-level observations in the regressions that consider employment growth and reallocation outcomes. The underlying number of establishments is much larger, because many target firms (and the corresponding control firms) have multiple facilities. We have fewer usable observations for labor productivity, as discussed below.

According to the "All Buyouts" column in Panel A, employment at target firms shrinks (on average) by a statistically insignificant 1.4 percentage points relative to control firms in the first two years after the buyout. Employment shrinks by 4.4 percentage points relative to controls when omitting post-buyout acquisitions and divestitures. These "bottom line" effects of PE buyouts on target firm employment are a bit larger than we found in Davis et al. (2014): -0.9 percentage points overall, and -3.7 points for organic growth. Appendix Table D.4 provides more detail on how target-control employment growth outcomes differ by margin of adjustment. To summarize the largest differences, target firms are more aggressive than control firms in shutting establishments from t to $t+2$ and in acquiring new establishments from t to $t+2$.

While the net employment effects of PE buyouts attract much interest, buyouts have larger effects on the pace of job reallocation. Overall job reallocation for a firm is the sum of its gross job gains due to new, expanding, and acquired establishments and its gross job losses due to exiting, shrinking, and divested establishments. Dividing overall job reallocation by base employment yields the job reallocation rate. A firm's *excess* reallocation rate is the difference between its job reallocation rate and the absolute value of its net employment growth rate. If a firm changes employment in the same direction at all of its establishments, its excess reallocation is zero. To the extent that a firm expands employment at some units and contracts employment at others, it has positive excess reallocation. If a firm adds jobs at some establishments and cuts an equal number at other establishments, its excess reallocation equals its overall job reallocation.[13]

According to Panel B in Table 3, the job reallocation rate is higher by 7.1 percentage points (of base employment) at targets for organic employment changes over two years after the buyout and by 11.5 points when including acquisitions and divestitures, both highly significant. These results confirm that PE buyouts accelerate the pace of reallocation at target firms, more so when including acquisitions and divestitures. Turning to Panel C, excess reallocation is 5.0 percentage points higher at target firms for all changes, but insignificantly different for organic changes. The implication is that the faster pace of job reallocation induced by buyouts mainly involves greater reallocation of jobs across firms rather than within target firms. In other words, PE buyouts lead to net job losses at some target firms (relative to control firms) and net job gains at other target firms. The extra between-firm reallocation of jobs induced by PE buyouts equals 6.5 (11.5 - 5.0) percent of base employment over the first two years after the buyout.

Panel D in Table 3 provides evidence on how PE buyouts affect firm-level labor productivity, measured as the natural log of revenue per worker.[14] Relative to Panels A-C, we lose observations for three reasons in Panel D. First, we cannot calculate productivity changes for firms that close all establishments by $t+2$. When we drop a target that dies in this sense, we also drop

[13] The excess reallocation concept is often used in the literature on gross job flows to analyze job reallocation within and across regions, industries and other categories. Examples include Dunne, Roberts, and Samuelson (1989) and Davis and Haltiwanger (1992, 1999). Here, we apply the same concept to the reallocation of jobs across establishments within the firm.

[14] RE-LBD labor productivity data are available in real terms using deflators at the NAICS2 and NAICS3 levels. These deflators have no effect on our estimates, which reflect productivity changes at targets relative to contemporaneous changes at controls within the same NAICS3.

controls in the cell associated with that target. If we drop a cell with many controls, we lose many observations. Second, even for targets that survive, some control firms in the cell do not – leading to the loss of additional observations. Third, we drop observations for which firm-level productivity is more than 200 log points from its mean in the same NAICS6-year cell in either the buyout year *t* or in *t+2*. We drop these outliers to guard against large productivity deviations due to errors in the revenue data, errors in linking revenue and employment at the firm level, and errors in the assignment of firms to industries. See Haltiwanger et al. (2017) for a discussion of how these errors can arise in the RE-LBD and why revenue data are unavailable for many firms.

To address the potential selection bias introduced by missing productivity observations, we construct inverse propensity score weights as in Haltiwanger et al. (2017) and similarly to Davis et al. (2014). These weights ensure that the re-weighted RE-LBD is representative of the LBD universe with respect to the size, age, employment growth rate, industry sector, and multi-unit status of firms. We apply these weights and the activity weights described in Section II in our regression analysis of how PE buyouts affect productivity growth.

Turning to the results, labor productivity rises by 7.5 percentage points at targets relative to controls from buyout year *t* to *t+2*. In undisclosed results, we find the largest post-buyout productivity gains at older and larger targets. Davis et al. (2014) estimate that PE buyouts raise total factor productivity by about 2.1 percentage points for target firms in the manufacturing sector. Here, we find a considerably larger effect of PE buyouts on labor productivity when looking across all industry sectors. To help understand this result, Panel C of Appendix Table D.4 decomposes this productivity gain into two pieces: one due to larger workforce reductions at targets, and the other due to greater revenue growth at targets. More than 80 percent of the estimated productivity gain reflects greater revenue growth at targets. We cannot decompose labor productivity gains into markup changes and physical productivity changes, given our data. However, Farcassi, Previtero, and Sheen (2018) show that the rapid post-buyout sales growth of retail and consumer products firms reflects the launch of new products and geographic expansion, not markup hikes.

C. *How the Effects Differ by Buyout Type*

Table 3 also reports estimated effects by type of buyout. According to Panel A, target employment shrinks by 12.6% (relative to controls) after private-to-public buyouts and by 11.5% after divisional buyouts. It rises by 12.8% after private-to-private buyouts and by 9.9% after secondary buyouts. Isolating organic changes, target employment shrinks by 10.0% after private-to-public buyouts and by 16.0% after divisional buyouts; it rises by 3.1% after private-to-private buyouts and by 6.1% after secondary buyouts. All of these estimates are statistically significant at the 1% or 5% level. Thus, we find strong evidence of buyout-induced employment effects that differ greatly by type of buyout. An F-test rejects the null hypothesis of no differences across buyout types in the estimated effects on target employment growth.[15]

Appendix Table D.5 provides more detail. For example, private-to-private and secondary buyouts create new job positions in new facilities at a faster clip than control firms – to the tune of 2.5% and 4.2% of base employment, respectively. In contrast, job creation at new facilities falls by 2.1% at targets relative to controls in public-to-private deals. Gross job destruction in the wake of divisional targets exceeds that of controls by 16% of base employment, mostly due to jobs lost in facility closures. A weaker version of the same pattern holds for public-to-private buyouts. Again, the key message is that employment effects of PE buyouts vary greatly by type of buyout.

[15] To implement the tests (and those in Tables 5 and 6), we replace the γPE_{it} in regression specification (1) with a set of four dummy variable terms, one for each buyout type. We then test for equality of the coefficients on these four dummy variables.

Perhaps this heterogeneity should not surprise. As discussed above, public-to-private deals (and many divisional deals, which are typically carved out of public firms) involve targets with highly dispersed ownership. These firms may suffer from poor corporate governance before the buyout and face an intense need for cost cutting. Meanwhile, buyouts of privately held firms may more often be motivated by a desire to professionalize management or improve access to financing.

Turning to Panels B and C in Table 3, buyouts bring more reallocation, but the effect again differs greatly by deal type. In divisional deals, overall (excess) target job reallocation rises by 19.4% (10.0%) of base employment relative to controls, 17.1% (7.6%) when netting out the role of acquisitions and divestments. In private-to-private deals, acquisitions and divestments entirely drive the post-buyout reallocation uptick at targets relative to controls. Buyouts bring higher job reallocation at targets in public-to-private deals but no statistically significant impact on excess job reallocation. This evidence implies – in line with our earlier discussion – that the extra job reallocation reflects a downsizing of some target firms (relative to controls) and an upsizing of others. Thus, targets show virtually no extra excess reallocation in public-to-private deals. By way of contrast, extra excess reallocation at target firms accounts for one-half to two-thirds of the extra buyout-induced job reallocation in the other deal types. The differences are significantly different at the 5% confidence level when examining the measures of organic reallocation.

Turning to productivity effects, we again find large differences by type of buyout, collectively significant at the 10% confidence level. Target firms in private-to-private deals experience a 14.7 percent productivity gain relative to controls. Targets in public-to-private deals enjoy similarly large gains, but the imprecise estimate precludes a sharp inference. Estimated productivity effects are smaller for other buyouts and statistically insignificant.

Taken together, the results in Table 3 on differences by buyout type suggest that there is little basis for treating private-to-private, public-to-private, divisional, and secondary buyouts as homogeneous in their effects on jobs, reallocation, and productivity. But they are broadly consistent with the limited evidence in previous research on the real-side effects of PE buyouts. According to our evidence, *private-to-private* deals exhibit high post-buyout employment growth (largely but not entirely via acquisitions) and large productivity gains. Meanwhile, *public-to-private* deals exhibit large job losses, often through facility closures, and large (imprecisely estimated) productivity gains. *Divisional* buyouts similarly involve large employment losses and massive reallocation effects. Finally, *secondary* deals exhibit high target employment growth, largely organic, high reallocation and few discernible effects otherwise.[16]

D. *How Buyout Effects Vary with Market Conditions at Close*

We now investigate how the economic effects of PE buyouts vary with market conditions when the deal closes. To do so, we estimate richer regression specifications of the form,

$$Y_{i,t+2} = \alpha + \sum_c D_{cit}\theta_c + \lambda_1 LEST_{it} + \lambda_2 LFIRM_{it} + \gamma PE_{it} + \beta\, PE_{it} * MktCondition_t + \varepsilon_{it}, \quad (2)$$

where the new term, $\beta\, PE_{it} * MktCondition_t$, captures the interaction between buyout status and market conditions. When using intra-year variation in market conditions, we also include the $MktCondition_t$ main effect. When using only annual variation, we cannot separately identify the main effect, since our cell-level controls encompass annual time effects.

We consider two measures of market conditions at the buyout close: the log change in real GDP over the four quarters leading up to (and including) the closing quarter, and the spread

[16] Secondary deals are somewhat of a grab bag, with PE groups on both sides of the transaction. That makes it hard to interpret the effects of secondary buyouts. Hence, and in the interest of brevity, we do not report breakouts for secondary deals in the rest of the paper.

between high-yield U.S. corporate bonds and the one-month U.S. LIBOR in the closing month.[17] Similar spread measures are widely used in the finance literature to characterize debt market conditions. Notably for our analysis, Axelson et al. (2013) show that this spread varies negatively in the extent the buyout transaction is levered and with the EBITDA-multiple paid, and positively with the ultimate financial return on the buyout to PE investors.

The macroeconomics literature offers multiple interpretations for the relationship of spreads to real activity. Viewed through the lens of the q-theory of investment, low bond prices (a high spread) reflect low expected returns to capital (Philippon, 2009). Gilchrist and Zakrajšek (2012) advance a different view. They highlight a major role for movements in "the compensation demanded by investors – above and beyond expected losses – for bearing exposure to corporate credit risk." As they also show, movements in this excess bond premium mirror movements in the equity valuations of financial intermediaries and in their credit default swap premiums. This evidence is broadly in line with our interpretation: a high spread reflects tight credit conditions.

Turning to the results in Table 4, we find no evidence that the post-buyout performance of target firms (again, relative to controls) varies with GDP growth in the four quarters leading up to the close. The β coefficients on the interaction term are imprecisely estimated and statistically insignificant for each dependent variable. In contrast, higher credit spreads at close involve large, statistically significant effects on excess reallocation and productivity growth.[18] Raising the credit

[17] GDP data are from the U.S. Bureau of the Economic Analysis, and the interest rate measures are from Datastream. For the bond rate, we use the yield to maturity on the Bank of America Merrill Lynch U.S. High Yield Index.

[18] From 1980 Q1 to 2013 Q4, the correlation between (a) the credit spread at quarter's end and (b) real GDP growth from four quarters previous to the quarter in question is a modest -0.288. In unreported results, we tried two other measures of external financial conditions: the credit spread measure of Gilchrist and Zakrajšek (2012), and equity market valuations, measured as the ratio of end-of month equity prices to the trailing twelve-month earnings S&P 500 firms. These alternative measures yielded broadly similar, but somewhat noisier, results.

spread by one standard deviation corresponds to a post-buyout productivity gain of 20.3 percent for targets relative to controls and an increase in excess reallocation of 4.6 percent of base employment. These large effects come on top of the baseline effects reported in Table 3.

The positive association between excess reallocation rates and productivity gains as credit conditions vary suggests that PE buyouts achieve productivity improvements by shifting inputs toward better uses within target firms. In a similar spirit, Davis et al. (2014) find that buyouts lead to TFP gains at target firms in the manufacturing sector, mainly due to the reallocation of activity from less productive plants to more productive ones. Here, we find that high credit spreads at the time of the buyout lead to greater productivity gains and greater reallocation activity in target firms in the two years after the buyout. Both sets of results link buyout-induced productivity gains to an accelerated, purposefully directed reallocation of activity within target firms.

Our credit spread results in Table 4 also suggest that PE groups have multiple tools for earning returns on their investments in portfolio firms. When credit is cheap and readily available, it may be more attractive to rely on financial engineering tools to generate returns, e.g., by issuing new debt to fund additional dividend payments to equity holders. When credit is costly and tight, financial engineering is less feasible and PE groups may generate returns through operational improvements that raise productivity in portfolio firms.

E. *How Buyout Effects Vary with the Evolution of Market Conditions After the Close*

We now consider how buyout effects vary with the evolution of market conditions after the close of the deal. We measure post-buyout changes in market conditions from March (or the first quarter) of the buyout year *t* to March (first quarter) of year $t+2$.[19] Table 5 focuses on the post-buyout change in credit conditions, and Table 6 focuses on post-buyout growth in real GDP.

Consider the results for all buyouts. Faster GDP growth in the two-year interval after buyouts brings greater post-buyout employment growth at targets relative to controls and greater excess reallocation. These effects are statistically significant and large: A unit standard deviation rise in the post-buyout GDP growth rate raises employment growth at targets relative to controls by 3.2 percent of base employment, and it raises target excess reallocation by 3.0 percent of base employment. A rise in credit spreads after buyouts brings slower post-buyout employment growth at targets relative to controls and slower excess reallocation. These effects are statistically significant and similar in magnitude to the ones associated with a unit standard deviation change in the GDP growth rate.

Figure 2 illustrates how post-buyout employment growth and excess reallocation at target firms (relative to controls) vary with the evolution of GDP growth and credit spreads. In the top panel, the baseline employment growth effect depicted in the center bar is of modest size, in line with our results in Table 3. However, the relative post-buyout employment performance of targets is highly sensitive to the evolution of market conditions. For example, a post-buyout decline in GDP growth by two standard deviations lowers the relative employment growth of targets by 7%. Changing credit spreads lead to a similar pattern in the lower panel. Excess reallocation rates at target firms are also sensitive to the post-buyout evolution of market conditions.

Tables 5 and 6 also report results by deal type. Recall that average buyout effects vary greatly by deal type (Table 3), and the mix of buyouts by deal type varies over the economic and

[19] Similar results obtain when using the change from the buyout closing date in year *t* to March of year $t+2$.

credit cycles (Figure 1 and Table 1). In line with remarks in Section I.B, Tables 5 and 6 provide evidence that the productivity effects are more sensitive to post-buyout macroeconomic and credit conditions for public-to-private than private-to-private deals, with divisional deals in the middle. In particular, when GDP grows faster or credit spreads narrow, the productivity growth of target firms is even higher (relative to controls) for the targets of public-to-private and divisional buyouts. A similar pattern holds for excess reallocation, except divisional buyouts show a greater sensitivity than public-to-private deals to post-buyout macroeconomic and credit conditions.

As articulated above, one explanation is that high leverage in public-to-private deals prevents management and investors from implementing pre-buyout operating plans when market conditions deteriorate or credit tights, with negative implications for productivity and reallocation. A similar dynamic may hold for divisional buyouts, which are likely to resemble public-to-private deals along important dimensions. Interestingly, the pattern goes the other way in private-to-private deals: deteriorating economic conditions or tighter credit conditions lead to greater productivity gains at targets relative to controls.

We do not find strong differences across buyout types in the responsiveness of target employment levels to post-buyout economic and credit conditions. For the most part, these interaction effects on target employment growth are statistically insignificant.

F. *Two Robustness Checks*

We now address two potential concerns about the forgoing analysis of market conditions. First, perhaps the results reflect our particular metrics for market conditions. Second, the results might be largely driven by the many buyouts undertaken in the run-up to the global financial crisis.

Table 7 addresses the first concern. Rather than looking at how buyout effects vary with a continuous measure of market conditions, we now take a simpler approach. Specifically, we interact the buyout indicator with a dummy for whether (a) the deal was executed during a recession or (b) the U.S. economy entered a recession in the two years after deal execution. Recession years are those for which at least half the months were part of NBER-designated recessions (i.e., 1981-82, 1990, 2001, and 2008-09). Table 7 reports these results for specifications and samples that parallel the ones in Table 4 and the "All Buyouts" columns in Tables 5 and 6.

The relative employment responsiveness of target firms to recessions is, if anything, stronger than when using continuous metrics. Both overall and organic employment growth at targets worsens (relative to controls) when the economy enters a recession after the buyout. Relative employment growth at targets is stronger for deals executed during a recession. Also, akin to results in Tables 5 and 6, deteriorating economic conditions post-buyout involve less reallocation at targets. Coefficients on the recession interaction variable in these cases are roughly equal to a three standard deviation shift in the continuous interaction variables in Tables 5 and 6. The productivity regressions, however, show smaller coefficients for the interaction variables and less statistical significance than obtained with continuous measures of economic conditions. Nevertheless, Table 7 indicates that our results continue to hold when using the recession indicator of market conditions rather than the continuous measures considered above.

Turning to the second concern, Figure 1 shows a huge surge in buyout activity in the quarters leading up to the GFC. Recall that the economy appeared strong in 2007 but then tumbled into a deep recession in 2008-09. To assess whether the runup in buyouts before the GFC drives our results, we re-estimated our models after dropping buyouts done in 2007. Table 8 repeats models considered in Tables 4, 5 and 6, but now omitting all targets and controls for buyouts in 2007. (Results are similar when also dropping buyouts in 2006.) By and large, the results are similar to before: Deals done amidst higher credit spreads show much greater productivity growth at targets. And, widening credit spreads and greater GDP growth after buyouts are associated with more reallocation at targets. The coefficients remain roughly the same size, but the responsiveness of target employment growth to economic conditions is weaker than before. In short, our results are not particularly driven by deals done in the run-up to the GFC.

G. *Market Conditions, or Deal Mix Changes over Time?*

Recall that public-to-private buyout volume is more pro-cyclical than that of other buyout types, especially private-to-private deals (Table 1). So, perhaps the greater job losses at target firms in public-to-private buyouts (Table 3) reflect a greater pro-cyclicality in their deal volume.

The sensitivity of our estimated buyout effects to market conditions could also reflect changes in the mix of PE sponsor characteristics over time. Gompers and Lerner (1999) and Kaplan and Schoar (2005), among others, show that the number of first-time funds is especially pro-cyclical. If the targets of young buyout groups have more adverse employment outcomes and are concentrated around market peaks, it could drive a cyclical pattern in our estimated effects of PE buyouts. More generally, a changing mix of active PE funds could drive time variation in the estimated PE effects. If true, that would be an interesting finding, but it would put our earlier results on the sensitivity of buyout effects to market conditions in a somewhat different light.

To explore these matters, we first undertook another large data collection effort to identify and characterize the PE sponsors of our nearly ten thousand buyouts. For 89% of the buyouts, we found information about the PE group in Preqin, Refinitiv, and other public sources. We assigned each PE group an identifier that follows the organization through spin-outs and name changes, as explained in Appendix C. We also gathered information about the organization type of the PE group, the number and dollar volume of its previous funds raised, and the group's historical track record (when available). We then merged these new data with our other data.

To analyze whether changes over time in the mix of buyout types and PE sponsor characteristics explain our results on how buyout effects vary with market conditions, we adopt a simple approach that lends itself to a useful decomposition, as we will explain. Specifically, for each buyout we create a "cell-adjusted" performance measure equal to the change from buyout year t to $t+2$ for the target minus the contemporaneous mean change for controls in the same cell (defined as before). We now dispense with controls for pre-buyout growth. We then sort observations by high and low values of a market conditions variable. Then we regress the cell-adjusted outcomes for buyout targets on a constant and the market conditions indicator, weighting buyout observations in the same way as before.

Panel A of Table 9 confirms that this simpler approach yields results very similar to the earlier ones on how target outcomes vary with market conditions. Specifically, relative target employment growth and reallocation rates increase when post-buyout GDP growth is high, and relative target productivity gains are greater for deals that close when credit spreads are high.

Next, we implement a Blinder-Oaxaca decomposition of the difference in relative target performance between high and low values of the market conditions variable. This type of decomposition has a long history in labor economics (Jann, 2008), but it can be readily applied to decompose the estimated difference between any two groups. In our application, the two groups are buyouts associated with high and low values, respectively, of a market conditions variable. For each subsample (i.e., the high-value and low-value observations), we regress the cell-adjusted buyout performance measure on indicator variables for buyout types and four measures of PE sponsor characteristics: the number of funds raised by the sponsor in the five years prior to its buyout of the target firm; the dollar amount it raised in the five years prior to the deal, divided by total U.S. PE fundraising in the same period; a dummy for whether the sponsor was independent, as opposed to a bank or corporate affiliate; and the number of buyouts undertaken by the sponsor in a five-year period around the deal in question. These measures quantify PE sponsor attributes related to the scale of its buyout activity, its fundraising success (a proxy for past performance), and its organization type.

The subsample regressions provide the ingredients of a Blinder-Oaxaca decomposition for the high-low difference in Panel A. We can express the decomposition as

$$(\bar{X}_H - \bar{X}_L)'\hat{\beta}_H + \bar{X}_H'\big(\hat{\beta}_H - \hat{\beta}_L\big) + (\bar{X}_H - \bar{X}_L)'\big(\hat{\beta}_L - \hat{\beta}_H\big), \qquad (3)$$

where $\bar{X}_H$ and $\bar{X}_L$ are vectors whose elements are the mean values of the explanatory variables in the "high" and "low" regression samples, respectively; and the $\hat{\beta}_H$ and $\hat{\beta}_L$ are the corresponding least squares regression coefficient vectors. The first term of (3) quantifies the contribution of changes in the mix of buyout types and PE sponsor characteristics to the high-low difference, the second term quantifies the contribution of market conditions, and the third term captures the interaction of between-group differences in the $\bar{X}$ and $\bar{\beta}$ vectors.

Panel B reports the decomposition results. The values in row (2) are statistically significant and roughly the same size as the corresponding high-low differences in Panel A. That is, the between-sample differences in the estimated coefficients largely account for the high-low differences in panel A. Moreover, for the employment growth rate and excess reallocation rate, the other two terms in the decomposition are small and statistically insignificant. Thus, for employment growth and excess reallocation, Table 9 confirms that buyout effects vary strongly with market conditions, *and* there is little role for temporal variation in the mix of buyout types and PE sponsor characteristics.

The message for buyout effects on productivity is murkier in two respects: the individual terms on the right side of (3) are imprecisely estimated because of the small sample, and the first and third terms are large and nearly offsetting. Our earlier claim that buyouts executed amidst tight credit conditions yield stronger productivity gains at targets still holds. However, we cannot say with any confidence whether, and to what extent, this result reflects time variation in PE sponsor characteristics or types of buyouts.

H. *Do Buyout Effects Differ across Private Equity Groups?*

Thus far, we have provided evidence that the real-side effects of PE buyouts differ with market conditions post buyout, with market conditions at close, by type of buyout, and with interactions between market conditions and buyout type. Another potential driver of heterogeneity in buyout effects are systematic differences among the PE sponsors themselves.[20]

As noted above, PE groups are characterized by management stability and distinct investment styles. In addition, persistence in financial performance has often been seen as a distinguishing feature of private equity groups, in contrast to hedge funds and mutual funds. (See Carhart (1997) and Brown, Goetzmann, and Ibbotson (1999) on hedge funds and mutual funds.) Studies that document persistence in the returns of PE groups include Kaplan and Schoar (2005), Ewens and Rhodes-Kropf (2015), Braun, Jenkinson and Stoff (2017), and Harris et al. (2020). We now investigate whether there are also persistent differences across PE groups in the employment effects of their buyouts. While it would be interesting to analyze persistence in productivity effects as well, we have too few buyouts with productivity data for an informative analysis.

To explore the impact of PE groups, Table 10 presents a series of regressions inspired by Kaplan and Schoar (2005) and Harris et al. (2020, and its 2014 predecessor). These authors examined persistence of financial performance at the fund level. Because it is hard for us to

[20] Table 9 speaks to whether PE sponsor characteristics explain *differences* in buyout effects between periods with high and low market conditions. This section and the next investigate whether PE sponsors and their characteristics influence buyout effects *on average*.

associate buyouts with particular funds, we instead aggregate all transactions associated with a given PE group in each of seven non-overlapping periods (1980-84, 1985-89, …, 2005-09, and 2010-11). As in the preceding section, we use the cell-adjusted employment growth rate over the two years after each buyout. For each period and PE group, we then compute the mean value of the cell-adjusted growth rates. We regress this period-by-PE group mean on its own lagged value (for the previous five-year period), dropping PE groups with buyouts in only one five-year period. We include time period dummies as well.

The results in columns (1) and (6) of Table 10 point to persistence over time at the PE group level in the employment effects of their buyouts. Persistence is much stronger, and statistically significant, for organic employment growth. The coefficient of 0.12 on lagged organic growth in regressions (6) through (8) compares to that of 0.17 in the public-market-equivalent buyout analysis of Kaplan-Schoar (2005; 8th regression in Table VII). This pattern supports the view that PE groups differ in their approach to operational improvements at target firms, leading to systematic differences in buyout effects on organic employment growth, while target-specific considerations influence decisions to acquire and divest. These results are robust to adding controls for the PE sponsor's volume of transactions in the five-year period and the change in its volume from the previous five-year period, as seen in columns (2), (3), (7) and (8).

The remaining columns contain two additional results. First, when we add an interaction between the date (expressed here as years since January 1960) and lagged employment growth (again at the group level), no evidence emerges of falling persistence in the group-specific growth effects. In contrast, the work of Harris et al. (2020) suggests that persistence in the financial performance of buyout funds dropped sharply after 2000. While PE groups may no longer show persistent differences in their ability to monetize their distinct approaches, our results say they continue to show persistent differences in how they affect target firms. Second, when we add firm fixed effects in columns (6) and (10), we obtain results similar to those in Table 9 of Harris et al. (2014): the coefficient on lagged performance turns sharply negative, which says there is regression to the (group-specific) mean in the employment growth rates of buyout targets.

I. *How Does Scaling at the Group Level Affect Employment in Portfolio Firms?*

Our final analysis investigates how scaling in buyout activity at the group level affects employment outcomes at targets. Previous research finds a detrimental impact of increasing fund size on fund manager returns – see, for example, Fung et al. (2008) for hedge funds (2008) and Chen et al. (2004) for mutual funds. Similarly, the work of Lopez-de-Silanes, Phalippou, and Gottschalg (2015) and Rossi (2019) suggests a negative relationship between the upscaling in buyout activity and the financial performance of PE groups.

Motivated by these earlier works, we investigate how the scaling of buyout activity by PE groups relates to the employment growth of their portfolio companies. To do so, we expand specification (1) to include variables that directly measure aspects of scaling or proxy for it, while also adding controls for buyout type. We consider four measures of scaling: funds raised by the PE group from $t-4$ to t for buyouts in t, divided by total buyout funds raised in the same period; financial performance of the group's last two buyout funds raised in the window from $t-12$ to $t-5$, calculated as returns as a multiple of invested capital (MoIC) minus the benchmark MoIC raised in the same period; the number of buyouts executed by the PE group in the five-year period (1980-84, 1985-89, and so forth) that contains the buyout year; and the change in the number of buyouts from the previous to the current five-year period. Appendix C explains how we constructed these scaling measures.

As shown in Table 11, upscaling in buyout activity at the group level involves lower post-buyout employment growth at target firms (again, relative to controls). The estimated upscaling effects are statistically significant at the 10 percent level for all scaling measures except for the change in the number of buyout deals. The estimated magnitudes differ a good deal. For example, a unit standard deviation increase in Adjusted Financial Performance involves a 4.4 percentage point decrease in the relative growth of organic employment at target firms, whereas a unit standard deviation increase in Funds Raised in Prior Five Years (Number of Buyouts in Current Five-Year Period) involves a decrease of only 0.7 (0.1) percentage points.[21]

In summary, upscaling in PE buyout groups is associated with a more negative employment impact on target firms, even after controlling for buyout type, the target's pre-buyout growth history and cell-level fixed effects. Of course, the scaling of PE groups is not exogenous (Rossi, 2019). In particular, past performance has a profound influence on the ability to raise new funds (Chung et al., 2012). Seen in this light, the results in Table 11 suggests that past success encourages a PE group to scale up its buyout activity, diluting the attention that key group personnel devote to individual portfolio companies. In turn, this dilution of attention leads to weaker employment growth among portfolio companies.

IV. Concluding Remarks

In his presidential address to the American Finance Association, Zingales (2015) makes the case that we "cannot argue deductively that all finance is good [or bad]. To separate the wheat from the chaff, we need to identify the rent-seeking components of finance, i.e., those activities that while profitable from an individual point of view are not so from a societal point of view."

[21] The larger implied effect for the Adjusted Financial Performance measure arises, at least in part, because its values are more highly dispersed across PE groups, as reflected in its relatively large coefficient of variation (ratio of standard deviation to mean).

Our study takes up that challenge for private equity buyouts, a major financial enterprise that critics see as dominated by rent-seeking activities with little in the way of societal benefits. We find that the real-side effects of buyouts on target firms and their workers vary greatly with market conditions, by type of buyout, across the private equity groups that sponsor buyouts, and with the sponsor's scale of buyout activity. To continue the metaphor, separating wheat from chaff in private equity requires a fine-grained analysis.

This conclusion cast doubts on the efficacy of "one-size-fits-all" policy prescriptions for private equity. Buyouts are associated with large productivity gains in many but not all circumstances. They are associated with large job losses in some circumstances and large job gains in others. This mixture of consequences presents serious challenges for policy design, particularly in an era of slow productivity growth (which ultimately drives living standards) and concerns about economic inequality.

There is a keen need to better understand the link between PE buyouts and productivity growth. Our evidence that buyouts executed amidst easy credit conditions bring smaller productivity gains suggests that PE groups exercise some latitude in how they create value for their investors. When credit is cheap and easy, PE groups may select buyouts – or structure them – to deliver private returns via financial engineering rather than operating improvements. Many PE groups were founded and seeded by investment bankers that historically relied on financial engineering to create private value, employing strategies such as repeatedly re-leveraging firms and dividending out excess cash (Gompers, Kaplan, and Mukharlyamov, 2016). In this light, it is unsurprising if PE groups de-emphasize operating improvements when leverage and dividends deliver high private returns. That said, our study provides evidence that buyout can, and often do, drive large productivity improvements in target firms. Policies that harness the power of PE buyouts to drive productivity gains can bring high social returns along with high private returns.

Our results reinforce some concerns about public-to-private deals, which account for 10% of PE buyouts from 1980 to 2013 and 31% of employment in target firms. In particular, public-to-private deals proliferate in advance of credit market tightening, and their targets exhibit poor productivity performance during aggregate downturns and when credit spreads widen.

Our study also points to several important outstanding questions: Do public-to-private and divisional buyouts cause avoidable employment losses? Or were targets in dire need of restructuring and retrenchment to prevent worse outcomes at a later date? More broadly, are job losses after certain types of buyouts essential to achieve post-buyout productivity gains and, if so, is the tradeoff an acceptable one? Does the pro-cyclical employment impact of buyouts reflect socially undesirable risk-taking by private equity or a preferred point on the risk-return frontier with social benefits in the form of high expected productivity gains? Resolving these questions is likely to require guidance from theory and novel identification techniques, but we hope our study helps pave the way to future research on these issues. Future studies that encompass more buyouts will be able to more fully examine the heterogeneous economic effects of buyouts.

Another important avenue for exploring these questions is to link private equity transactions to the Longitudinal Employee-Household Dynamics (LEHD) database. LEHD records on individuals will allow economists to study buyout effects on the compensation, unemployment spells, and employment trajectories of workers and to investigate spillover effects on local economies. We hope to pursue this research agenda in the years to come.

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Table 1. Market Conditions and Private Equity Buyout Frequency by Deal Type, Quarterly Data, 1980-2013

We regress 100 times the natural log of (type-specific PE buyout count) in quarter *t* on deal-type indicators interacted with market conditions at buyout close (top panel) and over the following two years (bottom panel), while controlling for deal type and a linear time trend. To characterize contemporaneous market conditions for buyouts that close in quarter *t*, we consider whether the credit spread in *t* is above or below its sample median value and whether real GDP growth from *t-4* to *t* is above or below its median. To characterize the evolution of market conditions over the next two years, we consider whether the change in the credit spread and real GDP from quarter *t* to *t*+8 are above or below their median values. After dropping quarter-type cells with no buyouts, each regression has 454 observations. In unreported results, we obtain very similar results when using the inverse hyperbolic sine transformation of the buyout count and retaining observations with zero buyouts. *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable: 100**ln*(type-specific buyout count in quarter *t*)

Market Conditions	Coefficient on Market Conditions (row) interacted with Deal-Type Indicator (column): Private to Private	Public to Private	Divisional Sales	Secondary Sale	R^2	Equality of Coefficients (p-value)
A. At Buyout Close						
High GDP Growth	28.2***	66.0***	41.2***	1.7		
	[9.5]	[16.1]	[15.6]	[14.4]	0.74	0.000
Wide Credit Spread	-20.7**	-26.6*	-18.1	-24.9*		
	[9.9]	[14.7]	[14.9]	[15.0]		0.019
B. Over Next 2 Years						
High GDP Growth	11.9	44.9***	52.3***	-40.7***		
	[11.2]	[14.7]	[16.3]	[15.3]		0.000
Widening Credit Spread	21.2*	67.8***	32.5**	20.0	0.75	
	[11.2]	[14.2]	[14.8]	[13.9]		0.000

Table 2. Summary Statistics for Private Equity Buyouts Matched to Census Micro Data

Panel A considers all matched targets in our 1980-2013 sample period. The first row in Panel B considers all matched targets in the 1980-2011 period, the second row excludes those matched using EIN numbers only, and the third row further restricts attention to "Two-year continuers," which include target firms that shut down all establishments by the second year after the buyout year. Panel C considers the same 1980-2003 period as the analysis sample in Davis et al. (2014).

	Number of Matched Buyouts (Target Firms)	Number of Target Establishments in the Buyout Year	Employment at Target Establishments in the Buyout Year
A. All, 1980-2013	6,000	177,000	6,890,000
Private-to-private	2,600	42,000	1,800,000
Public-to-private	600	67,000	2,130,000
Divisional Sales	1,300	25,000	1,120,000
Secondary Sales	1,300	31,000	1,280,000
Unknown Type	200	12,000	560,000
B. All, 1980-2011	5,100	164,000	6,400,000
After excluding EIN cases	4,500	144,000	5,690,000
Two-year continuers,	3,600	127,000	4,970,000
Private-to-private	1,800	32,000	1,450,000
Public-to-private	500	58,000	1,800,000
Divisional Sales	400	11,000	470,000
Secondary Sales	800	20,000	920,000
Unknown Type	100	6,000	330,000
C. All, 1980-2003	1,800	69,000	2,990,000
After excluding EIN cases	1,500	59,000	2,630,000
Two-year continuers,	1,200	49,500	2,210,000
Private-to-private	600	21,000	900,000
Public-to-private	200	16,000	690,000
Divisional Sales	200	5,000	210,000
Secondary Sales	150	3,600	180,000
Unknown Type	80	3,900	230,000

Table 3. Estimated Buyout Effects on Employment, Job Reallocation, and Productivity

The sample contains matched two-year continuers that underwent private equity buyouts from 1980 to 2011 and control firms in the same cells defined by the full cross product of firm age, firm size, industry, multi-unit status and buyout year. Some firms serve as controls for more than one buyout type. Outcome measures are (approximate) percentage amounts from the buyout year *t* to *t+2*. Each reported effect is the coefficient estimate [standard error] on a buyout indicator in a separate weighted least-squares regression that includes a full set of cell-level fixed effects and controls for pre-buyout growth histories. See Appendix B for an explanation of how we weight observations. Results for "All Margins" include the contribution of post-buyout acquisitions and divestitures, while results for "Organic Margins" exclude them. Reallocation measures are computed from establishment-level employment changes at the firm. The final column presents the p-value from F-tests of the equality of the coefficients of the four buyout type variables. Huber-White robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

	All Buyouts		Private-to-private		Public-to-private		Divisional		Secondary		p-Value,
Dependent Variable	Effect	R^2	Effect	R^2	Effect	R^2	Effect	R^2	Effect	R^2	F-test
A. Employment Growth, All Margins	-1.4 [2.2]	0.32	12.8*** [2.5]	0.37	-12.6*** [2.9]	0.38	-11.5** [4.7]	0.32	9.9*** [2.5]	0.32	0.000
Organic Margins	-4.4** [1.9]	0.29	3.1** [1.5]	0.33	-10.0*** [2.4]	0.39	-16.0*** [4.2]	0.29	6.1*** [2.3]	0.31	0.000
B. Job Reallocation, All Margins	11.5*** [1.8]	0.39	11.7*** [2.7]	0.39	9.6*** [2.3]	0.45	19.4*** [4.5]	0.43	9.4*** [2.7]	0.39	0.638
Organic Margins	7.1*** [1.8]	0.39	2.5 [1.9]	0.44	6.2*** [2.0]	0.44	17.1*** [4.4]	0.41	6.4** [2.8]	0.41	0.032
C. Excess Reallocation, All Margins	5.0*** [1.1]	0.40	5.5** [2.3]	0.42	1.7 [1.6]	0.39	10.0*** [1.9]	0.44	7.1*** [2.4]	0.45	0.175
Organic Margins	0.6 [1.5]	0.35	-3.8 [3.4]	0.40	-1.7 [1.8]	0.36	7.6*** [2.3]	0.37	4.2 [2.8]	0.40	0.030
Observations (000s)	6,400		3,900		400		2,300		600		
D. Labor Productivity	7.5* [4.1]	0.47	14.7*** [4.5]	0.44	14.3 [11.1]	0.62	-5.0 [7.6]	0.38	0.7 [5.6]	0.43	0.080
Observations (000s)	911		411		17		620		40		

Table 4. How Buyout Effects Vary with Macroeconomic and Credit Conditions at the Close

This table considers the same outcome measures, estimation method and samples as Table 3, but we expand the regression specification to include market conditions at the buyout close and its interaction with the buyout indicator. We measure market conditions using the Credit Spread or GDP Growth variable defined in the text and consider them in separate regressions. For each outcome measure, the table entries report the estimated coefficient on the interaction variable, its standard error, and the coefficient multiplied by the standard deviation of the interaction variable, which ranges from 3.1 to 3.5 Credit Spread across samples and from 1.6 to 1.9 for GDP Growth. Huber-White robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.

		Interaction Variable	
Dependent Variable		Credit Spread	GDP Growth
A. Employment Growth, All Margins	Coefficient	0.28	-0.24
	[St. Error]	[0.77]	[1.28]
	Unit S.D. Effect	1.0	-0.4
Organic Margins	Coefficient	-0.12	0.14
	[St. Error]	[0.62]	[1.08]
	Unit S.D. Effect	-0.4	0.3
B. Excess Reallocation, All Margins	Coefficient	1.32***	-0.66
	[St. Error]	[0.45]	[0.69]
	Unit S.D. Effect	4.6	-1.2
C. Labor Productivity	Coefficient	5.86**	-3.58
	[St. Error]	[2.56]	[4.47]
	Unit S.D. Effect	20.3	-6.8

Table 5. How Buyout Effects Vary with the Credit Spread Change in the Two Years after the Buyout

The outcome measures, samples, weighting method and regression specifications in this table follow Table 3 except for two extra explanatory variables in each regression: the change in the credit spread in the two years after buyout close and its interaction with the buyout indicator. For each outcome measure, table entries report the estimated coefficient on the interaction variable, its estimated standard error, and the coefficient multiplied by the sample standard deviation of the Credit Spread. This standard deviation ranges from 4.3 to 4.9 across the regression samples. The final column presents the p-value from F-tests of the equality of the coefficients of the three reported buyout type variables. Huber-White robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.

Dependent Variable		All Buyouts	Private-to-private	Public-to-private	Divisional	p-Value, F-test
A. Employment Growth,	Coefficient	-0.57*	-1.04**	-0.64	0.62	0.083
All Margins	[St. Error]	[0.30]	[0.48]	[0.39]	[0.66]	
	Unit S.D. Effect	-2.8	-4.9	-2.6	2.1	
	Coefficient	-0.30	0.25	-0.51	0.36	0.003
Organic Margins	[St. Error]	[0.26]	[0.25]	[0.34]	[0.56]	
	Unit S.D. Effect	-1.5	1.2	-2.1	1.2	
	Coefficient	-0.64***	-0.19	-0.49*	-1.14**	0.127
B. Excess Reallocation,	[St. Error]	[0.18]	[0.22]	[0.25]	[0.46]	
All Margins	Unit S.D. Effect	-3.1	-0.9	-2.0	-3.9	
C. Labor	Coefficient	-1.43	1.70*	-4.94**	-1.83**	0.014
Productivity	[St. Error]	[0.91]	[1.01]	[2.18]	[0.83]	
	Unit S.D. Effect	-6.1	9.2	-25.7	-4.6	

Table 6. How Buyout Effects Vary with the GDP Growth Rate in the Two Years after the Buyout

The outcome measures, samples, weighting method and regression specifications in this table follow Table 3 except for two extra explanatory variables in each regression: the GDP Growth Rate in the two years the buyout close and its interaction with the buyout indicator. For each outcome measure, table entries report the estimated coefficient on the buyout-GDP interaction variable, its standard error, and the coefficient multiplied by the sample standard deviation of the GDP Growth Rate, which ranges from 3.4 to 3.6 across the regression samples. The final column presents the p-value from F-tests of the equality of the coefficients of the three reported buyout type variables. Huber-White robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.

Dependent Variable		All Buyouts	Private-to-private	Public-to-private	Divisional	p-Value, F-test
A. Employment Growth, All Margins	Coefficient	0.96*	0.28	-0.05	1.82	0.106
	[St. Error]	[0.54]	[0.67]	[0.72]	[1.14]	
	Unit S.D. Effect	3.2	1.0	-0.1	6.3	
Organic Margins	Coefficient	0.34	-1.21***	-0.04	1.18	0.000
	[St. Error]	[0.40]	[0.34]	[0.53]	[0.84]	
	Unit S.D. Effect	1.1	-4.2	-0.1	4.1	
B. Excess Reallocation, All Margins	Coefficient	0.88***	-0.56	1.03***	1.67**	0.064
	[St. Error]	[0.28]	[0.40]	[0.35]	[0.74]	
	Unit S.D. Effect	3.0	-1.9	2.8	5.8	
C. Labor Productivity	Coefficient	0.98	-2.29*	4.86*	2.68*	0.216
	[St. Error]	[1.17]	[1.23]	[2.65]	[1.55]	
	Unit S.D. Effect	3.6	-10.4	16.4	10.0	

Table 7. How Buyout Effects Vary with NBER Recessions

This table considers the same outcome measures, estimation method, and samples as Table 4 and the first columns of Tables 5 and 6, but we modify the regression specification (2) in the paper to instead include interactions between the buyout indicator and (a) the presence of an NBER-defined recession during the year of the buyout close (column 1) or (b) the inception of such a recession within two years of the transaction (column 2) instead of interactions with market conditions using the Credit Spread or GDP Growth variable. For each outcome measure, the table entries report the estimated coefficient on the interaction variable and its standard error. Huber-White robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.

		Interaction Variable	
Dependent Variable		Recession at Close	Recession Afterwards
A. Employment Growth, All Margins	Coefficient	10.75***	-10.85***
	[St. Error]	[3.19]	[3.87]
Organic Margins	Coefficient	11.57***	-7.36***
	[St. Error]	[2.67]	[3.17]
B. Excess Reallocation, All Margins	Coefficient	2.08	-12.11***
	[St. Error]	[3.25]	[3.82]
C. Labor Productivity	Coefficient	-5.82	-12.82
	[St. Error]	[6.51]	[9.61]

Table 8. The Impact of Excluding Deals Most Impacted by the Global Financial Crisis

This table considers the same outcome measures, estimation method, and samples as Table 4, and the first columns of Tables 5 and 6, but we modify the sample by excluding observations from 2007. We measure market conditions using the Credit Spread or GDP Growth variable defined in the text and consider them in separate regressions. For each outcome measure, the table entries report the estimated coefficient on the interaction variable and its standard error. Huber-White robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.

		Table 4		*Table 5*	*Table 6*
Dependent Variable		Credit Spread	GDP Growth	Credit Spread	GDP Growth
A. Employment Growth, All Margins	Coefficient	-0.12	0.93	-1.71	0.08
	[St. Error]	[0.80]	[0.96]	[1.21]	[0.68]
Organic Margins	Coefficient	-0.40	1.35**	-1.34	-0.66
	[St. Error]	[0.60]	[0.66]	[1.03]	[0.44]
B. Excess Reallocation, All Margins	Coefficient	0.51	-0.59	-1.25**	0.86**
	[St. Error]	[0.46]	[0.43]	[0.58]	[0.44]
C. Labor Productivity	Coefficient	4.71*	-0.29	-8.02	-1.92*
	[St. Error]	[2.51]	[1.66]	[4.89]	[0.98]

Table 9. Blinder-Oaxaca Decompositions. The sample contains matched two-year continuers that underwent PE buyouts from 1980 to 2011 with sponsors that can be linked to fund-level commercial data sources. For each buyout, we compute the outcome measure from buyout year *t* to *t+2* for the target firm minus the corresponding average value for control firms in the same cell defined by the full cross product of firm-age category, firm-size category, industry, multi-unit status, and buyout year. Panel A presents coefficients from a regression of the outcome measure on a dummy for being above the median in (a) GDP growth in the two years after the buyout or (b) the credit spread at deal close. Panel B presents Blinder-Oaxaca decompositions of the difference between high and low values of the market conditions variable. The decompositions are based on separate regressions of the outcome measure on buyout type indicators and PE sponsor characteristics in subsamples defined by high and low values of the market conditions variable. See text for the full variable list. We use buyouts in the high-value subsample as the reference group when implementing the decomposition. *** p<0.01, ** p<0.05, * p<0.1.

	Outcome Measure (Target Minus Average of Controls)		
	Employment Growth Rate	Excess Reallocation Rate	Productivity Growth
A. Simple regression fit to all buyouts in sample			
Coefficient on a Dummy for High GDP Growth Post-Buyout – the “High-Low Difference”	7.14***	3.60***	
	[1.56]	[0.74]	
Coefficient on a Dummy for High Credit Spread at Close – the “High-Low Difference”			13.85**
			[6.02]
B. Blinder-Oaxaca Decompositions			
(1) Contribution of changes in buyout types and PE sponsor characteristics to the High-Low difference in Panel A	1.81	0.77	12.99***
	[1.57]	[0.63]	[4.01]
(2) Contribution of changes in coefficients on buyout types and PE sponsor characteristics to the High-Low difference in Panel A	6.10***	3.22***	15.37*
	[1.76]	[0.79]	[9.00]
(3) Contribution of interactions effects to the High-Low difference in Panel A	0.77	-0.39	-14.52
	[1.64]	[0.70]	[8.89]
Observation Counts	3,900	3,900	500

Table 10. The Persistence of Buyout Effects on Employment Growth at the Level of Private Equity Groups. The unit of observation for the regressions in this table is the average cell-adjusted target outcome for the buyouts of a given private equity sponsor in a particular five-year period (1980-84, 1985-89,…). Results for "Total Employment Growth" include the contribution of post-buyout acquisitions and divestitures, while results for "Organic Employment Growth" do not. See text for a full description of the explanatory variables. Huber-White robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

	Average Total Employment Growth Rate					Average Organic Employment Growth Rate				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged Average Employment Growth	0.0747	0.0744	0.0753	-0.0989	-0.3045***					
	[0.0461]	[0.0462]	[0.0462]	[0.3545]	[0.0747]					
Lagged Average Organic Growth						0.1229***	0.1226***	0.1226***	0.0504	-0.3174***
						[0.0465]	[0.0466]	[0.0464]	[0.3754]	[0.0842]
# of Buyouts in Current Five-Year Period		-0.0387***					-0.0361***			
		[0.0132]					[0.0117]			
Change in # of Buyouts from Previous to Current Five-Year Period			-0.4234					-1.292		
			[0.6443]					[0.8403]		
Time trend X Lagged Growth				0.3773					0.1569	
				[0.8043]					[0.8526]	
R^2	0.0128	0.0132	0.013	0.0131	0.7485	0.0283	0.0288	0.0307	0.0284	0.7725
Period fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
PE group fixed effects					YES					YES

Table 11. The Impact of Scaling at the PE Group Level on Employment Growth of Target Firms. The sample consists of matched two-year continuers that underwent private equity buyouts from 1980 to 2011 and control firms in the same cells defined by the full cross product of firm age, firm size, industry, multi-unit status and buyout year. Some firms serve as controls for more than one buyout type. The dependent variables are percentage changes from the buyout year *t* to *t+2* in "Total Employment Growth," which includes the contribution of post-buyout acquisitions and divestitures, and "Organic Employment Growth," which excludes them. Each reported effect is the coefficient estimate [standard error] on a buyout dummy interacted with the indicated group-level scaling measure. See text for a full description of the scaling measures. The mean and standard deviation values of the scaling measures pertain to the set of all buyouts from 1980 to 2011 for which we could identify the PE sponsor and collect information about the sponsor. This set is larger than the set of buyouts in the regression samples, which also involve matching to Census data on targets and controls. We estimate a separate weighted least-squares regression for each column and report Huber-White robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Scaling Measure for the Private Equity Group that Sponsored the Buyout	***Dependent Variable***							
	Total Employment Growth				Organic Employment Growth			
Funds raised in prior five years, normalized (Mean=0.0047, S.D.=0.0138)	-111.8*				-50.22*			
	[58.96]				[29.30]			
Adjusted financial performance of prior two funds (Mean=0.25, S.D.=1.12)		-7.32***				-3.97***		
		[1.66]				[0.93]		
Number of Buyouts in Current Five-Year Period (Mean=6.7, S.D.=8.5)			-0.0113*				-0.0122**	
			[0.0066]				[0.00556]	
Change in Number of Buyouts from Previous to Current Five-Year Period (Mean=0.43, S.D.=2.11)				-0.0709				-0.356
				[0.269]				[0.236]
R^2	0.396	0.260	0.394	0.393	0.355	0.236	0.355	0.355
Cell fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Deal type fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Controls for pre-buyout growth history of target firm	YES	YES	YES	YES	YES	YES	YES	YES

Figure 1. Quarterly Buyout Counts by Type, 1980 to 2013

Each panel shows buyout closings for the indicated deal type in quarter t, overlaid with the contemporaneous credit spread and the log change in real GDP from t-4 to t. We exclude about 300 buyouts that we cannot classify as to deal type. See Section I.A for an explanation of how we construct our sample of 9,794 leveraged buyouts sponsored by private equity firms.

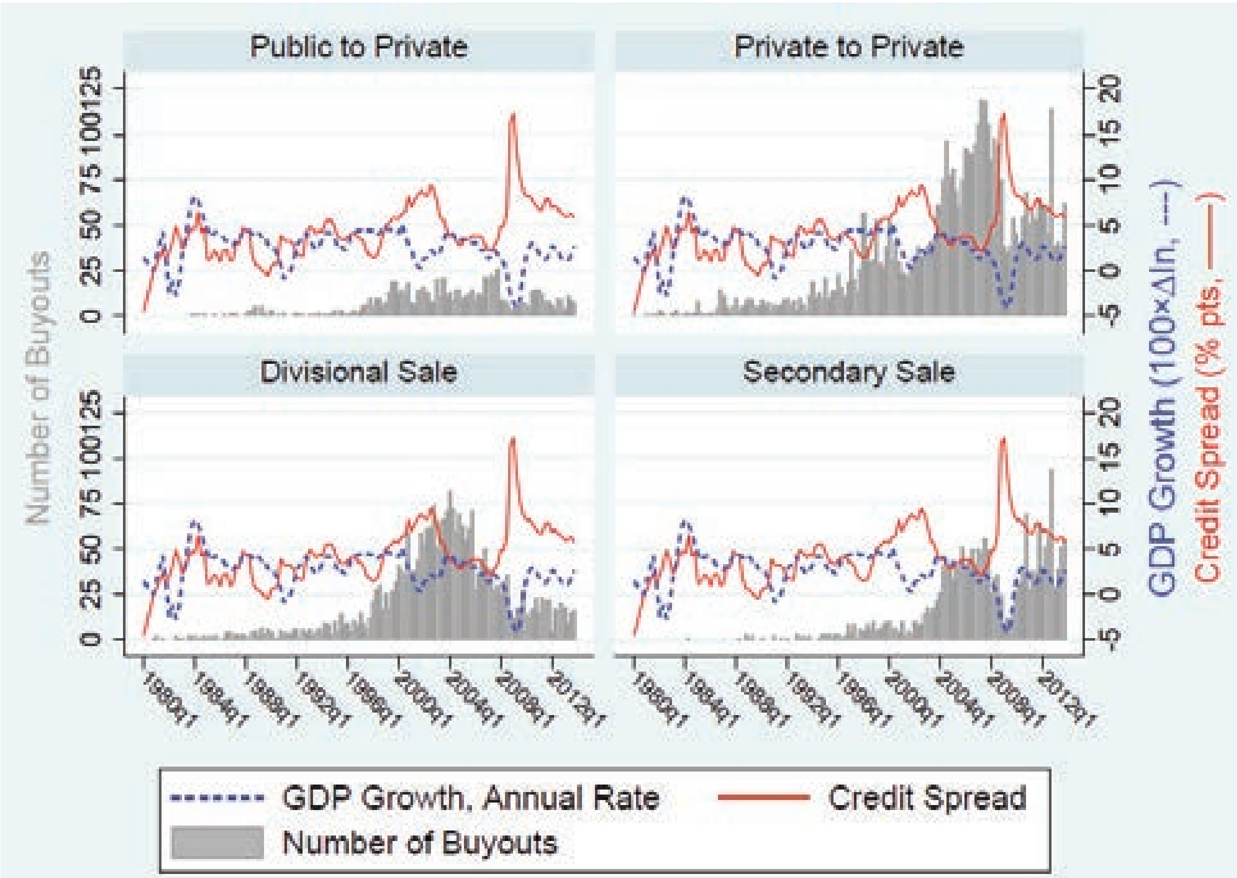
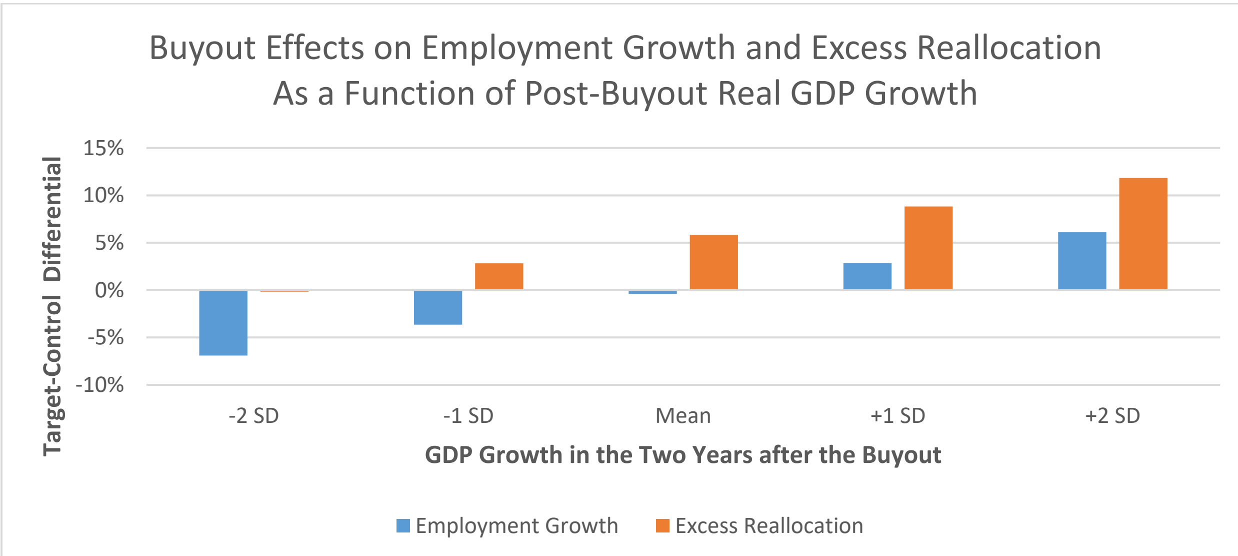
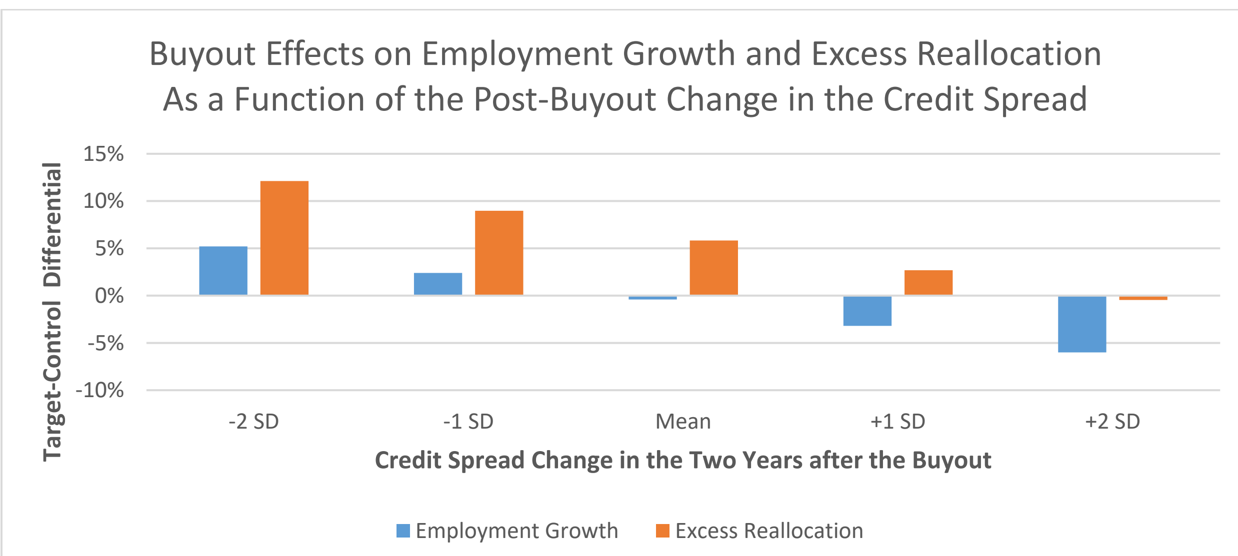


Figure 2. How Buyout Effects Vary with the Post-Buyout Evolution of Market Conditions
This figure uses the estimated interaction effects in Tables 5 and 6 to depict how the post-buyout employment growth rate and excess reallocation rate at targets (relative to controls) vary with the post-buyout evolution of market conditions. The center bars show the estimated target-control differential when evaluating at the sample mean of the market condition measures. The other bars show the target-control differential when evaluating the market condition measures at -2, -1, +1, and +2 standard deviations below or above their respective sample means.





Internet Appendix A: Sample Construction and Matching

1. Overview

We combine information on private equity buyouts from CapitalIQ and other sources with firm-level and establishment-level data held by the U.S. Census Bureau.

Specifically, we undertook a two-part effort, following Strömberg (2008). The first part drew on the CapitalIQ database to create a base sample of PE-sponsored leveraged buyouts. We selected all M&A transactions in CapitalIQ classified as a "leveraged buyout," "management buyout," or "JV/LBO" (joint venture/leveraged buyout) that closed between January 1, 1980 and December 31, 2013. To this sample, we added all M&A transactions undertaken by a financial sponsor classified as investing in "buyouts." We excluded management buyouts not sponsored by a PE firm and startup firms backed by venture capitalists. Although CapitalIQ has back-filled its database using various sources since starting its data service in 1999, its coverage remains incomplete in the early years of our sample. For this reason, the second part of our sample construction efforts relied on other databases,[22] the business press, and buyout lists for the 1980s compiled by other researchers.

The overlap between our initial sample of PE buyouts and lists of LBOs with a financial sponsor compiled by other researchers is high. For instance, 62 of the 77 buyouts in Kaplan's (1989) hand-selected sample of LBOs completed between 1980 and 1986 are captured by our CapitalIQ sample, a coverage rate of 81%. We added these 15 missing buyouts to our sample, as we did for other PE buyouts identified using various lists and other sources beyond CapitalIQ.

In the course of our investigations, we discovered that CapitalIQ classifies certain buyout fund transactions as "private placements" rather than acquisitions. In most cases, these private

[22] These include Dealogic, Preqin, and Thomson Reuters.

placements involve minority stakes or follow-on investments and, hence, are unsuitable for inclusion in our sample. Still, the distinction between buyouts and private placements is not always clear. In addition, some transactions reported as LBO deals were actually venture capital investments, which are not the object of our study. We sought to err on the side of caution by excluding ambiguous transactions and, as a result, may miss some bona fide LBOs.

We also excluded acquisitions not yet completed by the end of 2013, acquisitions of non-control stakes (typically associated with growth and venture deals, not classic buyouts), purchases of firms with foreign headquarters, stakes in public companies that remained publicly traded (PIPES), and other misclassified transactions. We identified these transactions through the careful review of text fields in CapitalIQ records and our own detailed research using other commercial databases, securities filings, and media accounts.

We then match these buyout deals to target firms and their establishments in the Census Bureau's comprehensive Business Register (BR). Our basic approach is as follows. First, we use name and address information to match a particular deal to a specific unit in the BR. Because the matching algorithm relies partly on address information, this step identifies a specific establishment owned by the target firm, which is often but not always a headquarters facility. Second, we use the BR link between that establishment's ID and its parent firm ID to identify the target firm in the BR. In most cases, this method identifies the target firm in the BR and all of its establishments.

We describes our matching process in detail below. The process yields a mapping to one or more firms in the BR for about 7,600 of the 9,794 U.S. buyouts that we identified from CapitalIQ and other sources. Of these 7,600 buyouts, about 4,100 match to BR identifiers for a single firm, while the other 3,500 map to identifiers for multiple firms. We resolved about 2,000 of these 3,500 cases to a unique match, leaving about 6,000 buyouts that we confidently match to a unique firm in the BR in the period from 1980 to 2013. The approximately 6,000 matched target firms acquired in PE buyouts from 1980 to 2013 operated about 177,000 establishments as of the buyout year and had nearly 7 million workers on their payrolls as of March in the buyout year.

The main reason we cannot confidently resolve the other 1,500 cases to a unique firm in the BR is because many targets undergo a complex reorganization during the buyout or shortly thereafter. The reorganization can involve the sale of multiple firm components to multiple parties, the emergence of multiple new firm IDs, and the introduction of a complex array of holding company structures. These cases present considerable matching challenges. Rather than include matches of dubious quality, we exclude them from our analysis.

Once matched to the BR, we can identify establishments owned by the target firm as of its buyout year. LBD longitudinal links let us compute employment changes for establishments and firms and track their entry, exit, and ownership changes. We supplement the LBD with firm-level revenue data drawn from the Census BR to obtain a revenue-enhanced version of the LBD (RE-LBD). The revenue data, available from 1996 to 2013, let us study the impact of PE buyouts on labor productivity, defined as real revenue per worker. About 20 percent of LBD firm-year observations cannot be matched to BR revenue data because firms report income under EINs that fall outside the set of EINs that Census considers part of that firm for employment purposes.

Treatment of Timing Matters

Given our interest in employment dynamics, the relationship of the LBD employment measure to the timing of PE buyouts requires careful treatment. The LBD reports total employment in the payroll period containing the week of March 12. Accordingly, for buyouts that close before October 1, LBD employment in March of the same calendar year serves as our contemporaneous employment measure. We assign buyouts that close on or after October 1 in calendar year *t* to the LBD employment value in March of *t+1*. October is the natural cutoff because it lies midway between March-to-March employment changes in the LBD.[23]

Henceforth, our references to buyout activity in year *t* refer to deals that closed from October of calendar year *t-1* through September of calendar year *t*. In particular, buyouts that closed in October, November or December of 2013 are shifted forward to 2014, beyond the time span covered by our LBD data. As a result, these matched targets are not part of our analysis.

Tracking Firms after the Buyout and Forming Our Analysis Sample

Of necessity, much of our analysis restricts attention to target firms that we can track after the buyout. While we can readily track establishments over time in the LBD, tracking firms is more challenging for two main reasons: the disappearance of firm identifiers (IDs) and irregularities in Census Bureau tracking of PE targets involved in certain divisional sales. We elaborate on these two reasons in turn.

Firm ID Disappearance. The disappearance of a firm ID in the LBD can occur for various reasons. One is the death of a firm and the closure of all of its establishments. Firm death in this sense presents no problem: we capture such events whether they involve target or control firms. A more difficult situation involves a target firm ID that vanishes in the first or second year after the buyout, even though some of its establishments (as of the buyout year) continue to operate. This situation can arise when the various components of the original firm are acquired by multiple firms. It is inherently difficult to define and measure firm changes when the original legal entity ceases

[23] Fractional-year mistiming of buyout deals is unavoidable when matching to the LBD, given its annual frequency. When buyouts are uniformly distributed over the year, an October cutoff minimizes the mean absolute mistiming gap. See Davis et al. (2018) for additional discussion. As an empirical matter, buyout closing dates are distributed fairly evenly over the calendar year.

to exist and has no obvious successor. We exclude these cases from our firm-level longitudinal analyses. To reduce the number of observations lost for this reason and other challenges in tracking firms over time, we restrict our longitudinal analyses to the buyout year and the next two years.

Divisional Buyouts. In principle, the annual Company Organization Survey lets Census accurately track the business units involved in divisional sales. However, we discovered divisional sales in which the firm ID of the (new) target firm remained the same as the firm ID of the selling firm. This situation indicates that the new firm created in the course of the divisional buyout did not receive a new firm ID, at least not in a timely manner. This problem does not preclude an establishment-level analysis, because we can often use an alternative identifier – the Employer Identification Number (EIN) – to accurately identify, as of the buyout year, the establishments involved in divisional sales. Unfortunately, EINs are unsuitable for tracking firms through time, because new and acquired establishments may obtain new EINs. Thus, we exclude divisional buyouts from our firm-level longitudinal analyses when the LBD lacks an accurate firm ID for the newly created target firm. We exclude some secondary buyouts for the same reason.

After matching to the BR, we use the Longitudinal Business Database (LBD) – essentially a longitudinal version of the BR – to follow target firms and their establishments over time. We also use the LBD to identify control units (comparable firms and establishments) and to follow them over time as well. In addition, we exploit common alphanumeric identifiers to incorporate other Census micro data for some aspects of our analysis.

The LBD tracks establishments and parent firms using a combination of administrative records and survey collections that include the Company Organization Survey (COS), the Economic Censuses, and the Annual Surveys of Businesses (e.g., the Annual Survey of Manufactures). Information about company structure is incorporated into the LBD by attaching firm identifiers to records for establishments. Ownership changes are identified when establishments switch parent firms through mergers, acquisitions, and divestitures.

The Census Bureau assigns a unique firm ID to all establishments under common ownership and control in a given year, including establishments that belong to subsidiaries under control of the parent corporation. This firm ID is distinct from a taxpayer ID such as the employer identification number (EIN).[24] The relationships among the various IDs are as follows. In any given year, an establishment is uniquely associated with a single taxpayer ID and a single firm ID. Moreover, each taxpayer ID is uniquely associated with a firm ID. For multi-establishment firms, a parent firm ID has multiple affiliated establishment IDs and potentially multiple EINs. Put differently, the EIN as a unit of observation is somewhere between an establishment and a firm.

2. Matching Buyout Targets to the Business Register (BR)

From Capital IQ and other sources, we obtain several pieces of information about the acquired entity in a private equity buyout. These pieces include the name of the seller, the name of the acquisition target, the target's address, and the acquisition date. The seller and target are typically the same in whole-firm acquisitions but not in partial-firm acquisitions – for example, when the private equity firm acquires one division of a multi-division company.

We match acquisition targets to firms in the BR using the data matching algorithms that are part of the SAS DQMatch procedure. This is an improved version of the matching algorithm and code we used in Davis et al. (2014). Our DQMatch implementation proceeds through 16 rounds of matching from the strictest criteria (requiring a perfect match on name and address) to progressively looser criteria that allow for fuzzier matching (exact name and fuzzy address, fuzzy

[24] The EIN is an employer tax identifier that may or may not change when ownership changes. It is often helpful in matching and tracking target firms and establishments involved in complex reorganizations.

name and exact address, exact name and zip code, etc.) Results from each pass are flagged and the results are stored for use in later analyses. For brevity, we do not discuss the DQMatch matching criteria and the algorithm used to identify matches in detail.[25] Here, we describe our overall matching strategy, explain how we resolve buyout deals that match to multiple target firm candidates in the BR, and discuss issues that arise in tracking firms over time.

A. *A Simple Case*

Suppose a private equity firm acquires firm A in its entirety during year *t* and places it under new ownership, possibly with a new name. A simplified version of our matching algorithm in this case works as follows: First, we find an establishment in the BR as of year *t* located at the target address and owned by a firm with the target name. Second, with this match in hand, we use the firm-establishment links in the BR to identify the full set of establishments operated by the target firm in *t*. From this point, we can measure the activity of the target firm in *t* and follow the firm (and its establishments) forward from *t* using the LBD.

B. *Challenges that Arise in the Matching Process*

In practice, several challenges arise in the matching process. First, because name and address data are noisy, we may find multiple BR firms that are candidate matches for the acquisition target.[26] All but one of these candidates, and perhaps all of them, are false positives.

[25] Programs to implement the DQMatch algorithm and master batch files to run them are available on the computing cluster servers in the Federal Statistical Research Data Centers.

[26] We use both physical and mailing address from the Business Register when available to generate matches. There is some noise in the addresses for new units in the Business Register that is typically resolved in an Economic Census. Our use of a multi-year window helps to partly overcome this source of noise. However, we did not find that our match rates peaked in Census years, suggesting that business name clarification in Economic Census years is not a big issue for our purposes.

Second, to cope with timing differences between datasets, we search for matches in the BR over a three-year window centered on the buyout year. While this approach can pick up good matches that we would otherwise miss, it can also introduce additional false positive matches. Whenever we have multiple candidate matches, we need some way to resolve to a unique match. When we cannot do so with sufficient confidence, we drop the acquisition target from our analysis.

Third, it can be hard to distinguish the seller firm from the acquisition target in some cases. For example, suppose a private equity firm acquires establishments e_1 and e_2 from firm A to form a new firm B in year *t*. In this case, the activity of establishments e_1 and e_2 are associated with both firms A and B in *t,* because each firm files tax records that cover e_1 and e_2 for part of the year. Thus, when we match the target address to an establishment, that establishment may link to two parent firms in the BR in the buyout year. In this situation as well, we need some way to resolve to a unique match.

Fourth, some private equity buyouts involve complex reorganizations of target entities that lead to the creation of multiple new firms or the piecemeal sale of the target entity to multiple parties. In these cases, even when we successfully match the target address to an establishment and correctly identify that establishment's parent firm, we may identify and track only some of the establishments acquired as part of the buyout. Indeed, there can be multiple true successor firms to the target entity in such cases, and we may capture and track only one of them.

Fifth, another challenge involves divisional buyouts, whereby the private equity firm acquires only part of a multi-division firm. For divisional buyouts, we could not always identify the correct target firm in the BR after matching the deal to a specific establishment. These instances arose because, in some cases, the Census firm ID associated with the matched establishments did not change to reflect the ownership change of the division involved in the buyout deal. We identified these problematic cases by observing that the matched target establishment remained affiliated with the parent seller firm even after the buyout. It is our understanding that the Census Bureau on occasion had difficulty tracking the new firm in divisional buyouts because of nonresponse on the COS or other survey instruments.

We thus had two types of divisional cases. The first are those where we could accurately identify the target firm using our main method, and the second where we could not. Even in those cases, we were able to link the matched establishment to at least a part of the target firm through the EIN (taxpayer ID). The complete target firm may or may not be identified in such cases, because the divisional business involved in the buyout may have operated with multiple EINs. In the main text and this appendix, we refer to such cases as EIN cases. In these EIN cases, we can accurately identify a part of the target firm in the buyout year and at least some of the corresponding target establishments, but we cannot be confident that we captured the entire target firm. We exclude EIN cases in our firm-level longitudinal analyses, because the EIN is not suitable for tracking firms over time. For example, if a target firm (i.e., an EIN case) creates or acquires a new establishment, it may obtain a new EIN for that establishment for accounting or tax reasons. In such cases, we would not know that the new establishment is part of the target firm.

C. How We Proceed

As explained above, our matching algorithm may initially yield zero, one or multiple candidate matched firms in the BR for a given buyout target. We now provide information about the frequency of these outcomes and describe our process for de-duplicating buyouts that match to multiple Census firm IDs.

<u>No Match</u>

In about 2000 of the 9794 deals in CapitalIQ, no companies within the BR matched even using the loosest matching criteria. Here and below, we provide rounded figures for counts of matched Census firms because of data disclosure restrictions.

Unique Matches

As noted above, we search for candidate matches in the BR over a three-year window centered on the buyout year, *t*. First, we select a year (*t-1, t* or *t+1*) in the three-year window for the buyout in question. Second, given the year, our algorithm proceeds through 16 rounds using progressively less stringent matching criteria. Third, if we obtain at least one candidate match in a given round, we do not proceed to later rounds for that year. For example, suppose a buyout target matches to a single BR entity in round 4 of our algorithm for year *t*. Even if the target firm matches to other BR entities in later rounds (which involve less stringent criteria), we stop in round 4 for year *t*. This process can lead to one or more candidate matches in each of *t-1, t* and *t+1.*

For about 4,000 of the 9,794 buyouts that we identified using CapitalIQ and other sources, the process described in the preceding paragraph yields a single match candidate. That is, the process yields at most one candidate in each of *t-1, t* and *t+1;* and, moreover, when it yields a candidate match in two or three of the years, it is the same firm in each year.

Non-Unique Matches and De-Duplications

The remaining set of about 3500 buyout deals match to multiple BR entities. This could happen, for example, if we find an exact match on address, but there are multiple firms in a single building with similar company names in the same year. As another example, Census often redefines the target firm's firm ID after the buyout. When it does, we often detect two match candidates within our three-year window centered on the buyout year: one match to the pre-buyout firm ID, and one to the post-buyout firm ID. We use three methods to arrive at a unique match between the buyout target and the Census firm ID in these and other cases that yield multiple candidate matches.

The first method for de-duplicating is to check the EINs of the match candidates. For about 25 percent of the duplicates, multiple match candidates have the same EIN. That tells us that each match candidate is owned by the same parent firm, and we proceed on that basis. This method is especially helpful in resolving duplicates that arise when Census changes the firm ID associated with the firm in question within the three-year centered window around the buyout transaction.

The second method for de-duplicating is to exploit the timing pattern of the matches. We consider cases with two candidate matches for the same deal. A common pattern in such cases is that one candidate is the birth of a new firm ID at time t or $t+1$, and the other candidate is a death at time $t-1$ or t. In this context, a "birth" is when a new firm ID appears at time t or $t+1$, one that did not appear earlier (in $t-1$ for births in t, or $t-1$ and t for births in $t+1$). A "death" is when a firm ID disappears in time t or $t+1$. We investigated cases that fit this pattern and determined that they likely reflect PE-precipitated reorganizations. Since these candidate matches satisfy name and address matching criteria, they are unlikely to be spurious. This second step uniquely resolves about 200 additional firm IDs in the BR to a particular target firm in a PE buyout.

If the first and second methods do not yield a unique match, we deploy a third method as follows. First, for the set of candidate matches, rank firm IDs by the strictness of the criteria that generated their inclusion as match candidates. Then create three flags:

- Set Flag 1 to 1 for those firm IDs with the highest rank among the match candidates. If there are two candidate matches, for example, one for year $t+1$ with an exact name and address match and one for year t that matches exactly only on the name, set Flag 1 to 1 for the one that matches exactly on both name and address.

- Among candidate matches with the highest rank, set Flag 2 to 1 for firm IDs that are present in year *t+1*.
- Among candidate matches present in year *t+1*, set Flag 3 to 1 for firm IDs that achieve the highest rank.

If one, and only one, firm ID satisfies Flag 1 = Flag 2 = Flag 3 =1, we treat that firm as the true match and use it in our analysis. This three-flag method resolves about 1000 additional buyouts to a Census firm ID. Altogether, our three resolution methods yield about 2000 additional matched deals. This gives us the total sample of approximately 6000 matched buyout deals.

3. Tracking Firms and Establishments after the Buyout

As explained in the main text, we cannot always track target firms with confidence in the years after the buyout. Tracking difficulties can arise because (a) a target is broken into many pieces, some or all of which are re-sold to other firms, and (b) errors and ambiguities in Census data prevent us from following the firm with confidence after the buyout. Thus, our econometric analysis in Section III examines the sample of "Two-Year Continuers" that we track with confidence. Our concept of "Continuers" includes firms that die in the sense that all of its establishments in the buyout year t cease to operate by t+2.

Tracking establishments in Census data is typically much easier than tracking firms. However, even establishments are challenging to track in certain limited circumstances. Every five years, the Census Bureau obtains a full list of establishments owned by multi-unit firms from the Economic Censuses. It obtains a full list of establishments owned by large multi-unit firms (250 or more employees before 2013) from the annual Company Organization Survey (COS). The COS also samples smaller multi-unit firms in a targeted manner based on information that they underwent rapid growth or organizational change. When this information is incomplete, Census may not promptly recognize new establishments operated by small, multi-unit firms in intercensal years. To address this matter, the LBD retimes the intercensal entry and exit of some establishments operated by small multi-unit firms. Still, the timing of M&A activity for small multi-units not covered by the COS or other Census surveys exhibits some bunching in Economic Census years. We do not think this limited bunching is a serious concern for our analysis, in part because small units get little weight in our employment-weighted regressions.

Internet Appendix B: Empirical Methods and Identification Assumptions

This appendix provides details about several aspects of our empirical methods. The first relates to how we track business outcomes over time. While we focus on firm-level outcomes, we exploit the establishment-level data in the LBD in several ways: to distinguish organic changes at the firm level from acquisitions and divestitures; to capture new facilities opened after the buyout; and to decompose firm-level employment changes into the gross job creation and destruction components associated with growing and shrinking establishments, respectively. The LBD's capacity to isolate each of these adjustment margins is one of its major strengths.

A second aspect relates to aggregation and the measurement of growth rates. Let E_{it} denote employment at establishment or firm i in year t – i.e., the number of workers on payroll in the pay period covering March 12. We measure the employment growth rate of unit i from $t-k$ to t as $g_{it,t-k} = (E_{it} - E_{i,t-k})/X_{it,t-k}$, where $X_{it,t-k} = 0.5(E_{it} + E_{i,t-k})$. This growth rate measure is symmetric about zero and lies in the interval [-2, 2], with endpoints corresponding to death and birth.[27] Employment growth at higher levels of aggregation is then given by $g_{t,t-k} = \sum_i (X_{it,t-k}/X_{t,t-k}) g_{it,t-k}$, where $X_{t,t-k} = \sum_i X_{it,t-k}$. Using these formulas, we can easily and consistently aggregate from establishments to firms, from individual units to industries, and over time periods. This approach to growth rates and aggregation also works for gross job creation and destruction, job reallocation, and employment changes along particular dimensions such as acquisitions and divestitures or continuing establishments.

[27] This growth rate measure has become standard in analyses of establishment and firm dynamics, because it shares some useful properties of log differences while also handling entry and exit. See Davis, Haltiwanger, and Schuh (1996) and Törnqvist, Vartia, and Vartia (1985).

A third aspect relates to the selection of control units for comparison to buyout targets in our regression models. We need suitable control units because the distribution of PE buyouts across industries and business characteristics is not random. Target firms are larger and older than the average firm and disproportionately concentrated in manufacturing, information technology, accommodations, and food services (Davis et al., 2014). They also differ by deal type, as shown above. Moreover, growth and volatility vary greatly by firm size and age, and workplaces and technologies differ greatly by industry.[28] Hence, we sort target firms into cells defined by industry, size, age, multi-unit status, and buyout year. We then identify all firms not backed by private equity that fall into the same cell as the given target firm(s), and treat those firms as control units for the target firm(s) in that cell. Specifically, we define our control cells as the full cross product of about 90 industries (at the three-digit NAICS level), ten firm size categories, six firm age categories, a dummy for firms with multiple establishments, and 32 distinct buyout years from 1980 to 2011.[29] This classification yields over 10,000 control cells per year. Of course, many cells are unpopulated, but the flexibility and richness of our approach to control units is clear.

Fourth, we estimate the effects of buyouts using a difference-in-difference approach. That is, we compare changes in jobs and productivity at target firms in the wake of buyouts to

[28] Much previous research highlights sharp differences in employment growth and the pace of job reallocation by firm size, firm age, and industry. See, for example, Davis, Haltiwanger, and Schuh (1996) and Haltiwanger, Jarmin, and Miranda (2013).

[29] We define industry for multi-unit firms based on the modal industry of their establishments, computed on an employment-weighted basis. Our firm size categories are 1-4, 5-9, 10-19, 20-49, 50-99, 100-249, 250-499, 500-999, 1000-2499, 2500-4999, 5000-9999, and 10000 or more employees. Our firm age categories are 0-5 years, 6-10, 11-15, 16-20, and 21 or more years. Following Davis et al. (2014), when a firm first appears in the LBD, we assign it the age of its oldest establishment. We then increment the firm's age by one year for each year it continues as a legal entity in the LBD. In this way, we avoid arbitrary increases or decreases in firm age due to the sale and purchase of establishments.

contemporaneous changes at their matched control units.[30] This approach, together with our control variables, facilitates an apples-to-apples comparison when estimating buyout effects.

A fifth aspect pertains to how we weight observations in the estimation. In this regard, we are mindful that buyout effects can vary with firm characteristics and economic conditions and by industry, deal type, and time period. Indeed, the main text documents material differences in the effects of buyouts on these dimensions. However, there is surely more heterogeneity in treatment effects than we can estimate with precision. Faced with this heterogeneity, our goal is to obtain a consistent estimate for the activity-weighted mean treatment effect on treated units under two common identification assumptions in regression studies of treatment effects:

- **CMI** (conditional mean independence): Conditional on controls and the treatment indicator, outcomes for treated and non-treated units are independently distributed within cells.
- **SUTVA** (stable unit treatment value): Treating one unit has no effect on the outcomes of other units.[31]

To achieve our estimation goal, we adopt two principles in weighting the observations:[32]

- **TS** (target-share weighting)**:** Weight each target (and each target cell) by its share of aggregate target activity, where "aggregate" refers to the sum over all buyouts in the regression sample.
- **SCT** (set control weights to targets): Set the sum of weights on controls in a given cell to the cell's target activity share.

[30] In Davis et al. (2014), we find that propensity score matching estimators yield very similar results. We stick with the control cell approach in this paper for simplicity.
[31] See Chapter 18 in Wooldridge (2002) for an extended discussion of CMI and SUTVA in panel regression studies of treatment effects.
[32] Neither equal weighting nor simple activity weighting of regression observations recovers the average treatment effect of interest.

To be precise, suppose we have two target firms in two separate control cells, and we are interested in target-control comparisons from t to $t+k$. The targets have activity levels $X_{1,t+k,t} = 0.5\left(E_{1,t+k} + E_{1t}\right)$ and $X_{2,t+k,t} = 0.5\left(E_{2,t+k} + E_{2t}\right)$. The first target's share of aggregate target activity is $\omega_{1,t+k,t} \equiv X_{1,t+k,t}/\left(X_{1,t+k,t} + X_{2,t+k,t}\right)$, and the second's share is $\omega_{2,t+k,t} \equiv X_{2,t+k,t}/\left(X_{1,t+k,t} + X_{2,t+k,t}\right)$. Since each control cell has a single target, these are also the control cell weights.[33] Principle SCT requires $\sum_{j}^{\mathbb{C}=1} \omega_{j,t+k,t} = \omega_{1,t+k,t}$ and $\sum_{j}^{\mathbb{C}=2} \omega_{j,t+k,t} = \omega_{2,t+k,t}$, where $\mathbb{C}$ indexes control cells, and j indexes control units in the cell.

Principle TS helps recover an average treatment effect that reflects the distribution over cells of target activity levels. Principle SCT has a similar motivation**.** It also ensures that the influence of control units on the coefficient estimates for covariates reflects the distribution over cells of target activity levels. Principle SCT is silent on exactly how to set control unit weights within cells, as long as they sum to the cell's share of aggregate target employment. In practice, we weight each control unit in proportion to its share of employment among the control units in the cell. After obtaining these proportions, we rescale them to satisfy SCT. We experimented with other approaches to weighting control units that comply with SCT. In particular, we tried equal weights for all control units within a given cell. We also tried winsorizing the weights of very large control units before rescaling to comply with SCT. These alternative approaches to weighting control units led to results similar to the ones reported below.[34]

[33] Note that we define a unit's activity level as the average of its employment at the start and end of the time interval under consideration. This practice conforms to our overall approach to aggregation and growth rate measurement, as discussed above.
[34] A subtle issue with weighting had to do with divisional buyouts, where one unit is spun out of a larger entity. Here we use employment in the spun-out entity after the buyout transaction, not that of its pre-buyout corporate parent.

Three concerns motivated our experimentation with alternative schemes that give less weight to larger control units, while still adhering to principle SCT. First, very large employment values for certain control units could reflect measurement error. This concern might apply to targets as well, but since our sample has only a few thousand targets, we scrutinize them carefully. We believe we have identified (and corrected) gross errors in target outcomes. A similarly careful approach for controls is infeasible, since there are so many of them. Second, it is often hard to fit very large firms into a particular industry category, even at the three-digit NAICS level. The classification challenges presented by such large firms raise concerns about the suitability of the treatment-control comparison. Third, the very largest control firms can be much larger than the corresponding target firm. The vast difference in size raises a different source of concern about the suitability of the treatment-control comparison. By applying equal weights to control units in a given cell or winsorizing the weights, we mitigate these concerns.

Recall that we aim to recover the average treatment effect on the treated (buyout) firms under CMI and SUTVA. A standard approach, which we took in Davis et al. (2014), is to fit a regression model with heterogeneous treatment effects, average over the treatment effect estimates, and compute the standard error for the average treatment effect by the delta method. (See Chapter 18 in Wooldridge, 2002.) Weighting principles TS and SCT afford a simpler econometric approach that recovers the average treatment effect of interest from a specification with a homogenous treatment effect. Under this simpler approach, we need not resort to the delta method to obtain standard errors. We can instead obtain them directly from the standard output for weighted least squares regressions in STATA and other widely used statistical packages. That is the approach we take in this paper.

Internet Appendix C: Creating the Private Equity Group-Transaction Sample

This appendix describes how we supplemented our database to capture information about the PE groups (also referred to as general partners, or GPs) that sponsor buyouts.

We transformed our original data for present purposes from being at the buyout level (as in Tables 3 through 8) to being at the buyout-PE group level. Thus, a single buyout transaction identifier may have multiple entries (with the same CapitalIQ transaction identifier), if there is a "club" (or syndicated) transaction with participation by multiple PE groups. In the Capital IQ database, there are 9809 distinct transactions meeting our criteria. In 89% of the cases, we obtained at least minimal information (organization type and fundraising history) about at least one buyout group active in the transaction. Because some transactions involve multiple PE groups, there are 11,606 distinct observations of PE group-buyout pairs. The most-active PE groups in the sample by deal count include some of the largest and most recognizable PE organizations, as well as leading specialists in middle market deals. (As we document in Table 2, sample sizes shrink once these data are matched to the Census information.)

PE Group Identifier

We assigned each PE group an identification number. That was simple when the group began as and remained an independent entity. Cases involving a change in control (and sometimes a name change), often associated with an acquisition or spin-off, were more complex.

Where there was a spin-out, we considered the spun-out entity to be a new PE group (with a new identifier), unless we were highly confident that it encompassed essentially all the PE investment activity of the predecessor group. In the latter case, a group might change status over time: i.e., from part of a bank or a family office to independent. When an independent group was acquired by another group, it was subsumed into the acquiring group after the acquisition, and its investments assigned to the acquirer's identifier. In addition to relying on entries in Capital IQ (the "Firm Description" field, a text description of the firm's history, its investment profile, and more), Refinitiv Thomson One, and Preqin databases, we undertook extensive online research to make these determinations. We especially relied here on searches using Factiva and Lexis-Nexis for historical information that was not accessible through searches of the unrestricted Internet.

In many cases, it was helpful to use information about the year the organization was founded in these determinations. Capital IQ often reports the year founded, sometimes in the "Firm Description" field instead of the "Year Founded" field. In cases where this information was missing, we used the start dates reported in Preqin.

Three complexities, however, arose in the determination of founding dates:

- Firms spun off from another institution (typically a bank) sometimes recorded their start date as that of the spin-off, and other times when the predecessor group was established. We standardized these (to the extent possible) to the year the predecessor group was established within the old parent institution. If instead of the spin-off of a clearly delineated group within the old parent institution, the creation of the firm entailed the departure of a few individuals within a larger body, the date of the actual firm formation was used.
- Groups that were still parts of a parent institution sometimes used the year the first PE program was set up at the parent, the year the specific initiative was established, or the year the parent was established. We standardized these to the extent possible to the year the first PE program was set up at the parent institution. If we could not get a start date of the first PE program or the specific investing program's inception, we left this information blank.

- Few corporations, family offices, and institutional investors disclosed when their private investment programs began, simply reporting when the overall entity was founded. If we could not get a date for the program's inception, we left this information blank.

Type of Organization

CapitalIQ was used to classify types of PE groups, particularly the fields "Primary Industry," "Institution Type," and "Firm Description." For groups whose status changed (e.g., due to an acquisition or divestiture), we used the information as it stood at the time of investment. Again, these changes were confirmed and precise dates identified using online searches. Where this information was incomplete, we supplemented it with online searches.

We used the following scheme to classify firms.

0- PE groups or diversified investors where private equity is an important component (e.g., Blackstone, Carlyle). This includes organizations with a "fundless" structure (e.g., who are investing off their balance sheet or on a "deal by deal" basis), as well as those who raised there last fund many years earlier.

1- Investment arms that are subsidiaries of other financial institutions, including investment/commercial banks, insurance companies, mutual funds, and brokerage houses, whether investing through funds or directly from these entities' balance sheets.

2- Investment arms that are subsidiaries of non-financial operating corporations, whether investing through funds or directly from these entities' balance sheets. In some cases, investment groups are identified by their largest holding, making them difficult to distinguish from operating companies. Other entities are unclear whether they are a business or investment company. A key test is whether there is a recognizable "core" business in a single or set of related industries. Berkshire Hathaway and GE are perhaps extreme cases. BH could be regarded as a (fundless) PE group, an insurer, or an operating company; we classified as a 0. On the other hand, General Electric or Mitsubishi's various financing subsidiaries could be regarded for much of the period as a (funded or fundless) PE group, a financial services firm, or an operating company; we classified them as a 2. Because the sample is limited to PE buyout transactions (i.e., excluding traditional strategically motivated acquisitions), no transactions by Danaher Corp., one of the most active acquirers of U.S. manufacturing firms, are included in the database. Thus, the only corporate transactions are those where the firms are either (a) undertaking their own PE-type transactions, often through a financing arm, or (b) co-investing with a large limited partner.

3- Investment arms that are subsidiaries of institutional and family investors, such as pensions, sovereign wealth funds, university endowments, and the like, whether investing through funds or (more commonly) directly from these entities' balance sheets. Again, we also include co-investments with PE groups; but as we point out elsewhere, the coverage of co-investment by CapitalIQ does not seem comprehensive and indeed biased (Fang, et al. [2015]).

4- Organizations with the bulk of their assets (90%+) in debt, hedge, and real estate funds or who primary lend off their balance sheets (excluding commercial banks, who are included in 1), but who do some PE investing on the side. This category does not include diversified investment managers who also own some of these funds.

Prior Fundraising

Fundraising data was bulk-downloaded from Preqin. The Preqin firm names were matched to the firm names in the Capital IQ data. This matching, in many cases, took considerable background research using online sources, due to the plethora of groups with similar sounding names (e.g., Pine Brook, Pine Creek, Pine Street, Pine Tree Equity, Pine Tree Growth, and PineBridge, not to mention various variants of White Pine).

Coverage of funds (amounts raised and performance) in Preqin is imperfect, particularly before 2000. We supplemented the Preqin information with fundraising data from Refinitiv Thomson One for those entities with no fundraising data in the relevant period. (Again, this took considerable research to resolve name matching.) In other cases, we found fundraising material online (e.g., state pension web sites) that summarized the timing and size of a group's funds.

We summed the count and size of the funds closed in the year between the deal year in the original data and four years before (t-4 to t), covering PE funds. All fund totals are expressed in millions of current U.S. dollars, converted from foreign currencies (if necessary) using the exchange rate at the mid-point of the year of the investment contained in the U.S. Federal Reserve Bank's H-10 series. We identified which funds to use based on the organization of the firm as of the time of the investment. Thus, for transactions in 2007 and before, we would look only at the funds raised by GSO Capital Partners. After its 2008 acquisition by Blackstone, we would compute the total raised by Blackstone (and GSO) in the five-year period.

We also created a normalized series: the funding divided by total funding raised at the beginning of the deal year in the original data and four years before (t-4 to t). These fundraising totals were for the years from 2000 to 2013 from Preqin (for U.S. based buyout and balanced private equity funds only) and from 1980 to 1999 from Thomson Reuters (North American-based buyout, mezzanine and growth funds).[35]

Prior Fund Performance

For these firms, performance data (as of the end of 2019 or the closest date prior to this point) for any funds from years t-12 to t-5 were also collected. We captured funds for banks and

[35] For years before 1980, we assumed based on press accounts an annual fundraising rate of $100 million per year in 1978 and 1979, and $50 million per year in 1976 and 1977.

corporations that raised funds under different divisions and programs (e.g., for General Electric, entities raising funds included GE Capital, GE Commercial Finance, and GE Holdings). These data were primarily taken from Preqin, but complemented with information from PitchBook and state public pension disclosure.

We focused on the performance of the most recent U.S. (or global) PE funds in that period with performance data and the two most recent funds. We looked at internal rate of return (IRR) and multiple of invested capital (MoIC), since this information was most readily available in Preqin. (Coverage of public market equivalents was much thinner.) In each case, we subtracted the benchmark performance calculated as the pooled IRR and weighted MoIC. The sources of the benchmark performance information were as follows:

- For vintages 1985, 1987 to 1988, and from 1990 to 2008: Preqin database, using data on North American buyout funds
- For vintages 1986 and 1989: Cambridge Associates via ThomsonOne, using data on US buyout and growth equity funds.
- For vintage years 1976 to 1984: Venture Economics, 1998 Investment Benchmark Reports, Newark, 1998, using data on US buyout funds (data on the 1976-83 period is consolidated in the report).
- For vintage years 1968 to 1975: Venture Economics, Venture Capital Performance 1989, Waltham, 1989, using data on all US private capital funds (data on the 1970-76 period is consolidated in the report).

In cases where we used multiple funds, we took a fund-weighted average of the fund net performance. Because this averaging process is more correct for TVPIs (an average of two IRRs may be quite different than the IRR of the combined cash flows), we focused in the TVPI measure in the paper.

This performance information was typically missing for groups that invested off their own balance sheet (which included many financial institutions, family offices, and corporations, and some private equity groups with fundless structures). In some cases, groups invested through both funds and their balance sheets, whether PE groups that have raised outside capital at the management company level (e.g., KKR) or more typically, banks and corporations. To cite one example, the amount raised through its funds was a small fraction of what GE invested, since most was done through its balance sheet. Unfortunately, there is no way to create a fund-like measure for balance sheet assets, since capital designated for investments is typically not segregated in financial reports. We thus computed the total for the formal funds.

We did a variety of diagnostic tests to verify the information and to catch potential errors. These exercises included:

- Looking at all PE investment entities with a start year before 1945. (Some entities did indeed start earlier, but we sought to be extra careful here.)
- Looking at PE investment entities with the same identification number but a different classification. (Again, due to spin-offs, some organizations did change status, but we were extremely careful and conservative here.)
- Looking at PE investment entities with the same identification number but a different start year. (Again, such cases could result as a result of a spin-off—see the rules delineated under Step 1—but we wanted to be sure.)

- Looking at PE investment entities with the same identification number and transaction year, but a different number and volume of funds raised in the prior five years. (These were typically the result of miscoding organizations with complex organizational histories.)
- Looking at PE investment entities with the same identification number, but with substantial discrepancies in the number and volume of funds raised in the prior five years between adjacent years. (These were typically a consequence of miscoding organizations with complex organizational histories.)

Internet Appendix D: Additional Results

Table D.1 tabulates the data presented in Figure 1 for three periods selected to highlight how PE deal flow sank during the financial crisis and recovered afterwards. Table D.2 follows Table 1 in the main text, except for using upper tercile splits rather than median splits for the GDP growth and credit spread variables. Table D.3 provides information about the distribution of PE buyouts by industry sector and deal type. It also uses the same sample as Figure 1.

In Table D.4, Panel A breaks down the overall employment change by establishment status. Here, "Continuers" refer to establishments that operate under ownership of the same firm (target or control) throughout the period from *t* to *t+2*. Continuer employment at target firms shrinks by (a statistically insignificant) 1.5% relative to control counterparts in the two years after buyout. The rate of employment change at growing continuers is essentially identical for buyouts and controls, as indicated by the "Creation" results. In contrast, contracting continuers shrink more rapidly at targets, as indicated by the "Destruction" results. Target firms experience 4.0% larger employment losses from shuttered establishments ("Deaths") and 1.2% greater employment gains due to new facilities ("Births"). They also add more jobs through acquisitions to the tune of 3.7% of base employment. All three of these differences are statistically significant. The difference in job changes from divestitures, however, is neither economically or statistically significant.

Because the regressions are employment weighted, we can sum the coefficients. Consider first the results for "Continuers" and "Deaths," which capture all employment changes for establishments owned and operated by targets and controls in the buyout year. Summing these two components yields a two-year employment growth rate differential of -5.6 percentage points (-1.53 – 4.03). That is, establishments operated by target firms as of the buyout year shed 5.6% of employment relative to controls over the next two years, largely through establishment shutdowns.

Factoring in the greater propensity of target firms to create more new jobs at new establishments adds 1.2 points to this sum. That yields a net differential of -4.4 percentage points for targets, the same as the organic growth change in the second row. Further factoring in the role of acquisitions and divestitures adds 3.0 points, yielding an overall buyout effect on firm-level employment of -1.4 percentage points over two years. The other panels in Table D.4 consider various results for job reallocation (overall and excess), compensation per worker, and labor productivity.

Table D.5 reports estimated buyout effects on employment by adjustment margin and buyout type.

Finally, Table D.6 provides evidence on the wage effects of PE buyouts using a larger, broader sample than previous studies. How buyouts affect wages has long been controversial. Critics argue that buyouts lead to lower wages, as formalized by Shleifer and Summers (1988). Indeed, Lichtenberg and Siegel (1990) find that buyouts lead to lower compensation for white-collar workers. More recently, Agrawal and Tambe (2016) suggest that buyouts can enhance human capital in target firms, particularly by developing employee knowledge of information technology. Survey evidence in Gompers, Kaplan, and Mukharlyamov (2016) is consistent with this view.

Our wage measure in Table D.6 is the change from buyout year *t* to *t+2* in the firm's gross annual compensation per employee.[36] The wage sample is smaller than in Panels A-C of Table 3

[36] Barth et al. (2014) provide a detailed description of the LBD wage measure: "The data follow the definition of salaries and wages used for calculating the federal withholding tax. They report the gross earnings paid in the calendar year to employees at the establishment prior to such deductions as employees' social security contributions, withholding taxes, group insurance premiums, union dues, and savings bonds. Included in gross earnings are all forms of compensation such as salaries, wages, commissions, dismissal pay, paid bonuses, vacation and sick leave pay, and the cash equivalent of compensation paid in kind. Salaries of officers of the establishment, if a corporation, are included. Payments to proprietors or partners, if an unincorporated concern, are excluded. Salaries and wages do not include supplementary labor

for the same three reasons discussed in regard to productivity in the text. In addition, compensation data are unavailable for some firms in the LBD.

The first column in Table D.6, Panel A reports a statistically insignificant wage drop of 0.28% at target firms relative to controls over two years post buyout. Because we derive this estimate as a difference-in-difference, it nets out persistent target-control differences in workforce composition. However, it does not control for changes from the buyout year *t* to *t+2* in firm-level workforce composition. Establishment births, deaths, acquisitions, and divestitures are potentially important sources of such changes in firm-level workforce composition.[37]

Panel A suggests that buyout-induced wage effects also differ greatly by type. Compensation per worker rises by 11% in divisional targets relative to controls over two years post buyout, while falling by 6% in private-to-private deals. We find smaller, statistically insignificant wage declines for public-to-private and secondary deals. Large post-buyout wage gains at divisional targets may partly reflect what practitioners call "job title upgrading." When a corporate division becomes a new stand-alone firm, the divisional general manager (or his replacement) becomes CEO, the divisional controller becomes CFO, and so on. The new titles and firm-wide responsibilities often come with (much) higher pay. The Carlyle Group's divisional buyout of DuPont Performance Coatings (renamed Axalta Coating Systems) in February 2013

costs such as employer's Social Security contributions and other legally required expenditures or payments for voluntary programs." Thus, our wage measure includes management compensation except for stock option grants, which are typically constructed to defer tax obligations until exercise or sale. Buyouts often tilt the compensation of senior management toward stock options (Leslie and Oyer, 2008), so we may slightly understate the true wage change at target firms.

[37] Appendix Table D.4. explores these firm-level adjustment margins and show that they are especially active at target firms in the wake of buyout deals.

offers a case in point.[38] Panels B and C display the relationship between the differences in wage changes and economic conditions at and after the buyouts, and find few significant relationships.

[38] The top five personnel of Axalta received compensation in 2013 of $17.2 million, including the aggregate fair value of stock option awards as of the grant date. While the reporting of option grants may differ for tax purposes (and hence in our data), even the total non-option compensation of the five individuals was $6.1 million. We cannot directly observe the compensation of the top five employees of DuPont Performance Coatings in 2012, but web sites such as Glassdoor suggest that senior divisional managers at DuPont received contemporaneous compensation packages in the mid-six figures. See Axalta Coating Systems, Schedule 14A, March 23, 2015 and Lerner and Tuzikov (2018). Thus, the compensation of top Axalta personnel in 2013 was much greater than what they, or their counterparts, likely earned as senior divisional managers before the buyout.

Table D.1. Private Equity Deal Flow Before, During, and After the Financial Crisis. The table reports the quarterly flow of private equity buyouts, overall and by deal type, in selected periods. It also reports the average value of the credit spread in the closing month and the annual real GDP growth rate over the four quarters that end in the closing quarter. The table entries are tabulated from the data plotted in Figure 1.

	All PE Buyouts	*Private to Private*	*Public to Private*	*Divisional Sales*	*Secondary Sales*
A. *Pre-Crisis, January 2004 to December 2007*					
Buyouts Closed Per Quarter	203	88	15	52	43
Average Credit Spread	3.27%				
Average Real GDP Growth Rate	2.85%				
B. *Crisis, October 2008 to June 2010*					
Buyouts Closed Per Quarter	87	46	5	17	18
Average Credit Spread	11.79%				
Average Real GDP Growth Rate	-1.40%				
C. *Post-Crisis, July 2010 to December 2013*					
Buyouts Closed Per Quarter	133	58	9	17	49
Average Credit Spread	6.81%				
Average Real GDP Growth Rate	1.97%				

Table D.2. Market Conditions and Private Equity Buyout Frequency by Deal Type, Quarterly Data, 1980-2013, Upper Tercile Split Instead of the Median Split in Table 1 in the Main Text. We regress 100 times the natural log of the PE buyout count in quarter *t* on deal-type indicators interacted with market conditions at buyout close (top panel) and over the following two years (bottom panel), while controlling for deal type and a linear time trend. The sample is the same as in Figure 1. To characterize contemporaneous market conditions for buyouts that close in quarter *t*, we consider whether the credit spread in *t* is in the top tercile or not and whether real GDP growth from *t-4* to *t* is in the top tercile or not. Similarly, to characterize the evolution of market conditions over the next two years, we consider whether the change in the credit spread and real GDP from *t* to *t*+8 are in the top tercile or not. After dropping quarter-type cells with no buyouts, each regression has 454 observations. *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variable: 100**ln*(type-specific buyout count in quarter *t*)

	Coefficient on Market Conditions (row) interacted with Deal-Type Indicator (column)					
Market Conditions	Private to Private	Public to Private	Divisional Sales	Secondary Sale	R^2	Equality of Coefficients (p-value)
A. At Buyout Close						
High GDP Growth	17.4	75.0***	39.1***	-11.4		
	[11.2]	[14.3]	[13.0]	[15.6]	0.74	0.000
Wide Credit Spread	-40.5***	-37.4**	-34.4*	-26.3**		
	[10.2]	[16.1]	[18.7]	[14.3]		0.000
B. Over Next 2 Years						
High GDP Growth	-3.9	9.9	12.9	-40.9**		
	[12.4]	[14.2]	[13.9]	[17.3]		0.120
Widening Credit Spread	19.7*	61.5***	24.5*	22.7	0.73	
	[11.3]	[14.8]	[14.1]	[14.8]		0.000

Table D.3. Private Equity Buyouts by Industry Sector and Deal Type, 1980-2013. Each column reports the percentage breakdown of buyouts for the indicated deal type, using the Standard & Poor's 2018 Global Industry Classification Standard (GICS). The sample is the same as in Figure 1.

		Buyout Type				
Sector	*GICS code*	*Private-to-Private*	*Public-to-Private*	*Divisional*	*Secondary*	*Total*
Energy	10	2.9	2.2	2.6	2.2	2.6%
Materials	15	8.1	5.7	9.3	8.6	8.3%
Industrials	20	28.9	19.0	23.4	28.6	26.5%
Consumer staples	25	18.6	24.6	18.8	20.7	19.6%
Consumer discretionary	30	7.4	4.6	4.0	6.2	6.0%
Health care	35	10.1	12.0	8.0	10.3	9.7%
Financials	40	3.9	4.7	4.7	2.7	3.9%
Information technology	45	11.5	15.8	17.7	12.3	13.7%
Communications services	50	7.2	7.5	8.1	7.4	7.5%
Utilities	55	0.6	1.0	2.1	0.8	1.1%
Real estate	60	0.8	3.1	1.3	0.2	1.0%
		100.0%	100.0%	100.0%	100.0%	100.0%

Note: A test of the null hypothesis that the industry distribution of buyouts is independent of deal type yields a Pearson Chi-squared statistic of 260.7 with a p-value of 0.000.

Table D.4. Buyout Effects by Adjustment Margin at Target Relative to Control Firms. The sample contains matched two-year continuers that underwent private equity buyouts from 1980 to 2011 and control firms in the same cells defined by the full cross product of firm age, firm size, industry, multi-unit status and buyout year. Some firms serve as controls for more than one buyout type. Outcome measures are (approximate) percentage amounts from the buyout year *t* to *t+2*, unless otherwise noted. All results in Panel A are expressed as percentages of firm-level base employment. Each reported effect is the coefficient estimate [standard error] on a buyout indicator in a weighted least-squares regression that includes a full set of cell-level fixed effects and controls for pre-buyout growth histories. A positive coefficient in each case indicates that activity on that dimension is greater for buyouts. See Section II in the main text for an explanation of how we weight observations. Results for "All Margins" include the contribution of post-buyout acquisitions and divestitures, while results for "Organic Margins" exclude them. Reallocation measures are computed from establishment-level employment changes at the firm. Huber-White robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

A. Employment Growth	Buyout Effect	Standard Error	R^2
All Margins	-1.35	[2.17]	0.32
Organic Margins	-4.38**	[1.90]	0.29
By Establishment Status			
Continuers	-1.53	[1.15]	0.28
Creation	0.20	[0.41]	*0.34*
Destruction	1.73*	[0.96]	*0.27*
Deaths	4.03***	[1.24]	0.30
Births	1.17**	[0.51]	0.34
Acquisitions	3.69***	[0.97]	0.38
Divestitures	0.65	[0.41]	0.26
Number of Firm Observations (000s)	6,400		

B. Reallocation (% of Base Employment)	Buyout Effect	Stan. Err.	R^2
Excess Reallocation, All Margins	4.95***	[1.14]	0.40
Excess Reallocation, Organic Margins	0.61	[1.54]	0.35
Job Reallocation, All Margins	11.47***	[1.82]	0.39
Job Reallocation, Organic Margins	7.13***	[1.76]	0.39
Number of Firm Observations (000s)	6,400		

C. Productivity Change at Targets Relative to Controls, and Separate Contributions of Revenue and Employment Changes

	Buyout Effect	Standard Error	R^2
Revenue Per Employee	0.0752*	[0.0406]	0.47
Revenue Contribution	0.0618	[0.0398]	0.47
Employment Contribution	-0.0133	[0.0230]	0.39
Number of Firm Observations (000)	911		

Table D.5. Buyout Effects on Employment by Adjustment Margin and Buyout Type. The sample contains matched two-year continuers that underwent private equity buyouts from 1980 to 2011 and control firms in the same cells defined by the full cross product of firm age, firm size, industry, multi-unit status and buyout year. Some firms serve as controls for more than one buyout type. Outcome measures are employment changes from the buyout year *t* to *t+2*, expressed as a percentage of firm-level base employment. A positive coefficient in each case indicates that activity on that dimension is greater for buyouts. Each reported effect is the coefficient estimate [standard error] on a buyout indicator in a separate weighted least-squares regression that includes a full set of cell-level fixed effects and controls for pre-buyout growth histories. See Section II in the main text for an explanation of how we weight observations. Results for "All Margins" include the contribution of post-buyout acquisitions and divestitures, while results for "Organic Margins" exclude them. Reallocation measures are computed from establishment-level employment changes at the firm. Huber-White robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

	Private-to-private		Public-to-private		Divisional		Secondary	
By Adjustment Margin:	Buyout Effect	R^2	Buyout Effect	R^2	Buyout Effect	R^2	Buyout Effect	R^2
Continuers	0.55 [1.04]	0.30	-1.59 [1.20]	0.33	-7.64*** [2.74]	0.29	2.63** [1.28]	0.36
Creation	0.27 [0.57]	0.36	0.23 [0.56]	0.29	-0.86 [0.96]	0.28	2.10* [1.08]	0.43
Destruction	-0.28 [0.77]	0.32	1.82* [0.99]	0.32	6.78*** [2.45]	0.33	-0.53 [1.02]	0.29
Deaths	-0.03 [1.04]	0.34	6.26*** [2.05]	0.44	9.76*** [2.00]	0.28	0.70 [1.58]	0.29
Births	2.51*** [0.77]	0.40	-2.13*** [0.71]	0.33	1.42 [1.20]	0.37	4.16*** [1.22]	0.42
Acquisitions	9.53*** [2.59]	0.44	0.40 [0.57]	0.42	3.32** [1.54]	0.38	3.29*** [0.96]	0.39
Divestitures	-0.27 [0.53]	0.20	3.01*** [1.04]	0.35	-1.02** [0.49]	0.23	-0.36 [0.61]	0.22
Observations (000s)	3,700		400		2,300		600	

Table D.6. Buyout Effects on Wages by Establishment-Level Adjustment Margin. The table presents tables identical to those in the paper, but for wages. Panel A replicates Table 3; Panel B, Table 5; and Panel C, Tables 5 and 6 (first column only). See tables in the paper for more information.

Panel A: Estimated Buyout Effects.

	All Buyouts		Private-to-private		Public-to-private		Divisional		Secondary		p-Value
Dependent Variable	Effect	R^2	Effect	R^2	Effect	R^2	Effect	R^2	Effect	R^2	SUR test
Annual Compensation Per Employee	-0.28 [1.6]	0.22	-5.9* [3.4]	0.13	-1.8 [1.6]	0.81	11.0*** [3.4]	0.41	-3.0 [2.5]	0.37	0.040
Observations (000s)	3,700		2,100		200		1,500		300		

Panel B: How Buyout Effects Vary with Macroeconomic and Credit Conditions at the Close.

		Interaction Variable	
Dependent Variable		Credit Spread	GDP Growth
	[St. Error]	[0.45]	[0.69]
	Unit S.D. Effect	4.6	-1.2
Annual Compensation Per Employee	Coefficient	0.66	-0.65
	[St. Error]	[0.62]	[0.78]
	Unit S.D. Effect	2.0	-1.1

Panel C: How Buyout Effects Vary with the Credit Spread Change and GDP Growth in the Two Years after the Buyout.

Dependent Variable		Credit Spread	GDP Growth
Annual Compensation Per Employee	Coefficient	0.33*	-0.24
	[St. Error]	[0.20]	[0.41]
	Unit S.D. Effect	1.4	-0.8

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Private Equity and Financial Stability: Evidence from Failed Bank Resolution in the Crisis

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Abstract

We investigate the role of private equity (PE) in the resolution of failed banks after the 2008 financial crisis. Using proprietary failed bank acquisition data from the FDIC combined with data on PE investors, we find that PE investors made substantial investments in underperforming and riskier failed banks. Further, these acquisitions tended to be in geographies where the other local banks were also distressed. Our results suggest that PE investors helped channel capital to underperforming failed banks when the "natural" potential bank acquirers were themselves constrained, filling the gap created by a weak, undercapitalized banking sector. Next, we use a quasi-random empirical design based on proprietary bidding data to examine ex post performance and real effects. We find that PE-acquired banks performed better ex post, with positive real effects for the local economy. Our results suggest that private equity investors had a positive role in stabilizing the financial system in the crisis through their involvement in failed bank resolution.

JEL Classification: E65, G18, G21
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1. Introduction

Private equity (PE) has become an important component in the financial system. An extensive literature explores the effects of private equity buyouts on firm-level outcomes, such as employment, productivity, product quality, and innovation, with some papers arguing that such buyouts positively affect the operations of target companies.[1] At the same time, the private equity industry generates much controversy. Critics of the private equity industry often argue that private equity transactions involve heavy financial engineering schemes that introduce a substantial debt burden on the target companies and default risks to the banking sector (Andrade and Kaplan, 1998; Kaplan and Strömberg, 2009). This concern could be exacerbated during an economic downturn due to the cyclicality of private equity investment (Bernstein, Lerner, and Mezzanotti, 2019).

How does private equity interact with and affect the stability of the financial system, especially during periods of crisis? Despite its importance, there has been little research on the matter. In this paper, we investigate this question by examining private equity investors' engagement in the failed bank resolution process in the aftermath of the 2008 crisis. This is a novel setting to study private equity and financial stability. To begin with, bank failures and their resolutions are a salient feature of financial crises, and have a significant real effect on the economy (Bernanke, 1983; Granja, Matvos, and Seru, 2017). Indeed, banks are central to the functioning of financial markets and have important externalities (Gorton and Winton, 2003). As a result, our setting allows us to examine private equity investors' role in one of the most crucial steps in stabilizing the financial system in a crisis. Moreover, the setting is unique compared to most of the PE literature, and thus demands a separate investigation. Compared to industrial firms in which private equity investors often intervene, banks are subject to more stringent regulation,[2] and require unique expertise and human capital. This non-bank involvement in banks also generates a lot of controversy.

The role of PE in failed bank resolution is a priori unclear. There are concerns that PE investors could exert negative influences on financial stability. PE investors may take advantage of the fragile banking sector and target high-quality assets under fire sales. Banks have safety nets

[1] See, for example, Kaplan (1989), Lichtenberg and Siegel (1990), John, Lang, and Netter (1992), Boucly, Srear, and Thesmar (2011), Lerner, Sorensen, and Stromberg (2011), Davis et al. (2014), Bernstein et al. (2016), and Bernstein and Sheen (2016).

[2] For example, a list of federal banking regulations can be found here: https://www.stlouisfed.org/federal-banking-regulations/.

and backstops that may also be exploited by PE investors. Further, PE acquisitions may be value destroying if PE investors are not well prepared to operate a bank.

On the other hand, PE investors could have a unique advantage in stabilizing the financial system through acquiring failed banks. First, PE investors have a higher risk appetite, and this may allow them to target riskier and lower quality failed banks that are less appealing to traditional bank acquirers. Under this line of reasoning, PE investors complement the bank acquirers through the "selection" of failed banks. Second, during those financial downturns, PE investors may have relatively more stable funding (Bernstein, Lerner, and Mezzanotti, 2019), bringing in new capital in times of capital scarcity. Third, PE investors have the expertise to turn around distressed firms in adverse economic situations (Hotchkiss, Smith, and Strömberg, 2011; Jiang, Li, Wang, 2012; Cohn, Hotchkiss, Towery, 2020).

This paper exploits detailed, proprietary failed bank acquisition data at the FDIC. We observe information on failed banks, bidding, and acquisition activities. We identify PE investors who participated in failed bank resolutions, both as bidders of the failed bank's assets in failed bank auctions and as acquirers of the failed bank's assets when awarded the winning bid. We further augment the data with bank operation data extracted from the Consolidated Reports of Condition and Income "Call Reports," the FDIC Summary of Deposits (SOD) and the FDIC Reports of Structure Change. We also supplement our data using PE-level information from Preqin.

Who do PE investors acquire? PE acquisitions are significant, totaling about a quarter of all failed bank assets acquired in the period 2009–2014. We find that PE investors bid for, and eventually acquire, failed banks that are of poorer quality and higher risk compared to those that were acquired by banks. PE-acquired banks, on average, are larger and more undercapitalized, evidenced in their lower tier 1 risk-based capital ratio (measuring a bank's core equity capital). They tend to have a lower ratio of core deposits (which measures a stable source of funds for the bank). PE-acquired failed banks also have lower profitability prior to failure, captured by the net interest margin. PE-acquired banks also hold larger proportions of riskier loans. For example, during the crisis, construction and development (C&D) loans had higher levels of underperformance leading to an increase in credit risk ratings. PE-acquired banks, on average, hold 27 percent more C&D loans, relative to the 17.9 percent C&D loans to total loans in bank-acquired institutions.

PE investors also focus on banks that are less likely to immediately synergize with healthier existing banks. Granja, Matvos, and Seru (2017) show that bank acquirers are more interested in purchasing failed banks that are geographically close to themselves to realize informational benefits and economies of scale. Hence the natural acquirers of failed banks are healthy local banks. We show that failed banks whose neighboring banks are in worse health are more likely to be acquired by PE investors—when neighboring banks have lower tier 1 capital, higher proportions of C&D loans and higher proportions of other real estate owned (OREO), which can reflect larger amounts of distressed real estate properties held by the bank due to foreclosure.

This evidence together points to a sorting pattern of failed banks with their plausible acquirers: PE acquirers complement banks in this market by bidding and ultimately acquiring lower-quality and higher-risk failed banks. In doing so, PE investors help channel capital that can fill the gap created by a weak, undercapitalized banking sector and help meet the huge needs for new capital. The PE presence allows more failed banks to avoid being liquidated and the local financial system to be preserved. Comparing our data with a simple counterfactual world without PE investors acquiring any banks, 25 (5.5 percent) more of the banks that failed during this time would have been liquidated, and another 37 (8.1 percent) would have gone to a higher-cost bidder. In total, we estimate that PE acquisitions allowed the FDIC to reduce resolution costs by $3.63 billion.

We next ask: how do PE-acquired banks perform post acquisition? Filling the gap in the failed bank resolution process left by undercapitalized bank buyers, as documented above, is valuable. However, if PE interventions introduce excessive risks and long-term underperformance into the financial system, the overall impact of PE would have to be viewed with caution. The empirical challenge to isolate the effect of PE on post-acquisition performance of banks is the very acquisition selection pattern that we present above. Banks and PE investors target a different segment of the failed bank market, making any post-acquisition pattern a combination of treatment and selection.

To better identify the effect of PE acquirers, an ideal experiment would compare the post-acquisition performance of two otherwise similar banks of which one is quasi-randomly allocated to a PE investor and one to a bank. Our empirical strategy leverages the proprietary FDIC failed bank bidding data to generate a quasi-random sample. We proxy the ideal experiment by focusing on a set of banks that were bid on by both PE investors and by banks (i.e., selectable to both PE investors and banks) and whose bidding values were close (below five percent of the total bank assets). Essentially, the exercise compares banks that were (marginally) won by bank acquirers and those (marginally) won by PE investors. This comparison allows us to significantly mitigate the confounding selection problem and more cleanly isolate the direct effect of PE intervention. Reassuringly, in this quasi-random sample, PE-acquired banks and bank-acquired banks look statistically identical along dozens of characteristics, and the winning probability of PE investors and banks in those auctions are nearly identical (52 percent vs. 48 percent).

Armed with this empirical strategy, we explore several different performance metrics. First, we track branch closures of acquired failed banks. PE-acquired failed bank branches are less likely to close than bank-acquired failed bank branches. This result is robust to our preferred specification in which we compare two bank branches that belong to two banks that failed in the same year and the same state. For these branches, the only difference is whether it was quasi-randomly won by another bank or a PE investor. It is important to note that the lower branch closing rate of PE-acquired banks is not due to the fact that bank mergers often lead to consolidation of local branches, which would make the higher closing rate in bank acquisitions mechanical. In fact, we also find a higher probability of exiting a county altogether in bank-acquired banks, which cannot be explained merely by consolidating local branches. Next, we find that PE-acquired banks experience a significantly higher increase, roughly 35 percent higher growth across different specifications, in branch-level deposits compared to other failed banks. Given deposits are the base for profits, lending capacity, and market power, we interpret this as a positive indicator for PE-acquired banks.

The ability to maintain the scale of operation and a robust deposit base is an important indicator of bank health and performance. More importantly, providing stable access to credit by operating a local branch has important consequences for local businesses and the recovery from the financial crisis (Nguyen, 2019). The positive performance patterns of PE-acquired failed banks lead us to hypothesize that those acquisitions facilitate the regional economic recovery from the crisis, and this is the basis of our next test.

We adapt the same quasi-random framework to a county-level analysis. In this analysis, we compare two counties—each county has a failed bank branch, but one is acquired by a PE investor and one is acquired by a bank. These counties are statistically identical prior to the acquisitions.

During the post-acquisition period, however, those counties with PE acquisitions experience stronger recovery from the crisis—faster employment growth and increased total and per capita income. One potential channel for this is the sustained lending activities supported by the acquired bank branches. Compared to bank-intervened counties, PE-intervened counties witness higher growth in small business lending, both in terms of the number and amount; those loans are also made at a lower interest rate.

The documented positive performance may be partially attributable to the expertise of the management team that PE investors bring into failed banks. Using hand-collected data on CEOs appointed at banks after PE acquisitions, we show that PE investors hire ex-bankers who, on average, have nearly 30 years of experience in the banking industry, and more than half of them were CEOs of other banks before being appointed at the failed banks. More than 60 percent of the CEOs had experience in the local area of the failed bank, more than a third specialized in turnaround management and troubled and distressed assets, and about a third had previously founded a bank that eventually merged with a larger buyer.

Taken together, our results suggest that private equity plays an important role in failed bank resolution in a time of crisis. PE investors provide much needed capital in acquisitions, which helps fill the gap of a weak banking sector at a time when the natural potential acquirers—local banks—are themselves in distress. PE acquirers also help turn around the acquired failed banks, preserving their branch structure, helping deposit growth, and managing the loan portfolio losses, with positive effects for the real economy. While there are natural policy concerns in allowing PE firms to form bank holding companies and in bringing in non-banks into banking in general, our results suggest that, despite these concerns, private financial investors can play a positive role in resolving distressed banks in a crisis.

This paper connects to several strands of literature. It is related to an extensive literature that studies the role of private equity in the economy (e.g., Kaplan, 1989; Lichtenberg and Siegel, 1990; John Lang and Netter, 1992; Boucly, Sraer, and Thesmar, 2011; Lerner et al., 2011; Cohn, Hotchkiss and Towery, 2013; Davis et al., 2014; Bernstein et al., 2016; Bernstein and Sheen, 2016; DeYoung et al., 2018), and particularly in some regulated industries in recent work (e.g., Eaton, Howell, and Yannelis, 2019; Kirti and Sarin, 2020; Gandhi, Song, and Upadrashta, 2021; Gupta et al., 2021). These studies mostly focus on firms and almost exclusively on normal times, while our focus is on the distressed state of the world. The paper on PE that is closest to ours is Bernstein, Lerner, and Mezzanotti (2019), which studies PE investment in industrial firms in the crisis and shows that PE investors did not exacerbate the negative shock to firms. However, the behavior of PE investors in a highly regulated and sensitive industry such as banking is likely different from PE's behavior elsewhere. Our key contribution is to tackle the role of PE on financial stability by directly examining the interaction between PE and the central actors—banks, particularly failed banks that can result in significant costs to the financial system.

This paper also relates to an emerging body of work examining the behavior of financial institutions during the financial crisis (e.g., Ivashina and Scharfstein, 2010; Ben-David, Franzoni, and Moussawi, 2012; Berger and Bouwman, 2013) and the resolutions of failed banks and their impacts (James and Wier, 1987; James, 1991; Vij, 2020). The closest bank failure paper to our work is Granja, Matvos, and Seru (2017), which provides a key economic insight that poor capitalization of local banks, who are the natural buyers of failed banks, results in substantial costs to the FDIC's resolution efforts for failed banks. Our paper contributes to this new area of research by introducing PE investors as financial buyers into the picture, a source that surprisingly buys 24 percent of the failed bank assets acquired in the resolution process during this period. We show that PE investors operate as a complementary source of funding in the resolution of bank failures at a time when the local bank buyers are themselves undercapitalized. Further, PE acquisitions do well and also benefit the real economy. From a policy perspective, our findings are supportive of the policy innovation of the OCC and the FDIC that allowed financial buyers to participate in the resolution of failed banks.

2. Institutional Background

In this section, we introduce background knowledge of how the FDIC resolves bank failures and, more importantly, how PE investors can become a qualified player in this process. Roughly five hundred banks failed during the financial crisis, putting a large strain on the financial system. This fact can be seen clearly in Figure 1, which plots the number of bank failures (Panel A) and the total assets at failure (Panel B) from 2000 onward.

When a bank fails, the FDIC is appointed receiver by the failing institution's chartering authority. To address bank failures, the FDIC used the Purchase and Assumption (P&A) resolution method in roughly 95 percent of the cases during 2009–2014, and these are the transactions studied in this paper.[3] In a P&A transaction, the FDIC uses a process that resembles a first-price sealed bid auction to sell some or all the assets and liabilities of the depository institution. Granja, Matvos, and Seru (2017) provide a detailed description of how the process of failed bank resolution works; we review relevant points here and refer interested readers to their paper and to the FDIC's *Resolutions Handbook*[4] for further details.

[Insert Figure 1 Here.]

To sell a failed bank, the FDIC first generates a broad list of potential bidders that have expressed interest in bidding for failed institutions and that satisfy a list of requirements, such as satisfactory capital and supervisory ratings. Upon signing a confidentiality agreement, interested parties may be granted access to a virtual data room for the review of available information, which can include loan reviews, schedules representing the value of items on the failed bank's balance sheet, and operational information. Interested parties can place sealed bids for the failed bank based upon standard transaction terms, resembling a first-price sealed bid auction. Using its proprietary least cost test,[5] the FDIC selects the bid whose terms entail the least-estimated cost for the Deposit Insurance Fund (DIF) if those costs are below the reservation value set by the FDIC, which is unknown to bidders. The bank is then closed, and the FDIC transfers assets and deposits to the acquirer.[6]

In the past, private investors have generally been excluded from bidding on failed institutions because they themselves were not chartered banks. However, in 2008 the Office of the Comptroller of the Currency (OCC) began making it easier for PE investors to participate in failed bank auctions by creating a "shelf charter" program. A shelf charter allows investors to bid on failed banks despite not being affiliated with an existing bank. The OCC also made available an

[3] The remaining failures were resolved by the FDIC through depositor payouts and asset liquidation.

[4] Federal Deposit Insurance Corporation (FDIC). 2019. *Resolutions Handbook*, Revised January 15, 2019. https://www.fdic.gov/bank/historical/reshandbook/resolutions-handbook.pdf.

[5] The least cost test evaluates the liquidation cost of the failed institution against the cost of alternative resolution options. A few details are worth noting here: The Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991 requires that the FDIC select the bid that results in the least costly resolution to the Deposit Insurance Fund (DIF). As a statutory requirement, this process for bid selection does not vary from bank to bank. Additionally, the FDIC's valuation of liquidation, the valuation of submitted bids, and the details of the least cost test itself are all unknown to bidders.

[6] Since failed banks are often smaller in size, concerns like "too big to fail" or antitrust issues generally do not come under consideration by the FDIC when managing the bidding process and picking the winner.

“inflatable charter,” which allows PE investors to buy a small, non-failing bank with the intention of growing it quickly through subsequent failed bank acquisitions. There were twenty distinct charters, obtained by nineteen PE consortia (more on “consortia” below), used to acquire failed banks by PE in the crisis.

[Insert Figure 2 Here.]

In the charter approval process, PE acquisition plans are subject to a high degree of regulatory scrutiny. Potential PE investors must submit details such as the proposed bank management team qualifications, the sources and amount of capital available to the bank, and the business plan describing intended operations of the acquired bank. The information gathering, application, and approval process typically occurs well in advance of any specific acquisition opportunities that may arise. In addition, because PE firms engage in non-banking activities, they must also apply to the Federal Reserve Board for preliminary approval to form a bank holding company (BHC).

Most PE investors apply for a bank charter and form a BHC as a consortium together with a number of other PE firms, often in the form of an LLC with PE firms as shareholders. This can allow greater access to capital and help to leverage relevant expertise and connections. From a BHC regulatory perspective there are advantages as well—firms with less than a 25 percent share of voting securities or up to one third of total equity (provided that this includes less than 15 percent of voting securities) are not subject to BHC regulation by the Federal Reserve Board. Applying as a consortium can help limit the equity investments of individual PE firms below these regulatory thresholds. For example, a number of PE firms might form an LLC with equity shares of the individual PE firm participants below the threshold. The LLC is then used for the proposed BHC and serves as the actual acquiring entity. Thus, while the holding company formed by the PE firms is exposed to BHC regulation, the individual PE firms themselves are typically not.

PE acquirers did not have restrictions on what they could bid on, aside from the usual criteria applied to other bank bidders, such as available capital and financial health. However, PE acquirers did have additional requirements imposed by the FDIC for operating the bank. Notably, PE acquirers were required to maintain a tier 1 common equity to total assets ratio of at least 10 percent for at least three years after the time of acquisition. They also had to maintain continuity of ownership for at least three years after the time of acquisition, absent FDIC approval. Further, they were not permitted to engage in any credit transactions with affiliates, meaning that they could not use the bank as a platform to lend to their affiliated companies or investments.[7] Additional PE requirements included: pledges of cross-support if investors own 80 percent or more of two or more banks; no ownership by entities in bank secrecy jurisdictions; no opaque ownership structures; no investors having 10 percent or more equity in the same bank before failure; and required disclosure about investors and ownership to the FDIC.[8]

[Insert Figure 3]

As shown in Figure 3, PE investors acquired about 8.5 percent of the banks in 2009 (11 out of 129). That number is larger in money terms, with PE investors acquiring 25.2 percent of the total failed bank assets that were acquired in the resolution process in that year.[9] PE investors remained active in acquiring failed banks through 2014, and through all those years, they acquired 13 percent of all failed banks acquired, or 24 percent in terms of assets acquired in resolution. After 2014, PE investors stopped acquiring failed banks. This might be due to two reasons. First, bank failures returned to pre-crisis levels (below 10 every year in number), leaving limited room for PE investors to pursue these investments. Second, PE funds formed during the crisis to pursue the strategy of failed bank acquisitions reached the latter part of their typical 10- to 14-year life cycle, and thus started to focus more on operations and exit. Our main analytical sample covers the period of 2009–2014.[10]

3. Data and Sample Overview

3.1 Banking Data

3.1.1 Failed Bank Data

Between 2009 and 2014, there were a total of 482 bank failures resolved by the FDIC. Private equity acquirers purchased 62 of these failed banks, while existing banks purchased 393 failed

[7] This explicitly prohibits lending to affiliates in which the PE firm has invested equity, ruling out the kind of cross-selling behavior documented in Fang, Ivashina, and Lerner (2013).

[8] For more details, see the *Final Statement of Policy on Qualifications for Failed Bank Acquisitions*, Federal Register, Vol. 74, No. 169, September 2, 2009.

[9] We removed liquidated banks in this analysis. Also, because the FDIC often retains a sizable portion of failed bank assets not purchased by the acquirer, the total assets acquired do not necessarily match to the total assets of the failed banks (as in Figure 1).

[10] It is worth noting that it is uncommon for troubled banks close to failure to restructure (e.g., be acquired by a healthy bank) outside of the FDIC resolution process. We do not find that PE investors participate in acquisitions of troubled banks outside of the FDIC resolution process.

banks.[11] There were 25 failed banks with no least cost bid that were liquidated by the FDIC; another two provided correspondent banking services to client banks only and were temporarily run by the FDIC as bridge banks after failure. We exclude these 27 banks from our analysis following Granja et al. (2017). Details on bank failures and their resolutions come from the FDIC. These include public information conveying the timing of failure and acquisition, the location and size of the institution at failure, the amount of assets passed to the acquirer, and the terms of the failed bank transaction (transaction type, loss share coverage, and so on). We also have proprietary FDIC information on the identity of the acquirer and on all the bidders and details of their bids.

Additionally, we utilize proprietary FDIC cost estimates used in evaluating failed bank bids. This includes the FDIC's estimated liquidation cost for the failed bank and the valuation of the winning and cover bids from the internal least cost analysis. We use these estimations to identify close bids of the same failed bank, which are useful for creating a quasi-random empirical design to isolate the effect of PE intervention. These data are also useful for making back-of-the envelope calculations of the difference in cost savings had PE investors been excluded from the auction process.

Finally, we use confidential FDIC data containing details on loan performance in loss share portfolios. Loss share participants are required to submit regular reports to the FDIC on the performance of loans covered by shared loss agreements and details on any losses incurred. Because acquired banks are typically absorbed into healthy existing banks, it is difficult to track the performance of failed bank assets once they have been acquired. However, the loss share performance data allow us to observe the performance of those assets over time, even after acquisition. This provides us with a unique and important window into the management of failed bank assets by PE and bank acquirers.

3.1.2 Bank Characteristics

We obtain data on the operational financial characteristics of failed banks and their acquirers from the FDIC's quarterly Consolidated Reports of Condition and Income (Call Reports) and from Thrift Financial Reports for institutions regulated by the Office of Thrift Supervision (OTS) prior

[11] One bank was split between two acquirers but was technically a single failed bank.

to 2012. These reports contain details of the income and balance sheet characteristics for all the banks in our sample.

The Summary of Deposits (SOD) database provided by the FDIC allows us to obtain bank branch location data for each commercial and savings bank and the level of deposits. The SOD database contains information on the geographical coordinates, address, and deposits of each branch of every commercial and savings bank operating in the United States. We also complement this data using the FDIC's Reports of Structure Changes. These reports provide information on branch office openings and closings. Together, we use these sources to analyze the closing of failed bank branches, and to track changes in deposits at the county level within the footprint of the failed bank.

This geographic information on bank branches also allows us to capture the characteristics of the neighboring banks of each failed institution. Granja, Matvos, and Seru (2017) show that neighboring banks' financial health is an important determinant of the failed bank resolution process. Consistent with their paper, we define local banks as banks whose branch network overlaps in at least one zip code with the branch network of the focal failed bank.

3.2 Private Equity Data

Our classification of PE acquisitions comes from the charter used to bid on failed banks—namely, acquisitions that were made by non-bank bidders that obtained a shelf or inflatable charter for the purpose of failed bank bidding. While most of the funds raised by those non-bank acquirers are from PE firms, they sometimes include non-PE sources such as asset management companies, institutional investors, and family offices. However, private equity firms are the key participant in this process. For example, based upon information in SEC registration statements and FDIC depository insurance applications, we estimate that PE sources account for more than 70 percent of the ownership for each consortium on average, based upon major consortia participants identified with five percent holdings or more. Additionally, the vast majority of acquisitions conducted by those private investor consortia were led by private equity firms.[12] In the Online Appendix, we show alternative definitions of PE-acquired banks based on the level of PE

[12] A few exceptions include two small failed banks in our sample that were single acquisitions primarily acquired through family offices and a community development bank largely acquired by institutional investors. We group these failures with PE acquisitions rather than those acquired by banks because non-bank investors made the acquisitions through the same shelf charter process used by PE. All analysis results are similar if we do not include those cases.

ownership (e.g., PE shares being larger than or equal to 75 percent), and our results are not affected by the definitions.

We collect additional information about those individual PE funds from several different sources. First, we hand match those PE funds with information from Preqin. Preqin collects the quarterly aggregated investments, distributions, and net asset values (NAVs) of PE funds as recorded by U.S. pension funds and obtained via routine Freedom of Information Act requests. For funds covered by the Preqin data, we collect information on the size of the fund, the vintage year, and the background of the PE firm. We also supplement this by searching additional information from PitchBook, Crunchbase, and a general internet search.

3.3 Real Economic Effects

To obtain local employment and startup creation information, we use data from the U.S. Census Quarterly Workforce Indicators (QWI) to compute total employment by firm age and by county. The QWI is derived from the Longitudinal Employer-Household Dynamics (LEHD) program at the Census Bureau. It provides total employment in the private sector in each county and employment tabulated for different firm age categories. Income data at the county level comes from the Internal Revenue Service (IRS) Statistics of Income and is measured in calendar years (i.e., January to December of each year).

For local access to small business credit, we use the small business lending data obtained from the Small Business Administration (SBA). We use contract-level information on 7(a) loans, one of the largest SBA programs, delivered through various methods (Certified Lenders Program, Preferred Lenders Program, SBA Express, etc.). We focus on both the quantity and pricing of SBA loans made in each region-year.

3.4 Summary Statistics

Table 1 provides summary statistics from the PE side. In the upper panel, we provide statistics at the consortium level, which is the relevant unit for failed bank purchases. As described above, typically multiple PE funds join forces to form a consortium and obtain a bank charter at the consortium level. On average, each bank acquisition consortium consists of around 3.4 PE investors, counting only those having shares of five percent or more. They, on average, bid on 5.2

failed banks,[13] and "win" 3.26 of them. Their bidding strategies are quite focused, and most of these consortia purchase banks within one state. Interestingly, 58 percent of the PE consortia include at least one PE firm that has actively participated in the distressed investment space as identified in Hotchkiss, Smith, and Strömberg (2011) and Jiang, Li, Wang (2012), suggesting that these PE firms have some experience in distressed investments and turnarounds.

[Insert Table 1 Here.]

In the bottom panel, we provide summary statistics at the individual PE level, conditioning on data availability from Preqin. On average, each PE firm joins 1.13 consortia. In other words, only around 10 PE firms joined more than one consortium. In some cases, multiple funds in the same PE firm joined the same consortium. Those PE investors are traditional independent PE investors and are not affiliated with other banks. Importantly, most of the investing funds are of recent vintages. The median fund vintage is 2007, and more than 25 percent of the PE funds are formed in or after 2009. This suggests that those funds were likely raised for the purpose of participating in failed bank resolutions, and that they had relatively adequate funding for such actions. Most of these funds are not first-time funds, so they have accumulated networks and human capital from prior activity in the PE markets.

[Insert Table 2 Here.]

Table 2 reports summary statistics of failed banks as of the last quarter prior to failure. Most failed banks in the crisis were small community banks. The median bank size was just above $200 million, but with a very long right tail in the size distribution. Unsurprisingly for banks that failed, the tier 1 risk-based capital ratios just prior to failure were very low—far below the average for other neighboring banks that did not fail. Liquid assets were just under 17 percent of total assets on average, and core deposits comprised almost 84 percent of total deposits. These banks tended to be heavily involved in CRE lending, making up almost 39 percent of the total loans on their balance sheets. They also held a large amount of C&D loans, comprising almost 19 percent of their total loans on average. The ratio of C&I loans to total loans was smaller at 10 percent, and the ratio of consumer loans to total loans was just over 2 percent. Residential lending averaged 25.9 percent of total loans. In addition, both the noncurrent loans to total loans and the OREO assets to total

[13] These are PE bids above the liquidation value. The average is only slightly higher at 5.7 when also including PE bids below the liquidation value.

assets at the failed banks were much higher than at other neighboring banks, indicating portfolios in distress. Two-thirds of the banks were resolved using loss sharing agreements with the FDIC.

4. Private Equity in Failed Bank Resolution

We first investigate which segment of the failed bank market was targeted by PE investors, and which was targeted by banks. The result of this analysis would indicate whether PE investors are complementary failed bank buyers to incumbent banks.

4.1 PE-Acquired and Bank-Acquired Failed Banks

We start by performing the analysis using a logit regression framework:

$$Pr(PE = 1) = \Phi(\alpha + \beta \cdot X_i + \gamma \cdot Control_i + \theta_t + \varepsilon_i). \qquad (1)$$

The analysis uses the cross-sectional sample of all failed banks that were eventually acquired by a bank or a PE investor. The dependent variable is a dummy that takes a value of one if the failed bank was eventually acquired by PE, and zero otherwise (acquired by a bank). We control for the size of the bank using the logarithm of the total assets at failure. Year-quarter fixed effects are included to account for the time-varying economic, market, and regulatory environments that could affect the failed bank resolution process.

[Insert Table 3 Here.]

Table 3 Panel A presents the results, reporting marginal effects calculated at the sample mean. Column (1) concerns the tier 1 risk-based capital ratio. Tier 1 capital includes the most loss-absorbing forms of capital, and therefore is an important representation of bank financial strength. The marginal effect of -0.013 suggests that, for a one standard deviation decrease in the tier 1 risk-based capital ratio, there is a 3.5 percentage point increase in the probability that the bank is purchased by PE. This is a 25.8 percent increase from the base rate of 13.6 percent. Bank size positively and significantly correlates with the probability that the bank is acquired by PE, indicating that PE investors may have had an advantage over existing banks in raising larger amounts of capital for these purchases.

In column (2) we switch to another measure of the stability of banks' sources of funding, namely the core deposits to total deposits ratio. Core deposits are made in a bank's natural demographic market and offer advantages to banks, such as predictable costs, low sensitivity to short-term interest rate changes, and lower run risks. The core deposits to total deposits ratio is negatively associated with PE acquisition. For a one standard deviation decrease in core deposits to total deposits, the coefficient of -0.220 translates to a 23.4 percent increase from the base rate of PE acquisition.

Column (3) shows that low-profitability failed banks are more likely to be acquired by PE investors. We use the net interest margin, which measures how much a bank earns in interest compared to how much it pays out as a ratio of interest-earning assets, as an indicator of bank profitability. This helps to mitigate the potential measurement noise for failing banks in other possible profitability measures like ROA or ROE. For example, interest-earning assets should be less wildly variable than total assets used in ROA calculations in the face of large, discrete charge-offs in nonperforming assets; it is also not uncommon for average equity to reach negative values in banks that are failing, in which case ROE is not reported. In addition, the net interest income should be less variable than the total net income used for calculating ROA and ROE, due to the provisioning behavior for loan and lease losses (which are treated as an expense to net income on the bank's income statement) at failing banks.

Columns (4) and (5) examine the loan composition of banks. Banks with riskier asset portfolios—captured by a higher proportion of C&D loans and OREO assets to total assets—were more likely to be acquired by PE investors. C&D loans can be more sensitive to economic or market conditions than other loan types for several reasons. For example, projects may experience budget overruns or a lack of timely progress, market conditions can change drastically in the intervening time between loan approval and project completion, and lenders may have greater difficulties extracting collateral value from an incomplete construction project in default. In the crisis, C&D loans turned out to be particularly problematic. As the FDIC describes in its history of the crisis (FDIC, 2017), "Most banks that failed or became problem banks did so because of large concentrations, relative to their capital, of poorly underwritten and administered commercial real estate loans and (especially) ADC [acquisition, development & construction] loans" (p.179). Similarly, a higher proportion of OREO assets is often a sign of a loan portfolio in distress.

Overall, Panel A suggests that PE investors capture a set of banks that tend to be riskier in terms of asset composition, more undercapitalized, less profitable, and may require larger capital injections due to their size. Moreover, these banks have lower profitability as indicated by their net interest margin. Those are all likely undesirable features in the eyes of incumbent banks. In this sense, PE investors target banks that other banks may be less willing or less able to take over.

4.2 Local Banking Market Conditions

Next, we further strengthen the argument that PE investors acquire a segment of banks that are unlikely to be taken over and operated by other incumbent banks. In recent work studying failed bank resolution in the crisis, Granja, Matvos, and Seru (2017) show that healthier banks are more willing to bid on and pay higher amounts for failed banks that could potentially create synergies with themselves. A primary source of synergistic benefit is in the form of geographic clustering: a large literature shows that the transmission of soft information depreciates with geographic distance (Petersen and Rajan, 2002; Stein, 2002). Moreover, geographically closer banks may be better able to harvest the economies of scale to achieve operational efficiencies. The implication of this work is that failed banks without a set of healthier banks in nearby geographic regions face greater challenges in the resolution process. This is particularly true when, as shown in Table 3, Panel A, certain failed banks had worse-than-average performance and held riskier asset portfolios that other banks may not have desired.

Is PE participation particularly important for those banks without a potential bank acquirer? We explore this question in a similar setting as in Eq. (1), except that the key explanatory variables are the conditions of the local banks. We create a set of measures to capture different dimensions of local bank conditions, in which "local" are those banks whose branch network overlaps in at least one zip code with the branch network of the focal failed bank.

Table 3, Panel B presents the results. In column (1), we focus on the neighboring banks' tier 1 risk-based capital ratio, which is calculated as the mean of this ratio for all the banks local to the failed banks. We find a negative and significant coefficient, which means that when a failed bank's neighboring banks, which are often considered the most likely acquirers, are in worse financial health, the failed bank is more likely to be acquired by private equity. The economic magnitude is in fact quite large. A one standard deviation decrease in the average neighboring bank tier 1 risk-based capital ratio is associated with a 2.92 percentage point increase in PE acquisition probability, which is a 21 percent increase from the base rate. This is consistent using other bank health measures like noncurrent loans (column (2)) and OREO (column (3)).

In column (4), we consider another factor that could affect the capability of acquisition by local banks—the size of these banks. Even if a neighboring bank remains healthy, it is unlikely for it to obtain enough capital to purchase anything that is at its size or larger than its size. In other words, banks that are considerably larger than the failed bank may be more likely to make the purchase. We show this using a variable No. of Local Banks (>3xSize), which is the number of local banks that are at least three times the size of the failed bank in terms of total assets. The larger this number is, the more likely that the bank will be sold to another bank and less likely to a PE acquirer.

In column (5), we examine the number of failed banks in the region. If a failed bank is in a region where a lot of other banks failed at the same time, they are more likely to be acquired by PE. This could be due to other local banks being on average less healthy and less capable of making the purchase and also because it is hard for any acquirer to purchase a large number of banks if too many fail in the same region. We show that the total number of failed banks in a state is associated with a higher probability that the bank is acquired by PE. In other words, PE investors inject new capital in regions where banks on average are in deeper distress. In the Online Appendix, we show that both the failed banks' own characteristics and their neighboring banks' characteristics matter when they enter the analysis simultaneously.

Overall, this evidence provides additional support that PE investors are complementary to existing players in the banking sector in acquiring failed banks. PE investors target a segment of the failed banks in which many traditional banks are unlikely to be interested or capable of acquiring. Specifically, they acquire underperforming banks that are riskier, particularly when the failed bank is in a region where neighboring banks experience deeper distress and thus are unlikely to be able bid.

4.3 Further Evidence on Failed Bank Acquirer Sorting and Matching

Results so far are based on the final bidding outcomes. But is there evidence that PE investors are actively pursuing this strategy, or are PE investors just passively bidding on all banks and only winning the low-quality ones?

Table 4 presents evidence that is consistent with the PE investors actively pursuing such a strategy. We gather this evidence by examining not only the winning PE acquisitions, but also the bidding histories of each PE. To do so, we leverage proprietary data on all bidding histories in

FDIC failed bank auctions. We create a variable, *PE Bid*, which indicates whether there was any PE bidding on the specific failed bank, whether it achieved the winning bid or not. The indicator captures PE bids that are above the liquidation value and non-public details on those that fall below, so it reflects all bidding activity by PE acquirers. This *PE Bid* variable is then analyzed as the dependent variable by using the same framework as in Eq. (1).

[Insert Table 4 Here.]

All the variables that are associated with the final acquisition outcomes, as shown in Table 3, also have similar effects in explaining the bidding activities of PE investors. Clearly, both the decision to bid and the outcome of winning are equilibrium outcomes accounting for the value and costs of the failed banks to different potential buyers and to the FDIC. Nevertheless, the evidence quite clearly suggests that PE investors actively, not passively, participate in the process.

In Figure 4, we push the argument further by visualizing the sorting and matching between acquirer types and bank characteristics. The graph compares the characteristics of failed banks and their neighboring banks across banks that are targeted by different acquirers—those bid on and acquired by PE investors, those bid on by PE investors but may eventually be won by a PE entity or an incumbent bank, and those that are only bid on and eventually acquired by other incumbent banks. For each of the characteristics, we separately show the mean across the three groups.

[Insert Figure 4 Here.]

Figure 4 shows a clear pattern of sorting. Panel A shows sorting on failed bank characteristics. PE investors bid on and successfully acquire the weakest banks (left bars) whether measured by tier 1 capital ratio, core deposits, net interest margin, or real estate owned. PE investors also target some slightly stronger failed banks over which they compete with other banks, and they may win or lose in such cases (middle bars). Banks, on the other hand, on average focus on the healthier banks in the failed bank set (right bars)—and PE investors are not even bidding in this segment. Panel B shows sorting on neighboring bank characteristics. Again, both PE bids and PE acquisitions are more likely when the neighboring banks are weak (whether measured by tier 1 capital ratios, nonperforming loans, real estate owned, or the number of failed banks in the state). This again confirms that PE investors complement bank acquirers in the market. This result also suggests that even though neighboring banks are likely the best potential buyers for failed banks operation-wise, they may be hesitant to bid and/or purchase when the bank is particularly risky or in deeper distress. PE investors have an edge in such cases due to their higher risk appetite and more abundant funding.

4.4 The Value of PE Participation: A World Without PE Bidding?

Evidence so far suggests that the value of PE investors in the financial crisis first comes from their participation and their unique focus in the failed bank market which is complementary to incumbent banks. In a world without PE investors selecting those lower-quality and riskier failed banks, they would either be acquired through lower-valued bids or be liquidated by the FDIC.

How economically important is this PE participation? We perform a simple back-of-the-envelope calculation using proprietary FDIC cost estimates used for evaluating auction bids from all failed bank deals. The FDIC estimates its cost for each submitted bid in determining the least cost resolution strategy. Starting with the total gross assets at the failed bank and taking details of each submitted bid into account, it subtracts the expected losses on assets and expected expenses from the receivership, as well as any claims on the receivership. The bidder's proposed premium on deposits or discount on assets are included as well. We use these proprietary estimates in our calculation to build on the counter-factual world in which no PE acquisitions occurred.

For all PE-acquired cases, we suppose one of the following two cases happen: (1) if there is at least one non-PE bidder, the best non-PE bidder wins, where the "best" means the lowest FDIC-estimated cost of resolution; (2) if there is no other non-PE bidder, the bank is liquidated by the FDIC, which as receiver must pay off insured depositors and dispose of the assets. The additional cost incurred to the FDIC without PE-acquirer participation thus can be roughly estimated by calculating the gap for PE acquirers and the counter-factual world outcomes. For case (1), there are 29 failed banks for which we calculate the difference in estimated FDIC resolution costs for the winning bid compared to the runner-up. In addition, we observe 8 further cases in which the runner-up bid in a PE acquisition was also from a PE bidder. For these, we measure the gap in cost between the winning bid and the next best non-PE bid. The aggregate savings are estimated to be around $2.34 billion. For case (2), we observe 25 failed banks that had no other non-PE bids with a cost below the liquidation cost and would have had to be liquidated by the FDIC. The total savings to the FDIC of those PE acquisitions over liquidation costs is estimated to be $1.29 billion.

How big is the economic magnitude of the $3.63 billion ($2.34 billion + $1.29 million) estimated? The FDIC estimated that the total cost to the Deposit Insurance Fund (DIF) of bank failures during the crisis was about $73 billion.[14] This means that PE participation helped the FDIC reduce the cost of failed bank resolution in the crisis by nearly five percent.

One caveat here is that in this simple back-of-the-envelope calculation, we implicitly assume that bank bidding behaviors remain the same in a world without PE. Given that the failed bank bidding process is a sealed-bid auction without even disclosing the potential bidders, removing PE investors from the bidder set should, arguably, have at best a mild impact. Additionally, this assumption likely leads us to underestimate the benefit of PE participation—without PE competition, banks will likely bid with even lower prices, expanding the wedge with PE bidding prices.

5. Bank Performance Post PE Acquisition

The natural next question is: are PE investors able to successfully turn around the failed banks? In this section, we examine the post-acquisition performance of failed banks that are acquired by PE and by other banks. We also study the real effects by examining the economic recovery of regions in which the failed banks are acquired by PE investors. The performance of PE acquisitions compared to bank acquisitions is a priori unclear. On the one hand, PE investors do not have bank-specific operational experience or sources of synergies, which may lead to poorer performance. On the other hand, PE investors' experience in distressed investment and turnaround operations (Hotchkiss, Smith, and Strömberg, 2011), together with the steadier financing source (Bernstein, Lerner, and Mezzanotti, 2019), may be well-suited for the turnaround of failed banks in crisis.

5.1 Quasi-Random Empirical Design

To study failed banks' performance changes post acquisition by different buyers, a basic regression would simply compare the performance proxies in PE-acquired and bank-acquired banks post the acquisition event. This specification would be informative but masks the combination of i) the sorting of acquirer-target, as documented in the previous section, and ii) the treatment effect of PE acquisitions on the acquired banks.

[14] Federal Deposit Insurance Corporation (FDIC). 2017. Crisis and Response: An FDIC History, 2008–2013. Washington, DC: FDIC. p.xiii-xiv.

An ideal experiment to isolate the effect of PE investors on post-acquisition performance would focus on a set of banks that are of interest to both PE investors and banks and for which the allocation to a PE investor or a bank is nearly random. We approximate this ideal experiment by exploiting a small set of banks where acquirer allocation can be viewed as quasi-random. We start from the sample of banks that were bid on by both PE investors and banks. We narrow down this sample to two sets of banks—those won by PE and at least one bank bid, and those won by a bank and at least one PE bid. We further require that in the auction the margin of victory of the winning PE/bank bidder over the closest losing bank/PE bid is small, within five percent to be precise.[15] Our empirical strategy compares failed banks that were just won by the PE investors and those that were just won by the banks in this quasi-random sample.

In our main specification, we use a local linear regression approach (Gelman and Imbens, 2019):

$$Performance_{b,i,t,z} = \alpha + \beta \cdot PE_i + \gamma \cdot Control_i + \theta_{t\times z} + \varepsilon_i. \qquad (2)$$

$Performance$ is the performance of a branch b, located in region z, of bank i, that failed in year t. PE is an indicator variable that equals one if the PE bidder won the auction and acquired the failed bank. $\theta_{t\times z}$ are region-by-time fixed effects controlling for the local time trends and are captured at the state-failed year level. Finer regional geographic delineation, say county-year, renders a very limited number of observations per group (on average 2.3 in each county-year unit), challenging the ability to correctly estimate the model. The analysis will later be adapted to other analytical units (like bank-level or region-level) by implementing the same logic, and aggregation details will be provided in subsections as we introduce the analysis.

[Insert Table 5 Here.]

The key identification assumption is that, for the specific subset of competitive auctions that we consider, whether a PE bidder wins or loses the bidding is "as good as" random. At first glance, out of the 48 acquisition deals that fall into our quasi-random sample, 25 were eventually acquired by a PE investor and 23 were eventually acquired by a bank—which suggests a fairly random pattern. Table 5 presents a balance test. We first examine whether bank-level characteristics differ between the bank-acquired and the PE-acquired samples. Among those characteristics shown to

[15] This approach is standard in the literature (Lee and Lemieux, 2010; Fisman et al., 2014; Colonnelli, Prem, and Teso, 2020).

matter in broader selection, none seem to matter in this quasi-random sample. We also compare the variables that later will be used as performance proxies—these include branch, bank, or regional level information. Again, we do not find any significant differences across bank-acquired and PE-acquired samples.

In our quasi-random sample approach, our empirical strategy improves upon common approaches in the PE literature that tackle the identification challenge through building counter-factual cases using matching methods.[16] Instead of assuming a matched firm that is equally selectable by PE, we leverage on the bidding setting in which PE bids and bank bids reveal their interests in selecting a publicly known target. Focusing on the sample of banks that are selectable and tightly bid on by both PE and banks further controls the selection effect.

One caveat is that even though this approach exploits a very tight control group, it is not a fully-specified regression discontinuity design in which we would better control for the micro-level variations in the bidding gaps (i.e., the running variable), which are unobserved by us. In our sample, the continuous bidding gap is coded to three categories by the FDIC—*below five percent, five to ten percent,* and *above ten percent*, while the underlying continuous variable is kept proprietary.

5.2 Banks: Branch Closure and Deposits

We first study bank performance post acquisition. The analysis focuses on the branch level for data observability reasons. Failed banks acquired by other banks are integrated into the acquiring institution, and it is thus difficult to observe standalone performance measures from standard sources such as the call reports. To overcome this problem, the approach in this section focuses on the performance of bank branches that can be tracked prior to and after the acquisitions.

Our first performance analysis concerns the closing of bank branches. Bank branch closure has important consequences for access to credit in the local economy and thus for financial stability. Nguyen (2019) shows that access to credit is very local, and bank branch closings lead to a persistent decline in local small business lending. This effect is particularly strong during the financial crisis.

[16] See, for example, Boucly, Sraer, and Thesmar (2011); Davis et al. (2014); Bernstein, Lerner, and Mezzanotti (2018); Fracassi, Previtero, and Sheen (2020).

Our sample includes all bank branches owned by a failed bank at the time of failure. For the key outcome variable, we code whether the bank branch is closed within three years post acquisition using the FDIC Reports of Structure Changes.[17] Control variables include those that have strong power in explaining PE investors' selection of acquisition—tier 1 risk-based capital ratio, core deposits to total deposits, C&D loans to total loans, and OREO to total assets. Fixed effects are included at the failed year by state level. Standard errors are clustered at the level of failed bank acquirers, who make strategic decisions for bank operations.

[Insert Table 6 Here.]

Table 6 reports the results. Columns (1) and (2) are our preferred specifications using the quasi-random sample. In column (1), we consider a thought experiment in which two bank branches are located in the same geographic region (at the level of state) and whose parent banks failed in the same year. In this way, we take out the potential impact of timing, i.e., banks may have a different operational strategy during different periods in the crisis. We also take out the potential impact of the branch location, since branches located in regions hit harder by the crisis may be more likely to close. The -0.148 coefficient in column (1) means that bank branches acquired by PE investors are 14.8 percentage points less likely to be closed. This is a 73.6 percent decrease from the base branch closing rate of 20.1 percent across the full sample.

This result is particularly important for us to understand the role of PE acquisitions in stabilizing the local financial system, considering our earlier findings that PE-acquired banks tend to be located in regions with an unhealthy financial sector, as shown in Table 4. To better articulate this point, in column (2) we explore a new dependent variable to capture the cases of closing and exit from a county. This variable is coded as one if a PE-acquired bank branch closes and there is no other branch of the bank serving the county; alternatively, it is also coded as one if a bank-acquired bank branch closes and there is no other branch of the bank nor an acquirer branch serving the county. The -0.070 coefficient suggests that PE acquired banks are less likely to close and exit a county they serve.

Column (2) also provides an opportunity to assess another potential force that could drive PE-acquired banks' lower closing probability, which is that bank-acquired failed banks are more likely

[17] The results are robust to coding the closure variable over alternative time horizons. Most closures happen during the first three years.

to close to retain limited branches in a region. In other words, bank acquirers may shut down an acquired branch because they already own one in the local area (i.e., consolidation of branches). The result in column (2) suggests that branches of bank-acquired failed banks have a higher frequency of closing, even for cases when the closure means a complete exit from the county.

In columns (3) and (4), we also report the regression with all bank branches as robustness checks. The results are similar. The point estimates for the PE effects are smaller in magnitude, which is consistent with the fact that PE investors, on average, acquire lower quality failed banks. Failing to account for this would underestimate the value-added by PE investors.

Next, we examine bank performance using the growth of deposits in local branches. Deposits are an important measure of bank performance, as they are related to the ability to lend and ultimately the ability to generate profit. Conceptually, the analysis appears to be simple to design—we would just compare the deposit growth of branches acquired by PE investors with those acquired by other banks. The challenge, however, is the active closing and consolidation of the bank-acquired branches. For example, assume there are two failed bank branches, A and B, in Durham County, NC, and that they are acquired by PE and another bank, respectively. Assume this acquiring bank has its own branch, labeled as C, in Durham. Branch B and C could have complex interactions post acquisition that make it inaccurate to simply track deposit levels at B or C. For example, branch C could completely absorb B, which would cause us to underestimate the level of deposits that B attracts.

Our first approach is to perform the analysis at the local county level and consider B and C jointly when evaluating the deposit growth. Specifically, our unit is at the bank-county level. The dependent variable is a failed bank's deposit change in the county region following the acquisition. For PE-acquired banks through shelf charters, this deposit change is for all branches in the local region; for bank-acquired banks and for PE acquisitions through inflatable charters or with multiple acquisitions, the deposit change is calculated using both the failed bank branches and the branches originally owned by the acquirer bank in order to account for the measurement issues that may arise from reorganization.[18]

[18] Note, we only keep counties where the failed bank did not completely exit, in which case the deposits would be –100 percent and which we have studied separately in Table 6.

[Insert Table 7 Here.]

Table 7 presents the results. In columns (1) and (2), using the quasi-random sample, we show that within one year, there was little difference in the deposit-level changes—this makes sense given that changing failed bank operations takes time. This also provides additional assurance for our quasi-random experiment since there are not observable differences between PE- and bank-acquired branches ex ante. As time goes by, the effect becomes stronger. In column (2), the comparisons are made by two failed banks' operations in the same county through the same period. PE-acquired banks have a higher three-year deposit growth by a magnitude of 35.6 percentage points. This economic magnitude is quite striking if we compare the three-year changes to the unconditional mean. Depending on the sample that we focus on, the averages of the deposit growth variables are negative as a national trend or only mildly positive.

In columns (3) and (4), we report results estimated using the full non-quasi-random sample. The results are qualitatively similar with milder quantitative magnitudes. As discussed in the branch closure analysis above, this is likely due to the fact that PE's acquisition strategy focuses on weaker banks to begin with, making it harder to detect a performance difference if such selection is not controlled for.

Of course, for most of the failed banks, the operations of the failed banks are combined with the acquirer's pre-existing bank operations (i.e., using the example, B and C are jointly considered). An alternative approach we take is to focus on a smaller sample of bank-county combinations in which the acquirer bank does not own an existing branch in the acquired failed bank's region. In other words, following the example, we study cases in which there is not a branch C. We report the results in Table 7 columns (5) and (6). After isolating the performance of the failed bank branches themselves, the PE-acquired banks still have higher deposit growth.

5.3 Bank Lending and Local Recovery

The banking sector plays an important role in the local economy. PE's ability to maintain branch operations and attract deposits thus leads to a natural hypothesis on whether the positive changes in bank branch operations also lead to better local economic recovery. We perform analysis at the county level using a model adapted from Eq. (2) but aggregated to the county level.

Essentially, we compare two counties with a failed bank branch in the same year (both of which were bid on by PE investors and banks), yet one bank branch was quasi-randomly allocated to an incumbent bank acquirer and one to a PE acquirer. The quasi-random design in this setting helps alleviate concerns about better performance arising mechanically because PE investors made purchases in worse-hit areas, and so a return to more "normal" conditions would look more dramatic for them. To cleanly identify the results, we also focus our sample on only counties that have one pure treatment, i.e., if a county has both bank acquisitions and PE acquisitions, we leave them outside the sample for empirical purposes.

[Insert Table 8 Here.]

Our first set of measures is about small business lending. Small business lending is an important function of local banks and creates important spillover effects for local economic growth. The analysis exploits both the extensive margin of small business lending and its intensive margin. Table 8 presents the results. In Panel A we use our preferred quasi-random sample. In column (1) we show that within the three years after a PE entity acquires a local bank, the number of small business lending deals experiences 32 percent faster growth compared to other counties. In column (2), we show that the increase in the total amount of small business lending is also higher in counties where the failed bank was acquired by PE.

The increase in the amount of small business lending could be partially related to the pricing of the loans. In column (3), we show that on average, the SBA loans are priced lower when PE investors intervene with the banks. The economic magnitude is roughly 32 basis points, which is five percent lower than the non-conditional mean of 6.4 percent as reported in Table 5. In column (4), we show that the average deal size increases only mildly, suggesting that the effect is more through the extension of credit to a larger number of small businesses rather than giving larger loans to a small set of small businesses. In Panel B, we report results using the full sample.

[Insert Table 9 Here.]

In Table 9 we present another set of regional variables that focus more on the recovery of local economic conditions. The analysis uses the same regression framework as in Table 8, and we also report analysis using both the quasi-random sample and the full sample. In columns (1) and (2), the outcome variables are job creation rates. We find that both the total number of jobs created and job creation in the startup sector are significantly higher in regions where the failed banks are acquired by PE investors. In columns (3) and (4), we move to examine the level of personal income.

We find that the change in personal income is higher, both in terms of total personal income and the level of per capita income.

5.4 Aggregate Loss Share Claims to the FDIC

Another angle from which to examine the value of PE acquisition is by studying the cost of failed bank resolution incurred by the FDIC. Specifically, we are interested in whether PE-acquired banks claim more losses to the FDIC. The loss sharing agreements with the FDIC typically grant the failed bank acquirers a time window to claim a portion of losses from loan portfolios of the failed banks. Commercial loan portfolios have five years of loss share coverage, with an additional three years of reporting to share any recoveries. Single-family loan portfolios have 10 years of loss share coverage.

If PE-acquired banks perform more poorly in managing the loans in their covered portfolios, we would expect these banks to claim more losses to the FDIC. To test this, we use proprietary data from the FDIC on the total losses claimed by each acquirer with a loss sharing agreement on the failed bank portfolio. We aggregate the claim amounts made and paid out during the coverage period of the loss share agreement. This aggregated amount is then scaled by the total assets covered by the agreement to give us a measure of total claimed loss rates comparable across different banks.

[Insert Table 10 Here.]

Table 10 presents the results. After controlling for the fact that PE investors acquired less healthy banks using the selection variables, the estimated differences in claimed losses are virtually zero. In other words, PE investors do not appear to be costlier than other acquirers for the FDIC. We include results for both the total reported losses on the portfolio and the amount of the losses incurred by the acquirer net of loss sharing payments made to the acquirer by the FDIC. Note that when using our quasi-random sample for the analysis (columns 3 and 6), the number of observations drops to 38 banks that fall into our criterion and have loss coverage on their loan portfolios. As a result, the analysis has low power, but it is reassuring that the economic magnitudes confirm prior results using the full sample.

5.5 Exit of PE-acquired Failed Banks

Private equity, as financial investors, are not in the business of permanently running a bank even though they were able to stabilize the acquired failed banks during the crisis period. How do they exit these investments, and how do these PE-acquired banks re-integrate into the banking sector? We hand collect information on the exit of PE-acquired banks from FDIC structure reports on bank merger activity. We obtain details on merger deal values, IPO activity, and any additional rounds of acquirer funding from S&P Global Market Intelligence. Note that this analysis is more informative at the acquiring bank level (consortium level) because different failed banks are consolidated into one bank after being acquired by the same consortium under the same charter.

[Insert Table 11 Here.]

Out of 19 banks/consortia, 15 have been acquired or consolidated by other commercial banks, two went IPO, one is still under PE operations, and one was liquidated.[19] We also report the bank-level counts that reflect the number of acquired failed banks in the acquiring consortia. Out of the 17 banks that were acquired or went IPO, PE investors held failed banks for 6.5 years on average. Interestingly, of the 15 acquisitions, 60 percent were acquired by a local bank—that is, a bank that overlaps with the footprint of the acquired bank at the zip code level. The number is even higher if we consider the banks to overlap at the county or state level.

This finding is consistent with the overall interpretation of what PE investors help achieve in this process. PE investors acquire failed banks that are too risky to acquire for incumbent banks who themselves may be in distress. Thus, PE investors fill the funding gap and turn around those banks with their hired expertise. These banks are later more suitable for a bank acquisition and return to traditional bank ownership. Slightly more than half of them are acquired by local banks, who were the natural buyers but were not necessarily in a good position at that time to make these acquisitions themselves.

We calculate the return by comparing consortium funds raised with exit prices. Ideally, we would hope to use the total cash disbursement, which is unobservable in some cases of our data. When these data are not available, we instead rely on the total committed capital to proxy for that cash disbursement component in IRR calculation. Given capital disbursement is lower than committed capital, our IRR calculation provides a lower bound of return calculation. We also supplement this with data on reported additional private placements or offerings from S&P Global Market Intelligence, particularly when additional funds were raised to contribute to additional

[19] One bank was liquidated by the acquirer after deposit insurance was terminated due to unsound banking practices.

failed bank purchases. Merger announced deal values are obtained from S&P Global Market Intelligence as well. We find that the deal multiple is 2.11 on average and 2 at the median. We also calculate a rough IRR of 12% after accounting for the holding period, with adjustment for the interim additional funding. This is a good PE return: based on recent estimates from Brown et al. (2015), PE funds of similar vintages earned an IRR below 8%.

5.6 Management of PE-Acquired Failed Banks

Taken together, evidence thus far paints a positive picture of the role of PE investors in stabilizing the financial system through participating in the process of failed bank resolution. A final question that we ask is: PE investors are not bankers, so how can PE intervention bring about those positive changes to the acquired failed banks? We attempt to answer this question by exploring the management human capital of the PE-acquired failed banks. We collect CEO backgrounds of the PE-acquired failed banks by hand from publicly available information on the internet, such as company bios, professional profiles, and featured articles.

[Insert Table 12 Here.]

Private equity investors hire ex-bankers to manage the acquired failed banks. Those bankers, on average, have nearly 30 years of experience in the banking industry, and more than half of them were CEOs of other banks before being appointed at the failed banks. More than 60 percent of the CEOs had experience in the local area of the failed bank, and nearly 70 percent of the hired bankers had experience working in a community bank. Interestingly, more than a third of the hired CEOs specialized in turnaround management and troubled and distressed assets.

6. Conclusion

This paper studies the role of private equity in stabilizing the financial system in the 2008 crisis through failed bank resolution. Using detailed and proprietary failed bank data from the FDIC combined with information on private equity investors, we provide the first empirical investigation of PE investors' role in failed bank resolution—an economically important but potentially controversial role.

An extensive literature explores the effects of private equity on firm-level outcomes, such as employment, productivity, product quality, and innovation. However, whether or not PE should be allowed in banking, one of the most central sectors in the financial system, has been an unexplored question. Our paper suggests that understanding the role of PE in the economy should take into broader account how the industry interacts with and affects the stability of the financial system. Further, our paper sheds light on the policy debate on whether to introduce private investors into the process of failed bank resolution.

We find that PE investors acquired failed banks that were generally underperforming and riskier than bank-acquired banks were. PE investors also acquired failed banks when the neighboring banks were also in distress and therefore had a lower ability to make failed bank acquisitions. Thus, our findings suggest that PE investors fill the capital gap in scenarios where the natural local bank buyers are themselves distressed or capital constrained. Using a quasi-random empirical design, we find that PE-acquired failed banks recovered as well as those acquired by banks despite being underperforming ex ante, and we show some evidence of them outperforming other distressed banks in various dimensions. Our quasi-random empirical design further shows positive real effects on the local economy of PE failed bank acquisitions. Overall, our results suggest a positive role for PE in helping to stabilize the financial system in the crisis through their participation in failed bank resolution.

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Appendix 1. Variable Definition and Description

Variable	Definition and Description
Asset size (in $Million)	Total assets. Sum of all assets owned by the institution including cash, loans, securities, bank premises and other assets.
% Tier 1 risk-based capital ratio	Tier 1 capital divided by adjusted average assets (%). Tier 1 capital includes common equity plus noncumulative preferred stock plus minority interests in consolidated subsidiaries less goodwill and other ineligible intangible assets. Adjusted average assets are average total assets minus disallowed intangibles.
Liquidity ratio	Sum of cash, fed funds sold, and securities, excluding mortgage-backed securities, divided by total assets.
Core deposits to total deposits	Total domestic deposits minus time deposits of more than $250,000 and brokered deposits of $250,000 or less, divided by total deposits.
Net interest margin (%)	Quarterly net interest income as a percent of a two-period average earning assets.
CRE loans to total loans	Ratio of commercial real estate (CRE) loans to total loan and lease financing receivables. Includes all nonfarm, nonresidential properties secured by real estate and multifamily (5 or more) residential properties secured by real estate held in domestic offices.
C&D loans to total loans	Ratio of construction and development loans (C&D) to total loans and lease financing receivables. Includes all construction and land development loans secured by real estate held in domestic offices.
C&I loans to total loans	Ratio of commercial and industrial (C&I) loans to total loans and lease financing receivables.
Residential loans to total loans	Ratio of total loans secured by 1-4 family residential properties held in domestic offices to total loans and lease financing receivables.
Consumer loans to total loans	Ratio of loans to individuals for household, family, and other personal expenditures to total loans and lease financing receivables.
Noncurrent loans to total loans	Ratio of noncurrent loans and leases to gross loans and leases. Includes total loan and lease financing receivables 90 days or more past due and in nonaccrual status.
OREO to total assets	Ratio of other real estate owned to total assets. Includes real estate acquired and direct and indirect investments in real estate.
Loss-sharing agreement	Agreement between the FDIC and a failed bank acquirer in which the FDIC absorbs a portion of the losses on a specified pool of assets.
Neighbor % tier 1 risk-based capital ratio	Mean tier 1 risk-based capital ratio for banks that share at least one branch zip code with the focal bank (%).

Neighbor noncurrent loans to total loans	Mean noncurrent loans to total loans for banks that share at least one branch zip code with the focal bank.
Neighbor OREO to total assets	Mean other real estate owned to total assets for banks that share at least one branch zip code with the focal bank.
No of local banks (>3xSize)	Number of local banks at least three times the size and sharing at least one branch zip code with the focal bank.
No of failed banks in state	Number of failed banks in state where focal bank headquarters is located.

Appendix 2. Institutional Details—The General Process of Failed Bank Resolution

Bank resolution activities are initiated by a failing bank letter to the FDIC from federal and state banking regulators who monitor the financial condition of banks. Such initiation is triggered when a banking institution becomes critically undercapitalized or insolvent.[20]

The FDIC then contacts the management of the failing depository institution. The FDIC also engages a third-party financial advisor to conduct a review of the assets and compile initial information. Importantly, in this review process, the financial advisor estimates a loss factor for each asset category using an identified sample of assets. This information is further used by the FDIC to set the reservation value on the subsequent resolution of the depository institution.

During the financial crisis, the FDIC used the Purchase and Assumption (P&A) resolution method in roughly 95 percent of the cases, and these are the transactions studied in this paper. In a P&A transaction, the FDIC uses a process that resembles a first-price sealed bid auction to sell some or all of the assets and liabilities of the depository institution. Only in cases when the auction does not generate any bidding or when the highest bid is below the FDIC's reservation value will the FDIC use an alternative resolution method. The resolution process can be categorized into four steps: marketing and identifying the bidder pool, providing information, bidding, and resolution.

The first step of selling failed banks is to identify a pool of potential buyers that have expressed interest in bidding on failed institutions and that satisfy a list of requirements. To be approved to bid in a P&A transaction, the potential bidder must be a chartered financial institution or an investor group that has received a conditional charter or is in the process of obtaining a "de novo" charter. PE investors fall into the latter category of "investor group" as bidders. Moreover, the bidding financial institution must be well capitalized and possess a CAMELS[21] rating of 1 or 2, a satisfactory Community Reinvestment Act (CRA) rating, and a satisfactory anti-money-laundering record.

In the second step, eligible bidders receive notification of an acquisition opportunity, and those who are interested in pursuing the opportunity must sign a confidentiality agreement. The FDIC then provides eligible bidders with an information package on the failed institution. The information contains loan reviews, schedules representing the value of the items on the failed bank's balance sheet, and operational

[20] A bank is deemed by regulators to be critically undercapitalized when the ratio of tangible equity to total assets is at or below 2 percent. Tangible equity is the amount of tier 1 capital plus outstanding non-tier 1 perpetual preferred stock.

[21] CAMELS is short for (C)apital Adequacy, (A)sset quality, (M)anagement, (E)arnings, (L)iquidity, and (S)ensitivity to market risk. CAMELS ratings are assigned by bank supervisors after an on-site examination at each bank.

information. As part of their onsite due diligence, potential bidders can request to review the individual loan documents.

In the third step, the formal bidding, the process generally starts 12 to 15 days before the scheduled closing of the failed bank. Bidders can place one or more sealed bids for the failed bank. The FDIC then chooses the bid that is least costly to the Deposit Insurance Fund (DIF)[22] after evaluating all submitted bids using its proprietary least-cost test model. The FDIC selects the bid whose terms entail the least-estimated cost for the DIF if those costs are below the reservation value set by the FDIC, which is unknown to bidders. Bids are not submitted as a single "price," but rather they frequently vary along multiple dimensions for each bid. For example, these pricing dimensions can include the amount of discount applied to the assets, the premium paid for deposits, the amount and types of assets acquired, the type of transaction for purchase (whole bank, loss share, etc.), the extent of any coverage for shared losses, and so on. The least cost test must take all of these factors into account when estimating the resolution cost associated with each bid for comparison.

In the final step, i.e., when a failing depository institution enters receivership, the FDIC takes custody of the failed bank's premises, records, loans, and other assets. The priority for paying allowed claims is given to depositors, including the FDIC as subrogee, over other general and unsecured creditors. The DIF took a loss on most bank failures that occurred during the recent financial crisis, suggesting that the receivership proceeds do not cover the FDIC's subrogated claim and that the FDIC is the residual claimant in most receiverships (Hynes and Walt, 2010). Between 2008 and 2013, the DIF lost approximately $73 billion due to depository institution failures.[23] The fund reached a negative balance on an accounting basis during the third quarter of 2009. It has since recovered and stood at $100 billion at the end of 2018, resulting in a reserve ratio of 1.36 percent.[24] The FDIC responded to the large losses on its DIF by collecting a special assessment of 5bps on all depository institutions and requiring prepaid assessments to boost the fund's liquidity. In addition, the FDIC updated its risk-based pricing for deposit insurance.[25]

[22] This is mandated by The Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991.

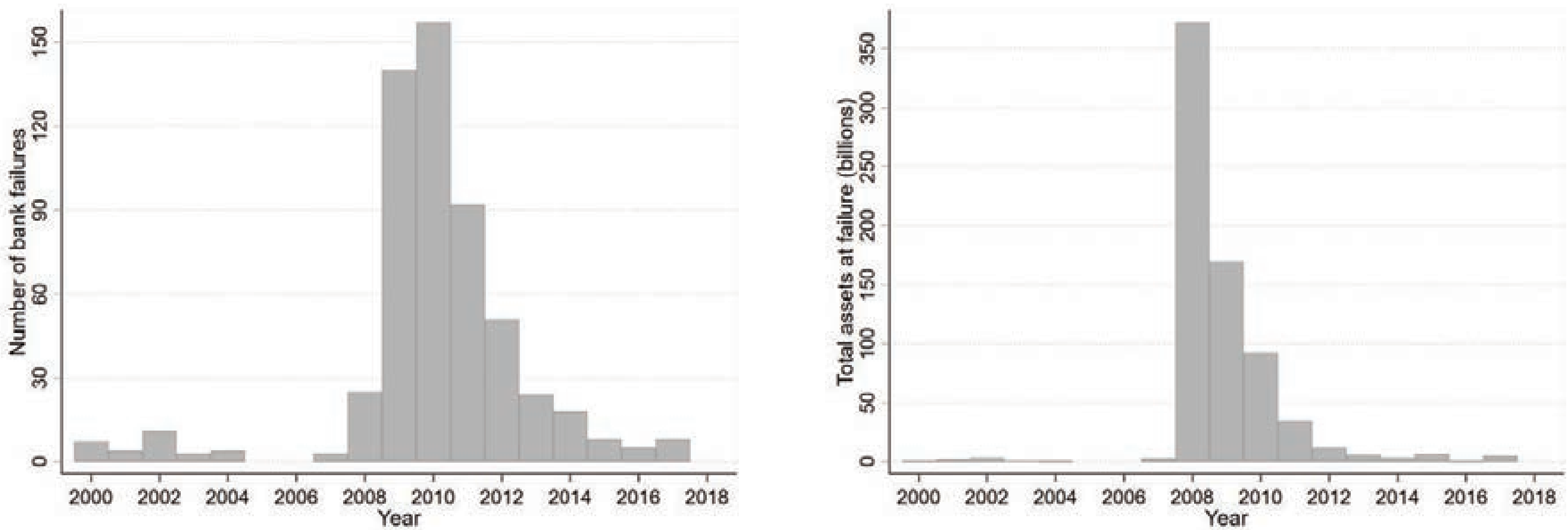
[23] Federal Deposit Insurance Corporation (FDIC). 2017. *Crisis and Response: An FDIC History, 2008-2013*. Washington, DC: FDIC. p.xiii.

[24] *Quarterly Banking Profile, Third Quarter 2018*. https://www.fdic.gov/bank/analytical/qbp/2018sep/qbp.pdf.

[25] Federal Deposit Insurance Corporation (FDIC). 2017. *Crisis and Response: An FDIC History, 2008-2013*. Washington, DC: FDIC. Chapter 5.

Figure 1. Bank Failures over Time

This figure plots the time series of bank failures irrespective of resolution method and acquirer type during the period 2000 to 2018. Data are from the Federal Deposit Insurance Corporation and are available at https://www.fdic.gov/bank/individual/failed/banklist.html. The time series includes the failed banks whose resolution process was a P&A transaction or a deposit payoff, but does not include open bank assistance. In Panel (A) we plot the total number of bank failures, and in Panel (B) we plot the total assets (in Billion USD) at failure.



Panel (A) Panel (B)

Figure 2. Illustrative Flow Chart of Failed Bank Resolution and PE Participation

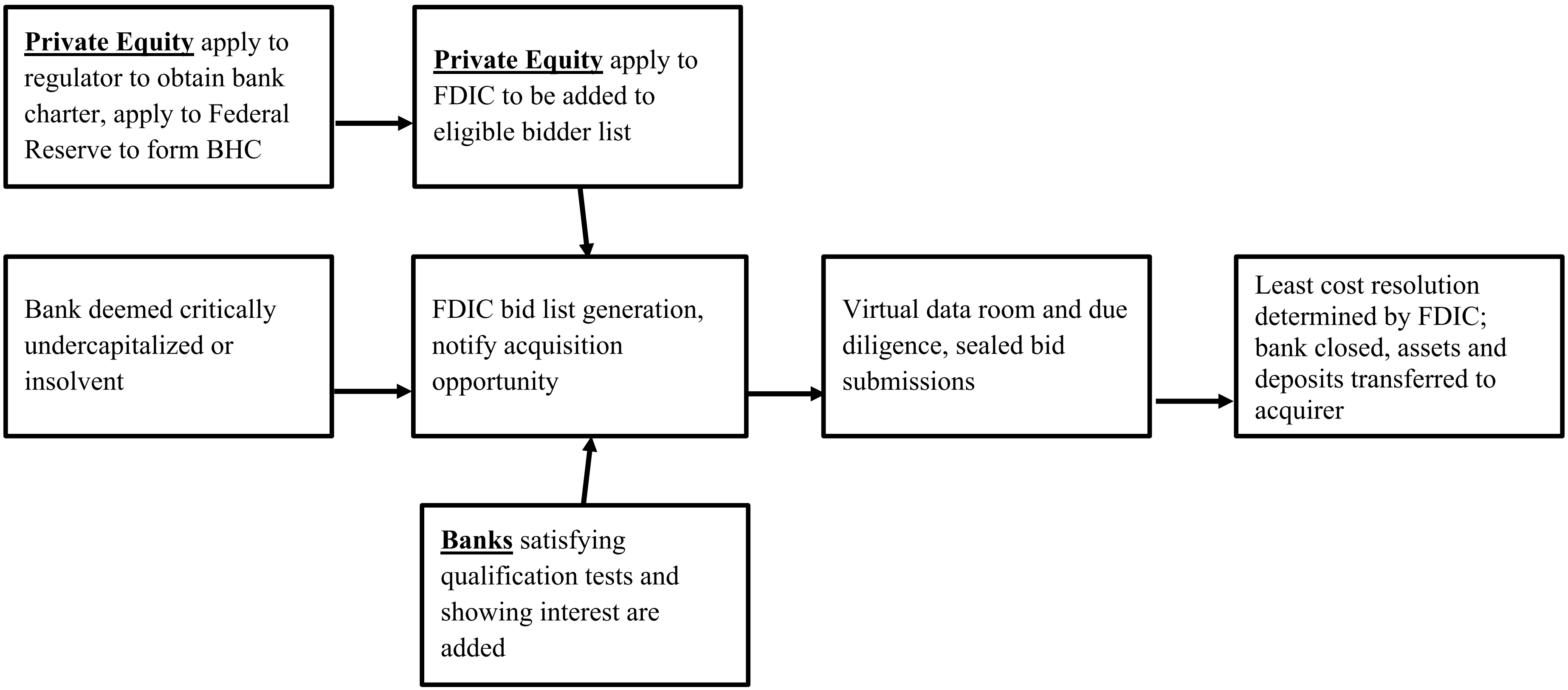
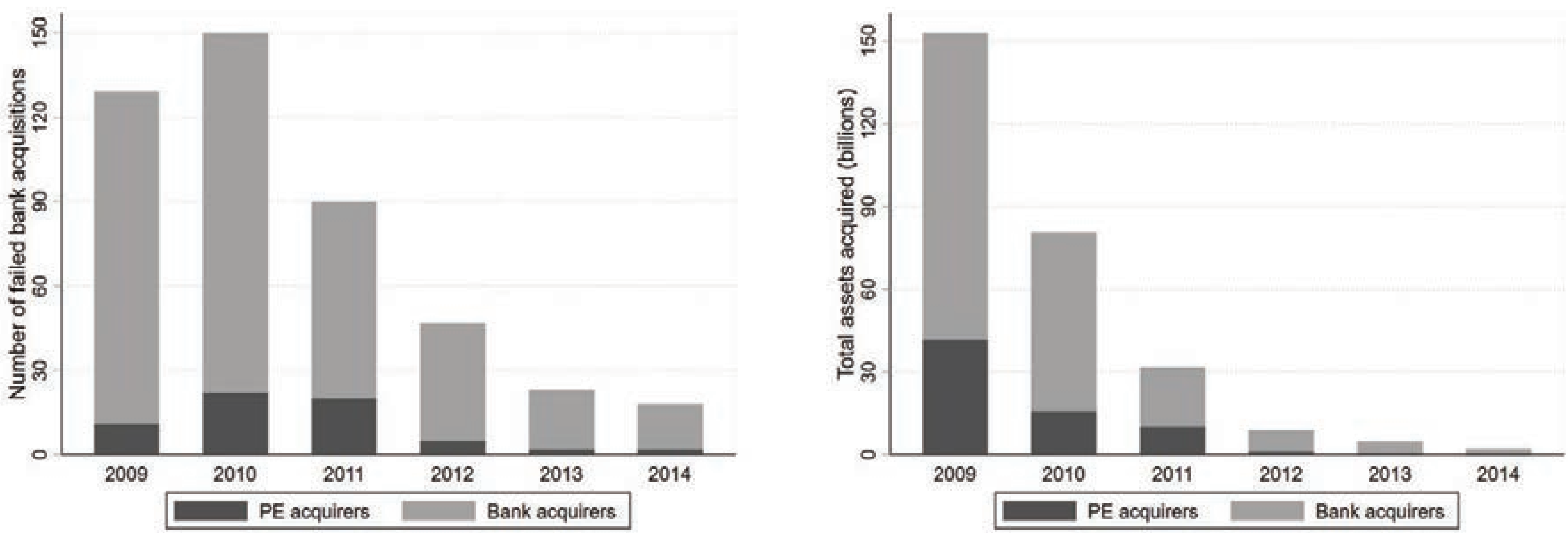


Figure 3. PE Participation in Failed Bank Acquisitions

This figure shows the number of failed banks acquired by other banks and by PE during 2009–2014. Panel (A) is plotted based on the number of failed bank acquisitions. Panel (B) is based on the total assets acquired. Years 2009–2014 are active years for PE acquisitions during the crisis. Prior to 2008, PE acquirers were not yet allowed to participate in failed bank auctions, and 2009 was the first successful PE acquisition. After 2014, they were allowed to participate but no PE acquisitions of failed banks were made.

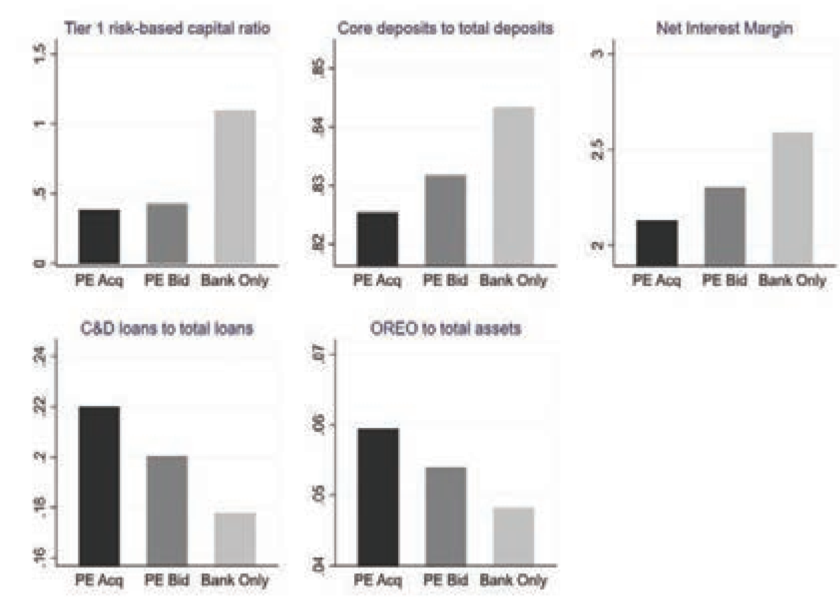


Panel (A) Panel (B)

Figure 4. Comparing Banks in Different Acquisition Groups

This figure presents the characteristics of failed banks (and those of their neighboring banks) targeted by different pools of acquirers: those that were bid on and eventually acquired by PE investors, those bid on by PE investors but may eventually be won by a PE investor or an incumbent bank, and those that were only bid on and eventually acquired by other incumbent banks. For each characteristic, we present the sample mean across the three groups.

Panel (A): Sorting on Failed Banks' Own Characteristics



Panel (B): Sorting on Neighboring Banks' Characteristics

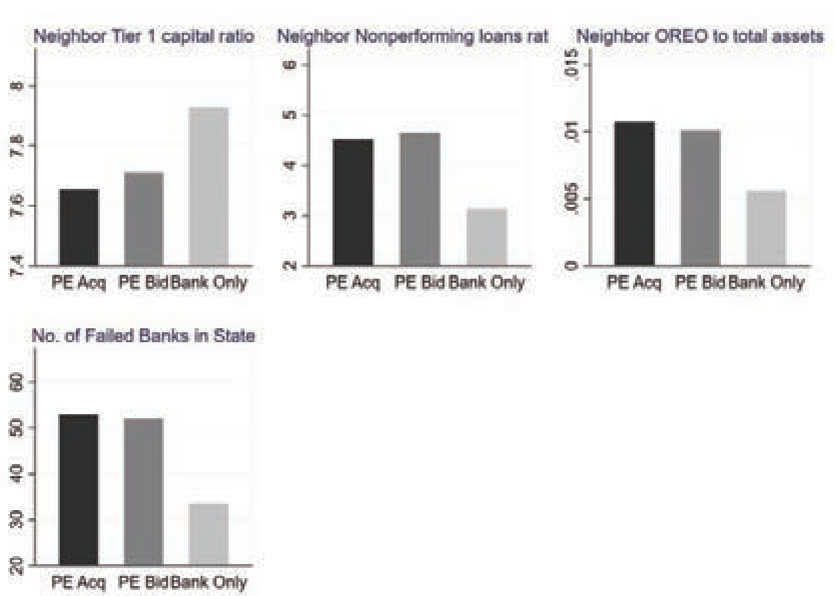


Table 1. Summary Statistics for the Private Equity Buyers

This table presents summary statistics of the PE buyers in failed bank acquisitions. We report the summary statistics at the consortia level and PE fund level. Consortia are the groups of PE investors that collaborate in acquiring failed banks, and consortia-level information is collected from the FDIC. Of the 20 distinct PE charters, one acquirer purchased failed banks under two separate charters that were then consolidated and is counted as a single consortium in the data below. PE-level information is collected from Preqin. For each variable, we report mean, standard deviation, and 25th, 50th, and 75th percentiles.

	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
Consortium-Level (N=19)					
Number of PE firms per consortium	3.37	2.29	2	4	4.5
Share of PE ownership in consortium[26]	68.9	35.5	62	76	100
Total number of failed banks bid on	5.2	4.18	1.75	3	8
Number of states (bids)	1.32	0.82	1	1	1
Number of acquisitions (bid and "win")	3.26	3.07	1	2	4
Number of states (acquisitions)	1.26	0.56	1	1	1
Prior experience in financial distress	0.58	0.51	0	1	1
Private Equity Level (N=42, available on Preqin)					
Fund vintage	2007.52	2.95	2006	2007	2009
Fund size (million USD)	2724.21	4075.23	654.05	1393.15	3100.00
First-time fund (0 or 1)	0.18	0.39	0	0	0

[26] PE ownership shares include three acquisitions that occurred through non-bank charters but are exceptions in their funding structure. Of these, two were small banks acquired by single investors, and one was a community development bank with funding provided by large institutional investors. We count those PE ownership shares as zero in the above table. Excluding these banks results in a mean PE ownership share of 82 percent and a median of 85 percent.

Table 2. Summary Statistics of the Failed Banks

This table presents summary statistics for failed banks between 2009 and 2014. Variables are obtained from the Call Report submitted by the failed bank in the quarter prior to failure. *Asset size* is the amount of assets at the failed bank in millions. % *Tier 1 risk-based capital* is the tier 1 risk-based capital divided by adjusted average assets, as a percentage. *Liquidity ratio* is the sum of cash, fed funds sold and securities, excluding mortgage-backed securities, divided by total assets. *Core deposits to total deposits* is total domestic deposits minus time deposits of more than $250,000 and brokered deposits of $250,000 or less, divided by total deposits. *Net interest margin* (%) is the quarterly net interest income as a percent of a two-period average earning assets. *CRE loans to total loans* is non-farm, non-residential properties secured by real estate and multifamily (5 or more) residential properties secured by real estate, divided by total loans. *C&D loans to total loans* is construction and land development loans secured by real estate divided by total loans. *C&I loans to total loans* is commercial and industrial loans, divided by total loans. *Consumer loans to total loans* is loans to individuals for household, family, and other personal expenditures, divided by total loans. *Residential loans to total loans* is loans secured by 1-4 family residential properties, divided by total loans. *Noncurrent loans to total loans* is the ratio of noncurrent loans to total loans. *OREO to total assets* is the ratio of other real estate owned to total assets. *Loss sharing agreement* is an indicator variable that is equal to 1 if the P&A in resolution included an agreement for the FDIC to partially indemnify losses incurred on covered assets. Neighboring and local bank variables are constructed as the mean of banks that share at least one branch zip code with the focal bank. *No of failed banks in state* is defined as the number of failed banks located in the same state as the headquarters of the failed bank.

N = 456	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
Failed bank characteristics					
Asset size ($ millions)	727.0	2,352	101.7	207.4	461.2
% Tier 1 risk-based capital to total assets	0.925	2.698	0.155	1.105	1.995
Liquidity ratio	0.168	0.082	0.110	0.156	0.211
Core deposits to total deposits	0.837	0.145	0.742	0.878	0.958
Net interest margin (%)	2.550	1.248	1.850	2.560	3.285
CRE loans to total loans	0.387	0.170	0.272	0.379	0.491
Construction and development loans to total loans	0.186	0.137	0.0842	0.158	0.261
C&I loans to total loans	0.107	0.089	0.044	0.083	0.143
Consumer loans to total loans	0.023	0.040	0.004	0.012	0.027
Residential loans to total loans	0.259	0.184	0.127	0.231	0.326
Noncurrent loans to total loans	0.164	0.095	0.097	0.150	0.203
OREO to total assets	0.052	0.049	0.017	0.039	0.071
Loss-sharing agreement (Yes/No)	0.662	0.473	0	1	1
Neighboring bank conditions					
Neighbor % tier 1 risk-based capital ratio	7.930	1.340	7.133	7.945	8.650
Neighbor noncurrent loans to total loans	0.036	0.035	0.009	0.024	0.053
Neighbor OREO to total assets	0.007	0.010	0.001	0.003	0.009
No. of local banks (>3xSize)	2.877	2.259	1	2	4
No. of failed banks in state	37.41	28.75	8	35	69

Table 3. Characteristics of PE-Acquired Failed Banks

This table presents the estimation results from a logit regression framework in the following form:

$$Pr(PE\ Acquired = 1) = \Phi(\alpha + \beta \cdot X_i + \gamma \cdot Control_i + \theta_t + \varepsilon_i).$$

The analysis is performed on the cross-sectional sample of all failed banks that were eventually acquired by a bank or a private equity consortium. The dependent variable is a dummy that takes value 1 if the failed bank was eventually acquired by PE and 0 otherwise (i.e., acquired by a bank). Panel A investigates characteristics of the failed banks themselves. Panel B investigates characteristics of the neighboring banks of the focal failed bank. All variables are defined in Table 2 and in the appendix of variable definition. We control for the size of the bank using the logarithm of the total assets of the bank. Failed Year-Quarter fixed effects are included to account for the time-varying economic and regulatory environments that could affect the failed bank resolution process. Robust standard errors are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Characteristics of Failed Banks and PE Acquisitions

	(1)	(2)	(3)	(4)	(5)
			I(PE Acquired)		
% Tier 1 risk-based capital ratio	-0.013***				
	(0.005)				
Core deposits to total deposits		-0.220**			
		(0.103)			
Net interest margin (%)			-0.054***		
			(0.012)		
C&D loans to total loans				0.229*	
				(0.123)	
OREO to total assets					0.626**
					(0.253)
Log(asset in $000)	0.057***	0.052***	0.044***	0.052***	0.058***
	(0.011)	(0.011)	(0.009)	(0.012)	(0.011)
Observations	456	456	456	456	456
Failed Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.181	0.170	0.218	0.172	0.175

Panel B: Financial Health of Neighbor Banks and PE Acquisitions

	(1)	(2)	(3)	(4)	(5)
			I(PE Acquired)		
Neighbor % tier 1 risk-based capital ratio	-0.020*				
	(0.012)				
Neighbor noncurrent loans to total loans		0.825***			
		(0.319)			
Neighbor OREO to total assets			3.905***		
			(1.435)		
No. of local banks (>3xsize)				-0.011*	
				(0.006)	
No. of failed banks in state					0.002***
					(0.000)
Log(asset in $000)	0.062***	0.051***	0.058***	0.060***	0.055***
	(0.012)	(0.010)	(0.012)	(0.011)	(0.010)
Observations	456	456	456	456	456
Failed Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.167	0.175	0.188	0.167	0.217

Table 4. Private Equity Bidding Activities

This table presents the estimation results from a logit regression framework in the following form:

$$Pr(PE\ Bidding = 1) = \Phi(\alpha + \beta \cdot X_i + \gamma \cdot Control_i + \theta_t + \varepsilon_i).$$

The analysis is performed on the cross-sectional sample of all failed banks in 2008–2015. Observation numbers are higher than in previous tables because additional failures in years 2008 and 2015 are added, in which a few PE bids were made on failed banks but did not win. The dependent variable is a dummy that takes value 1 if at least one PE bid on the failed bank and 0 otherwise (i.e., only bid on by banks). Panel A investigates characteristics of the failed banks themselves. Panel B investigates characteristics of the neighboring banks of the focal failed bank. All variables are defined in Table 2 and in Appendix 1. We control for the size of the bank measured using the logarithm of the total assets of the bank. Failed Year-Quarter fixed effects are included to account for the time-varying economic and regulatory environments that could affect the failed bank resolution process. Robust standard errors are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Characteristics of Failed Banks and PE Bidding

	(1)	(2)	(3)	(4)	(5)
			I(PE Bidding)		
% Tier 1 risk-based capital ratio	-0.025***				
	(0.006)				
Core deposits to total deposits		-0.162			
		(0.158)			
Net interest margin (%)			-0.056***		
			(0.019)		
C&D loans to total loans				0.152	
				(0.389)	
OREO to total assets					0.656*
					(0.389)
Log(asset in $000)	0.088***	0.080***	0.075***	0.080***	0.085***
	(0.015)	(0.015)	(0.015)	(0.016)	(0.015)
Observations	487	487	487	487	487
Failed Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.144	0.118	0.136	0.118	0.122

Panel B: Financial Health of Neighbor Banks and the PE Bidders

	(1)	(2)	(3)	(4)	(5)
			I(PE Bidding)		
Neighbor % tier 1 risk-based capital ratio	-0.034**				
	(0.016)				
Neighbor noncurrent loans to total loans		1.539***			
		(0.461)			
Neighbor OREO to total assets			6.718***		
			(2.043)		
No. of local banks (>3xSize)				-0.005	
				(0.008)	
No. of failed banks in state					0.003***
					(0.001)
Log(asset in $000)	0.097***	0.079***	0.091***	0.090***	0.090***
	(0.018)	(0.015)	(0.018)	(0.016)	(0.014)
Observations	487	487	487	487	487
Failed Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.137	0.151	0.158	0.129	0.204

Table 5. Balance Test of the Quasi-Random Bank Allocation to PE Investors and Banks

This table provides the balance test for the quasi-random acquisition sample by comparing characteristics prior to bank failures. The sample consists of failed bank auctions in which (1) PE investors and banks both bid, (2) one is the winning bidder (acquirer) and one is the cover bid, and (3) the bidder value difference is smaller than five percent of total bank assets. The balance test compares the banks that were marginally won by a bank and those that were marginally won by a PE investor, and it reports the mean, the standard deviation, and the *t*-test of the two samples. Variables are defined in prior tables or used in tables to follow.

	PE-acquired		**Bank-acquired**		
	Mean	Standard Deviation	Mean	Standard Deviation	*t*-stat
Failed bank characteristics					
Log(asset in $000)	12.758	0.829	13.073	1.464	0.921
% Tier 1 risk-based capital ratio	0.139	1.769	0.497	2.384	0.358
Core deposits to total deposits	0.870	0.134	0.822	0.152	-1.153
Net interest margin (%)	2.367	0.865	2.415	0.788	0.197
CRE loans to total loans	0.444	0.148	0.482	0.168	0.834
C&D loans to total loans	0.208	0.100	0.190	0.119	-0.571
OREO to total assets	0.077	0.068	0.051	0.071	-1.198
Neighboring bank conditions					
Neighbor % tier 1 risk-based capital ratio	7.735	1.475	7.188	2.445	-0.940
Neighbor noncurrent loans to total loans	0.059	0.049	0.045	0.039	-1.411
Neighbor OREO to total assets	0.015	0.015	-0.037	0.215	-1.200
Branch-level Conditions					
Branch closure rate (%) (2005-2007)	4.082	1.267	6.667	2.644	0.982
Branch deposits ($000)	51,777.11	91,362.15	57,660.35	100,444.4	0.513
County-level Condition					
Log(SBA loan amount)	15.463	1.881	15.900	2.075	1.304
Log(SBA loan number)	2.672	1.541	3.136	1.925	1.640
SBA loan interest rate	6.412	0.590	6.352	0.589	-0.588
Log(SBA loan average loan size)	12.791	0.841	12.764	0.839	-0.187
Log(startup employment)	8.197	1.755	8.337	2.235	0.430
Log(employment)	8.565	1.834	8.654	2.310	0.264
ΔLog(total personal income)	0.023	0.127	0.047	0.122	0.977
ΔLog(per capital income)	-0.032	0.052	-0.034	0.034	-0.256

Table 6. Branch Closing Post Failed Bank Acquisition—Branch-level Regression

This table studies failed bank branch closings after being acquired by a PE investor or by another bank. The analysis uses the following specification at the branch b level (located in region z), of bank i, that failed in year t:

$$Pr(Closing = 1)_{b,i,t,z} = \Phi(\alpha + \beta \cdot PE_i + \gamma \cdot Control_i + \theta_{t\times z} + \varepsilon_i).$$

The key explanatory variable is the dummy variable indicating whether the bank is acquired by a PE acquirer or by another bank. The dependent variable in columns (1) and (3) is a dummy variable indicating whether the branch closes within the three-year window post acquisition. Columns (2) and (4) use a dependent variable indicating whether the branch closes and simultaneously makes the bank exit the county. Control variables include those that have strong power in explaining PE investors' selection of acquisition—tier 1 risk-based capital ratio, core deposits to total deposits, C&D loans to total loans, OREO to total assets, and total assets.

Fixed effects are included at the failed year by branch state level. Standard errors are double clustered at the state and failed year levels and are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Quasi-Random Sample		**Full Sample**	
	(1)	(2)	(3)	(4)
	Closing	Close and Exit from County	Closing	Close and Exit from County
I(PE Acquired)	-0.148***	-0.070**	-0.072***	-0.027**
	(0.037)	(0.029)	(0.028)	(0.013)
% Tier 1 risk-based capital ratio	-0.006	-0.008	0.002	0.003
	(0.004)	(0.006)	(0.003)	(0.002)
Core deposits to total deposits	-0.929***	-0.657***	-0.537***	-0.224***
	(0.233)	(0.161)	(0.107)	(0.066)
C&D loans to total loans	-0.282**	-0.286***	0.039	0.027
	(0.135)	(0.107)	(0.080)	(0.053)
OREO to total assets	0.645	-0.137	0.158	-0.210
	(0.691)	(0.358)	(0.333)	(0.194)
Log(asset in $000)	-0.074*	-0.035*	-0.029***	-0.010**
	(0.031)	(0.019)	(0.005)	(0.003)
Observations	617	617	4,476	4,476
R-squared	0.345	0.234	0.236	0.143
State x Failed Year FE	Yes	Yes	Yes	Yes
Mean of Dependent Var	0.201	0.117	0.241	0.045

Table 7. Post-Acquisition Performance in Deposit Growth

This table shows the deposit changes of bank- and PE-acquired failed bank branches post acquisition. The analysis is at the county-bank level, using the following specification,

$$\Delta Deposit_{i,t,z} = \alpha + \beta \cdot PE_i + \gamma \cdot Control_i + \theta_{t\times z} + \varepsilon_i.$$

The dependent variable is failed bank i's (in region z) one-year or three-year deposit change since i's year of failure t. For PE-acquired banks using shelf charters, this deposit change is for all branches in the local region; for bank-acquired banks or PE-acquired banks using inflatable charters or with multiple acquisitions, the deposits are calculated using both the failed bank branches and the branches originally owned by the acquirer bank in order to account for the measurement issues that may arise from reorganization. We only keep counties where the failed bank did not completely exit. The analysis incorporates a combination of state and failure year fixed effects. Standard errors are double clustered at the level of state and failed year, and they are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Quasi-Random Sample		**Full Sample**		**Quasi-Random + No-overlap Sample**	
	(1)	(2)	(3)	(4)	(5)	(6)
	1-Yr ΔDeposit	3-Yr ΔDeposit	1-Yr ΔDeposit	3-Yr ΔDeposit	1-Yr ΔDeposit	3-Yr ΔDeposit
I(PE Acquired)	-0.018	0.356***	0.067	0.214***	-0.014	0.351**
	(0.141)	(0.111)	(0.056)	(0.037)	(0.135)	(0.115)
Observations	431	431	1,685	1,685	417	417
R-squared	0.594	0.611	0.459	0.505	0.162	0.248
State x Failed Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dependent Var	0.0627	-0.0288	-0.0605	-0.173	0.0408	-0.0401

Table 8. Real Economic Outcomes: Small Business Lending

This table studies regional economic activities after failed banks were acquired by a PE investor versus an incumbent bank. The analysis is at the county level, exploiting the quasi-random allocation of banks, and focuses on counties with only one type of acquirer. The analysis studies small business lending activities. The dependent variables are three-year growth of SBA lending activities in terms of quantity, total amount, interest rate, and average loan size. Panels A and B use the quasi-random sample and the full sample, respectively. The analysis incorporates a combination of state and failure year fixed effects. Standard errors are double clustered at the level of the state and failed year and are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Small business lending activities—Quasi-random sample

	(1) ΔSBA Number	(2) ΔSBA Amount	(3) ΔSBA Interest Rate	(4) ΔSBA Average Loan Size
I(PE Acquired)	0.320**	0.154**	-0.323*	0.165
	(0.112)	(0.049)	(0.147)	(0.107)
Observations	276	276	276	276
R-squared	0.797	0.901	0.777	0.479
State x Failed Year FE	Yes	Yes	Yes	Yes

Panel B: Small business lending activities—Full sample

	(1) ΔSBA Number	(2) ΔSBA Amount	(3) ΔSBA Interest Rate	(4) ΔSBA Average Loan Size
I(PE Acquired)	0.125*	0.077*	-0.065*	-0.012
	(0.071)	(0.042)	(0.035)	(0.084)
Observations	2,181	2,181	2,181	2,181
R-squared	0.863	0.936	0.816	0.612
State x Failed Year FE	Yes	Yes	Yes	Yes

Table 9. Real Economic Outcomes: Regional Recovery

This table studies regional economic activities after failed banks were acquired by a PE investor versus an incumbent bank. The analysis is at the county level, exploiting the quasi-random allocation of banks, and focuses on counties with only one type of acquirer. The analysis studies regional economic indicators, and the dependent variables are three-year growth in startup employment, total employment, total personal income, and per capita income. Panels A and B use the quasi-random sample and the full sample, respectively. The analysis incorporates a combination of state and failure year fixed effects. Standard errors are double clustered at the level of the state and failed year and are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Regional economic recovery—Quasi-random sample

	(1) ΔStartup Employment	(2) ΔEmployment	(3) ΔTotal Income	(4) ΔPer Capita Income
I(PE Acquired)	0.042*	0.065**	0.015***	0.007*
	(0.023)	(0.029)	(0.006)	(0.004)
Observations	276	276	276	276
R-squared	0.957	0.949	0.600	0.412
State x Failed Year FE	Yes	Yes	Yes	Yes

Panel B: Regional economic recovery—Full sample

	(1) ΔStartup Employment	(2) ΔEmployment	(3) ΔTotal Income	(4) ΔPer Capita Income
I(PE Acquired)	0.026**	0.039**	0.011*	0.002
	(0.012)	(0.015)	(0.006)	(0.002)
Observations	2,181	2,181	2,181	2,181
R-squared	0.976	0.964	0.671	0.408
State x Failed Year FE	Yes	Yes	Yes	Yes

Table 10. Loss Share Claims for Failed Banks

This table studies loss share claims submitted by failed bank acquirers and examines the difference in whether the bank is acquired by a PE investor or by another bank. There were a total of 304 failed bank purchase agreements during the crisis that included loss share coverage. The analysis uses the following specification at the bank i, failure year-quarter t, and bank state s level:

$$Loss\ Share_{i,t,s} = \alpha + \beta \cdot PE_i + \gamma \cdot Control_i + \theta_{t \times s} + \varepsilon_i.$$

The key explanatory variable is the dummy variable indicating whether the bank is acquired by a PE investor or by another bank. The dependent variable is the aggregate loss rate by the bank during the period of loss share coverage. We aggregate all the loss claims during the coverage period that could last for several years. This aggregated amount is then scaled by the total assets covered by the FDIC loss sharing agreement to give us a measure of total claimed losses comparable across different banks. *Total loss rate* is the total losses on the acquired portfolio as a ratio of covered assets. *Incurred loss rate* is the losses incurred by the acquirer as a ratio of covered assets after netting out any payments received from the FDIC according to the terms of the loss share agreement. Control variables include those that have strong power in explaining PE investors' selection of acquisition—tier 1 risk-based capital ratio, core deposits to total deposits, C&D loans to total loans, and OREO to total assets. Fixed effects are included at the state-by-fail year level. Standard errors are clustered at the level of failed bank acquirers are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
			Total Loss Rate			
	Total Loss Rate			Incurred Loss Rate		
I(PE Acquired)	-0.015	-0.013	0.044	0.007	0.003	-0.007
	(-0.544)	(-0.406)	(0.690)	(0.648)	(0.207)	(-0.263)
% Tier 1 risk-based capital ratio	-0.005**	-0.007**	-0.024	0.000	0.001	-0.002
	(-2.578)	(-2.368)	(-0.769)	(0.268)	(0.510)	(-0.330)
Core deposits to total deposits	-0.028	0.042	-0.049	0.015	0.023	0.070
	(-0.486)	(0.736)	(-0.164)	(0.801)	(0.930)	(0.863)
C&D loans to total loans	0.307***	0.334***	-0.300	0.055**	0.063*	-0.094
	(5.688)	(3.933)	(-0.463)	(2.340)	(1.921)	(-0.681)
OREO to total assets	0.339*	0.560***	2.426	0.054	0.106	0.329
	(1.694)	(3.206)	(1.208)	(0.851)	(1.320)	(0.754)
Observations	304	304	38	304	304	38
R-squared	0.836	0.939	0.266	0.650	0.815	0.124
Quasi-random Sample	No	No	Yes	No	No	Yes
State FE	Yes	No	No	Yes	No	No
Failed Year FE	Yes	No	No	Yes	No	No
State x Failed Year FE	No	Yes	No	No	Yes	No

Table 11. Exit of PE-Acquired Banks

This table presents the exit outcomes of PE-acquired failed banks as of 2020 Q1. We hand collect information on the exit of PE-acquired banks from FDIC structure reports on bank merger activity. We obtain details on IPO activity from S&P Global Market Intelligence. The analysis is primarily performed at the acquiring bank level (consortium level) because different failed banks are lumped into one bank after being acquired by the same consortium under the same charter. We also report the bank-level counts that reflect the number of acquired failed banks in the acquiring consortia. The exit outcomes include still active, merger and acquisitions (acquired) or consolidated, IPO, and closed and liquidated. For acquired banks, we also code the acquirer identity. For the purpose of this table, *Local bank buyer* is identified here as a bank that has a branch network that overlaps with the acquired bank's branch network in at least one zip code. *Non-local bank buyer* is identified here as a bank that does not overlap with the acquired bank's branch network in at least one zip code.

Outcomes	**PE-Acquired Failed Banks**		**Bank-Acquired Failed Banks**	
	Acquirer-level	Bank-level	Acquirer-level	Bank-level
Still active under acquirer ownership	1	1	158	273
Acquired or Merged	15	52	54	95
Local bank buyer	9	30	24	47
Non-local bank buyer	6	22	30	48
IPO	2	4	11	24
Closed and liquidated	1	5	2	3

Table 12. Characteristics of Management in PE-acquired Banks

This table presents the background information of the CEOs appointed by PE investors after acquiring failed banks. CEO background information is hand-collected from publicly available information on the internet, such as company bios, professional profiles, and featured articles. *Prior experience in banking* is an indicator variable for whether the new CEO appointed at the PE-acquired failed bank had a history of employment in commercial banking. *Years of prior experience in banking* is the number of years the individual was employed in commercial banking prior to joining the PE-acquired failed bank. *Formerly at failed bank* is an indicator variable for whether the CEO was at the failed bank prior to failure. (In most cases, the FDIC does not allow existing management to stay on at failed banks.) *From PE firm* is an indicator variable for whether the new CEO came directly from the PE firm. In all instances, CEOs came from the commercial banking industry. *Local banking experience* is an indicator variable for whether the CEOs had prior banking experience in the state where the PE acquisition was located. *Community banking experience* is an indicator variable for whether the CEO's prior experience was at a bank with a footprint within a single state (as opposed to regional or national footprints). *Prior CEO of bank* is an indicator variable for whether the CEO held a previous CEO position at a bank. While a little over half had prior CEO experience, all CEOs at PE-acquired banks had prior experience in upper banking management. *Prior founding of bank* is an indicator variable for whether the CEO had previously founded a bank. Almost a third of these CEOs had experience in starting up a new bank and later selling it. *Prior experience in turnaround management, troubled debt, distressed assets* is an indicator variable for whether the CEO had experience rehabilitating troubled institutions or products.

$N = 19$	Mean	Standard Deviation	Median	25^{th} percentile	75^{th} percentile
Prior experience in banking	1	0	1	1	1
Years of prior experience in banking	29.3	7.6	30	25	37
Formerly at failed bank	0	0	0	0	0
From PE firm	0	0	0	0	0
Externally hired	1	0	1	1	1
Local banking experience	0.63	0.51	1	0	1
Community banking experience	0.68	0.48	1	0	1
Prior CEO of bank	0.53	0.51	1	0	1
Prior founding of bank	0.32	0.48	0	0	1
Prior experience in turnaround management, troubled debt, distressed assets	0.37	0.5	0	0	1

Online Appendix for

Private Equity and Financial Stability: Evidence from Failed Bank Resolution in the Crisis

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The analysis, conclusions, and opinions set forth here are those of the author(s) alone and do not necessarily reflect the views of the Federal Deposit Insurance Corporation.

Online Appendix 1. Sample of Failed Bank Acquisitions and PE Participation

In this appendix, we provide details on the sample construction of failed banks in our main analysis, which focuses on 456 failed bank acquisitions. None of the data processing steps described below change the results of the paper in any meaningful way, either qualitatively or quantitatively.

From 2009–2014 (the main dates of our sample, because these are the years in which PE investors acquired failed banks), the cumulative number of failed bank observations is 483. This includes 394 bank failures acquired by banks,[1] 62 bank failures acquired by PE investors,[2] 25 failures that received no winning bid and were thus liquidated by the FDIC, and 2 banks that were temporarily run by the FDIC as bridge banks. The 25 liquidations and 2 bridge banks are excluded from our analysis, leaving 394 + 62 = 456 failed bank acquisitions for our main analysis.

The amount of assets at the failed banks in Figure 1, Panel B shows total assets held at failed banks in the quarter before failure. The sample includes assets at banks that were acquired, liquidated, or temporarily run as a conservatorship or bridge bank. These numbers differ from the total assets *acquired*, depicted in Figure 3, Panel B. Figure 3 only includes assets from banks that were acquired, so it excludes any assets from banks that were liquidated and two bankers' banks that failed and were temporarily run as bridge banks by the FDIC. In addition, acquirers rarely purchase 100 percent of the assets at the failed bank, so the FDIC retains a large portion overall. Any assets retained by the FDIC in the resolution process are excluded from the measure of assets acquired. This is why the amount of assets at failure and the amount of assets acquired are different between Figure 1, Panel B, and Figure 3, Panel B, in the paper, capturing details of bank failures vs. acquisitions.

[1] One bank that failed in 2010 was split between two different acquirers – these are counted as separate observations in our analysis.

[2] One bank failed in 2008 but was run by the FDIC as a conservatorship before being acquired in 2009 by a PE entity.

Online Appendix 2. Additional Results

Table A1. Bank Failures and PE Participation in Resolutions

This table shows the number and size of failed bank acquisitions by year. Column (1) is the year in which the acquisition occurred. Column (2) is the total number of failed bank acquisitions in a given year. Column (3) is the total amount of failed bank assets in millions acquired in a given year from internal resolution data at the FDIC. Column (4) is the number of failed banks acquired by PE in a given year. Column (5) is the percentage of failed bank acquisitions by PE in a given year relative to the total failed bank acquisitions that year. Column (6) is the total assets in millions passed to the acquiring banks in a given year from internal FDIC resolutions data. Column (7) is the percentage of assets acquired by PE in a given year relative to total assets acquired in that year. Column (8) is the number of failed banks acquired by banks in a given year. Column (9) is the percentage of failed bank acquisitions by banks in a given year relative to the total failed bank acquisitions that year. Column (10) is the total assets passed to the bank acquirers in a given year from internal FDIC resolutions data. Column (11) is the percentage of assets acquired by banks in a given year relative to total assets acquired in that year.

Year	Total failed bank acquisitions		Failed banks acquired by PE				Failed banks acquired by other banks			
	Number	Total assets ($Million)	Number	%	Total assets ($Million)	%	Number	%	Total assets ($Million)	%
2009	129	151,605	11	8.53%	38,181	25.18%	118	91.47%	113,423	74.82%
2010	149	79,620	22	14.67%	15,847	19.90%	127	85.33%	63,774	80.10%
2011	90	31,888	20	22.22%	10,240	32.11%	70	77.78%	21,648	67.89%
2012	47	8,723	5	10.64%	1,149	13.17%	42	89.36%	7,574	86.83%
2013	23	4,794	2	8.70%	363	7.57%	21	91.30%	4,431	93.43%
2014	18	2,173	2	11.11%	210	9.68%	16	88.89%	1,963	90.32%
Overall	456	278,803	62	13%	65,990	24 %	394	87%	212,813	76 %

Table A2. Summary Statistics of the Failed Banks

This table presents summary statistics for failed bank acquisitions by PE and other banks between 2009 and 2014. *Asset size* is the amount of assets at the failed bank in millions. *% Tier 1 risk-based capital* is the Tier 1 risk-based capital divided by adjusted average assets, as a percentage. *Liquidity ratio* is the sum of cash, fed funds sold, and securities (excluding mortgage-backed securities) divided by total assets. *Core deposits to total deposits* is total domestic deposits minus time deposits of more than $250,000 and brokered deposits of $250,000 or less divided by total deposits. *CRE loans to total loans* is non-farm, non-residential properties secured by real estate and multifamily (5 or more) residential properties secured by real estate divided by total loans. *C&D loans to total loans* is construction and land development loans secured by real estate divided by total loans. *C&I loans to total loans* is commercial and industrial loans divided by total loans. *Consumer loans to total loans* is loans to individuals for household, family, and other personal expenditures divided by total loans. *Noncurrent loans to total loans* is the ratio of noncurrent loans to total loans. *OREO to total assets* is the ratio of other real estate owned to total assets. *Loss-sharing agreement* is an indicator variable that equals 1 if the transaction included an agreement with the FDIC to share in a portion of the losses on covered assets and 0 if no loss-sharing agreement was included. Neighboring bank variables are constructed as the mean of banks that share at least one branch zip code with the focal bank.

	PE Acquisitions				**Bank Acquisitions**				**T-test**	
	N	Mean	Standard Deviation	Median	N	Mean	Standard Deviation	Median	*t*-stat	*p-val*
Failed bank characteristics										
Asset size ($ millions)	62	1,354	4,216	341	394	628	1,890	193	-2.267**	0.024
% Tier 1 risk-based capital ratio	62	0.165	2.418	0.615	394	1.045	2.722	1.190	2.402**	0.017
Liquidity ratio	62	0.168	0.085	0.156	394	0.168	0.081	0.156	0.030	0.976
Core deposits to total deposits	62	0.824	0.148	0.889	394	0.839	0.144	0.874	0.753	0.452
Net interest margin (%)	62	2.019	1.320	2.115	394	2.634	1.217	2.625	3.655***	0.001
CRE loans to total loans	62	0.400	0.165	0.394	394	0.385	0.171	0.378	-0.649	0.516
C&D loans to total loans	62	0.227	0.149	0.199	394	0.179	0.135	0.152	-2.571**	0.011
C&I loans to total loans	62	0.083	0.080	0.065	394	0.111	0.090	0.085	2.284**	0.023
Consumer loans to total loans	62	0.014	0.013	0.010	394	0.024	0.042	0.012	1.842*	0.066
Residential loans to total loans	62	0.253	0.184	0.209	394	0.260	0.184	0.237	0.303	0.762
Noncurrent loans to total loans	62	0.183	0.088	0.162	394	0.161	0.096	0.143	-1.716*	0.087
OREO to total assets	62	0.065	0.057	0.051	394	0.050	0.047	0.037	-2.386**	0.017
Loss-sharing agreement	62	0.839	0.371	1	394	0.632	0.483	1	-3.224***	0.001
Neighboring bank conditions										
Neighbor % tier 1 risk-based capital ratio	62	7.692	1.274	7.713	394	7.972	1.345	7.956	-1.479	0.140
Neighbor noncurrent loans to total loans	62	0.048	0.041	0.038	394	0.034	0.033	0.022	2.870***	0.004
Neighbor OREO to total assets	62	0.012	0.013	0.006	394	0.006	0.009	0.003	4.106***	0.000
No. of Local Banks (>3xSize)	62	2.949	1.682	2.000	394	3.337	2.178	3.000	-1.300	0.194
No. of Failed Banks in State	62	52.9	29.4	69	394	35.0	27.9	21	17.9***	0.000

Table A3. Robustness: Comparing PE-Acquired and Bank-Acquired Failed Banks

This table presents the estimation results from a logit regression framework in the following form:

$$Pr(PE = 1) = \Phi(\alpha + \beta \cdot X_i + \gamma \cdot Control_i + \theta_t + \varepsilon_i).$$

The analysis is performed on the cross-sectional sample of all failed banks that eventually got acquired by a bank or a private equity investor. The dependent variable is a dummy that takes value 1 if the failed bank was eventually acquired by a PE investor and 0 otherwise (i.e., acquired by a bank). This table differs from Table 3 of the paper by using alternative definitions of PE acquisitions. We required PE holding to be above 75% or 66% respectively.

	(1)	(2)	(3)	(4)	(5)
	Pr(PE Acquired); PE defined as PE Ownership > 75%				
% Tier 1 risk-based capital ratio	-0.011**				
	(-2.183)				
Core deposits to total deposits		-0.268**			
		(-2.073)			
Net interest margin (%)			-0.075***		
			(-4.657)		
C&D loans to total loans				0.347**	
				(2.480)	
OREO to total assets					0.728***
					(2.654)
Log(asset in $000)	0.052***	0.048***	0.043***	0.043***	0.054***
	(4.099)	(3.931)	(3.587)	(2.807)	(4.260)
Observations	408	408	408	408	408
Failed Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.131	0.132	0.204	0.148	0.138

	(1)	(2)	(3)	(4)	(5)
	Pr(PE Acquired); PE defined as PE Ownership > 66%				
% Tier 1 risk-based capital ratio	-0.012**				
	(-2.300)				
Core deposits to total deposits		-0.248*			
		(-1.858)			
Net interest margin (%)			-0.082***		
			(-4.849)		
C&D loans to total loans				0.365**	
				(2.512)	
OREO to total assets					0.866***
					(3.262)
Log(asset in $000)	0.060***	0.056***	0.050***	0.050***	0.061***
	(4.554)	(4.391)	(4.090)	(3.271)	(4.770)
Observations	428	428	428	428	428
Failed Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.156	0.152	0.229	0.171	0.169

Table A4. Robustness: Comparing PE-Acquired and Bank-Acquired Failed Banks

This table presents the estimation results from a logit regression framework in the following form:

$$Pr(PE = 1) = \Phi(\alpha + \beta \cdot X_i + \gamma \cdot Control_i + \theta_t + \varepsilon_i).$$

The analysis is performed on the cross-sectional sample of all failed banks that eventually got acquired by a bank or a private equity investor. The dependent variable is a dummy that takes value 1 if the failed bank was eventually acquired by a PE investor and 0 otherwise (i.e., acquired by a bank). This table differs from Table 3 of the paper by simultaneously incorporating bank characteristics of the failed banks and their neighboring banks, as defined in the paper.

	(1)	(2)	(3)	(4)	(5)
			I(PE Acquired)		
% Tier 1 risk-based capital ratio	-0.017***				
	(0.005)				
Neighbor % tier 1 risk-based capital ratio	-0.018*				
	(0.011)				
Core deposits to total deposits		-0.591**			
		(0.254)			
Neighbor core deposits to total deposits		-0.401*			
		(0.217)			
Net interest margin (%)			-0.073***		
			(0.021)		
Neighbor net interest margin (%)			-0.012		
			(0.041)		
C&D loans to total loans				0.309***	
				(0.101)	
Neighbor C&D loans to total loans				0.324**	
				(0.147)	
OREO to total assets					0.492**
					(0.234)
Neighbor OREO to total assets					3.397**
					(1.444)
Log(asset in $000)	0.064***	0.029*	0.027**	0.025**	0.060***
	(0.012)	(0.018)	(0.011)	(0.010)	(0.012)
Observations	456	456	456	456	456
Failed Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.198	0.118	0.141	0.0951	0.196

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Private Equity and Financial Fragility during the Crisis
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ABSTRACT

Do private equity firms contribute to financial fragility during economic crises? We find that during the 2008 financial crisis, PE-backed companies increased investments relative to their peers, while also experiencing greater equity and debt inflows. The effects are stronger among financially constrained companies and those whose private equity investors had more resources at the onset of the crisis. PE-backed companies consequentially experienced higher asset growth and increased market share during the crisis.

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1 Introduction

The recent global financial crisis increased the attention paid by policy makers, regulators, and academics to financial stability. While much attention has been devoted to deficiencies in the banking system in this and earlier crises (Bernanke and Gertler, 1990; Reinhart and Rogoff, 2009; and Fahlenbrach, Prilmeier, and Stulz, 2012), high levels of corporate debt have also triggered concerns. Highly leveraged firms may enter financial distress during a crisis, exacerbating cutbacks in investment and employment and contributing to the persistence of the downturn (Bernanke, et al., 1988; and Bernanke, 1983).

The practices of the private equity (PE) industry in particular have raised concerns. In the three years leading up to the crisis (between 2006 and 2008), global PE groups raised almost $2 trillion in equity[1], with each dollar typically leveraged with more than two dollars of debt (Kaplan and Stromberg, 2009). This phenomenon was not confined to the recent crisis. Private equity markets are prone to distortions introduced by credit cycles. As documented by Axelson, et al. (2013), periods characterized by booming financial markets also experienced greater private equity fundraising, higher transaction valuations, and critically more leverage.

The impact of PE investment patterns on the economy during periods of financial turmoil, however, remains poorly understood. On the one hand, the cyclicality of private equity activity, combined with the leveraging of their portfolio companies, may exacerbate the negative effects of shocks to the financial sector, aggravating the boom and bust dynamic of the economy. In line with this idea, the Bank of England suggests that buyouts should be monitored for macro-prudential reasons, because "the increased indebtedness of such companies poses risk to the

[1] http://www.preqin.com

stability of the financial system."[2] Moreover, the pressure to complete deals during boom times may lead to the financing of lower-quality firms (Kaplan and Stein, 1993), leaving PE-backed companies more exposed to changes in underlying economic conditions. Finally, the increased fundraising and investment during boom periods may reduce the ability of private equity groups to effectively monitor and fund their portfolio companies once economic conditions deteriorate. These concerns have led to efforts to cap the amount of leverage used in PE transactions by the U.S. Federal Reserve Bank and the European Central Bank.

Alternatively, PE-backed companies may be resilient to downturns, and therefore play a stabilizing role during bad times. In particular, these companies may be better positioned to obtain external funding when financial markets are dysfunctional. First, PE groups have strong ties with the banking industry (Ivashina and Kovner, 2011) and may be able to use these relationships to access credit for their firms during periods of crisis. Second, because PE groups raise funds that are drawn down and invested over multiple years—commitments that are very rarely abrogated—they may have "deep pockets" during downturns. These capital commitments may allow them to make equity investments in their firms when accessing other sources of equity is challenging.

Motivated by these alternative hypotheses, this paper seeks to understand whether private equity contributed to the fragility of the economy in the United Kingdom (UK) during the recent financial crisis. The UK is a perfect environment to study this question. First, the UK had the largest private equity market as a share of GDP before the crisis (Blundell-Wignall, 2007)— with PE assets at about 11% of GDP[3] — and one of the largest in absolute value. In line with these numbers, the Bank of England estimated that before the crisis, PE-backed companies had issued

[2] *Bank of England Quarterly Bulletin*, 2013Q1
[3] This number is obtained by dividing the total fundraising between 2004 and 2008, as estimated by the European Venture Capital Association and PEREP Analytics, by GDP in 2008 (as reported by the World Bank).

more than 10% of all non-financial corporate debt in the UK.[4] Second, the UK provides detailed income statement and balance sheet information for almost every active company, whether public or private (Brav, 2009; and Michaely and Roberts, 2012). Similar financial data are not available in the United States. Finally, the UK experienced a severe credit market freeze during the 2008 crisis, with a dramatic decline in private sector investment and lending (Riley, Rosazza, Bondibene, and Young, 2014). As illustrated in Figure 1, aggregate investment declined by more than 20% during 2008 in the UK, which simultaneously experienced a sharp credit contraction (Figure 2).

To address the above questions, we study the relative evolution of PE-backed and non-PE companies in the wake of the financial crisis. We focus on the financial decisions and performance of these firms during this period, in an attempt to understand whether private equity exacerbates or dampens the sensitivity of the economy to credit cycles.

Our main analysis focuses on a final sample of almost five hundred companies that were backed by PE prior to the financial crisis. Using a difference-in-difference approach, we study how the financial decisions and performance of the PE-backed companies were affected by the onset of the crisis relative to a control group. The control group employs companies that were operating in the same industry as the PE-backed companies and had similar size, leverage, and profitability in 2007, following the methodology of Boucly, Sraer, and Thesmar (2011).[5] The matching firms had similar trends in the years leading to the crisis along dimensions such as investment, revenue, returns on assets, equity contributions, and debt issuances. Therefore, this approach allows us to

[4] Bank of England Quarterly Bulletin, 2013Q1
[5] As we discuss in the paper, the main results are confirmed also when using a similar matching procedure but excluding leverage as a matching variable.

explore differences that stem from organization structure, rather than their balance sheet or investment characteristics.

We start by comparing the PE-backed companies and their peers' behavior during the financial crisis. We find that PE-backed companies decreased investments less than non-PE-backed companies did during the financial crisis, with between five and six percent greater spending, an effect that is strongly statistically significant. Looking at the timing of the effects, the two groups did not differ significantly in the pre-crisis period, but the investment rate of the PE group substantially diverged from the control group beginning in 2008. In fact, the divergence of the PE group occurs exactly when aggregate investments and credit growth in the UK started to decline sharply.

We then show that the higher investments by PE-backed companies reflect the fact that these firms appear to have been less bound by financial constraints. We find that debt issuance over assets was four percentage points higher for PE-backed companies during the crisis, and similarly, equity issuances over assets increased by two percentage points relative to their peers. At the same time, the cost of debt, measured by interest expense over total debt, was relatively lower for PE-backed companies during the crisis. As before, these effects appeared first in 2008 and continued through the remainder of the period (with varying levels of statistical significance).

The idea that private equity firms can help relax the financial constraints of portfolio companies is also consistent with two additional findings. First, the positive effect on investment is particularly large among companies that were ex-ante more likely to be financially constrained during the crisis. We find this result using various proxies of financial constraints, such as size, industry dependence on external finance (Rajan and Zingales, 1998), and pre-crisis leverage.

Second, the increase in investment is larger when the private equity sponsor had more resources available at the onset of the crisis to help the portfolio company. To explore this dimension, we exploit the heterogeneity across private equity firms. First, we focus on the amount of dry powder—capital raised but not yet invested – that is available to investors at the time of the financial crisis. Second, we look at to whether their most recent fund was at an earlier stage at the time of the financial crisis. These tests are based on the underlying assumption that PE firms that are at the early years of their fund and with more dry powder have more resources—both financial and operational—to invest in their portfolio companies during the crisis. Our results confirm this hypothesis.

Taken together, these results illustrate that PE-backed companies do *not* appear to be more sensitive to the onset of the financial crisis. Rather, during a period in which capital formation dropped dramatically, PE-backed companies invested more aggressively than peer companies did. This ability to maintain a high level of investment appears related to the superior access of PE-backed companies to financing, in terms of both equity and debt issuances, and the lower cost of debt.

The results are robust to a battery of checks. Throughout the analysis, we control for firm fixed effects, and thus remove time-invariant characteristics of the control and treatment firms. We also show that the results are not driven by non-parallel trends in the pre-crisis period and they are not affected by the addition of company controls. Second, our main results generally do not change when we exclude companies whose private equity deals were management buyouts (MBOs), a class of transactions in which the engagement of private equity firms is traditionally lower. Third, it does not appear that the results simply reflect differences in attrition between PE and non-PE companies. Fourth, the results remain unchanged if we control for time-varying industry shocks around the crisis. Lastly, we also confirm that the results are robust to alternative matching estimators. In particular, we find that removing leverage from the variables used to match companies does not affect our results.

In the final part of the paper, we examine the performance of PE-backed companies during the financial crisis. We find that PE-backed companies experienced a greater growth in their stock of assets in the years after the crisis, consistent with the greater investment seen above. Similarly, we find that PE-backed companies increased their market share in the industry during the crisis. At the same time, PE-backed companies did not underperform their peers: that is, they did not become relatively less profitable, whether measured by the ratios of EBITDA to revenue or net income to assets. These findings are contrary to what would be expected if companies were pursuing value-destroying investments during this period.

We also examine the exit patterns of PE-backed companies relative to the control group during the crisis period. We find that PE-backed companies were not more likely to go bankrupt, but they were more likely to be sold through non-distressed M&A transactions. Overall, these results regarding exits—while by their nature limited—again seem to be inconsistent with the hypothesis that PE financing increases the financial fragility of the portfolio firms.

This paper relates to an extensive body of work examining the behavior of financial institutions during the financial crisis and their consequences for operating firms (e.g., Ivashina and Scharfstein, 2010; and Ben-David and Franzoni, 2012). The conclusions, though, are more benign here than many of the studies examining other financial institutions, including banks, rating agencies, and hedge funds. The role of private equity groups seems more akin to those of the Japanese banks during the 1980s documented by Hoshi, Kashyap, and Scharfstein (1990, 1991), where better information and aligned incentives allowed bank-affiliated firms to overcome the capital constraints that limited investments of their peers without such relationships. During the financial crisis, the greater alignment and relatively longer time horizons of private equity investors may have allowed firms to more successfully respond to the economic dislocations.[6] The paper is also related to an extensive literature that explores the effects of private equity ownership on firm outcomes (e.g., Bernstein, et al., 2016; Bernstein and Sheen, 2016; Boucly, Sraer, and Thesmar, 2011; Cohn and Towery, 2013; Davis, et al., 2013; John, Lang, and Netter, 1992; Kaplan, 1989; and Lichtenberg and Siegel, 1990).

The paper is organized as follows. In Section 2, we present the data used in this study. Section 3 then describes the empirical approach employed in the paper. Sections 4 and 5 present the main results on investment and performance, discussing the possible mechanisms behind our results and presenting a battery of robustness tests. Finally, Section 6 summarizes our results and conclusions.

2 Data

2.1 Sample Construction

We start our data construction by extracting from Capital IQ all UK companies backed by private equity before the financial crisis. We identified private equity deals in Capital IQ by searching for events such as "going private," "leveraged buyout," "management buyout," and "platform." In so doing, we excluded "growth buyouts," "venture capital" and "expansion capital" investments, where investors generally buy a stake in the company using little or no leverage. Since we are interested in studying the behavior of UK PE-backed companies around

[6] The high-degree of diversification among different types of limited partners (LP) of buyout funds may explain why they were able to support their portfolio companies during the crisis. In contrast, Illig (2012) argues that that venture capital funds had difficulties in raising capital and had to defer capital calls during the crisis because their LPs base was less diversified and more concentrated among endowments.

the financial crisis, we selected only firms that (i) were headquartered in United Kingdom at the time of the deal; (ii) had received a PE investment by the end of 2007 and (iii) did not experience an exit by the PE group by the end of 2008.[7]

We then further filter our data, keeping only those firms that had balance sheet and income statement information in Amadeus, a Bureau Van Dijk (BvD) data set of European companies. Amadeus collects data from the "Companies House," the United Kingdom official national registrar office. As already pointed out by other authors (Brav, 2009; Michaely and Roberts, 2012), the United Kingdom is a perfect setting for studies of private companies. According to current regulations, every registered limited company is required to provide financial and income information annually to the public register.

The extent of the requirement to disclose financial information in the UK, however, varies with the size of the company. Small (and some medium-sized) companies are allowed to file abbreviated accounts.[8] Since the amount of information small firms disclose to Companies House (and hence in the Amadeus dataset) is quite limited, we excluded this group from our analysis. The reliability of the source and its coverage of the remaining private firms is a key strength of our study. Most of the companies in our sample consist of middle-sized private enterprises, for which similar financial data are not available in the United States.[9]

We supplement Amadeus data with Orbis, another data product from BvD. While both Amadeus and Orbis collect information from the Companies House, Amadeus generally removes firms from the sample after a few years of inactivity. This is not the case for Orbis. Since the post-

[7] During 2008, there were 28 exits of PE firms. The results remain unchanged if we include them in the sample.
[8] Since 2008, a small company is defined as one meeting at least two of the following criteria: total assets less than £3.26 million, annual turnover less than £6.5 million, and an average number of employees fewer than 50. This group usually reports only assets, revenue, and profits.
[9] One limitation of this data set is that balance sheet items are always reported at the book value.

financial crisis period was characterized by an increase in firm exit, using only Amadeus would have generated selection concerns that could undermine the reliability of our results.[10]

Therefore, we further restrict the sample to firms meeting the following criteria: (i) matched to Amadeus; (ii) not a small firm, as defined by the Companies House; and (iii) not operating in the financial (SICs 600-699), public (SICs 900-999), or utility sectors (SICs 489-493).[11] This led to an initial sample of 987 unique firms. Once we exclude firms that did not meet minimum data requirements for the matching process described below, the sample includes 722 firms.[12]

2.3 Other Data

We supplement the data from Amadeus/Orbis to identify potential acquisitions and bankruptcies during the crisis. We start by constructing two different variables that identify whether a firm went out of business. In particular, we generate a dummy "Out of Business," which is equal to one if the firms' information is missing in Amadeus/Orbis by 2011, suggesting that the firm no longer exists.[13] On its own, the interpretation of this variable is unclear, since a firm can exit from the company registry for many different reasons, such as bankruptcy or acquisition.

We thus further refine this measure by generating a dummy— "Bad Exit"— that identifies companies that went out of business unambiguously because of distress. We generate this variable using the firm status history, available through Orbis. The data provider collects information from

[10] Orbis and Amadeus are essentially the same data product. The main two differences are the deletion of exited firms, as discussed above, and the interface used to distribute the data.
[11] This industry sample selection is common to the private equity literature. Similarly, Michaely and Roberts (2012) apply similar filter with the same data set.
[12] We require that companies have data on industry, return on assets, capital expenditures, asset, and leverage in 2007.
[13] In particular, we look at the total assets variable to identify company exits. Information on total assets is always required by UK reporting rules, and therefore when this field is missing, the company no longer exists.

the Companies House and assigns to each firm a status, such as active, dissolved, dormant, or in liquidation, which may change over time. We define a company status as a "bad exit" if (a) the firm was not active by 2011 and (b) before disappearing from the data, its status implied that the firm was in liquidation or in insolvency proceedings.

Similarly, we use Capital IQ to identify potential profitable exits by looking at firms involved in M&A transactions from 2008 onwards. Since M&A transactions may also arise because of distress, we provide an alternative measure by excluding companies that were involved in M&A but were also identified in the same period as in distress, as discussed above.

Lastly, we also collect information on the history of the PE investors for each portfolio company, in order to identify when the PE investors raised their last fund before the crisis. The younger the last fund at the onset of the crisis, the more likely that the private equity firm will have more financial and operational resources available, since the PE firm had less time to deploy capital and commit time to existing portfolio companies. In order to compile this information, we manually search the private equity firms in ThomsonOne and Capital IQ and collect information about their fundraising history.[14]

We also construct a measure of PE firm "dry powder," a proxy for the dollar amount of financial resources that the PE investors have available by the time of the crisis. To generate this measure, we collect in ThomsonOne the fundraising and investment history for the PE investors during the 2001-2007 period, and calculate aggregate fundraising and investments.[15] The dry

[14] If a portfolio company has more than one PE firm, we conservatively use the most recent fundraising year among all investors.

[15] In order to measure capital investments of PE investors, we sum the total equity investment made over the specified period. The estimated equity investment in each case is estimated in the following manner. If available, we use the estimated equity investment as reported by ThomsonONE. When this is not available, we estimate the equity investment by the fund as the total amount of equity invested in the firm divided by the total number of funds investing in the round. When ThomsonONE does not report the total equity invested, we use the value of the deal minus the debt (we assume debt to be zero when missing). Since the fund used for investment is not always reported, we use the total investment made by the PE group over the period.

powder measure is the difference between the PE firm fundraising and investment. Using this variable, we construct a dummy "high dry powder" that is equal to one if the company's PE investors are in the top quartile for dry powder. If a company has more than one PE, we use the shareholder with most resources.

3 Empirical Strategy

To understand how the crisis affected the financial and investment policies of PE-backed companies, we develop a difference-in-difference design where we compare PE-backed companies to a control group of non-PE backed companies around the financial crisis. We first describe how we construct the sample of matched firms and then discuss the empirical specification.

3.1 Constructing a Matched Control Group

Private equity-backed companies are clearly not a random sample of the population: for instance, they are likely to be larger and more leveraged than the average firm. Therefore, the first step in the analysis is to identify a proper control group for the set of PE-backed companies.

Following Boucly, Sraer, and Thesmar (2011), we identify a suitable control group through a matching procedure for each PE-backed company in our sample. We identify a set of control firms that operate in the same industry and had a similar size, leverage, and profitability in 2007. This procedure involved two steps. First, for all private equity-backed companies in our data, we selected every company in the Amadeus/Orbis sample that (a) belonged to the same two-digit SIC; (b) had a return on assets (ROA), defined as net income over total assets, within a 30% bracket around our PE firm; (c) had assets within a 30% bracket around our PE firm; and (d) had leverage within a 30% bracket around our PE firm. Second, if this first step identified more than five firms, we selected the closest five, based on quadratic distance computed based on the variables.

Overall, this procedure is a more conservative version of Boucly, Sraer, and Thesmar (2011), since we add an additional variable to the matching—leverage—and use a narrower matching bandwidth.[16] Using this methodology, we were able to match 434 of the 722 firms, generating a total sample of 1,984 firms. In the robustness section, we present an alternative matching procedure that is closer to Boucly, Sraer and Thesmar (2011), by eliminating leverage in the matching procedure.[17]

For every firm in the final sample, we extract from Amadeus/Orbis the full set of income and financial information available for the period from 2004 to 2011. Using these data, and following Brav (2009) and Michaely and Roberts (2012), we construct several measures of firm activity. In particular, we calculate capital investments as the change in assets plus the reported depreciation. Furthermore, we identify equity injections in the company by measuring the change in equity minus profit. Similarly, debt issuance is computed as the change in total liabilities in the year. All these variables are normalized by total assets. In addition, we measure firm leverage as total liabilities over total assets, and cost of debt as the ratio of total interest expenses to total debt. In order to limit the influence of outliers, we winsorize all ratios at 1%. The Data Appendix provides more information about the variables and the sample.

Panel A of Table 1 shows the industry distribution of PE-backed companies in the sample. We compare it with the universe of the UK firms, after we eliminate small businesses and

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[16] The other difference is that we measure size in terms of assets and not employment. The reason for this choice is that employment variable in Amadeus is significantly less populated than assets. However, in a robustness test, we added employment as a fourth variable in our matching procedure and show that this does not affect the results.
[17] In a previous version of the paper, we have used wider matching boundaries (50% instead of 30%), which is in line with Boucly, Sraer, and Thesmar (2011). In general, these changes increase the size of our final sample and marginally reduced the quality of the matches, but did not affect the main results.

companies in the financial or regulated sectors. The majority of the sample firms are in either the services (38%) or manufacturing (32%) industries. Other important industries include wholesale trade, construction, and retail. The sample industry distribution is relatively close to the universe of companies: the major difference is that PE-backed companies tend to be more concentrated in manufacturing, and less represented in the construction industry and services. Both treatment and control samples have the same industry distribution due to the matching procedure.

In Panel B of Table 1, we compare the characteristics of firms in the treatment and the matched control group in 2007. The average firm in the sample is a mid-sized firm with around $80 million in revenue. Across the two groups, firms have very similar ROA, investment, leverage, and equity and debt issuances. These differences are insignificant, with small economic magnitude. The only exception is that PE-backed companies are slightly larger than the control group in terms of revenue. Overall, this matching procedure suggests that differences in funding patterns across the treated and control groups mostly disappear when we compare firms with similar sizes, leverage ratios, and profitability within the same industry.[18]

Since this paper relies on a difference-in-difference analysis, it is important to explore the assumption of pre-crisis parallel trends. We explore whether this assumption holds in the observables in Panel C. In particular, we compare one and two-year growth rates ending in 2007 for the main firm characteristics considered so far. We find that the differences in the growth rates between the two groups are not significantly different from zero across all observables. Similar patterns can be seen graphically in Figures 3, 4, and 5, in which both treatment and control firms follow similar trends in the years leading to the crisis.

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[18] One residual concern regards the presence of listed firms in the control group. In principle, listed firms may have been differentially affected by the financial crisis and this feature may have partially affected the result. However, we have only 19 control firms (<2%) that are public.

Overall, these analyses suggest that PE-backed companies were similar in 2007 to the control group. In principle, this is not a necessary condition for our identification—which instead hinges on the presence of parallel trends between the two groups—but it allows us to exclude the possibility that differences in behavior around the crisis were due to differences in other observable characteristics. Later in the paper, we further show that our results are also stable when we augment our model with a set of controls for firm characteristics in 2007, which should absorb any residual differences in observables across the two groups.

Moreover, the two groups present similar growth paths before the crisis, which alleviate concerns that PE-backed companies were outperforming the control group before the crisis. As we discuss below, our estimates are consistent with the assumption of parallel trends between treated and control groups during the pre-crisis period leading to the crisis, the main identification assumption in our difference-in-difference design. A more formal and direct test of the parallel trend assumption will be discussed in Section 4.

3.2 Identification Strategy

We estimate this model using a panel data set from 2004 to 2011, a symmetric window around the 2008 shock.[19] The choice of 2008 as the first year of the crisis is in line with a large body of empirical evidence on the crisis (e.g., Duchin, Ozabas, and Sensoy, 2010; Kahle and Stulz, 2013), as well as official statistics on the UK provided by the Bank of England. As we show in Figure 1, aggregate investment in the UK declined by more than 20% between the beginning of

[19] For consistency, both PE-backed companies and each corresponding control group enter in the sample at the same time, which is 2004 or the year of the PE deal if after 2004.

2008 and mid-2009. At the same time, credit availability experienced a sharp contraction starting in the first quarter of 2008 (Figure 2).[20] We estimate the following equation:

$$y_{it} = \alpha_t + \alpha_i + \beta_1(PE\ firm_i * Crisis) + \theta X_{it} + \varepsilon_{it} \qquad (1)$$

where y_{it} is an outcome variable measured for company i at time t, (α_i,α_t) are a set of company and year fixed effects, $PE\ firm_i$ is a dummy for the companies that are backed by PE investors, and *Crisis* is a dummy for the period from 2008 to 2011. Furthermore, we augment our specification with a set of firm covariates X_{it}. Lastly, we cluster standard errors at the firm level (Bertrand, Duflo, and Mullainathan, 2004).

The inclusion of firm fixed effects removes time-invariant differences between treatment and control firms. However, the causal interpretation of the results crucially depends on the parallel trend assumption. In particular, we need to assume that PE-backed companies would have experienced the same change in behavior as non PE-backed companies in the absence of the financial crisis.[21] The parallel trend assumption is intrinsically untestable, since we cannot observe the true counterfactual in the absence of the shock. However, we can strengthen the interpretation of our analysis by providing evidence consistent with this assumption, exploring pre-shock trends.

First, it is important to recognize that our treatment and control groups are similar, at least in terms of observable characteristics. By construction, both groups have the same industry distribution, and as we discussed before, profitability, investment, and leverage are similar across these groups. Even more importantly for the parallel trend assumption, the PE and non-PE companies have similar growth rates in the years leading up to the crisis, as we illustrate below.

[20] Statistics are taken from the Bank of England "Trends in Lending - April 2009" (2009).
[21] For instance, it would be problematic if treated firms differed from untreated firms along some characteristics that would be affected by the financial shock independently from their status as a PE-backed company.

Pushing this argument one step further, we can formally examine the time-varying behavior of the treatment effects for the main outcomes in our analysis by estimating:

$$y_{it} = \alpha_t + \alpha_i + \sum \beta_k (PE\ firm_i) + \theta X_{it} + \varepsilon_{it} \qquad (2)$$

where we estimate a different β_k for every year between 2004 and 2011, using the last year before the crisis, 2007, as the reference year. If our parameter β_k in the standard equation is correctly capturing the causal effect of the crisis on private equity firms—rather than a differential trend between the two groups—then we expect the effect of private equity to appear only at the onset of the crisis. In the next section, we will show evidence consistent with this argument.

In the paper, we take two additional steps to strengthen the analysis further. First, we augment our specifications with controls that capture the heterogeneity across firms in important characteristics before the crisis. In particular, we control for firm size (log of revenue), growth of revenue, normalized cash flow (cash flow over assets), profitability (ROA), and leverage. To avoid concerns regarding the endogeneity of controls (Angrist and Pischke, 2008; and Gormley and Matsa, 2014), these variables are measured in the pre-crisis period (2007) and then interacted with the crisis dummy to allow them to have a differential impact around the shock. These controls further alleviate concerns regarding the presence of some unbalanced observable characteristics across treatment and control groups before 2008.

Second, as a robustness test for our main results, we also add a full set of time-varying industry fixed effects, which can account for changes in industry demand and other industry considerations around the financial crisis. In particular, we interact two-digit industry fixed effects with the post dummy. We discuss this, as well as additional robustness tests, in Section 4.2.

4 Investment and Funding

4.1 Main Results

We start by examining whether companies backed by PE investors were more or less affected by the financial crisis. While overall investments dropped significantly in the UK during the crisis period, it is important to understand whether PE-backed companies experienced even a more severe decline during the crisis.

We start our analysis by studying the change in investment policies in PE- and non PE-backed companies. In column (1) of Table 2, we find that PE-backed companies decreased investments less than non-PE backed companies around the financial crisis. This effect is not only statistically significant, but also large in economic magnitude. Normalized by assets, the PE firms saw their investments increase almost 6% relative to the non-PE companies in the post-crisis period. In column (2), we find that the results are unchanged—in terms of both size and statistical significance—when we add the standard set of firm-level controls.[22]

In Figure 3, we plot the year effects estimates around the crisis—and the corresponding standard errors—separately for the PE-backed companies and matched companies. As illustrated in the figure, both treated and control firms followed similar paths before the crisis: the estimates are not statistically different from one another. Hence, the estimates seem to satisfy the parallel trends assumption. Once the crisis ensued, both the PE-backed companies and the matched companies decreased investments dramatically during 2008 and 2009. However, the PE-backed companies decreased their investments significantly less during the crisis years, consistent with the evidence in Table 1. This higher level of investment persisted in the years after the crisis.

[22] Since we focus on the PE treatment effects around the crisis and therefore after the PE investments, our results do not account for the potentially positive impact of the initial private equity investment on operation and financing. Since the effects of the initial investment has been generally found to be positive (e.g. Kaplan, 1989), our estimates may under-estimate the overall effect of PE on the portfolio companies.

Similar conclusions arise from Column (1) of Table 3, where we estimate equation (2) to capture year-by-year PE effects (we add company controls in column (2)). This analysis formally estimates the significance of the differences between the two groups, confirming the lack of statistically significant patterns before the crisis. In contrast, note that investments by PE-backed companies substantially diverged from the control group at the same time as the sharp decline in aggregate investments and credit in the UK, as illustrated in Figures 1 and 2. This positive difference persists in the next few years. We plot the estimates in column (2) graphically in Panel A of Figure A.1 in the Appendix.

Overall, the results so far suggest that companies backed by private equity firms were more resilient in the face of the financial crisis than a similar set of non-PE backed companies, therefore contradicting the claim that PE firms increased financial fragility. Next, we move to explore the mechanism behind this finding. One hypothesis is that private equity firms help their portfolio companies to maintain high investment levels by relaxing their financial constraints, particularly during periods of financial upheaval. This can happen in two ways. First, private equity firms have fund commitments that are rarely abrogated and may therefore be in a better position to inject equity into the companies if access to financial markets is barred. Second, private equity firms have strong ties with banks (Ivashina and Kovner, 2011) and should therefore find it easier to access credit markets during periods of turmoil. We find evidence that is generally consistent with both these channels in Table 2.

We find that net equity contributions increased more for PE-backed companies than for the control group around the crisis (Table 2, Columns 3 and 4).[23] Normalized by assets, equity

[23] Notice that we define equity contribution by looking at the changes in equity that are not explained by profit (see Data Appendix). Therefore, we cannot distinguish whether positive effects are due to raising more capital or paying out fewer dividends.

contributions during the financial crisis were 2% higher for PE-backed companies relative to non-PE firms. As illustrated in Figure 4, equity contributions for both classes of firms dropped significantly during the crisis. However, the decline was smaller for PE-backed companies. This suggests that PE funds were willing to support the operations of their portfolio companies by injecting equity into the firms. As illustrated in Columns (3) and (4) of Table 3, there are no divergent trends before the crisis. This divergence in financial policy appeared only in 2008. We plot these estimates in the Appendix, in Panel B of Figure A.1.

At the same time, Column (5) of Table 2 illustrates that PE-backed companies also experienced a relative increase in debt issuance.[24] While on average debt issuance over assets declined during the financial crisis, this decline was 4% smaller for PE-backed companies. The result is similar when adding controls, as illustrated in Column (6). These patterns can be observed in Figure 5. In the years leading to the crisis, PE-backed companies and matched companies followed similar, parallel trends. Both treated and control companies experienced a significant decline in debt issuances during the crisis. PE-backed companies, however, experienced a relative increase in debt issuance in 2008, exactly when lending conditions and aggregate investment started to decline in the UK. We find similar results when estimating equity issuances on a yearly basis in Columns (5) and (6) of Table 3. Again, we plot these estimates graphically in the Appendix, in Panel C of Figure A.1.

While overall debt issuance was greater, PE companies did not materially increase their leverage, as is evident from columns 7 and 8 in Table 2. The PE coefficient in this regression is positive, but it is non-significant and small in magnitude. This null result reflects the joint increase in equity and debt. However, in columns (9) and (10) of Table 2, we find that the relative cost of

[24] As discussed in the data section and in the Appendix, this is measured as the change in total debt, scaled by assets.

debt, measured by the ratio of interest expense of total debt, declined for the PE-backed companies. This is also illustrated over time in Columns (7) and (8) of Table 3, confirming that the relative decline in cost of debt appears first in 2008, the onset of the financial crisis.

One concern regarding the interpretation of the results is that by matching on leverage (in addition to other variables), we may have captured firms that are somewhat unrepresentative due to their high leverage. For this reason, we repeat the main analyses using an alternative matching that does not rely on leverage, but only on size, ROA, and industry. This matching estimator allows the two groups to have different leverage ratios in the pre-crisis period. This approach has two main advantages. First, this matching is closer to the approach of Boucly, Sraer, and Thesmar (2011). Second, using fewer matching variables allow us to match a larger number of observations.

In Table 4, we repeat the analysis with the alternative matching methodology. We find that all results remain unchanged. In Columns (1) and (2), we find as well that PE-backed companies experience a smaller decline in investment during the crisis and the effect is still highly statistically significant. Similarly, we find similar results with respect to equity contribution (Columns 3 and 4) and debt issuances (Columns 5 and 6). The only difference with our main results is a positive increase in the relative leverage ratio for PE-backed companies (Columns 7 and 8), but the effect is small in magnitude and only of borderline significance. Moreover, as is the case in the main results, we still find a decline in interest expense during the crisis for PE-backed companies.

Overall, these analyses suggest that private equity firms alleviated financing constraints of portfolio companies during the financial crisis, allowing them to invest more when credit markets were frozen and economic uncertainty high. In particular, private equity firms appear to have taken advantage of their fund structures and bank relationships to provide both equity and debt financing to their portfolio companies, with the latter at a lower cost.

4.2 Robustness

In this section, we examine a set of robustness analyses. First, we drop management buyouts from the main sample. At least historically in the UK, MBOs were characterized by lower engagement of private equity firms. If their inclusion completely drove the results, the interpretation and generalization of the analysis might be subtler. To explore whether this is the case, we eliminate MBOs from the sample and repeat the main analysis. As we show in Table A.1 in the Appendix, we find similar. In columns (1) and (2), we find that the effect on investment when MBOs are dropped is even larger than the effect in our baseline model. Similarly, we confirm the expansion in equity contribution and debt issuance, the relative stability in the leverage ratio, and the decline in interest expense. Therefore, the exclusion of MBOs does not affect the results.

Second, we explore whether the main results can be driven by attrition. As usual with panel data, the endogenous exit of firms from the data may bias results. Exit may be particularly problematic if PE-backed companies are more likely to enter into distress or be targeted in M&A transactions. To start, note first that as illustrated in Table 3, the shift in investment and financing policies occurred in 2008, immediately at the onset the financial crisis and arguably concerns about attrition may take place only later. We can also illustrate this pattern more directly by estimating our standard model using data from 2007 and 2008 only (Table A.2), in which we find similar results. In other words, much of the shift in corporate policy happened soon after the onset of the crisis.

Another alternative robustness test to revisit attrition bias concerns is to focus only on firms that did not exit the sample. In Table A.3, we take this conservative approach and drop every firm that exited the database before 2011. This approach leads to approximately 15% fewer observations in the sample.[25] Even with this reduced sample, the main results remain unchanged. PE-backed companies appear to experience a lower decline in investment and a relative increase in equity contributions and debt issuance. At the same time, the leverage ratio stays constant, and interest expense declines.

Third, we show that our results are robust to changes in industry dynamics. One concern is that PE-backed companies may be more or less sensitive than the control group to changes in demand that are contemporaneous to the shock. In principle, this should not be a problem, because the treatment and control groups are matched across industries. Nonetheless, we augment our analysis with a full set of (two-digit) industry fixed effects interacted with the crisis dummy. This set of fixed effects can control non-parametrically for changes in demand and other time-varying industry characteristics. As we show in Table A.4 in the Appendix, despite the large number of fixed effects that the model introduces, the main results remain unchanged. The estimates are still close in magnitude and statistical power to the one presented before.

4.3 The Heterogeneity of PE-Backed Companies

The results so far are consistent with the idea that private equity can play an important role during financial turmoil by relaxing the financial constraints faced by their portfolio companies. In this section, we provide more evidence consistent with this hypothesis by focusing on financially constrained firms.

We use several measures as proxies for financing constraints. First, we study how the effect of PE backing on investment differs between large and small firms (Table 5, Panel A). Consistent with the idea that small companies are more likely to be financially constrained, small businesses

[25] For every PE-backed company, there are up to five matched control firms. There are 310 companies that exit before 2011, which corresponds to 245 groups of companies that are dropped.

have been shown to be more sensitive to credit market shocks (Petersen and Rajan, 1994; Chodorow-Reich, 2014; and Bottero, Lenzu, and Mezzanotti, 2015). In our sample, we identify large firms by looking at the top quartile of employment at 2007, the last year in our pre-shock period, and classify remaining firms as small. Using this measure, we show in Columns (1) and (2) that the positive effect on investment is stronger for small companies.

Second, we find similar results when we look across companies that operate in industries that are more likely to depend on external finance, identified using the standard Rajan-Zingales (RZ) index (Rajan and Zingales, 1998). In particular, we define more financially dependent firms as companies operating in two-digit SIC industries characterized with an above-median share of capital expenditure that is externally financed.[26] In principle, firms that were more dependent on external finance should have been more affected by the financial crisis, given the dramatic decline in credit availability. Therefore, if private equity provides some relief to financial stresses, companies in industries characterized by larger RZ indices should benefit more from PE. Consistent with this idea, in Columns (3) and (4) of Panel A of Table 5, we find that the positive effect of being backed by private equity is larger for firms in more financially dependent industries.

Third, we find similar results when comparing firms that were more leveraged entering into the crisis. In general, firms with higher leverage are characterized by lower financial flexibility and higher interest payment burdens. Therefore, they face more risks when credit markets dry up. Comparing companies based on their 2007 leverage levels, we define high-leverage firms if they are at the top quartile of the leverage distribution at the onset of the crisis. We find that companies with high pre-crisis leverage experienced lower investment post-crisis. But high leverage

[26] In line with the literature, this measure is computed using data from US corporations between 1980 and 2008, available through Compustat. In particular, for each two-digit SIC industry, we measure the RZ index as the median of CAPEX minus cash flows from operation, scaled by CAPEX.

companies backed by PE investors increased investments significantly more than their non-PE counterparts (Table 5, Panel A, Columns 5 and 6). The presence of a PE investor counter-balanced the negative effect of high leverage on investments.[27]

Similarly, we find that the effect of PE on debt issuance seem to be stronger among financially constrained companies (Table 5, Panel B). This is true when looking across size (Columns 1 and 2) and dependence on external finance (Columns 3 and 4). When sorting by leverage (Columns 5 and 6), however, the result is positive but not statistically significant. In Panel C of Table 5, we explore the case of equity issuances. While the coefficients are generally in the expected direction, they are not statistically significant. This suggest that financially constrained firms particularly benefited from debt issuances to alleviate financing constraints. By way of contrast, equity contributions benefited all PE-backed companies similarly.

Overall, these results suggest that the positive effect of private equity on investments was stronger among firms that are more likely to be financially constrained. Differences in funding strategies in response to the financial crisis—particularly with regard to debt—seem to explain this result.

4.4 The Heterogeneity of PE Firms

To further explore the underlying channel of the findings, we exploit heterogeneity across the private equity groups themselves. We focus on the differences in the firms in their financial and operational resources that were available by 2007, at the onset of the financial crisis. We look at this hypothesis in two ways.

[27] Clearly, leverage at 2007 is endogenous to many firm characteristics, in particular debt capacity. If anything, firms that expect to respond more successfully to a negative credit shock should ex-ante employ more debt. Therefore, it is reasonable to think that the results are actually characterized by a downward bias.

First, we compare PE groups based on the amount of "dry powder" that they had available. As we discuss in the data section, we have collected information from ThomsonOne about amount of capital that PE firms had raised, but not invested, in the pre-crisis period. Firms with more capital available may be better positioned to provide liquidity to their portfolio companies and may be able to commit more time and attention to portfolio companies since they deployed less capital. As discussed in the data section, we used Capital IQ and ThomsonOne to identify the PE investors in each PE-backed company. We divided the PE-backed companies in two groups, depending on whether they had PE investors that were on the top quartile of dry powder in 2007.

In Table 6, we present the results. We naturally restrict the sample to PE-backed companies only, since the variation is at investor level is therefore available only for PE-backed companies. In Columns (1) and (2), we find that firms whose PE investors had considerable amount of dry powder at the beginning of the crisis increased their investment level relatively more. The result is both statistically and economically significant: a high dry powder firm experienced a 10% increase in investment (normalized again by assets) relative to the control group. Consistent with this result, we find that this group of PE firms were also more active in financing their portfolio companies. Companies financed by high dry powder groups had 5% greater debt issuances (Columns 5 and 6) and, importantly, 7% larger equity injections (Columns 9 and 10), consistent with their greater availability of capital.

Second, we test this hypothesis using an alternative measure, which is whether the PE group's most recent fund was of a relatively recent vintage in 2008. This analysis is based on the underlying assumption that PE firms with younger funds have more resources available—both financial and operational—to provide to their portfolio companies. Over the course of the first three to five years of the fund, PE firms deploy capital and commit their time and attention to portfolio companies. Therefore, PE funds that are younger at the onset of the crisis could direct more financial and operational resources to portfolio firms. We identify the year in which these investors raised their last fund before the financial crisis. We use a dummy that equals to one if the fund was formed in the years between 2002 and 2007.[28]

In Table 6, we also find a larger increase in investment when PE investors had raised a fund more recently (Columns 3 and 4), suggesting the importance of the availability of resources for the PE group. We find similarly strong patterns with respect to debt issuances, which have increased much more for companies where the investors had raised a fund more recently (Table 6, Columns 7 and 8). The effects are both economically and statistically significant. The results for equity contributions are similarly positive and statistically significant in Column 11. When adding firm controls in Column 12, however, while coefficients remain similar, they are no longer statistically significant.

Overall, the results in this section are consistent with the hypothesis that portfolio companies with PE investors that had more resources at the onset of the crisis, financial and operational, managed to increase investments in portfolio companies during the crisis.

5 Performance and Company Outcomes Analysis

5.1 Company Performance

In this section, we attempt to understand to what extent greater investment increased the long-term prospects of PE-backed companies. We examine this question by looking at various measures of company performance. Were the investment by PE-backed companies imprudent or

[28] The result is also robust when using a continuous measure of fundraising time, the year of the last fund raised before 2007.

wasteful, we would expect that these decisions would have had detrimental effects on their performance.

In Columns (1) and (2) of Panel A in Table 7, we find that PE-backed group assets grow faster than the matched firms'. This is consistent with prior findings that illustrate that PE-backed companies increased their relative investment during the crisis. Next, we turn to explore accounting measures of firm performance around the crisis period. In Columns (3) and (4), we explore EBITDA scaled by revenue, and in Columns (5) and (6), ROA, defined as net income over assets. In both cases, we do not find that PE-backed companies experienced worse performance relative to the matched firms during the crisis.

This analysis suggests that the average performance of PE-backed companies was not differentially affected by the financial shock: the increase in investment of PE-backed companies did not lead to a low quality or excessively risky projects. However, given the long-term nature of the returns in many corporate capital expenditures, these accounting measures of performance may fail to fully capture the underlying changes in asset quality and company value around the crisis. Therefore, next sections will explore two alternative dimensions of firms' performance. First, to capture the potential benefits of an increased investment, we explore how firms' market shares evolve around the crisis. Second, we examine exit patterns—both positive (M&A acquisition) and negative (bankruptcy)— in the post-crisis period.

5.2 Market Share

The increase in investment may yield long-term profitability (and valuation) benefits if it allows the firm to capture a larger share of its market. We explore this hypothesis in Panel B of Table 7. For each firm in our sample, we measure its market share as the firm's sales relative to the total operating revenue in its industry (using the three-digit SIC codes).[29] Then, using a log-specification, we explore the change in market share of PE-backed companies relative to their peers during the crisis.

In Columns (1) and (2), we explore this question focusing on market share outcomes in the first two years in the crisis (2008 and 2009), where we found the largest divergence in investment and funding policies. In other words, using market share as a dependent variable, we repeat the standard difference-in-difference model using the 2004-2009 period. We find that in the crisis period, PE-backed companies experienced an 8% increase in market share relative to the control group. In Columns (3) and (4), we show that results are also similar when we use the full sample period (2004-2011), albeit smaller and less precisely estimated.[30]

In order to explore what may drive this slight difference in the result, in Columns (5) and (6), we employ the fully interacted model where we examine the effect of being a PE-backed company on every year in our panel. Consistent with our previous results, we find that PE-backed companies experience a larger increase in market share in 2008 and 2009, but this effect becomes smaller and statistically non-significant in 2010 and 2011. This is consistent with the fact that the change in investment and funding policy were mostly concentrated in the 2008 and 2009, a period during which the financial turmoil and credit market freeze were most severe.

Overall, our results suggest that PE-backed companies may have channeled their investment towards an increase in market share rather than increasing their short-term profitability.

[29] The total operating revenue of the industry is constructed using only medium and large firms in the Orbis/Amedeus data, as previously discussed. Results are also similar using the SIC two-digit industry classification.
[30] In Appendix Table (A.5), we show that these results are robust to an alternative specification. In particular, rather than using the full panel, we employ only cross-sectional variation. In particular, in Columns (1) and (2), we show that PE-backed companies were more likely to have larger market share in 2009 relative to 2007 (conditional logit model). Similarly, in Columns (5) and (6), we look at the growth in market share over the same period and we find that this growth in market share was 6% higher.

In the next section, we look at exit patterns as another relevant dimension to understand firms' performance.

5.2 Exit Analysis

In this section, we examine exit patterns in the post-crisis period. In particular, we compare the relative likelihood that PE-backed companies entered distress, went bankrupt, or were successfully acquired. This will provide an additional perspective on the performance of PE-backed companies during the crisis, potentially capturing dimensions not easily captured by accounting measures or market share.

As we discussed in the Section 2, we define "bad exits" when firm exit the sample after a status of financial distress or bankruptcy. We identify "potentially profitable exits" as company acquisitions without prior company distress. Thus, we examine how post-crisis exit patterns differed across PE-backed and non-PE companies. The variation under study is only cross-sectional, as we explore the status of the sample firms in 2011. Therefore, the difference-in-difference design is not suitable for these tests. To make PE and non-PE-related companies comparable in the cross-section, we control for industry fixed effects and firm characteristics. Even with these adjustments, a causal interpretation of these results requires much stronger assumptions than the previous set of results.

In particular, we estimate the following equation:

$$Exit_i = \alpha_{ind(i)} + \beta(PE\ firm_i) + \gamma X_i^{PRE} + \varepsilon_{it}$$

where $Exit_i$ is a firm-level dummy that identifies the type of exit activity ("bad" or "potentially profitable"), $\alpha_{ind(i)}$ are industry-level fixed effects at two digit SIC level, $PE\ firm_i$ is a dummy variable identifying PE-backed companies, and X_i^{PRE} are the firm-level characteristics measured before the crisis (2007). Since the outcome here is only cross-sectional and discrete, we estimate this model using a conditional logit model. To facilitate interpretation, all the results are presented as marginal effects at the mean.

In Panel C of Table 7, we show the main results. We find that PE-backed companies were more likely to experience a potentially profitable exit (Columns 1 and 4). The results are similar with and without controls, but the magnitude is a bit smaller with controls. The most conservative estimates suggest that PE-backed companies were about 30% more likely to be acquired in the post-crisis period. At the same time, PE-backed companies were not more likely to go out of business or enter into distress in the post-crisis period (columns 5-8). The results are not only insignificant, but also small in magnitude.

Overall, in the post-crisis period, PE-backed companies were more likely to be targeted in a potentially profitable M&A transaction, and also were not more likely to go out of business. Despite the limitations of the cross-sectional analysis, the results are inconsistent with the hypothesis that PE financing increased the financial fragility of the PE-backed companies.

6 Conclusion

In this paper, we have studied how PE-backed companies responded to the turmoil caused by the 2008 financial crisis by exploring their investments, financing, and performance. One of the main objectives of this analysis is to explore whether PE-backed companies increased the fragility of the economy during the financial crisis, as recently articulated by the Bank of England and others. Furthermore, this analysis can improve our understanding about the relationship between economic cycles and financial intermediaries more generally.

We find that PE-backed companies decreased investments relatively less than the control group during the financial crisis. This result can be explained by the ability of PE-backed companies to utilize the resources and relationships of their private equity sponsors to raise equity and debt funding in this difficult period, and to lower their cost of capital, as captured by the interest expense. Furthermore, we find that the positive investment effects of private equity were particularly large in companies more likely to be financially constrained at the time of the crisis and more likely to occur when PE firms have more resources. The increase in investment during the crisis led to increased asset growth, market shares, and ultimately a higher probability to be acquired. Altogether, these results are inconsistent with the hypothesis that private equity contributed to the fragility of the economy during the recent financial crisis.

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Figure 1: Investment in United Kingdom around the financial crisis

This figure shows the quarterly business investment volume in the United Kingdom (seasonally adjusted). Currency values are at 2013. The measure does not include expenditure on dwellings, land and existing buildings and costs of ownership transfer of non-produced assets. The data is available at the "Office of National Statistics" in the UK.(https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/businessinvestment/quarter3julytosept2016revisedresults).

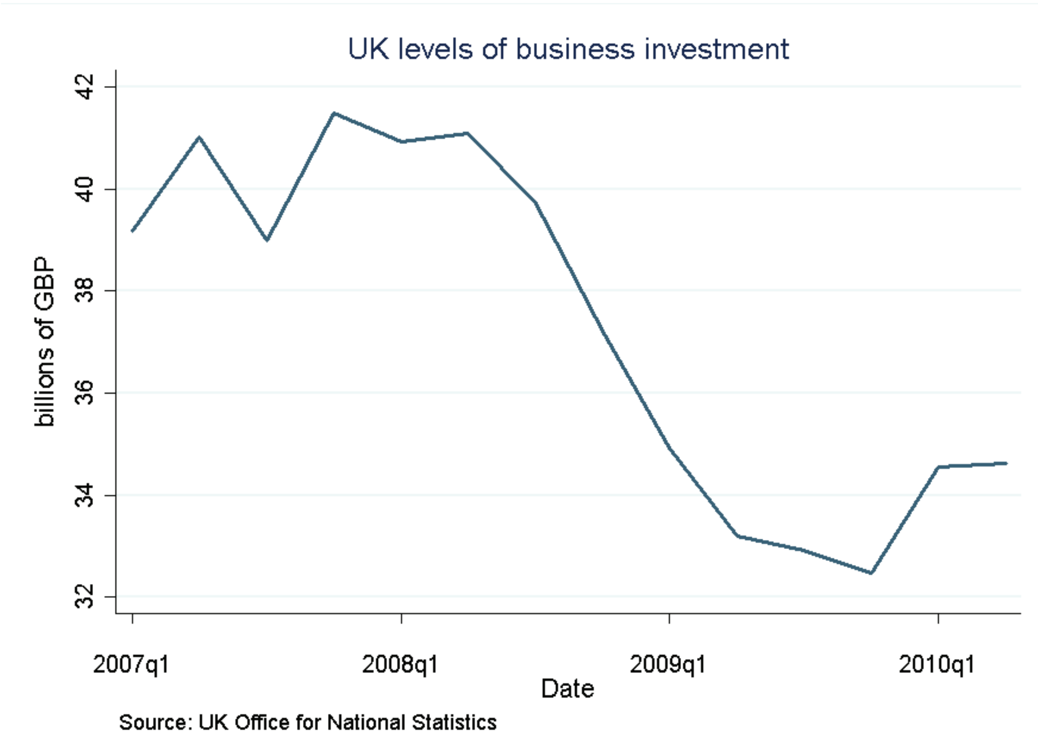


Figure 2: Lending growth in UK around the financial crisis

This figure shows the growth rate in the stock of lending by UK monetary financial institutions to private non-financial corporations (PNCF) or non-financial businesses. The stock of lending is the total amount of outstanding net lending. Series included are PNFC M4Lx (seasonally adjusted), sterling loans to PNFCs (seasonally adjusted), all currency loans to PNFCs (seasonally adjusted), all currency loans to non-financial businesses (non-seasonally adjusted). PNFC M4Lx is the lending to PNFCs, which includes loans, securities, reverse repos, overdrafts, and commercial paper. The other three measures each includes loans, reverse repos and overdrafts. The data is available at the official statistics of the Bank of England and they are reported in the report "Trends in Lending (2014)." http://www.bankofengland.co.uk/publications/Pages/other/monetary/trendsinlending2014.aspx .

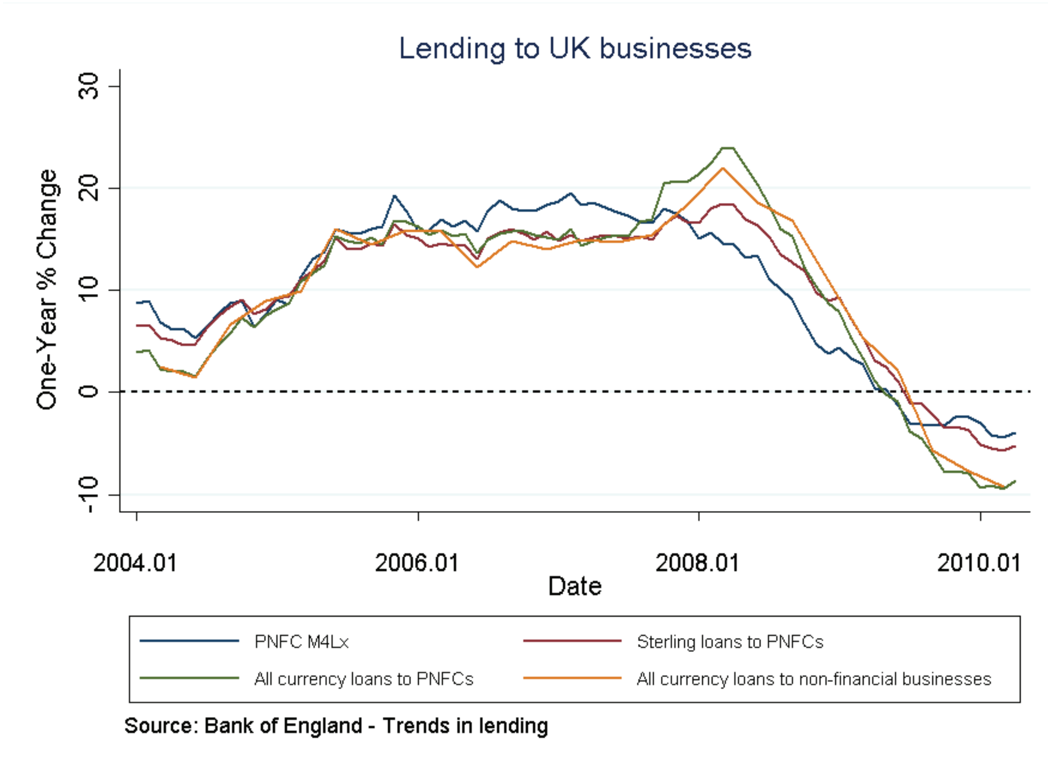


Figure 3: Effect of PE-backed companies on investment over time

This figure illustrates the change in investment separately for both PE and non-PE companies in our sample. Specifically, the figure reports α_t of the following equation: $y_{it} = \alpha_t + \alpha_i + \varepsilon_{it}$, estimated separately for PE and non-PE companies, where α_t capture year fixed effects, and α_i firm fixed effects. The year 2007 is used as base period and therefore the corresponding coefficient is normalized to zero. The estimates are plotted with standard errors above and below the point estimates. Standard errors are clustered at firm-level.

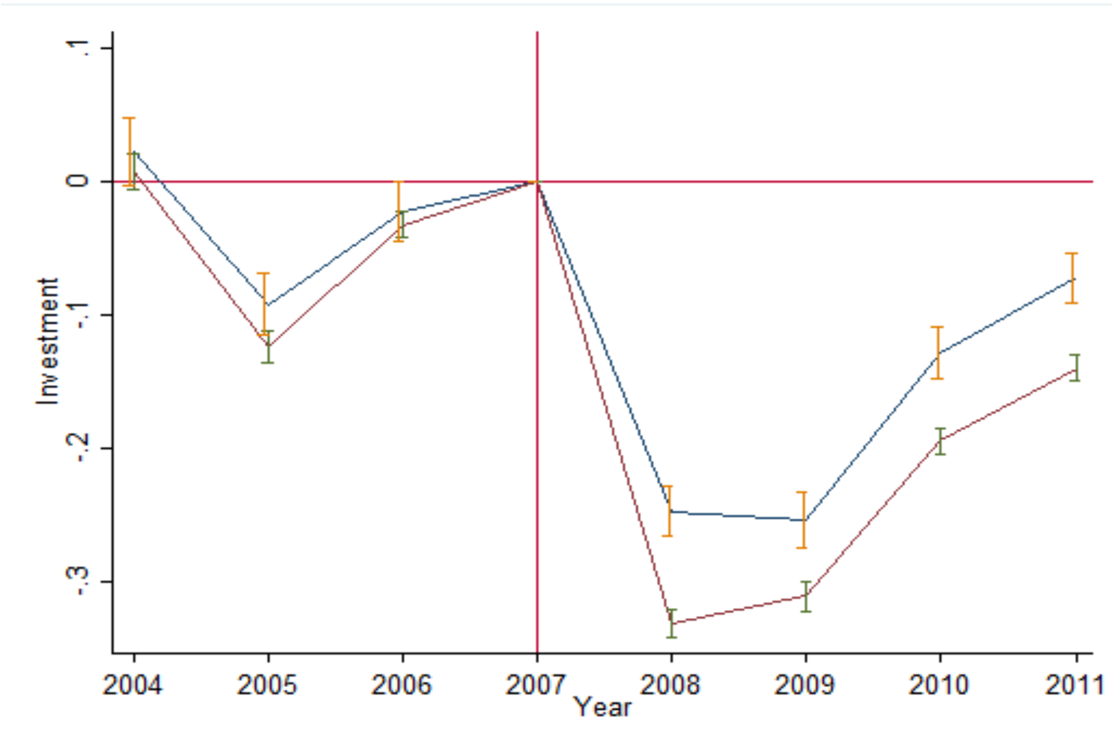


Figure 4: Effect of PE-backed companies on equity contributions over time

This figure illustrates the change in equity contributions separately for both PE and non-PE companies in our sample. Specifically, the figure reports α_t of the following equation: $y_{it} = \alpha_t + \alpha_i + \varepsilon_{it}$, estimated separately for PE and non-PE companies, where α_t capture year fixed effects, and α_i firm fixed effects. The year 2007 is used as base period and therefore the corresponding coefficient is normalized to zero. The estimates are plotted with standard errors above and below the point estimates. Standard errors are clustered at firm-level.

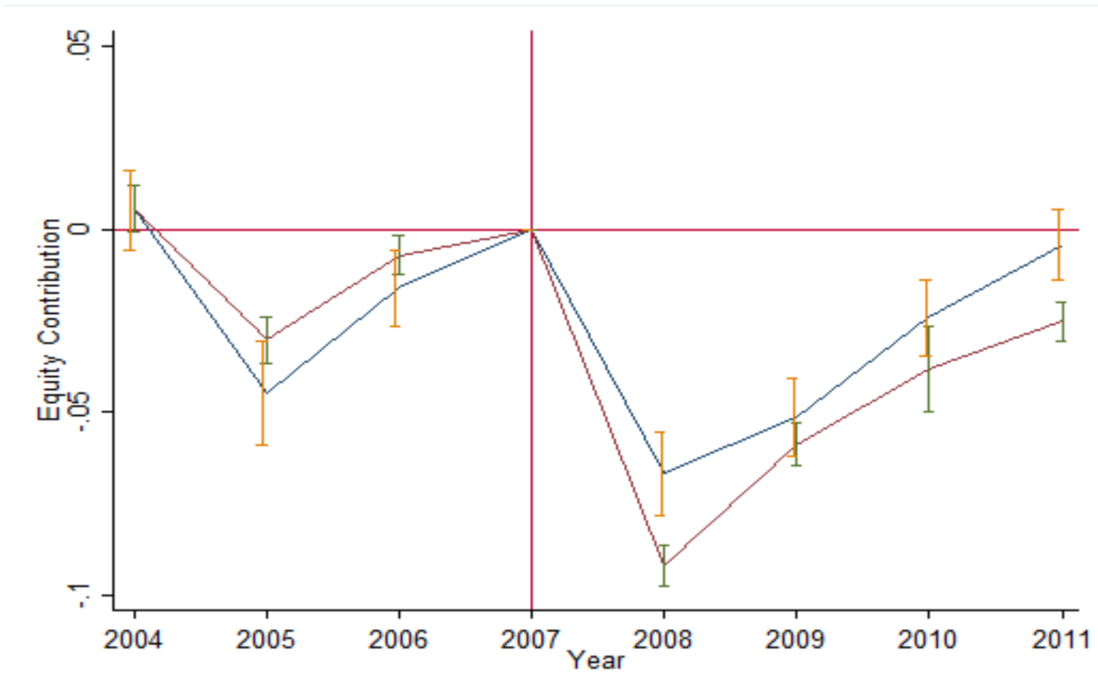


Figure 5: Effect of PE-backed companies on debt issuances over time

This figure illustrates the change in debt issuances separately for both PE and non-PE companies in our sample. Specifically, the figure reports α_t of the following equation: $y_{it} = \alpha_t + \alpha_i + \varepsilon_{it}$, estimated separately for PE and non-PE companies, where α_t capture year fixed effects, and α_i firm fixed effects. The year 2007 is used as base period and therefore the corresponding coefficient is normalized to zero. The estimates are plotted with standard errors above and below the point estimates. Standard errors are clustered at firm-level.

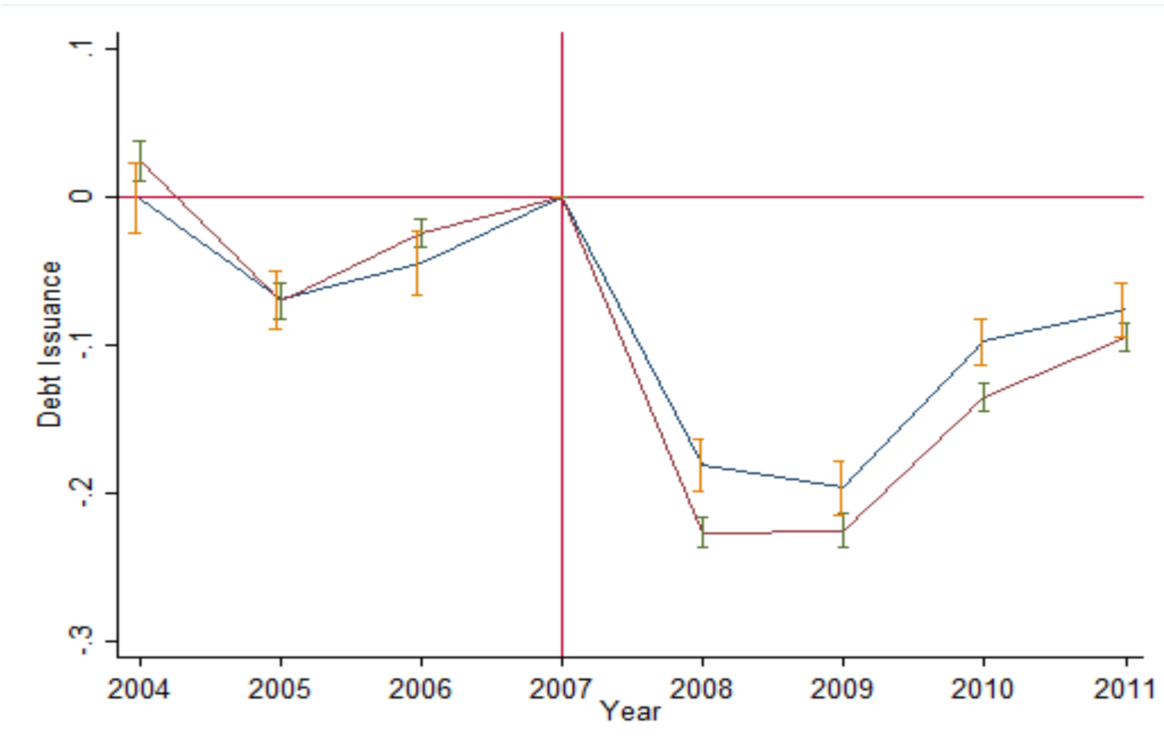


Table 1: Summary Statistics

Panel A reports the industry distribution at the macro industry level (1-digit SIC) for the PE sample and the whole universe of medium and large UK firms, but excluding financial, insurance, regulated or public administration. In Panel B reports the summary statistics of sample firms in 2007 across treated (PE-backed companies) and non-treated firms (non-PE companies). The last column reports the mean difference across the two groups. Level variables are in millions of dollars. Panel C reports the one-year and two-year growth in the characteristics in 2007. The last column reports the mean difference across the two groups. More information on variable definition is available in the Appendix. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

Panel A: Industry distribution

Industry Distribution	PE Sample	Full Sample
Mining	1%	2%
Construction	6%	15%
Manufacturing	32%	17%
Wholesale Trade	12%	11%
Retail Trade	7%	6%
Transportation	4%	6%
Services	38%	44%

Panel B: Firms' characteristics in 2007

	PE Sample				Matched Sample				
	N	Mean	Median	SD	N	Mean	Median	SD	Mean Diff.
Revenue (M$)	432	98.05	35.30	240.81	1527	77.64	29.86	184.49	20.41*
ROA	434	0.09	0.09	0.23	1550	0.09	0.09	0.22	0.01
Investment/Asset	434	0.19	0.20	0.18	1550	0.20	0.20	0.18	-0.01
Equity Contr/Asset	415	-0.02	0.01	0.13	1513	-0.01	0.01	0.13	-0.01
Net Debt Iss. /Asset	415	0.09	0.10	0.23	1513	0.11	0.08	0.24	-0.01
Debt/Asset	434	0.71	0.70	0.39	1550	0.69	0.67	0.39	0.02

Panel C: Firms' trends in 2007

	PE Sample				Matched Sample				
	N	Mean	Median	SD	N	Mean	Median	SD	Mean Diff.
One Year Growth									
Revenue	423	0.37	0.18	1.34	1456	0.35	0.17	1.17	0.02
ROA	427	0.71	-0.03	5.21	1483	0.79	0.07	4.48	-0.07
Investment/Asset	386	1.54	0.10	5.86	1434	1.37	0.05	5.20	0.17
Equity Contr/Asset	372	-0.59	0.39	15.96	1376	-0.93	0.09	13.73	0.34
Net Debt Iss. /Asset	376	2.95	0.32	15.09	1428	2.25	0.20	12.86	0.70
Debt/Asset	418	0.02	-0.03	0.34	1516	0.02	-0.02	0.31	0.01
Two Year Growth									
Revenue	393	0.56	0.33	2.08	1362	0.71	0.34	2.33	-0.15
ROA	400	1.10	0.05	8.33	1388	1.40	0.11	6.97	-0.29
Investment/Asset	339	1.85	0.61	6.22	1333	2.39	0.94	6.06	-0.54
Equity Contr/Asset	330	0.43	1.09	23.44	1274	0.70	1.05	18.95	-0.28
Net Debt Iss. /Asset	343	3.45	0.65	18.73	1359	2.94	0.76	13.99	0.51
Debt/Asset	382	0.01	-0.04	0.46	1442	0.04	-0.04	0.60	-0.03

Table 2: Investment and funding policies

This table reports the estimates of a difference-in-difference fixed effect model on the investment and funding variables. All specifications include firm and year fixed effects. The main parameter of interest is the interaction between the crisis dummy and PE-backed company dummy variable. Odd columns contain the baseline regression and even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables include firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) is net equity contribution over assets; in Columns (5) and (6) is the net debt issuance scaled by assets; in Columns (7) and (8) is the total leverage; in Columns (9) and (10) on average interest rate. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Crisis	0.059***	0.056***	0.022***	0.021***	0.042***	0.039***	0.013	0.012	-0.003**	-0.003**
	(0.013)	(0.013)	(0.007)	(0.007)	(0.011)	(0.011)	(0.015)	(0.014)	(0.001)	(0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	12456	11910	12469	12003	12903	12274	13205	12553	10222	9831
Clusters	1984	1878	1981	1876	1982	1876	1984	1878	1841	1743
R-squared	0.160	0.161	0.040	0.059	0.090	0.104	0.011	0.029	0.016	0.022

Table 3: Investment and funding policies over time

This table reports the estimates from a time-varying fixed effects model. All specifications include firm and year fixed effects. Specifically, the table reports β_t of the following equation: $y_{it} = \alpha_t + \alpha_i + \beta_t(PE\ firm_i) + \varepsilon_{it}$ where α_t capture year fixed effects, and α_i firm fixed effects. E columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) the outcome is net equity contribution over assets; in Columns (5) and (6) is the net debt issuance over assets; in Columns (7) and (8) is average interest rate. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Interest Rate	
PE firm x y2004	0.015	0.018	-0.000	0.002	-0.026	-0.028	0.001	-0.000
	(0.029)	(0.029)	(0.013)	(0.013)	(0.027)	(0.028)	(0.003)	(0.003)
PE firm x y2005	0.032	0.032	-0.015	-0.013	0.001	0.000	-0.002	-0.002
	(0.026)	(0.026)	(0.015)	(0.016)	(0.023)	(0.023)	(0.002)	(0.002)
PE firm x y2006	0.010	0.009	-0.009	-0.010	-0.020	-0.024	0.002	0.002
	(0.024)	(0.025)	(0.012)	(0.012)	(0.024)	(0.024)	(0.002)	(0.002)
PE firm x y2008	0.084***	0.087***	0.025**	0.025**	0.046**	0.043**	-0.003**	-0.003**
	(0.022)	(0.022)	(0.013)	(0.012)	(0.021)	(0.020)	(0.001)	(0.001)
PE firm x y2009	0.057**	0.050**	0.008	0.006	0.029	0.022	-0.002	-0.002
	(0.024)	(0.024)	(0.012)	(0.012)	(0.021)	(0.021)	(0.002)	(0.002)
PE firm x y2010	0.067***	0.064***	0.014	0.013	0.037**	0.032*	-0.003*	-0.004**
	(0.021)	(0.021)	(0.012)	(0.012)	(0.018)	(0.018)	(0.002)	(0.002)
PE firm x y2011	0.068***	0.064***	0.021*	0.018*	0.019	0.019	-0.002	-0.003
	(0.021)	(0.021)	(0.011)	(0.011)	(0.020)	(0.020)	(0.002)	(0.002)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes
Observations	12456	11910	12469	12003	12903	12274	10222	9831
Clusters	1984	1878	1981	1876	1982	1876	1841	1743
R-squared	0.160	0.161	0.040	0.059	0.090	0.104	0.016	0.021

Table 4: Main results with alternative matching sample

This table reports the estimates of a difference-in-difference fixed effect model on the investment and funding variables using an alternative matching estimator based only on ROA, industry and size. All specifications include firm and year fixed effects. The main parameter of interest is the interaction between the crisis dummy and PE-backed company dummy variable. Odd columns contain the baseline regression and even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables include firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) is net equity contribution over assets; in Columns (5) and (6) is the net debt issuance scaled by assets; in Columns (7) and (8) is the total leverage; in Columns (9) and (10) on average interest rate. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Crisis	0.057***	0.053***	0.025***	0.022***	0.040***	0.037***	0.026*	0.024*	-0.003***	-0.004***
	(0.012)	(0.012)	(0.007)	(0.007)	(0.011)	(0.011)	(0.015)	(0.015)	(0.001)	(0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	16318	15672	16347	15790	16872	16150	17259	16512	12808	12369
Clusters	2598	2477	2596	2475	2596	2475	2598	2477	2356	2251
R-squared	0.153	0.153	0.040	0.076	0.075	0.103	0.009	0.026	0.011	0.015

Table 5: Heterogeneity across firms' financial constraints

These tables estimate standard difference-in-difference fixed effect model and repeat the specification of Table 2 while exploring various proxies of financing constraints in 2007. All specifications include firm and year fixed effects. In each table, the interaction term in Columns 1 and 2 is based on firm size, and equal one if the firm is at the top quartile of firm employment versus the rest of the sample. The interaction in Columns 3 and 4 is based on dependency on external finance, measured by RZ index (Rajan and Zingales, 1998). The interaction equals one if dependence on external finance is above the median, and zero otherwise. In Columns 5 and 6, the interaction is based on firm leverage. The interaction equals one if firm leverage is at the top quartile within the sample. Panel A reports the results using investment as an outcome, Panel B uses instead debt issuance over assets as dependent variable and lastly Panel C reports the results with net equity contributions over assets. Even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

Panel A - Investment / Assets

	(1)	(2)	(3)	(4)	(5)	(6)
PE firm x Crisis	0.014	0.011	0.030**	0.023	0.023	0.023
	(0.020)	(0.020)	(0.014)	(0.014)	(0.017)	(0.018)
Interaction x Crisis	-0.025*	-0.016	-0.047***	-0.041***	-0.055***	-0.038***
	(0.013)	(0.015)	(0.012)	(0.012)	(0.012)	(0.014)
Interaction x Crisis x PE	0.053**	0.051**	0.067**	0.077***	0.072***	0.064***
	(0.026)	(0.026)	(0.027)	(0.026)	(0.025)	(0.025)
Interaction Variable	Small		External Dependence		High Leverage	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	11539	11105	12456	11910	12456	11910
Clusters	1824	1742	1984	1878	1984	1878
R-squared	0.160	0.162	0.161	0.162	0.162	0.162

Panel B - New Debt Issuances / Assets

	(1)	(2)	(3)	(4)	(5)	(6)
PE firm x Crisis	-0.004	0.003	0.014	0.012	0.036***	0.033**
	(0.019)	(0.019)	(0.013)	(0.012)	(0.013)	(0.013)
Interaction x Crisis	-0.015	-0.030**	-0.049***	-0.035***	-0.152***	-0.096***
	(0.014)	(0.014)	(0.012)	(0.011)	(0.011)	(0.013)
Interaction x Crisis x PE	0.055**	0.046*	0.062***	0.062***	0.028	0.023
	(0.024)	(0.024)	(0.024)	(0.024)	(0.021)	(0.021)
Interaction Variable	Small		External Dependence		High Leverage	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	11891	11400	12903	12274	12903	12274
Clusters	1823	1741	1982	1876	1982	1876
R-squared	0.089	0.101	0.091	0.105	0.105	0.109

Panel C - Net Equity Contr./Assets

	(1)	(2)	(3)	(4)	(5)	(6)
PE firm x Crisis	0.035***	0.026**	0.016*	0.013	0.011	0.013
	(0.012)	(0.012)	(0.009)	(0.009)	(0.012)	(0.012)
Interaction x Crisis	-0.006	0.014	0.002	-0.002	0.067***	0.044***
	(0.007)	(0.008)	(0.007)	(0.006)	(0.006)	(0.006)
Interaction x Crisis x PE	-0.016	-0.008	0.015	0.016	0.011	0.009
	(0.016)	(0.015)	(0.015)	(0.014)	(0.015)	(0.014)
Interaction Variable	Small		External Dependence		High Leverage	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	11564	11183	12469	11989	12469	11989
Clusters	1823	1739	1981	1873	1981	1873
R-squared	0.045	0.063	0.040	0.059	0.053	0.064

Table 6: Heterogeneity across funds

This table reports the estimates from a difference-in-difference fixed effect model, while exploring heterogeneity across resource availability of PE firms backing the company. The analysis is a cross-section estimated using only the set of PE-backed companies. High Dry Powder is a dummy variable equals to one if PE investors are at the top quartile for amount of dry powder at 2007, defined based on the amount of capital raised but not invested. The variable 1(Fund 02-07) is a dummy variable equals to one if the PE firm raised its latest fund between 2002 and 2007. All specifications contain firm and year fixed effects. Even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. More information on the variables are available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Investment/Assets				Net Debt Iss./Assets				Net Equity Contr./Assets			
Post*High Dry Powder	0.105**	0.086**			0.053*	0.062**			0.070***	0.055**		
	(0.048)	(0.041)			(0.031)	(0.03)			(0.025)	(0.022)		
Post*1(Fund 02-07)			0.075*	0.090**			0.064**	0.073***			0.036*	0.030
			(0.039)	(0.036)			(0.026)	(0.026)			(0.021)	(0.021)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1582	1539	1582	1539	1589	1546	1589	1546	1565	1527	1565	1527
Adjusted R-squared	0.108	0.117	0.106	0.117	0.064	0.068	0.064	0.068	0.028	0.048	0.023	0.044

Table 7: Performance Analysis

Panel A reports a standard difference-in-difference fixed effect model exploring various performance measures. All specifications include firm and year fixed effects. In Columns (1) and (2) the outcome is one year assets growth; in Columns (3) and (4) is total EBITDA scaled by revenue; in Columns (5) and (6) is ROA. Standard errors are clustered at firm level. In Panel B, the dependent variable is firm market share, measured as the log of share of firms' revenue scaled by total revenue at the level of three-digit SIC industry. Columns (1) and (2) estimate the standard model, but using only data from 2004-2009. Columns (3) and (4) instead uses the full sample period of 2004-2011. Lastly, Columns (5) and (6) report the coefficient from the time-varying regression. Standard errors are clustered at firm-level. In Panel C, we report the marginal value (at the mean) of a conditional logit model where we study the effect of being a PE-backed company on various exit outcomes. Even columns have firm level controls at 2007. In Columns (1) and (2) the outcome is a dummy equal to one if the company was the target of an M&A activity in the post-crisis period; in Columns (3) and (4) the outcome is instead a dummy equal to one if the company was a target of an M&A activity and the company does not exit from the data in the same time frame; in Columns (5) and (6) the outcome is the dummy equal to one if the company exit the data set in the post period; lastly in Columns (7) and (8) the outcome is a dummy if the company exit the data and it reported some financial difficulties before the exit. In all three panels, even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. See the Appendix and the paper for more info on the variables. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

Panel A- Accounting Performance

	(1)	(2)	(3)	(4)	(5)	(6)
	Assets Growth		EBITDA/REV		ROA	
PE firm x Crisis	0.148***	0.124***	-0.009	-0.010	-0.003	-0.004
	(0.040)	(0.038)	(0.013)	(0.014)	(0.009)	(0.008)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	13180	12528	12507	12137	12865	12364
Clusters	1984	1878	1960	1878	1984	1878
R-squared	0.026	0.042	0.001	0.015	0.005	0.041

Panel B: Market Share

	(1)	(2)	(3)	(4)	(5)	(6)
PE firm x Crisis	0.081**	0.079**	0.050	0.055*		
	(0.035)	(0.034)	(0.034)	(0.033)		
PE firm x y2004					0.039	0.048
					(0.057)	(0.059)
PE firm x y2005					0.035	0.047
					(0.050)	(0.049)
PE firm x y2006					-0.035	-0.020
					(0.036)	(0.035)
PE firm x y2008					0.094***	0.106***
					(0.031)	(0.034)
PE firm x y2009					0.072**	0.088***
					(0.031)	(0.033)
PE firm x y2010					0.039	0.052
					(0.037)	(0.039)
PE firm x y2011					-0.007	0.005
					(0.053)	(0.055)
Sample	2004-2009		Whole Sample		Whole Sample	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes
Observations	9090	8847	12697	12326	12697	12326
Clusters	1960	1878	1960	1878	1960	1878
R-squared	0.035	0.087	0.021	0.064	0.021	0.064

Panel C - Exit Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Marginal Eff.	1{M&A}		1{M&A, No Distress}		1{Exit}		1{Bankruptcy}	
PE Firm	0.351***	0.325***	0.351***	0.318***	0.058	0.039	0.092	0.099
	(0.023)	(0.101)	(0.024)	(0.100)	(0.085)	(0.087)	(0.103)	(0.106)
Industry (2-digit) F.E.	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls 2007		Y		Y		Y		Y
Observations	1635	1635	1635	1635	1368	1368	1360	1360

Appendix

A.1 Data and variable construction

Aside from Capital IQ, all the data in the paper come from the Amadeus/Orbis database, produced by Bureau Van Dijk. To minimize the chances that data errors could drive our results, we winsorize at 1% every ratio and growth rate used in the analysis. The winsorization was undertaken over the full sample of Amadeus/Orbis, companies. All variables in levels are in millions of dollars.

The main variables we used in the analysis are the following: (a) Investment/Assets, where investment is constructed as the change in assets over the past year, plus depreciation; (b) (Net) Equity Contribution/Assets, where the equity contribution is measured as the difference in total equity (shareholder value) over the past year, minus the profit; (c) (Net) Debt Issuance/Assets, where the debt issuance is measured as the overall change in debt; (d) Leverage, which is simply total debt (short- and long-term) divided by assets; (e) ROA, which is net income over assets; (f) EBITDA/Assets, where EBITDA is the earnings before interest, taxes, depreciation, and amortization; (g) the Logarithm of Market Share, where market share is the ratio of the firm revenue in a specific year and the total revenue of all medium and large firms in the same SIC two-digit industry.

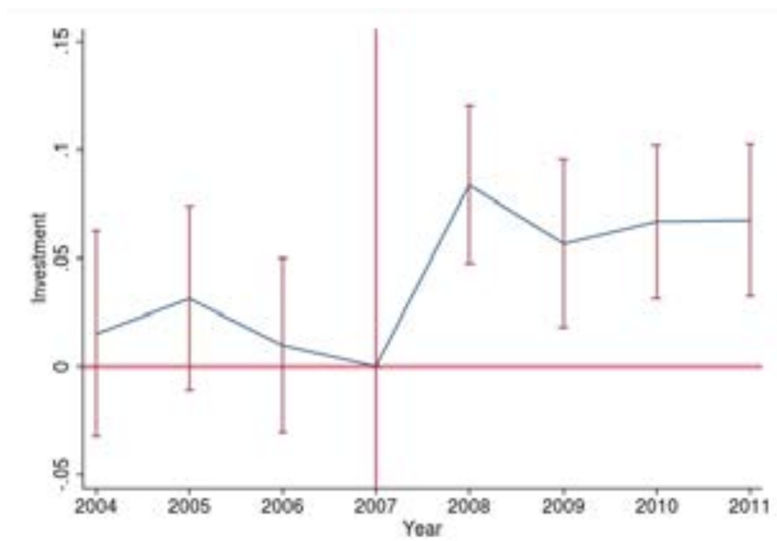
In the paper, we use different methodologies to determine companies that are more or less likely to be financial constrained at the time of the financial crisis. First, we use size by looking at the top quartile of revenue in 2007, across the sample. Second, we identify firms that are in the top quartile of leverage in 2007. Third, we identify companies operating in industries that are more dependent on external finance. The index is constructed using all firms in Compustat between

1980 and 2007: we construct a score for every two digit SIC code, which is the median of CAPEX minus operating cash flow, scaled by CAPEX.

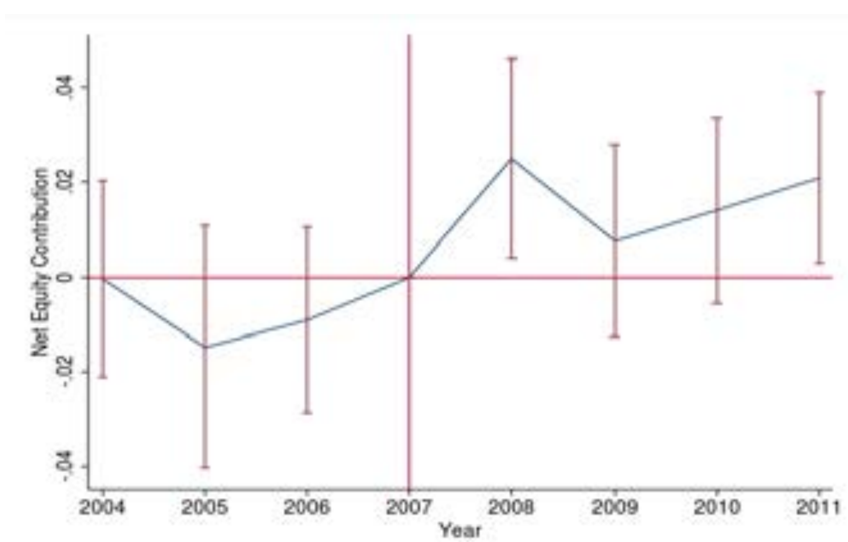
Figure A.1 : Effect of PE-backed companies over time

This figure reports the time-varying effect of being a PE-backed company on the main outcomes. Panel A reports the effect on investment, Panel B on debt issuance and Panel C on equity contribution. Specifically, this Figure reports the β_t of the following equation: $y_{it} = \alpha_t + \alpha_i + \beta_t(PE\ firm_i) + \varepsilon_{it}$. As explained in the paper, the year 2007 is used as base period and therefore the corresponding coefficient is normalized to zero. The central dot reports the point estimate while the straight vertical lines report the 90% confidence interval. The confidence interval is constructed using standard errors clustered at firm level. More info on this measure is available in the paper and in the Appendix.

Panel A - Investment



Panel B – Equity Contributions



Panel C – Debt Issuance.

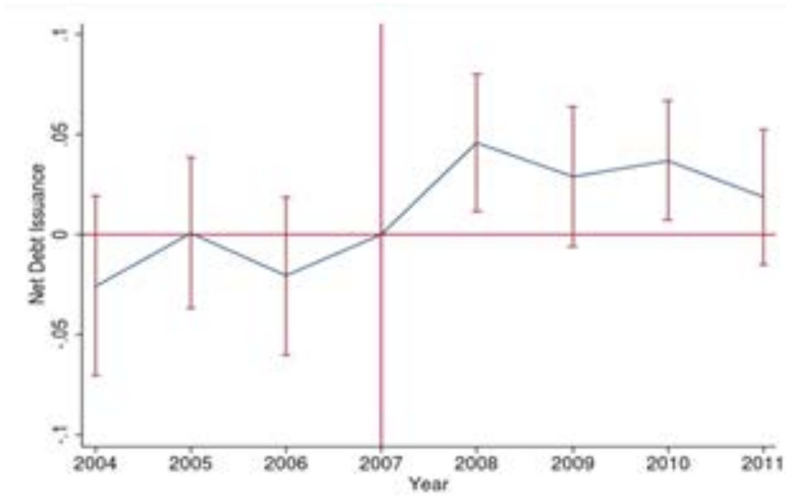


Table A.1: Robustness excluding MBO

This Table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on the main outcome variables dropping the PE-backed companies whose deal is identified as a management buyout (MBO) and the corresponding matched companies. Every specification contains a set of firm and year fixed effects. The main parameter of interest is the interaction between the crisis dummy and a dummy identifying PE-backed companies. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) is net equity contribution; in Columns (5) and (6) is the net debt issuance; in Columns (7) and (8) is leverage; in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Crisis	0.068***	0.072***	0.022**	0.018**	0.047***	0.053***	0.022	0.022	-0.003	-0.003*
	(0.017)	(0.017)	(0.010)	(0.009)	(0.015)	(0.015)	(0.020)	(0.020)	(0.002)	(0.002)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	8295	7965	8316	8028	8557	8181	8764	8376	6711	6483
Adjusted R-squared	0.157	0.159	0.039	0.064	0.085	0.103	0.009	0.029	0.016	0.021

Table A.2: Robustness using only 2007-2008

This table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on various outcomes using only data from 2007 and 2008. This corresponds to the last year before the crisis and the first one in the crisis. Every specification contains a set of firm and year fixed effects. The main parameter of interest is the interaction between the post dummy and a dummy identifying PE-backed companies. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by assets; in Columns (3) and (4) is net equity contribution; in Columns (5) and (6) is the net debt issuance; in Columns (7) and (8) is leverage; abd in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Crisis	0.083***	0.085***	0.027**	0.029**	0.047**	0.039*	0.004	0.001	-0.003**	-0.003**
	(0.022)	(0.022)	(0.013)	(0.012)	(0.021)	(0.021)	(0.010)	(0.010)	(0.001)	(0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	3924	3715	3860	3672	3892	3696	3948	3737	3183	3019
Adjusted R-squared	0.385	0.399	0.139	0.262	0.234	0.296	0.002	0.020	0.009	0.020

Table A.3: Robustness using only companies not experiencing exit

This table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on various outcomes using only data only for groups of matched firms where no company is identified as leaving the data by 2011 (survivorship bias free). Every specification contains a set of firm and year fixed effects. The main parameter of interest is the interaction between the post dummy and a dummy identifying PE-backed companies. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is Investment scaled by asset; in Columns (3) and (4) is net Equity Contribution; in Columns (5) and (6) is the net Debt Issuance; in Columns (7) and (8) is leverage; in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Crisis	0.044***	0.040***	0.017**	0.016**	0.030**	0.025**	0.003	0.000	-0.002	-0.003*
	(0.014)	(0.014)	(0.008)	(0.008)	(0.013)	(0.012)	(0.014)	(0.014)	(0.001)	(0.001)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	9658	9271	9700	9367	10020	9567	10242	9776	7963	7683
Adjusted R-squared	0.160	0.160	0.046	0.061	0.090	0.102	0.029	0.040	0.020	0.026

Table A.4: Robustness adding time-varying industry fixed effects

This table reports a robustness test, where we estimate the standard difference-in-difference fixed effect model on various outcomes adding set of fixed effects generated as the product of industry (two digit SIC) and the post dummy. Every specification contains a set of firm and year fixed effects. The main parameter of interest is the interaction between the post dummy and a dummy identifying PE-backed companies. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. In Columns (1) and (2) the outcome is investment scaled by asset; in Columns (3) and (4) is net equity contribution; in Columns (5) and (6) is the net debt issuance; in Columns (7) and (8) is leverage; and in Columns (9) and (10) is ROA. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Investment/Assets		Net Equity Contr./Assets		Net Debt Iss./Assets		Leverage		Interest Rate	
PE firm x Crisis	0.055***	0.053***	0.022***	0.021***	0.039***	0.037***	0.012	0.013	-0.002*	-0.003**
	(0.013)	(0.013)	(0.007)	(0.007)	(0.011)	(0.011)	(0.015)	(0.014)	(0.001)	(0.001)
Industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	12456	11910	12469	12003	12903	12274	13205	12553	10222	9831
R-squared	0.163	0.163	0.042	0.060	0.093	0.105	0.019	0.040	0.021	0.026

Table A.5: Robustness of Market Share Results

This table reports a robustness test on the market share results. All regressions are cross-sectional regressions, where we compare firms across PE and non-PE backed companies. In Columns (1)–(4), we estimate a conditional logit model, where the outcome is a dummy equal to one if the market share of the firm increased over 2009 and 2007 (Columns 1 and 2) or over 2011 and 2007 (Columns 3 and 4). The reported beta are marginal effect at the average and the model is estimated with SIC two-digit fixed effects. In Columns (5)-(8), we estimate an OLS model where the outcome is the growth rate in market share between 2009 and 2007 (Columns 5 and 6) or 2011 and 2007 (Columns 7 and 8). The market share growth is winsorized at 1% to reduce the influence of outliers. Odd columns contain the baseline regression where instead even columns augment the baseline model with a set of firm level controls measured before the crisis and interacted with the post dummy. These variables are firm size (log of revenue), growth in revenue, cash flow over assets, ROA, and leverage. More information on the variables is available in the Appendix. Standard errors are clustered at firm level. *** denotes significance at the 1% level, ** at the 5%, and * at the 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Market Share Increase - Dummy				Market Share Growth			
	2007-2009		2007-2011		2007-2009		2007-2011	
PE Firm	0.054**	0.032*	0.042	0.017	0.046*	0.063**	0.027	0.054
	(0.024)	(0.018)	(0.027)	(0.012)	(0.027)	(0.031)	(0.049)	(0.050)
Industry (2-digit) F.E.	Y	Y	Y	Y	Y	Y	Y	Y
Firm Controls 2007		Y		Y		Y		Y
Observations	1639	1639	1564	1564	1655	1655	1565	1565

AUGUST 2018

Companies Rush to Go Private

Jakob Wilhelmus and William Lee

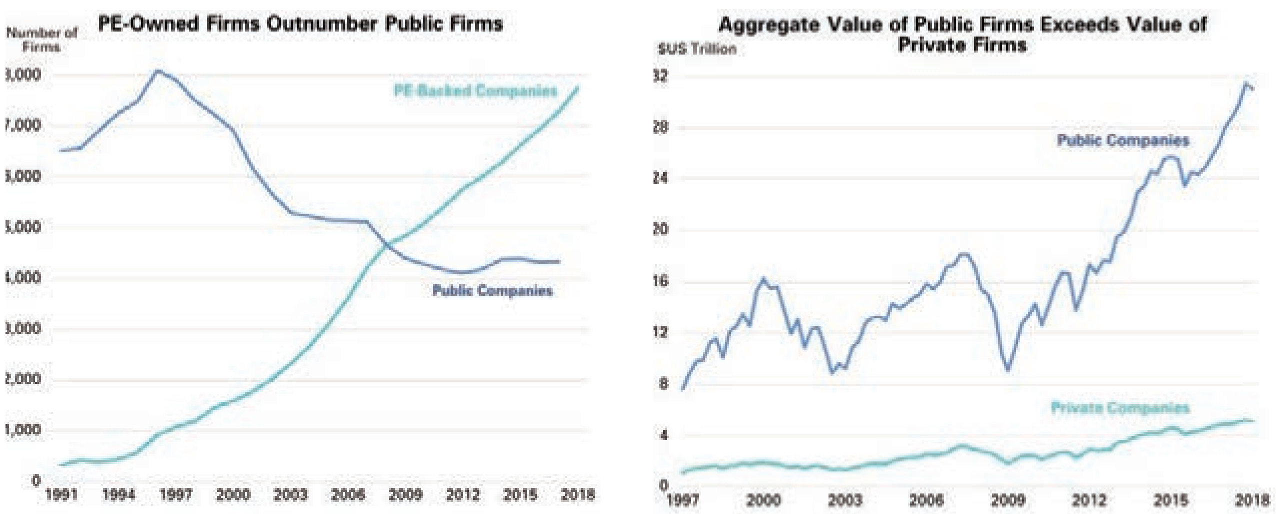
ACCESS TO CAPITAL

MILKEN INSTITUTE

COMPANIES RUSH TO GO PRIVATE

The storm over Elon Musk's awkward attempt to take Tesla private is the latest wave of the continuing tsunami that began in 1995 when firms started their rush to "go private." Even Saudi Arabia has announced intentions to delay the listing of their nationally owned oil company Saudi Aramco until 2020 or beyond. We now have more firms owned by private equity (PE) investors than are listed on all the U.S. stock exchanges, although they are small when compared with their listed counterparts (Figure 1).[1] As market breadth narrows, questions are being raised about the efficacy of listing on U.S. equity markets. More investors and company managers are re-examining the role of public equity markets for financing new companies and innovative investments, which traditionally have helped boost U.S. productivity and sustainable economic growth.[2]

Figure 1. More U.S Companies Are Owned by Private Equity than Are Listed on Public Stock Exchanges



Source: World Federation of Exchanges, Federal Reserve, SEC, Thomson Reuters Eikon, and Milken Institute; March 2018
Note: Public domestic companies, excl. investment trusts

[1] The Federal Reserve estimates the total value of all publicly traded firms to be $31.1T at the end of 2018Q1 compared with $5.2T for all privately held companies.

[2] Demirguc-Kunt and Levine (1997) highlight "how stock markets might boost long-run economic growth" and Levine's (2005) literature review outlines the positive relationship between financial deepening and growth. Unfortunately, there is little empirical research on the implications of capital market broadening for boosting productivity and growth.

Private capital markets have become a favored alternative source of company financing. In addition, private equity firms have become more innovative in developing options for financing the growth of small and emerging firms, and converting many publicly listed companies into private companies. Consequently, more companies are choosing to be privately owned, or are staying private for longer periods before becoming publicly listed.

There is a myriad of reasons to explain why companies may prefer private versus public ownership but none are definitive. One often cited reason for companies going private are burdensome regulatory disclosure and reporting requirements of being a listed company. Yet there is little definitive evidence to substantiate such claims.[3]

The hostile interactions between Elon Musk and company analysts during recent quarterly earnings calls for Tesla illustrate the tension over public disclosure and accountability requirements, and company managers' desire for autonomy. In addition, firms that are publicly listed are vulnerable to managerial interference by activist shareholders who often agitate for disruptive changes in management strategies, especially after reported misses in achieving quarterly earnings expectations.[4] Even President Trump has joined in on this debate by asking the Securities and Exchange Commission to assess potential gains from changing corporate quarterly earnings reporting practices.[5] Certainly, PE firms may also require even more frequent reporting, and may impose severe measures to ensure accountability in the face of poor earnings performance. Indeed, PE owners may choose to make major changes in the management personnel, managerial strategies, and company operations. However, PE company managers are not subject to additional public pressure from stock price gyrations and judgmental company analysts.

[3] More key arguments and findings regarding regulatory burden will be detailed in our upcoming research report.

[4] Jamie Dimon and Warren Buffett propose eliminating quarterly earnings reporting for public companies to reduce shareholder pressure and stock market turmoil in response to earnings misses. This issue is discussed here.

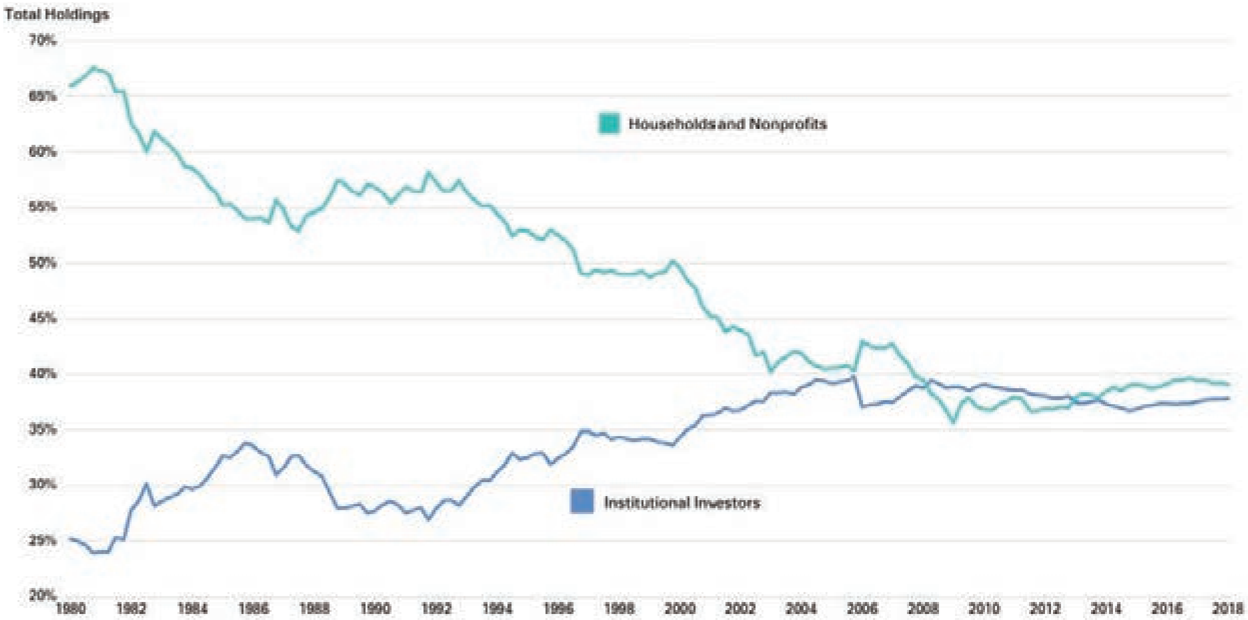
[5] President Trump tweeted on August 17, 2017: "In speaking with some of the world's top business leaders I asked what it is that would make business (jobs) even better in the U.S. 'Stop quarterly reporting & go to a six month system,'" said one. That would allow greater flexibility & save money. I have asked the SEC to study!"

COMPANIES RUSH TO GO PRIVATE

PRIVATE CAPITAL FAVORED BY SHIFT IN COMPOSITION OF EQUITY OWNERSHIP

Incentives for companies to favor private ownership increased in the late 1990s when institutional investors began to dominate individual/household equity investors. Following the end of WWII, households owned most of the shares in publicly listed companies directly, and until 1980, they held close to 70 percent of all corporate equity (Figure 2).[6] Since then, the household ownership share has declined steadily until 2003, after which it stabilized at approximately 40 percent. During the same period, institutional investors' share doubled from 20 to 40 percent.

Figure 2. Corporate Equity Investors Shift from Households to Institutions, January 1980-March 2018



Source: Federal Reserve and Milken Institute; as of June 2018
Note: Institutional investors include insurance companies, private pension funds, mutual and closed-end funds, and exchange-traded funds

The growing presence of institutional investors allowed companies to raise funds more efficiently and without many of the reporting and disclosure requirements necessary for publicly traded companies with retail investors. That is because institutional investors tend to rely on other intermediaries (e.g., venture capital and private equity firms) to monitor and manage how companies use investor funds. By comparison, less-sophisticated retail investors generally are presumed to need a higher level of investor protection, which implies stringent regulatory, disclosure, and governance requirements enforced by various government agencies.[7]

[6] Corporate equities in the Federal Reserve's Financial Accounts include both public and private equity.

[7] See "Remembering the Forgotten Investor" by then acting chairman of the SEC Michael S. Piwowar. It questions the sharp delineations in the definition for accredited or qualified investors stemming from Regulation D of the 1933 Act. They are individuals with an annual income of at least $200,000 in each of the past two years ($300,000 for joint income) or a net worth of at least $1 million

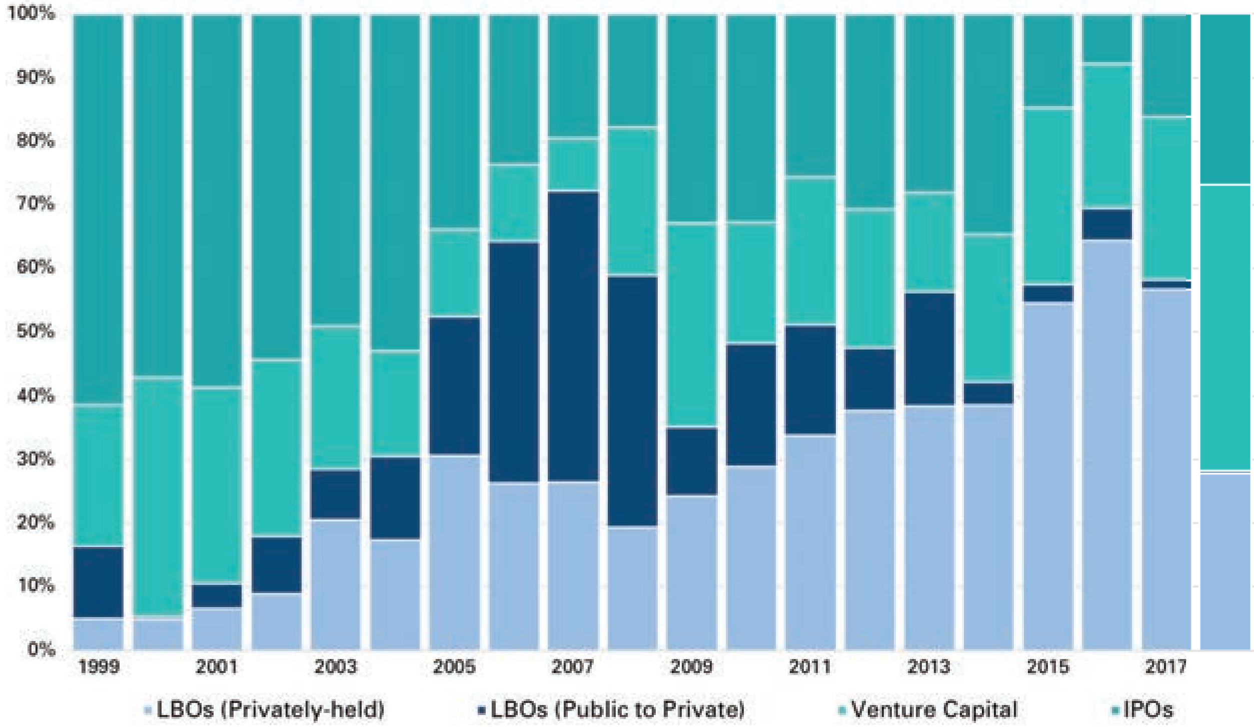
PRIVATE CAPITAL BECOMES FAVORED ALTERNATIVE FOR COMPANY FINANCING

Private equity firms provide financing options that have become the favored alternatives for companies that are eager to raise funds. Companies can raise capital more efficiently (e.g., at a lower administrative cost) with private placements to "qualified" investors than by a public offering.[8] In addition, households may continue to benefit from corporate gains by buying shares in the few publicly traded firms conducting private financing (e.g., listed PE firms), or by allowing their pension funds to do the investing for them. Investing indirectly with institutional investors such as pension funds would allow households to own indirectly a more diversified portfolio containing securities that would otherwise not be available for small investors.

Regulations that segregate investment opportunities, and exclude large groups of investors from profitable investment opportunities have severe consequences that include worsening the distribution of wealth. Such exclusionary practices raise thorny social justice issues regarding whether all investors should have equal access to investment opportunities. Because they are considered "unsophisticated," most households are not even given the opportunity to choose to invest in some opportunities regardless of their level of education or investment experience. They will not meet necessary regulatory requirements for being a "qualified" or "accredited" investor that is necessary to invest in most private equity funds. Indeed, current regulatory policies limit most individual and household investments to a segmented (and shrinking) universe of publicly listed companies.

[8] A private placement is a debt or equity security that does not involve a public offering, and is therefore exempt from registration with the SEC. These investments are limited to accredited investors, see previous sidenote.

Figure 3. IPOs Account for a Diminishing Share of Capital Raised/Invested



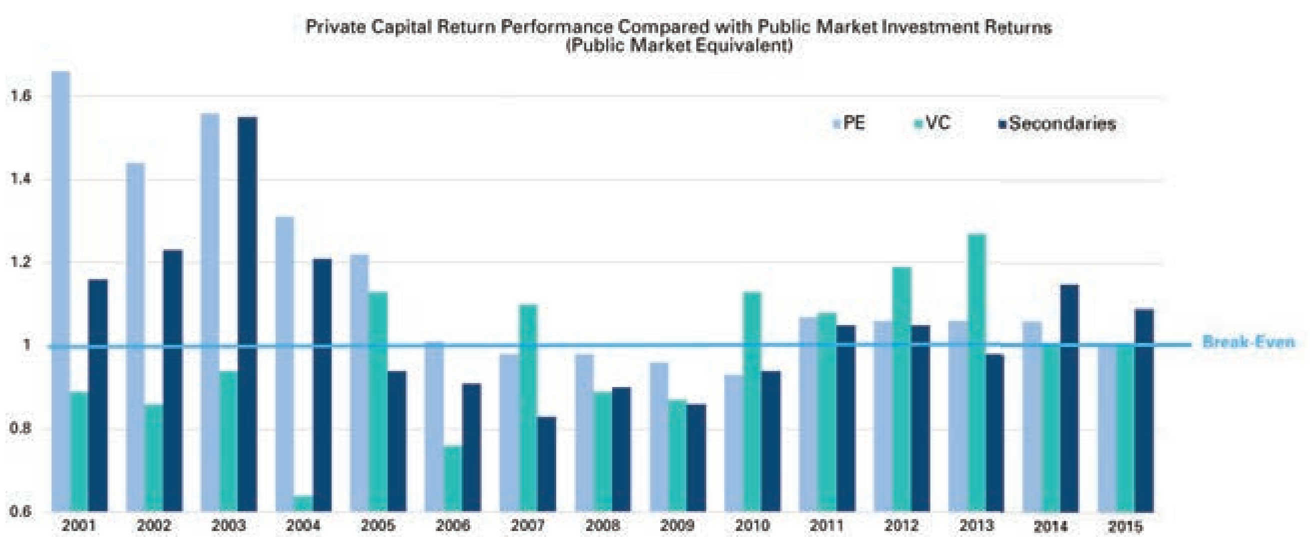
Source: Pitchbook, Thomson Reuters Eikon, and Milken Institute; 2018 reflects the time period through May 2018
Note: Limited to companies headquartered in the U.S. and initial public offerings on NASDAQ or NYSE

Notwithstanding their limited investor base, private equity (PE) firms are becoming a major source of funding for companies that do not wish to list on the public stock exchanges, or for those listed companies desiring to “go private.” PE now provides five times more capital than raised with IPOs. By comparison, less than two decades ago PE-supplied capital was only 75 percent of the capital raised by IPOs (Figure 3). The dramatic shift began in 2004, when PE sponsors spent more than $150 billion to take public companies private; a year when IPOs did not account for more than 50 percent of all equity capital raised.

PRIVATE EQUITY OFFERED INVESTORS HIGHER RETURNS THAN LISTED COMPANIES

For some time, private equity has offered investors returns that were substantially higher than those available from investing in listed companies. Prior to the Crisis, the returns on PE funds exceeded the returns offered by publicly listed firms (e.g., the S&P 500) by a wide margin (20 to 60 percent) (Figure 4).[9] However, in the years after the Crisis, the performance of PE funds deteriorated significantly, and barely paced the S&P 500 in 2015.[10] The development of secondary markets for PE assets have allowed PE firms to realize higher returns in the post-Crisis years. However, because secondary PE market transactions are negotiated, pricing and realized returns may not be as efficient as under full price discovery in public equity markets. Secondary PE market valuations may be ephemeral once companies are listed on public stock exchanges.

Figure 4. Private Equity Returns Were Much Higher



Source: Pitchbook and Milken Institute

The increased use of leverage has helped boost apparently sagging returns. PE firms often finance funds participating in the leveraged loan market that helps finance leveraged buyouts (LBOs). Often the companies involved with PE funds already are

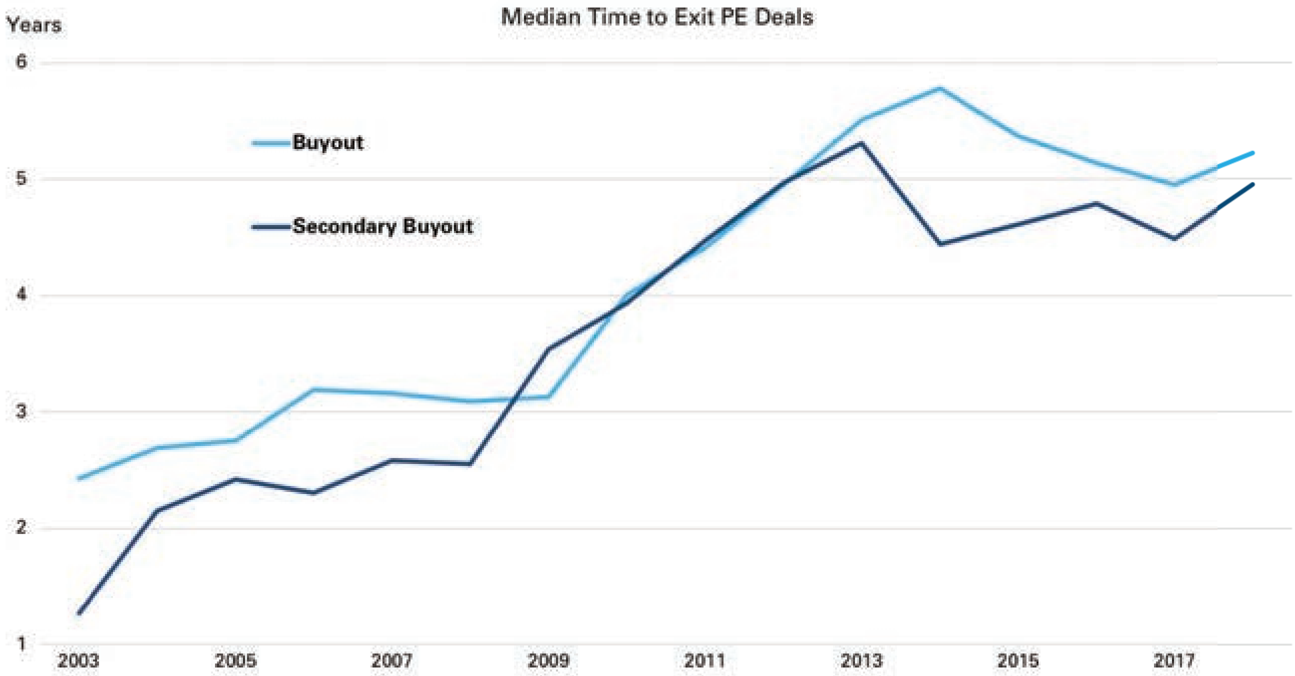
[9] To compare private equity returns we used the "public market equivalent" measure, which compares the return of PE funds relative to the S&P 500; a value greater than 1 implies outperformance. See "PME Introduction" by Henly (2013) for more detail.

[10] The breakeven point is where private capital returns equal the returns from the S&P500 or an alternative stock market index representative of the private capital investment. Venture capital funds (who supplied capital to firms at an earlier stage of development) had slightly better returns than PE funds during the 2010 to 2013 period.

heavily indebted and the loans to fund LBOs have weak lending terms ("covenant lite").[11] Credit rating agencies have recently issued warnings about the risk associated with such corporate borrowing as interest rates rise and the pace of PE deal-making surges.

The larger range of financing options (including secondary PE market sales) utilized by PE firms appears to have lengthened the duration firms remain private. The time for firms to "turn-around," i.e., between a fund's entry and exit from PE ownership, has increased significantly over the last two decades. Indeed, the median time to exit for both initial and secondary buyouts has tripled since 2002 (Figure 5). Providing company managers more time to shape and execute their strategic and operational plans could allow these companies to be more profitable once they do "go public."

Figure 5. Private Equity Deals Take Longer to Exit



Source: Pitchbook and Milken Institute, May 2018

[11] Leveraged loans are debt of companies with below investment grade credit ratings. Leveraged loans are typically senior to the company's other debt and are used mainly to fund leveraged buyouts.

CONCLUDING THOUGHTS

EXPANDED PRIVATE FINANCING IS IMPORTANT FOR ADVANCED CAPITAL MARKETS

The means by which companies raise capital have changed over time. As the headlines for Elon Musk's recent misadventures with Tesla suggest, so have the relative advantages of private over public ownership. While the decline in the number of listed domestic companies is well documented, little attention has been paid to the consequences of the growing private equity market and its institutional investor base. As equity owners shifted from households to institutional investors, the importance of private financing as a means for improving the efficiency and profitability of U.S. companies has amplified.

Investing in PE firms has become more popular among institutional investors, despite fading expectations for earning higher-than-market returns from investments in companies restructured by the PE managements. PE firms make extensive use of a rich menu of securities and leverage to shape capital structures that can incentivize more efficient company operations and provide better stakeholder returns.

In addition, corporate managers have sought PE financing to escape the frequent disclosure requirements and costly internal controls aimed at investor protection that come with public listing. Moreover, we see that nationalized companies, such as Saudi Aramco, are reassessing the balance of benefits from listing on U.S. and global stock exchanges against potential disclosure requirements and legal liabilities that may arise. Some corporate managers want shelter from stock price pressure and interference from shareholder activists. In addition, the development and expansion of secondary private equity markets for trading assets among PE firms has benefited PE investors and company managers. Investors may realize their gains sooner, while corporate managers are able to prolong the time for improving corporate strategies and operations before listing on a public stock exchange.

CONCLUDING THOUGHTS

We believe the severe drop in the volume of domestic IPOs and rise of PE financing reflects an ongoing evolution in U.S. capital markets. Such market broadening is a byproduct of financial innovations that occur when companies and investors continuously re-optimize their capital structures.

However, as more companies are owned by PE funds in which households cannot invest, social policy questions about the fairness of maintaining an unequal distribution of investment opportunities need to be addressed. Moreover, legislation that mandates listed companies to meet more social and wealth distribution objectives that are not directly related to the operations of the company, likely will incentivize even more delistings from stock exchanges and exits into private ownership. This, in turn, likely will exacerbate the unequal distribution of investment opportunities and worsen the already skewed distribution of wealth.

Nevertheless, private capital plays an important and growing role connecting financial resources to investment opportunities. IPOs, publicly listed companies, and private equity are all complementary investment vehicles. Each plays a vital role that allows companies more efficient access to capital for improving productivity, boosting long-term growth, and creating better jobs.

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Private Equity in the Global Economy:

Evidence on Industry Spillovers

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Private Equity in the Global Economy:

Evidence on Industry Spillovers

July 29, 2019

Abstract

Using a novel dataset on global private equity investments in 19 industries across 52 countries, we find that labor productivity, employment, profitability, and capital expenditures increase for publicly-listed companies in the same country and industry as private equity investments. Our results show that positive externalities created by private equity firms are absorbed by other companies within the same industry. Consistent with prior literature on competitive spillovers, these effects are more pronounced in country-industries with higher levels of competition, stronger institutions, and moderate levels of technological development suggesting that the competitive pressures from private equity-backed firms cause industry peers to react.

1 INTRODUCTION

Several studies find evidence of improvement in firm performance following a private equity (PE) transaction (Cumming et al. 2007, Guo et al. 2011, Kaplan and Stromberg 2009). However, little is known about how PE transactions impact competing firms in the same industry. This is surprising given frequent negative publicity about PE transactions adversely spilling over to the broader industry; for example, legislation recently introduced in the United States Senate seeks to prevent private equity firms from "looting companies" and "toppling markets."[1] Using a novel dataset on actual PE investments between 1990 and 2017, this paper explores the dynamic relationship between PE investments and performance characteristics (such as productivity growth, employment growth, capital expenditures, etc.) of public market firms in the same industry over the next several years.

Our analysis builds on the idea of "knowledge spillovers" dating back to Marshall (1890). A large literature has examined how technological advancements and productivity gains at some companies spill over to the other companies within the same industry. In a review of studies related to spillovers from multinational corporations onto local companies, Blomstrom and Kokko (1998) conclude that technology and productivity spillovers take place within an industry as companies compete and directly interact with each other or knowledge is transferred through employees.[2] Similar to FDI, operational and financial changes made by PE firms after a transaction likely create positive and negative spillovers for the industry as a whole. [3] Hence, how overall industry dynamics change following PE investments is an important issue for understanding if documented economic gains from PE investments increase welfare or simply come at

[1] See "Elizabeth Warren Takes Aim at Private-Equity Funds," *The Wall Street Journal*, July 18, 2019, p. A1.
[2] Blomstrom and Persson (1983), Bolmstrom (1986), Blomstrom and Wolff (1994), Caves (1971), Javorcik (2004), Kokko (1994) and Kokko (1996) and are examples of studies providing evidence for the existence of spillovers from foreign multinationals to domestic companies.
[3] One channel of spillovers is that the other firms copy the best practices and new technologies of the private equity-backed firms. It could also be the case that they are forced to come up with their own practices and technologies to become more efficient in order to keep up with the competitive pressure from the more efficient private equity-backed firms.

the expense of comparable losses at other (often publicly traded) firms in the industry.

One exception to the dearth of research on the broader economic impact of PE transactions is Bernstein et al. (2016). In their study of 26 OECD countries, they document that industries with at least one PE transaction in the past five years grow faster in terms of employment and productivity and are less exposed to aggregate shocks. The focus of their paper is aggregate industry performance, rather than peer firms within the same industry, and therefore they are not able to determine if the effects they document are driven by the improvements at PE target firms or competing firms. Thus, our study is the first to directly show that benefits spillover to other companies within the same industry. Additionally, our larger sample of 52 countries provides the first evidence on the impact of PE investments in developing economies as well as novel cross-sectional evidence regarding how the spillover effects are different for countries and country-industries with different institutional characteristics. This variation is an important tool for causal inference as well and allows us to identify specific country and industry characteristics associated with large PE spillovers. The dataset used in the paper is provided by Burgiss and is unique in its detailed coverage of PE investments at the global level. Investment values are aggregated using actual portfolio company investments by both buyout and venture capital funds. The data cover a total PE capital of $1.9 trillion invested in 52 countries across 19 industries from 1990 to 2017 and is the first dataset providing actual dollars of invested PE capital at the industry level across a large number of countries.[4]

As a motivating example for our analysis, consider the buyout of the rental car company Hertz Corporation in 2005. Hertz's performance improved significantly following the transaction, but more to the point of this study, Hertz's two main competitors, Avis-Budget and Dollar-Thrifty, soon implemented new strategies to increase efficiency, perhaps triggered by competitive pressure from the increasingly efficient Hertz. For example, over the two years following the buyout of Hertz, profitability and productivity

[4] Harris, Jenkinson and Kaplan (2014) also use private equity fund flow data supplied by Burgiss in their study of private equity fund performance. Brown et al. (2015) compare Burgiss and other commercially available data sets in terms of what they say about private equity performance.

increased at both Avis-Budget and Dollar-Thrifty.[5] We can illustrate the empirical strategy in this paper by examining a specific observation in our data set: the food and beverage industry in Thailand. In 1999 the Food and Beverage Industry received its largest injection to date of $29 million in buyout capital. Figure 1 depicts how overall industry employment, sales, and capital expenditures changed for Thai public companies in the Food and Beverage Industry. All three measures increased significantly over the three years following the increase in buyout investment. These trends are consistent with positive spillovers from PE onto the public companies within the same industry.

However, many factors may affect country-industry characteristics, so our empirical analysis must separate the impacts from PE investments from other factors. Likewise, it can be a challenge to determine causality due to the potential endogenous nature of discretionary actions (in this case, PE investments). For our analysis, we utilize a panel vector autoregression (panel-VAR) method to alleviate problems of reverse causality. This approach conditions effects on the recent history of industry-country characteristics' and PE investment. We therefore control for past values of employment growth, profitability growth, and labor productivity growth that may be associated with the amount of PE capital invested in an industry overall.

Our results indicate a statistically significant link between PE investments and the real economy. We find that PE capital invested in an industry leads to higher employment growth, profitability growth, and labor productivity growth within the *public firms* in the *same domestic industry* over the next few years. On average, following a one standard deviation increase in the amount of PE capital invested (adjusted by industry sales) employment growth increases by 0.6%, labor productivity growth increases by 0.8%, and profitability growth increases by 2.9% within one year. These effects are economically large – each is on the order of a one standard deviation increase in aggregate growth rates. Private peer firms are also likely to experience spillovers and we are possibly underestimating total industry spillovers. However, we focus on public firms for two reasons. First, we do not have the data on private firm performance at the country-

[5] See the appendix for a more detailed discussion of the buyout of Hertz Corporation.

industry level. Second, as private firms are more likely to receive PE investment and our data does not allow us to observe firm-level PE investments, focusing on public firms helps us to more clearly identify the spillover effects rather than performance improvements at PE targets.

Given the different goals and structures of buyout and venture capital (VC) transactions, we compare how the impact of private equity on the performance of public firms is different after buyout versus VC investments. Overall, our findings are intuitive and indicate that buyout investments are more likely to lead higher profitability through operational spillovers, while venture capital investments create positive industry-wide externalities through the introduction of new technologies and innovation. We also examine the dynamic relationship between industry-wide investment among the public firms and private equity and find that higher levels of private equity investment lead to higher growth in industry-wide capital expenditures. This suggests that private equity companies not only contribute to short-term performance advancement but also facilitate long-run growth through more real investment at the industry-level.

Our large panel of country-industries enables us to provide the first evidence on PE spillovers in developing nations and explore country and industry characteristics that are necessary for spillovers to be realized. These comparisons also enhance our power to test for the existence of a causal effect of PE on industry spillovers. We find that the impacts of PE investments are concentrated in country-industries with higher levels of competition which is consistent with the hypothesis that spillovers come from competitive pressures applied by more efficient PE-backed companies. Strong legal institutions are necessary for PE companies to better implement the governance structures that make their portfolio companies more efficient (Cumming and Walz 2009). Consistent with this hypothesis we find positive spillover effects onto the public companies are stronger in countries with better quality legal institutions and intellectual property rights.[6] The existing evidence on spillovers from foreign direct investments (FDI) shows that productivity

[6] The protection of intellectual property rights is particularly important as it impacts how extensive the private equity companies would introduce new technologies at their portfolio companies. Similarly, Mansfield (1994) finds that technology spillovers are weakest in countries with weak intellectual property protection.

spillovers are strongest for companies in countries with moderate levels of technological advancement. (Kokko 1994, Kokko et al. 1996). We also find that PE investment spillovers are strongest in countries with moderate levels of innovative capacities. Overall, these results provide additional support for a causal effect of PE investments on industry spillovers given that no alternative explanations we are aware of would predict these cross-sectional differences.

While the existing research on PE has utilized mostly data on U.S.-based funds, studying global investments in a cross-country setting is important for two reasons. First, while PE fund formation was primarily a U.S. and U.K. phenomenon pre-1990, by 2017 about 30-40% of the total global PE capital was invested in countries other than the U.S. and the U.K. and yet there is little research on global PE activity.[7] Second, the cross-section of countries allows for the study of the different impacts of PE in countries and industries with different characteristics as noted already.

We conduct a range of tests (discussed below) to gauge the robustness of our results. While it is theoretically possible that PE funds have better foresight than other investors about industry prospects and invest accordingly, this alternative explanation cannot explain our cross-sectional findings. Moreover, even if PE funds have some industry foresight not captured by the panel-VAR, our findings are still important as they provide evidence on PE companies facilitating industry growth by identifying this potential growth and allocating capital accordingly.

This paper contributes to several literatures in finance and economics. First, we build on the growing body of studies that examine how company performance changes after PE transactions (Cao and Lerner 2009, Davis et al. 2009, Kaplan 1989). With the evidence for positive spillover effects at the industry-level, our results support and complement the existing firm-level evidence. Second, our work contributes to the existing spillovers literature by exploring spillover of management practices, knowledge, and technology from PE-backed companies to public companies within the same industry. We provide

[7] See Figure 3 and Table 1, discussed subsequently in the data section.

evidence for a different channel for spillovers other than multinational corporations which is the most discussed channel in the literature.[8] Finally, we also contribute to the large literature of finance and growth that examines the link between financial development and economic growth. Existing studies look at how the development of a country's public and credit markets affects output growth by providing a better allocation of capital (King and Levine 1993, Levine 2004). We consider the impact of a different financial asset class, PE, and show that its entrance into an industry also enhances industry growth by creating positive externalities within the industry.

The remainder of the paper is organized as follows. The next section further discusses the related literatures and how the paper fits in. Section 3 introduces the data and presents some descriptive analysis. Section 4 outlines the empirical strategy using the panel-VAR approach. Section 5 presents our main results and robustness tests. Section 6 concludes.

2 RELATED LITERATURE

Jensen (1989) argues that PE ownership, as compared to public equity ownership, can be a superior ownership structure as it provides a better alignment of incentives between owners and managers as well as a more efficient management of resources.

According to Kaplan and Stromberg (2009), PE companies improve their portfolio companies using practices that can be summarized under three main headings: financial engineering, governance engineering and operational engineering. Financial and governance engineering refer to changes in the structure of ownership and financing that may lead to better monitoring and incentive alignment to overcome agency problems at the portfolio companies. Operational engineering refers to management practices that PE owners use to improve operational efficiencies of their portfolio companies. Firm-level performance after

[8] This is an important contribution as 'the degree to which other modes of international business (besides traditional inward FDI) generate appropriate spillover benefits for the host country is an exceedingly important policy issue for which there is a disappointing amount of evidence.' (Blomstrom et al. 1999, p.15).

PE transactions has been examined in the existing literature in studies looking at transactions in the U.S., the U.K. or European Union countries. Kaplan (1989) tracks large management buyouts of publicly held companies and finds evidence for improved operating performance at these companies as well as increased market values. Similarly, Muscarella and Vetsuypens (1990) study reverse leveraged buyouts (LBO), and find that profitability at target companies increases following the transactions. More recently, Cressy et al. (2007) study U.K. buyouts over the period 1995 to 2002 and find that profitability of PE-backed companies is higher than those of comparable companies over the initial years following the buyout. They further find that industry specialization of PE firms enhances this improvement in profitability. Davis et al. (2009) show that U.S. firms receiving PE investment experience higher subsequent productivity growth. Similarly, studying a sample of PE-backed companies in Western Europe, Acharya et al. (2009) also find evidence for performance gains related to PE investments. Amess et al. (2016) find that LBOs have a positive impact on patent production suggesting that PE firms do not cut long-term investments for the sake of short-term profits. Complementing the existing evidence on operating performance, Cao and Lerner (2009) provide evidence for superior stock market performance for reverse LBOs. On the employment side, Davis et al. (2011) examine establishment-level job creation and destruction at U.S. establishments using data from the U.S. Census Bureau. They find that PE-backed companies have higher job destruction at existing establishments, but at the same time higher job creation at new establishments. Similarly, Popov and Roosenboom (2008) find that venture capital leads to higher new business creation in their study of 21 European countries over the period 1998 to 2008. Agrawal and Tambe (2016) find that employees at PE-backed firms acquire more valuable skills than employees at non-PE firms contributing to better long-run employability. Bernstein and Sheen (2016) also find evidence for gains in human capital to employees of PE-backed companies in their study of PE buyouts in the restaurant industry. On the contrary, Goergen et al. (2016) find evidence for lower employment in their sample of U.K. firms following institutional buyouts as well as no evidence of improvement in productivity or profitability.

Most of the existing studies on PE transactions have found evidence for superior subsequent performance at the firm-level. However, it is still unknown how PE transactions affect the other firms, which do not receive PE capital, within the same country and industry. There is a large established literature that has provided evidence for the existence of productivity spillovers.[9] For example, several studies on different countries, including Caves (1974) on Australia, Globerman (1979) on Canada, and Blomstrom and Persson (1983) on Mexico, demonstrate positive spillover effects from FDI to domestic industries (see Blomstrom and Kokko, 1998 for a detailed review). Similarly, Bernstein and Nadiri (1989) provide evidence for research and development spillovers within an industry and find that overall costs in an industry decline following improvements in technology as knowledge migrates to other firms. On the other hand, Aitken and Harrison (1999) find that the entrance of foreign companies negatively impacts the performance of local firms.

Related to our study, there has been some work on the effects of LBOs on peer firms. Chevalier (1995a, 1995b) studies the impact of LBOs on product market competition and pricing at the rival firms showing that LBOs have broad implications for the industry. Phillips (1995) and Kovenock and Phillips (1997) study the impact of LBOs on rival firms' decisions regarding plant closures and investments. However, all of these studies concern the implications of the capital structure of the LBO firms rather than operational spillovers from the PE target firms. An exception is the recent study by Harford et al. (2015) which finds that peer firms increase real investment and enter into more strategic alliances following an LBO in the industry. On the contrary, Hsu et al. (2010) also study competitive effects of PE investments and conclude that competitors of PE targets experience a decline in stock prices and operating performance. In addition, Cumming, Johan, and Zhang (2014) find evidence of a positive impact of entrepreneurship on

[9] The idea of spillovers was first introduced by Marshall (1890) in the form of knowledge spillovers among firms, and then improved by Arrow (1962), and Romer (1986). Later, Glaeser et al. (1992) put the ideas together and defined the Marshall-Arrow-Romer (MAR) model of knowledge spillovers, which argues that knowledge is industry specific and spills over within an industry once its created.

the real economy (GDP per capita, exports, patents, and unemployment). Our findings complement their country-level results by providing evidence for positive industry-level spillovers from private investments.

This paper also complements a recent study by Bernstein et al. (2016). In their study of 26 OECD countries between 1991 and 2007, they find that industries with at least one PE transaction in the past five years grow faster in terms of employment and productivity. They, however, do not find evidence for differences between industries with high versus low amounts of PE capital. There are several significant differences between our paper and theirs. First, they look at the overall industry performance following a PE transaction, including the companies receiving PE capital and do not specifically explore spillovers, while we focus on aggregate industry measures of publicly listed companies only. This allows us to clearly identify the spillover effects from PE-backed companies to companies that do not receive PE capital within the same industry. Second, their measure of PE is the existence of a PE transaction in an industry, whereas we look at actual dollars of PE capital invested. Third, they study a sample of OECD countries between 1991 and 2007, while we study 52 countries, including both developed and developing nations. This comprehensive sample does not only allow us to provide the first evidence on the impact of PE investments in developing nations but also to compare how the spillover effects are different for countries and country-industries with different institutional characteristics (which can also provide a tool for causal inference). Finally, our analysis includes an additional 10 years from 2008-2017 which has seen substantial growth in PE investment globally.

3 DATA AND DESCRIPTIVE STATISTICS

3.1 Data

The PE investment data come from Burgiss, a services company providing record keeping and performance analysis to the largest institutional investors in the PE universe. The major advantage of this dataset over others is that Burgiss sources its data exclusively from limited partners, as opposed to general partners

(GP); so, the typical biases associated with GP-sourced datasets are not present.[10] Brown et al. (2015) compare different commercial PE datasets in what they say about PE performance. For detailed information about Burgiss and its coverage of the PE universe, see Harris et al. (2012) and Brown et al. (2011).[11]

The primary variable from the Burgiss data is the amount of PE capital measured in U.S. dollars, including both buyout and venture capital, at the country-industry-year level over the period 1990 to 2017. The data cover more than 100 countries though we examine only 52 because of other data limitations and sparse PE investment in some countries. Burgiss provides company-level PE investments aggregated to the industry-country level based on the Industry Classification Benchmark (ICB). So, an example of a unit of observation used in our analysis would be the *U.S. dollar equivalent amount of PE capital invested* in *India* in the *technology* industry in *2003*. This is the first dataset having actual dollar amounts of PE capital invested at this level of detail globally. As the dataset is unique in its coverage of PE investments around the globe, we start with some basic descriptive analysis.

Table 1 presents the distribution of PE capital invested globally among 52 countries in the sample from 1990 to 2017. Panel A ranks the countries based on the total dollar amount of PE capital received, with amounts in million U.S. dollars and inflation adjusted to 2017. Column 1 shows that the U.S. and the U.K. have received the most capital. While venture capital makes up about 25% of total capital invested in the U.S., its share is only about 5% for the U.K. Developed European countries receive large amounts of PE investment – similar to the U.K., around 95% of capital received is associated with buyout activity. China and India rank 3rd and 8th, receiving more than $72 billion and $26 billion of PE investment, respectively. About 55% of the total is venture capital in China, whereas VC makes up 43% of investment in India.

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[10] GP-sourced databases on private equity may have significant biases as GPs strategically stop reporting. In many cases, Burgiss cross-checks data across different investors in the same fund which leads to a high level of data integrity and completeness.

[11] We note that the Burgiss data primarily covers funds of "institutional" quality. However, investments from the large institutional investors constitute the vast majority of the total private equity capital raised around the world.

In Panel B, countries are ranked by the total amount of PE capital received as a percentage of the GDP.[12] The U.S is again on the top of the list, while Luxembourg, Sweden and Denmark rank 2nd, 4th and 5th while they were ranked only 31st, 9th and 17th in Panel A, respectively. Israel, Hong Kong, and Singapore also rank high. China and India, on the other hand, move down the list considerably. Overall, Table 1 shows that PE has become global, and although U.S., U.K., and other big European countries remain big hubs for PE investments, emerging economies such as China, India, and Brazil also get a large portion of the total PE capital invested globally.

Table 2 provides the industry distribution of total PE, buyout and venture capital investment globally from 1990 to 2017. The technology sector receives the highest amount of capital, followed by industrial goods and services, and health care. The technology sector has more venture capital than buyout ($205 versus $176 billion) while a very big portion of PE capital invested in industrial goods and services is buyout (only 7% of total invested capital is venture capital). The health care sector receives $251 billion of PE capital in total, with 37% of it being venture capital. In almost all the other sectors, buyout capital makes up more than 90% of the investments with the exception of telecommunications where the share of venture capital is around 20%. Overall, Table 2 shows that venture capital investment is more concentrated in R&D intensive sectors such as technology and health care, while buyout capital dominates most other sectors.

The data on industry performance variables come from DataStream's Global Equity Indices that provide accounting as well as market price data for different industries in 53 countries using the Industry Classification Benchmark (ICB). DataStream's indices cover over 75,000 securities worldwide. The industry-wide measures are calculated using data from financial statements of publicly listed companies whose stocks cover at least 75% of the total market capitalization in each country-industry. The PE investment data are matched to the industry performance data at the country-industry-year level using the

[12] The ratio is calculated separately for each year between 1990 and 2017, and then the average is reported for each country.

ICB classification. Additional country-level variables used in the analysis come from World Bank's World Development Indicators (WDI), which are then matched to the other data by country and year. Country-level data on legal environment, such as the quality of institutions and intellectual property rights, and level of innovative capacity come from World Economic Forum's Global Competitiveness Index database. The final matched dataset has around 17,000 country-industry-year observations covering 52 countries and 19 industries.

Table 3 presents summary statistics for the industry- and country-level variables. Variable definitions are provided in Table A1. Over the sample period, industry-wide employment grew an average of 5.9% annually, while median employment growth is 1.8%. Labor productivity growth averages 4.2% annually. These are fast rates for industry-wide employment and productivity growth, but we note that the sample includes developing economies where production in industries outside of agriculture often grows rapidly. Average (median) net profit margin growth is 0.3% (0.8%). Panel B presents summary statistics for country-level variables. Average (median) GDP growth is 2.1% (2.2%). Public market is a measure of the liquidity of a country's stock markets, measured as the total value of stocks traded as a percentage of GDP. The average (median) market value of public equities is 40% (15%) of GDP. Similarly, private credit to GDP is a proxy for the credit market development of a country, measured by the total amount of credit given to the private sector as a percentage of GDP. Private sector credit is on average 78% of a country's GDP.

3.2 Univariate Comparisons of Performance across Country-Industries

In Table 4, we compare average and median employment growth, profitability growth and productivity growth, along with some other variables, in subsamples of country-industry-years. Columns 1 and 2 of Panel A present mean (median) values for the subsamples based on a PE indicator which takes the value of 1 if the country-industry received capital in that year, and 0 otherwise. Column 3 presents *p*-values for the mean (median) difference between these subsamples from a *t*-test (Wilcoxon rank-sum test). Average employment growth and profitability growth are both higher in country-industries with a PE investment, while average labor productivity growth is higher in the subsample of country-industries that did not receive any PE capital. The negative association with productivity growth might reflect PE companies choosing less productive country-industries to invest where there is more room to add value. The average growth in capital expenditures, net debt and industry returns are not significantly different among the subsamples.

Next, we limit the sample to country-industry-years with positive amounts of PE capital invested, and compare means among subsamples of high versus low levels of investment. Results are presented in Columns 4, 5 and 6 in a similar fashion. Several of the results are similar to the earlier comparison. Country-industries that received higher amounts of PE capital have faster growth in employment, profitability, and capital expenditures on average at the time of investment, and the differences are larger in magnitude. In contrast to results reported in Panel A, industries that receive higher amounts of PE capital seem to have higher industry returns and debt growth, not controlling for other differences.

Overall a couple of observations can be made from the univariate comparisons. Industries that receive PE capital have higher employment and profitability growth than industries that do not, and among the industries that received investment, those with higher amounts of capital experience faster growth. Labor productivity growth seems to be lower in industries with PE investments, but among the industries with PE investments, there is no statistically significant difference. These results suggest a possible positive relationship with the level of PE capital invested in an industry and employment growth, profitability growth, and capital expenditures growth. The relationship of PE with productivity growth, on the other hand, seems to be ambiguous.

Although these results are suggestive, it is not possible to draw conclusions about the relationship between PE and industry performance given the host of other factors that determine industry characteristics. For example, the decision of PE companies to invest in a specific industry and country is likely determined by industry growth, efficiency, etc. Thus, we exploit the panel nature of the dataset and utilize a Vector

Autoregression (VAR) model on the panel of country-industry-years to address the issue of jointly determined variables.

4 EMPIRICAL STRATEGY – PANEL-VAR

A VAR is a system consisting of N linear equations with N variables where each variable is explained by its own lagged values together with the current and past values of the remaining $N - 1$ variables in the system. After being introduced by Sims (1980), it has been widely used to explain the dynamic behavior of multivariate economic and financial time series. The main advantage of this estimation methodology is that it treats all the variables in the system as endogenous which leads to a better identification of the dynamic relationships between the variables in the system. In the absence of exogenous instruments, VAR estimation is useful for addressing issues related to endogenous variables.

Although the VAR approach is long-established, it has not been widely used on panel data until more recently. Love and Zicchino (2006) apply a VAR model on firm-level panel data from 36 countries in their study of the dynamic investment behavior of firms in an attempt to isolate the impact of financial factors from fundamental factors that affect firm investment. We follow their empirical methodology and apply a VAR to our panel of country-industry data. In addition to utilizing the time-series component of the data treating the variables in the system as endogenous, the panel-VAR also allows for unobserved individual heterogeneity by including country-industry fixed effects in the estimation. More specifically, following Love and Zicchino (2006), we estimate a panel-VAR system of the following form:

$$X_{ci,t} = \alpha_0 + \alpha_1 X_{i,t} + \mu_{ci} + \tau_t + E_t \,, (1)$$

where

$X_{ci,t}$ is a matrix consisting of industry-level variables and a measure of PE capital invested

$\mu\mu_{ci}$ are country-industry fixed effects

τ_t are time fixed effects.

Country-industry fixed effects are included to control for any unobserved time-invariant individual heterogeneity in the variables. In a single model specification, fixed effects may be removed by demeaning all the variables in the model at the individual observation level (country-industry in this case). However, in this type of VAR specification, where all variables are instrumented by their lagged values, fixed effects introduced by demeaning would be correlated with the regressors violating the exclusion restriction of the instruments. To avoid this problem, we apply a forward-mean differencing method, also known as the "Helmert" procedure (Arellano and Bover, 1995), where only the forward-mean for every country-industry-year is removed. After the Helmert transformation, the model is then estimated using a system GMM where lagged values of the regressors are used as instruments. The specification also includes time-fixed effects to remove the effect of global macro shocks that might affect all the variables in the system.

In a VAR specification, the ordering of the variables in the estimation does matter. VAR methods assume that every variable in the system affects the subsequent variables both contemporaneously and with a lag, while later variables affect the previous ones only with a lag. In other words, variables that appear earlier in the ordering are assumed to be more endogenous. In the estimations throughout the paper, we assume that PE capital invested affects the industry variables both contemporaneously and with a lag, while it is impacted only with a lag. However, all the results in the paper stay the same when we change the ordering of the variables in the system.

The goal of the panel-VAR methodology is to identify the direction of causality between PE capital invested in an industry and industry growth in terms of employment, productivity, and profitability. It should be noted that as the industry measures are aggregated from publicly listed companies in an industry, the effect that will be identified would be a measure of spillovers from PE-backed companies to the public firms in the industry.

5 PE INVESTMENT AND SPILLOVERS WITHIN THE INDUSTRY

5.1 PE and the Real Economy

As discussed above, PE investments into a particular company may incentivize firms not receiving investments to improve efficiency by utilizing new technologies and practices to compete with increasingly efficient PE-backed firms. Thus, there are potential industry-wide externalities from the competitive pressure introduced by PE. If companies are capable of absorbing the spillovers from private-equity backed firms, the industry might experience overall performance gains. On the other hand, if the companies that do not receive PE investment cannot keep up with the new technologies and the competitive pressure, the efficiency gains at the PE-backed companies might drive away demand from their competitors.[13] Hence, the pressure might negatively affect the rest of the industry.[14]

In this section, we estimate a panel-VAR as in equation 1, where the X matrix includes the amount of PE capital invested in an industry, adjusted by industry sales, industry-wide employment growth, profitability growth and labor productivity growth. This method identifies the impact of PE capital on the growth in employment, productivity and profitability of the public firms in an industry so as to measure technology and productivity spillovers from PE backed-companies to the rest of the industry. PE transactions may also lead to integrations, reorganizations, and restructurings, changes in the level of competition, as well as human resource shifts within an industry, which all may impact the performance of peer companies and result in spillovers.[15]

If the PE companies generate spillovers, we should observe a positive impact on industry prospects and thus positive coefficients on the PE variables.[16] Table 5 presents the results of the panel-VAR

[13] Aitken and Harrison (1999), for example, find that the entrance of more efficient foreign companies negatively impacts the performance of local firms because they attract customers away from domestic firms. Djankov and Hoekman (2000), Feinberg and Majumdar (2001), and Kathuria (2002) are other examples of studies providing evidence for negative impacts of spillovers from foreign direct investments.

[14] Even if competitive pressures drive the most inefficient companies out of the market, this may still be beneficial for the economy as a whole since PE-backed firms act as catalysts of a creative destruction process.

[15] We thank an anonymous referee for the suggestion of these alternative channels for spillovers.

[16] Reverse causality could stem from private equity companies' predictions about the industry prospects. However, the cross-sectional evidence presented in Section 5.4 is consistent with a causal effect of private equity on industry spillovers, while an explanation of superior foresight would not have the same cross-sectional predictions.

estimation.[17] The first column shows how the amount of PE capital invested at time t is affected by employment growth, profitability growth and productivity growth at time t -1. Only the variable's own lag is statistically different from zero suggesting that PE capital invested is not affected by how the industry did a year ago in terms of employment, profitability, and labor productivity growth, after controlling for the amount of capital invested at time t -1 and removing country-industry, and time fixed effects. The significant coefficient on the amount of PE capital at time t *-1* suggests that PE capital is persistent, which is not surprising given that many PE (and especially VC) investments are completed in rounds.

The second column presents the results from the part of the estimation where the dependent variable is employment growth. Employment growth at time t is significantly affected by productivity growth, and profitability growth at time t*-1*. After an industry experiences faster growth in profitability and higher productivity, it also grows faster in terms of employment subsequently. The main variable of interest for the purpose of this paper is PE capital invested. It also has a positive and statistically significant coefficient indicating that public companies in industries that receive more PE capital experience faster employment growth following the investment. Recall that any unobserved time-invariant heterogeneity is removed by country-industry fixed effects in the estimation. Because employment growth is total employment growth of the public companies in the industry (which do not receive PE investment)[18], the measured effect is the spillover effect from PE-backed targets on to public industry peers. This result is consistent with the

[17] Although the paper provides results with a one-year lag VAR only, results do not change when we estimate VARs with two- or three-year lags. Existing statistical tests for the optimal number of lags cannot be applied to panel data. However, a likelihood ratio test between models with one, two and three lags indicates that the models with two or three lags do not fit significantly better than the model with one lag. Furthermore, Cochrane (2005) suggests that economic theory does not say much about the orders of autoregression terms, and short order autoregressions should be used to approximate for processes.

[18] We thank to an anonymous referee for drawing our attention to the fact that public companies might still be receiving private capital through PIPEs. When we check PIPE volumes though, we see that they represent a very small proportion of the overall public market universe – for instance, in the U.S. $39 billion of PIPE capital was raised in 2010 while the total market capitalization of public companies was above $17 trillion the same year. Hence, the improvements we document at public companies should largely represent spillovers rather than changes at public targets.

hypothesis that as PE-backed companies invest in an industry, other companies within the same industry also improve operations to stay competitive which results in industry-wide employment growth.

The third column shows how labor productivity changes following a PE investment into the industry controlling for changes in employment and profitability together with the growth in labor productivity from the previous year. The coefficient on the amount of PE capital invested is positive and significant at the 5% level indicating that overall industry labor productivity grows faster following the investment of PE capital. So, not only employment, but also labor productivity of public peers grows faster subsequent to PE companies investing in an industry. This result is consistent with PE companies introducing practices and technologies that increase operational efficiency of their portfolio companies, and these efficiency gains spilling over to higher productivity at competing firms.

While the second and third columns show the positive impact of PE on labor productivity and employment growth, they do not provide evidence about the cost effectiveness of these improvements. The higher growth of employment and labor productivity together suggest an increase in output, but do not show that this higher output is more profitable. For example, if output increases because of expensive new investments, profits may deteriorate. This, in turn, may lead to lower firm values. As such, it is important to see how profitability changes in response to the PE investment within the industry (fourth column in Table 5). The amount of PE capital again has a positive and statistically significant relation: after an industry receives PE investment, profitability grows faster in comparison to years with no or low PE capital.[19] This result indicates that the gains in productivity and growth in employment are also reflected in profits. The spillover effects documented here are comparable in magnitude to the effects found in Bernstein et al. (2016), the only other study looking at industry-level changes. [20]

[19] One might be concerned that profit margins increase due to a reduction in sales as profitability is measured as net profits over sales. However, in unreported tests we find that sales growth increases as well indicating that the increase in profitability results from higher sales and lower costs.
[20] However, we note that the Bernstein et al. (2016) industry measures include the companies that receive private equity investments while we examine changes in public companies within the same industry. Thus, we would expect

Overall, the results in Table 5 show that following PE investments into an industry, public companies within the same industry that do not receive investment experience higher employment, productivity and profitability. These results suggest that after some companies in an industry receive PE investment, other companies within the same industry respond in ways that generate value for the industry as a whole. This may result from the competitive pressure from the private-equity backed companies as well as from imitation of better practices implemented by the PE companies. Because the panel-VAR method controls for reverse causality (to the extent that PE companies make their decisions about investing in a particular industry based on what happened in the industry in the past), we can feel more confident that industry performance is not related to the amount of PE capital invested. This suggests a causal effect where PE investments lead to spillovers within industries.[21]

The reported results indicate that PE investments create positive externalities within an industry. As such, the gains at the rest of the industry suggest that private-equity backing leads to efficiency gains at the target company first, which then are also absorbed by the other companies within the same industry. Previous research has shown that PE leads to performance gains at the target companies.[22] The evidence indicates firm-level performance gains ranging from 10% to 40% depending on the study and the measure of operating performance examined. The economic magnitudes of the positive effects presented here are

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their results to be larger in magnitude. Also, they use an indicator variable for the existence of a private equity transaction, making it harder to compare their results to the magnitudes documented here.

[21] This is to the extent that private equity investments are exogenous after incorporating the information about how the industry performed in the past. While this finding excludes reverse causality stemming from past values of industry performance affecting private equity investments, there might be other time-varying unobservables that are driving the findings. For example, one could argue that private equity companies have superior foresight and time their investments based on their expectations about the industry prospects going forward. As with any empirical work, it is impossible to perfectly control for expectations and fully exclude all alternative explanations. However, although no single finding would be conclusive by itself, the evidence provided throughout the paper, including the different findings for buyout versus venture capital as well as the cross-sectional findings, altogether are indicative of a causal relationship where private equity investments lead to spillovers. A full discussion of alternative hypotheses is provided in the robustness section.

[22] Kaplan (1989) and recently Guo et al. (2011) both have shown that profitability increases after buyouts. Furthermore, Lichtenberg and Siegel (1990) and Davis et al. (2009) provided evidence for productivity gains following buyouts. The higher growth in industry-level productivity and profitability confirm the findings of the aforementioned studies.

significantly smaller than firm-level effects, which is logical given that what is being captured here are spillover effects only. The effects become larger when looking at a two- or three-year window, but are still significantly smaller than the documented firm-level effects. Nonetheless, implied increases in growth rates are of the same order of magnitude as a one-standard-deviation change in aggregate growth rates for these variables.

5.2 Buyout versus Venture Capital

The previous section shows that PE investments lead to performance gains within the industry; however, we did not differentiate between the two main types of PE investments: buyout transactions and venture capital. In a typical buyout transaction the PE firm acquires a mature target firm by purchasing all of the outstanding equity, often with a significant amount of debt financing. Although buyouts are sometimes criticized for loading-up target companies with debt, cutting jobs, and reducing capital expenditures, the previously cited evidence shows that buyouts on average make their targets more efficient.

On the other hand, a typical venture capital transaction is an investment into a young and growing company, typically made in multiple rounds and without acquiring majority control. Venture capital investments often provide financing for small businesses that otherwise cannot get financing due to high risk and informational asymmetries. As such, venture capital prevents young companies from having to forgo positive investment opportunities. Additionally, venture capital investments are typically associated with an increase in the target company's innovative potential by allowing for more research and development investments and by providing expertise and guidance related to innovation. Kortum and Lerner (2000) provide evidence that venture capital investments indeed spur innovation, and this result is replicated in other studies using both U.S. and European data (see, Bernstein et al. 2016, Popov and Roosenboom 2012).

Given the very different structures of these two transactions and the different stages of financing they provide for the targets, they might also differ in terms of their impact on industry dynamics. To explore if buyout and venture capital have different impacts on industry dynamics, we repeat the panel-VAR analysis for buyout and VC separately. The results in Panel A of Table 6 indicate that the impact of total PE capital invested on industry employment and profitability are replicated when using buyout capital only. However, buyout transactions do not lead to significantly higher productivity at the industry level. We note though that this difference is largely driven by the difference in statistical power of this test as the estimated coefficient is quite similar. Nonetheless, these results suggests that buyout transactions may lead to improvements in profitability through other mechanisms, but the impact via the labor productivity channel is uncertain.[23]

Panel B presents the results with venture capital. The coefficient on lagged PE is larger for venture capital suggesting that VC investments are more persistent than buyout investments (and consistent with VC investments being conducted in multiple rounds). The impact of venture capital investment on employment growth and profitability growth is not statistically different from zero – however, we again note that this is a question of statistical power not a change in coefficient magnitude. So, unlike buyouts, we do not find reliable evidence for profitability gains or faster employment growth resulting from venture capital investments into an industry. Industry-level labor productivity, on the other hand, grows significantly faster following a venture capital investment. The finding that profitability and employment do not increase following venture capital investments, despite the significant increase in productivity, is consistent with costly investments in new technologies and more innovation that limit the need for labor (e.g., automation).

Venture capitalists typically make investments into small companies that are research and development intensive and have higher long-term growth opportunities. Therefore, we might expect little or no employment or profitability spillovers onto the rest of the industry in the short-run. Nonetheless, if

[23] This could be interpreted as buyouts leading to higher profits by cutting costs or through financial engineering, where higher leverage leads to tax benefits as well as disciplines managers with the pressure of making higher interest payments.

venture capital leads to innovation and productivity spillovers, this should lead to higher profitability and employment growth in the long-run. To investigate this possibility, we also estimate panel-VARs with 2- and 3-year lags (results not tabulated) and find some support for this hypothesis. The amount of venture capital invested at time *t-2* leads to significantly higher employment growth as well as higher profitability at time *t*.[24]

To summarize, while buyout investments lead to an increase in employment and profits we do not see an immediate (statistically significant) impact on these from VC. However, VC has an impact on productivity growth in the next year and the evidence suggests a longer time may be needed for impacts to be reflected in higher profits and employment growth after venture capital investments. The lack of significant productivity spillovers from buyouts suggests that the operational and financial improvements introduced by PE companies in buyout transactions are more focused at reducing costs and increasing profits, but do not necessarily lead to higher sales growth. The large impact of venture capital on productivity growth is consistent with the existing evidence showing a positive relation between venture capital and subsequent innovation (Kortum and Lerner, 2000; Mollica and Zingales, 2007; Bernstein et al., 2016). It is also consistent with Gonzales-Uribe (2016) which shows that venture capitalists spur innovation through a better diffusion of knowledge. The impact on industry productivity may also be related to the absorptive capacity of the industries receiving venture capital investment. Venture capital investments are more common in high R&D industries, which have been shown to better absorb spillovers due to higher levels of technical knowledge and human capital in the FDI spillovers literature (Kogut and Chang, 1991).

5.3 PE and Investment

[24] The effect of twice-lagged venture capital invested on profitability growth is larger in magnitude than the effect of lagged buyout capital invested. While a one standard deviation increase in lagged buyout invested leads to a 2% increase in profitability growth, a one standard deviation increase in twice-lagged venture capital invested leads to a 3% increase in profitability growth.

Some evidence documents reductions in capital expenditures at PE-backed companies (Kaplan, 1989). While reduced expenses might increase profitability in the short-run, it raises concerns about future cash-flows being sacrificed for short-term operational gains. In contrast, studies looking at stock market performance of PE-backed companies that are taken public provide evidence for superior returns, which indirectly suggests that long-run prospects are not hurt. To examine this issue directly, we estimate the panel-VAR model with growth in free cash flow, growth in capital expenditures, growth in market-to-book, and the PE measure to detect the dynamic relationship between industry-level investment and PE. Free cash flow is included to control for the sensitivity of investment to the availability of internal financing, while market-to-book is used as a proxy for investment opportunities. Table 7 presents the results.

The first column of Table 7 shows that the amount of PE capital is not related to past values of cash flow, capital expenditure, and market-to-book growth. The second column shows that growth in free cash flows at time *t* is not related to PE investments and capital expenditures at time *t-1* (after controlling for cash flow growth at time *t-1* together with country-industry and year fixed effects). The third column shows that capital expenditures grow faster following PE investments within an industry suggesting that technology spillovers resulting from PE companies lead to faster growth in capital expenditures at other firms.[25] This finding suggests that other companies within the same industry increase capital expenditures to compete with the PE-backed firms. As such, the increased level of investment in the industry will facilitate overall industry growth. This finding is also consistent with Harford and Kolasinski (2012) who find that PE transactions do not lead to underinvestment at the target companies, as well as with Lerner et al. (2008) who provide evidence on increased portfolio company patent productivity as an example of long-run investment after buyout transactions. More closely, our finding is consistent with Harford et al. (2015) who find that LBOs lead to higher R&D investment at a target's industry peers.

[25] As expected, lagged cash flow growth is also found to be positively related to capital expenditure growth suggesting that availability of internal financing facilitates investment as found in previous studies examining cash-flow sensitivity of investment. Furthermore, capital expenditure growth is also related to past values of market-to-book showing that investment increases in response to higher investment opportunities.

5.4 Spillovers and Country-Industry Characteristics

5.4.1 *Competitiveness*

The results so far suggest that there exist productivity spillovers from PE-backed companies in an industry to the public firms within the same industry. How much improvement PE companies provide for their portfolio companies and how well the resulting positive externalities are absorbed by the other firms within the same industry should depend on the characteristics of the country as well as the industry. In this section, we exploit the cross-section of countries and industries to investigate where the spillovers from PE-backed companies are most pronounced.

First, we explore the level of competition within a country-industry. Caves (1974) and Blomstrom and Kokko (1998) suggest that within industry competition leads to more productivity spillovers from FDI. Similarly, as in the example of the Hertz buyout, we expect the spillover effects from PE to be higher in more competitive industries. We investigate this and report results in Table 8 (estimation is identical to the earlier panel-VAR).[26] The table presents the main panel-VAR results on subsamples of country-industries with high versus low levels of competition. We use two proxies for the level of industry competition: industry-level gross margins and industry-level asset turnover ratios. Higher margins can be charged in less competitive industries; hence lower margins would proxy for more competition. Similarly, more competitive industries tend to have more efficient use of assets in generating sales; hence higher asset turnover ratios would proxy for more competition. As predicted, we find that the positive impacts on employment, productivity and profitability are concentrated in country-industries with higher levels of competition (lower margins or higher asset turnover) suggesting that the competitive pressure within an industry is indeed an important factor leading to spillovers.

5.4.2 *Legal Environment*

[26] For brevity, we only present the results for the private equity variable (the first row from Table 5) All the other results are identical: none of the industry variables at time t-1 are related to the amount of private equity capital invested at time t mitigating concerns about reverse causality.

Starting with the seminal work of La Porta et al. (1998) which examines the interaction of law and finance, many studies have examined the relationship between the legal environment, financial development and growth of a country. Lerner and Schoar (2005) show that legal origin and level of law enforcement affect the type and value of PE transactions. In countries with a weaker legal endowment, PE companies can add value by mitigating contractual shortcomings with private contracting; however, Balcarcel et al. (2012) show that reliability in the legal environment limits the flow of PE capital into countries with less developed legal systems. So, although PE might be more beneficial to countries with weaker legal institutions, the weak legal environment discourages PE investment and more importantly limits the implementation of technologies and practices that add value to the portfolio companies. Cumming and Walz (2009) find that PE companies have higher returns in countries with stronger legal conditions and conclude that external corporate governance mechanisms are necessary for PE companies to implement more efficient governance structures at the firm level. Blomstrom and Kokko (1998) discuss that efficient regulations and institutions in a country might lead to higher spillovers from multi-national corporations onto local companies, but they also note that there is not enough evidence to make a clear conclusion about the issue. Mansfield (1994) finds that the strength of a country's intellectual property protection has a significant effect on FDI flows as well as on the extent of technology transferred from U.S. firms to their foreign affiliates. This would suggest that the implementation of new technologies and practices is expected to be stronger in countries with stronger intellectual property rights.

Based on these arguments, we predict that the positive impacts documented earlier should be more pronounced in countries with stronger legal institutions as well as better intellectual property protection. We examine how the legal environment impacts spillovers by splitting the sample based on a measure of the quality of legal institutions and a measure of intellectual property rights from the global competitiveness index published by the World Economic Forum.[27] The results are presented in Table 9. Panel A-B and C-

[27] Institutional quality index combines information on the judicial efficiency, law enforcement, corruption, investor protection, and reporting standards in a country.

D present the results for countries with weak versus strong institutional quality and intellectual property rights, respectively. The results show that the effects are more pronounced for the subsamples of countries with stronger legal institutions and intellectual property rights. These findings underline the importance of a country's legal environment for PE companies to facilitate efficiency gains at their portfolio companies and create spillovers within the industry.

5.4.3 *Innovative Capacity*

Another important facet of spillovers is the ability of local companies to absorb them. A large literature in development economics argues that less developed economies will grow faster because they have lower diminishing returns to capital, and in the long-run, they will catch-up with developed economies (Barro, 1997).[28] In line with the catching-up theory, countries where initial inefficiencies are higher and skills are in short supply will be in greater need of the better practices and technologies potentially introduced by the PE companies. Hence, industries in countries with lower technology levels might benefit more from the entrance of PE capital. On the other hand, productivity spillovers might not take place in countries where starting technology levels are too low, because companies in such countries might be unable to provide a competitive response to PE-backed companies, and PE may lead to a crowding out of existing firms. Several studies have provided evidence on this issue suggesting that too large of a technological gap between the home country of a multinational corporation and the host country leads to smaller spillover effects. For example, Kokko et al. (1996) find that spillovers are only absorbed by companies that have moderate technology gaps with foreign firms.[29] To study the spillovers from PE investments in countries with different levels of technological advancement, we repeat the panel-VAR in subsamples of countries created based on a measure of innovative capacity. The innovative capacity score comes from the global competitiveness index created by the World Economic Forum. Table 10 presents the results. Panel A and B present the results for the subsamples of countries with low and high innovative capacity scores,

[28] For example, Blomstrom and Wolff (1994) show that the entrance of U.S. corporations into Mexico leads to a convergence in productivity levels of local Mexican firms and U.S. firms.
[29] Haddad and Harrison (1991), Cantwell (1989), and Kokko (1994) also find similar results.

respectively. Panel C presents the results for the rest of the countries, which have moderate levels of innovative capacities. As predicted, the positive impact of PE investments on industry growth is most pronounced for the countries with moderate levels of innovative capacities. While the coefficients are mostly positive for countries with the highest or lowest levels of innovative capacities, the results are not statistically different from zero. The results are identical when we use technological readiness score from the global competitiveness index as the proxy for the absorptive capacity of a country.

Overall, the cross-sectional findings in this section indicate that the positive impacts of PE capital on industry dynamics are most pronounced in countries and industries with specific characteristics. Three main conclusions can be drawn. First, the positive impacts of PE investments are concentrated in competitive country-industries suggesting that the competitive pressure is an important channel for spillovers. Second, stronger legal institutions are needed for manifesting positive spillovers. Third, the spillover effects are most effective in countries with moderate levels of technological development as these countries are not only still in need of the new practices and technologies introduced by the PE companies, but also have the sufficient level of technological development that enables them to absorb the spillovers.

Besides providing the first cross-sectional evidence of PE spillovers, the results in this section are also very important as they provide support for a causal effect of PE investments on industry dynamics. All the cross-sectional results are consistent with the argument that PE companies lead to positive externalities and spillovers within the industry, which are reflected in higher employment, profitability and productivity growth. It is hard to identify alternative explanations that would provide the same predictions about the results for the cross-section of countries and industries.

5.5 Private Equity and the Financial Economy

So far, our analysis has focused on how the real side of the economy is affected by PE. In this section, we study the impact of PE capital on two financial variables: leverage and stock returns. In buyout transactions, PE companies typically buy their target companies using high levels of debt which may lead to higher rates of financial distress and bankruptcy.[30] On the other hand, higher leverage can also be a source of value creation at the target companies by providing better incentives for management as well as tax benefits. Jenkinson and Stucke (2011) find that leveraged buyouts generate significant value by higher tax shields. Similarly, Guo et al. (2011) argue that about 30% of returns of PE transactions are due to the tax benefits of higher leverage. Thus, it is important to examine the implication of buyout capital for the overall debt level of an industry.

Additionally, the results so far have provided evidence for industry-wide performance improvements following PE investments. However, it is not shown what the implications are for share values. If these improvements are reflected in investor beliefs, we should observe a positive association between industry returns and the amount of PE capital invested. A thread of the PE literature has provided evidence that PE companies invest into industries/companies that recently had high stock market returns. Our panel-VAR approach allows us to examine two-way causality.

To investigate these questions, we estimate a panel-VAR model with the amount of PE invested, growth in industry-wide debt, and growth in the value of industry return index to examine the dynamic relationship between PE and the two financial variables. Table 11 presents the results. Panel A and B have the results for buyout and venture capital, respectively. The first columns of Panel A (B) show that the amount of buyout (venture) capital invested at time *t* is not related to debt growth at time *t-1*. The insignificant coefficient on lagged industry returns in the first columns of both panels contradicts the existing evidence that PE companies chase returns and further reduces concerns about reverse causality. The second column in Panel A shows that buyout capital is not significantly related to growth in industry-wide debt and there is no evidence of debt causing higher PE investment.[31] The third column in Panel A

[30] The existing evidence on this issue is mixed. Andrade and Kaplan (1998) find that 23% of large public to private transactions defaulted during the 1980s. Kaplan and Stromberg (2009), on the other hand, find that the average default rate of leveraged buyouts is lower than the average default rate for all U.S. corporate bond issuers.

[31] In a previous version of this paper with less up-to-date data, we found evidence for positive spillovers on industry-wide debt growth for earlier years of the sample. This is consistent with PE funds shifting their focus in more recent years toward operational engineering and away from financial engineering.

shows that buyout investments in an industry are not significantly related to stock values within a year. The second column of Panel B shows that there is no significant relationship between the amount of venture capital invested and industry debt. Similarly, the third column of Panel B shows that there is no significant relationship between venture capital and industry stock returns within a one-year time frame.

Overall, two conclusions can be drawn from the results in this section. First, financial structures PE companies are applying in their portfolio companies do not seem to be replicated by public peers. Second, the positive externalities created by the PE companies in an industry on the real side are not reflected in higher stock returns over the time frame we examine.

5.6 Robustness

5.6.1 *The Alternative Explanation of Market-Timing*

An alternative explanation for our findings is "market-timing" by PE funds. If PE companies have superior foresight about an industry's prospects, they could invest in a specific country-industry and this could drive the results we document. The panel-VAR controls for this to the extent that the expectations of the PE companies about the industry growth are shaped by how the industry did in the past. However, it would be impossible to fully exclude an information story where the PE companies have foresight based on additional information. Nevertheless, market-timing cannot be the only driver of the findings of the paper for several reasons.

First, existing evidence suggests that PE companies are not simply timing the market when investing in a portfolio company (see, Ball et al., 2011, and Gredil, 2019). Furthermore, if PE firms time investments in an industry, they would be expected to invest when equities are undervalued to generate superior returns when they exit. This suggests that industry stock returns would be higher following PE investments in contrast to the results we present in Table 11. Second, the cross-sectional findings presented in Section 5.4 are consistent with spillover effects from PE-backed companies to the publicly listed firms within the same industry while they are inconsistent with a market-timing explanation. Specifically, there is no reason why PE companies would have informational advantages in countries with better legal institutions but not in other countries. In contrast, it seems more plausible that informational advantages of PE companies are stronger in countries with weaker legal institutions where informational asymmetries are higher. Likewise, it is not clear why PE companies would be able to time the market in countries with a moderate level of technological capacity, but not in others. Finally, we predict and find that spillovers are stronger in more competitive country-industries, and it is again hard to determine why market-timing would work for competitive country-industries, but not for others. While none of the above explanations may be sufficient to fully exclude a market-timing hypothesis, when put together they support a causal link where PE investments lead to spillovers resulting in superior industry performance. Even if somehow selection could explain all the findings, our results still indicate that PE companies are facilitating economic activity by selecting the best sectors for investment and growth.

5.6.2 *Robustness Checks*

The panel-VAR allows us to utilize the time-series of the data and treat all the variables in the system as endogenous. However, it limits our ability to include additional control variables and a saturated set of fixed effects other than country-industry and time fixed effects that we already include in the panel-VAR. Consequently, to examine the robustness of our results, we estimate our models with different OLS specifications with the industry growth variables as the dependent variable. If the PE companies have a global investment function for investment, it would be important to control for country-level demand and supply shocks as well as industry-level global shocks across time. Hence, we include a rich set of fixed effects in our OLS specifications such as country, industry, and year fixed effects; country-by-industry and year fixed effects; country-by-year fixed effects; industry-by-year fixed effects; country-by-year and industry-by-year fixed effects. None of the fixed effects models change our results.

We also include a set of country-level control variables in our OLS specifications to allow for time-varying macro-economic and institutional factors that could be related to industry performance. Specifically, we control for GDP per capital growth, stock and credit market development, and country-level governance indicators such as rule of law, regulatory quality, shareholder rights and creditor rights together with country, industry, and time fixed effects.[32] Our results are very similar to our panel-VAR results. Additionally, when estimating OLS models we also include a measure of exogenous growth opportunities similar to Bekaert et al. (2007) to control for the PE fund expectations about the country-industry's prospects. Specifically, we utilize the world-wide price-earnings ratio for an industry which should capture growth options including expectations about the future for a specific industry in a country. The results stay the same when this measure is included in the specifications.

Because not all country-industries receive any PE capital in all years, the PE investment data has many values that are exactly zero. To determine if this truncation affects the statistical inference, we repeat our analysis with only the subset of non-zero observations. All of our results get stronger both economically and statistically with this subset. When industry measures and PE investments are aggregated to a broader 9-industry level, the results also stay the same. This provides further evidence against market timing since timing is more difficult at the more aggregated level (see, Gredil, 2019).

One of the shortcomings of the Burgiss data is lower coverage before 1995 (Brown et al., 2012), but all of the results are similar when years before 1995 are dropped from the sample. As the U.S. and the U.K. receive a large portion of PE capital invested, one might be concerned that the results in the paper are driven by these two countries only. We repeat all of the analysis excluding the U.S. and the U.K. and find that all the primary results are the same. Spillovers may take longer than a year or two to occur, so as noted already we repeat the analysis in the paper using VAR's with two- and three-year lags. The main results do not change and the strongest effect is indeed in the first year following the PE investment.[33] Overall, the main results of the paper seem to hold regardless of the estimation method, set of fixed effects, controls, or sample used.

[32] Results are the same when we include country*industry and time fixed effects instead.

[33] It should also be noted that a 1-year VAR will still have responses past 1 year by nature of how the systems are autoregressive, i.e. shocks will continue to propagate.

6 CONCLUSION

PE investments have risen dramatically during the last two decades, not only in developed countries but in developing economies as well. While research has explored how PE firms impact their portfolio companies, it is surprising that there is no evidence on the implications of PE for the global economy as a whole. The well-established spillover literature in economics provides evidence that productivity spillovers exist within industries. Our dataset on global PE investments in 19 industries across 52 countries allows us to study the impact of PE on industry dynamics. By focusing on aggregate industry measures of publicly listed companies, we are able to identify spillovers from PE-backed companies to the other companies within the same industry.

In our analysis of the real economic impact of PE investments, we find that employment growth, profitability growth, and labor productivity growth all increase across the public companies in an industry following PE investments. Additionally, we find that industry-level capital expenditures grow faster as well. Considering the endogenous nature of PE investment into a specific industry, we utilize a panel-VAR. While treating all the variables in the system as endogenous, the model also allows for fixed effects to control for individual heterogeneity at the country-industry level. Concerns about reverse causality are reduced as we do not find evidence that past values of industry dynamics are significantly related to the amount of PE capital a country-industry receives. The improvements in industry-level performance documented in this paper are consistent with an interpretation that the companies receiving PE capital become more efficient and put pressure on the other companies within the same industry, which leads to overall performance gains among the public companies within the industry. As such, while providing novel evidence on industry spillovers from PE onto industries, our findings are also consistent with the existing evidence on the positive impact of PE on firm-level performance.

The spillover effects we document are found to be concentrated in country-industries with higher levels of competition suggesting that competition is an important channel for these spillovers. We further find that the impacts on industry growth are more pronounced in the subsample of countries with stronger institutions and intellectual property rights suggesting that PE companies need a strong legal environment to be able to implement governance practices that lead to efficiency gains at portfolio companies. The positive effects are also concentrated in countries with moderate levels of innovative capacities. These results are largely consistent with the literature that examines spillovers from foreign direct investments onto local industries and finds that companies with moderate levels of technological advancement are better absorbers of productivity spillovers. Overall, the cross-sectional results further indicate a causal effect where PE investments lead to higher industry growth through spillovers.

The findings of the paper are important as they provide evidence on the impact of PE on industry dynamics, rather than individual companies, which is a largely unexplored area. The PE industry has been criticized for their impact on the companies in which they invest. This paper presents a more complete picture of the implications of PE for the global economy. Hopefully, future research will more clearly identify the specific channels which create spillovers from PE-backed companies to the broader set of firms in each industry.

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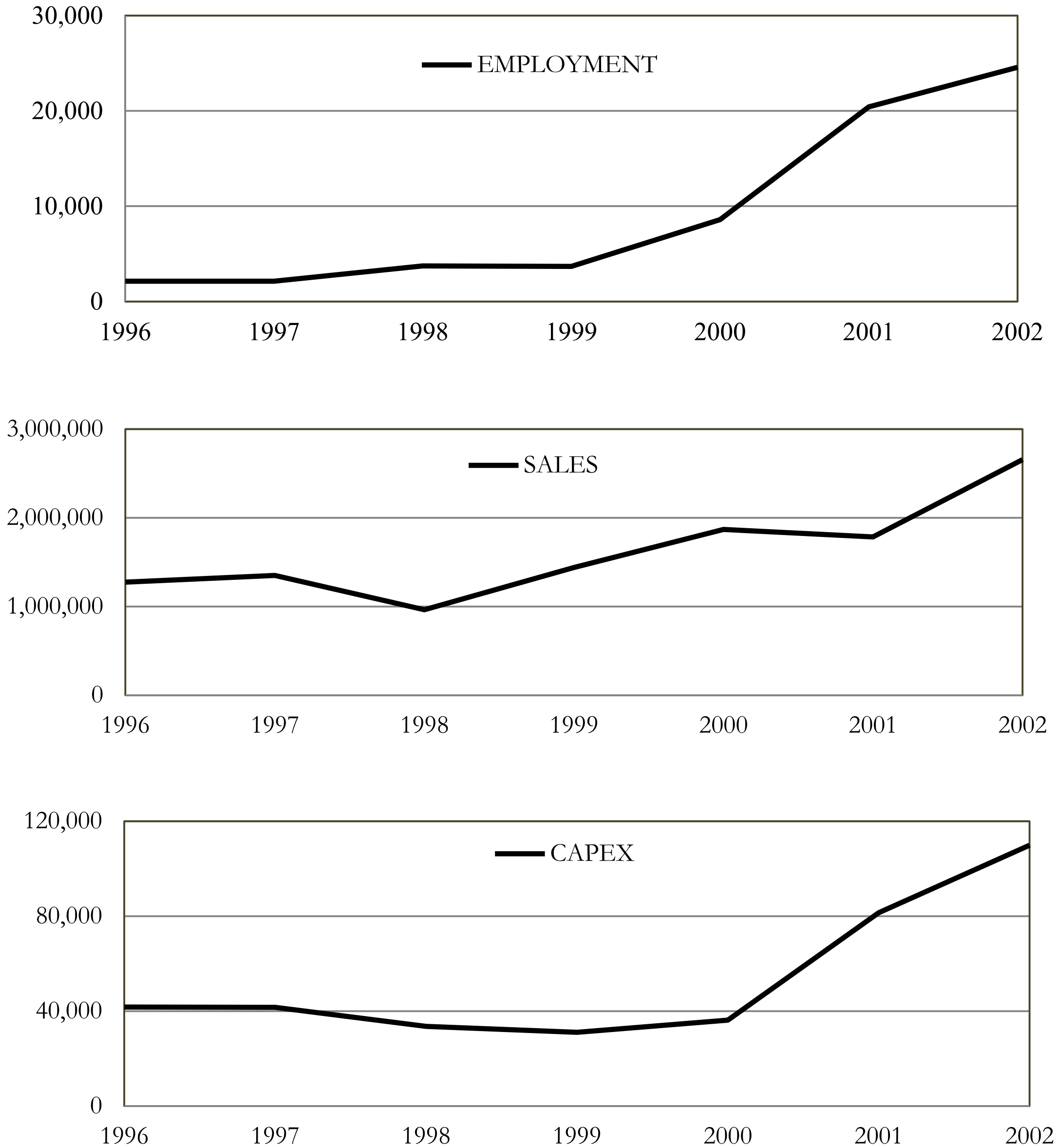
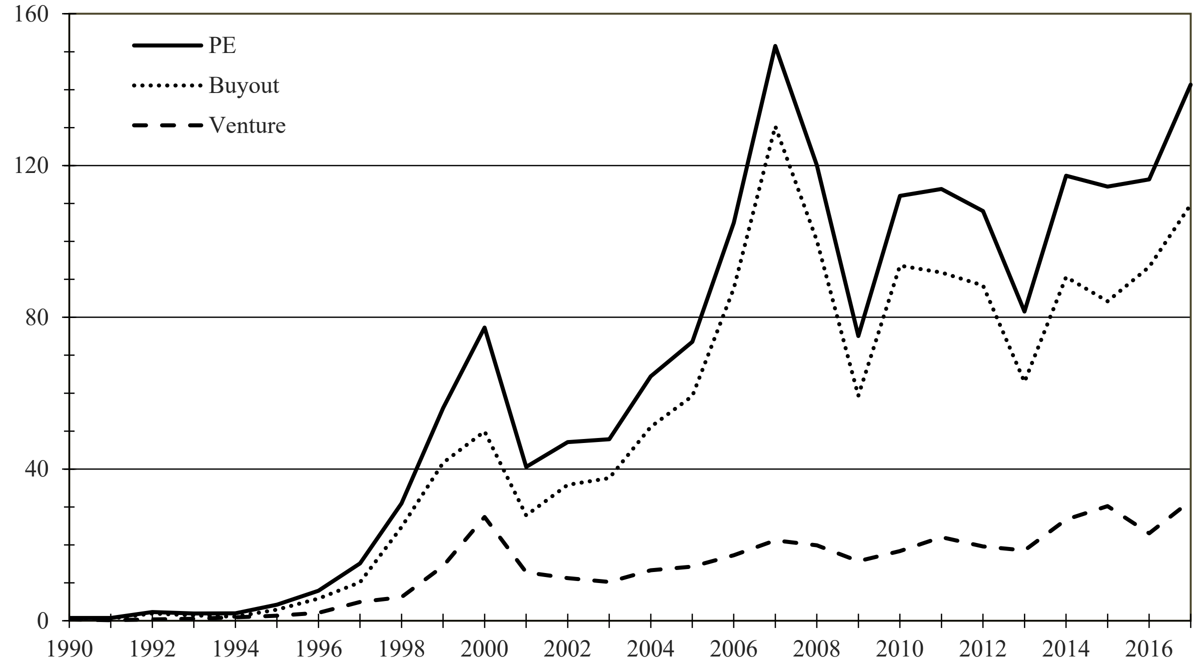
Figure 1: Thailand Food and Beverage Industry around 1999



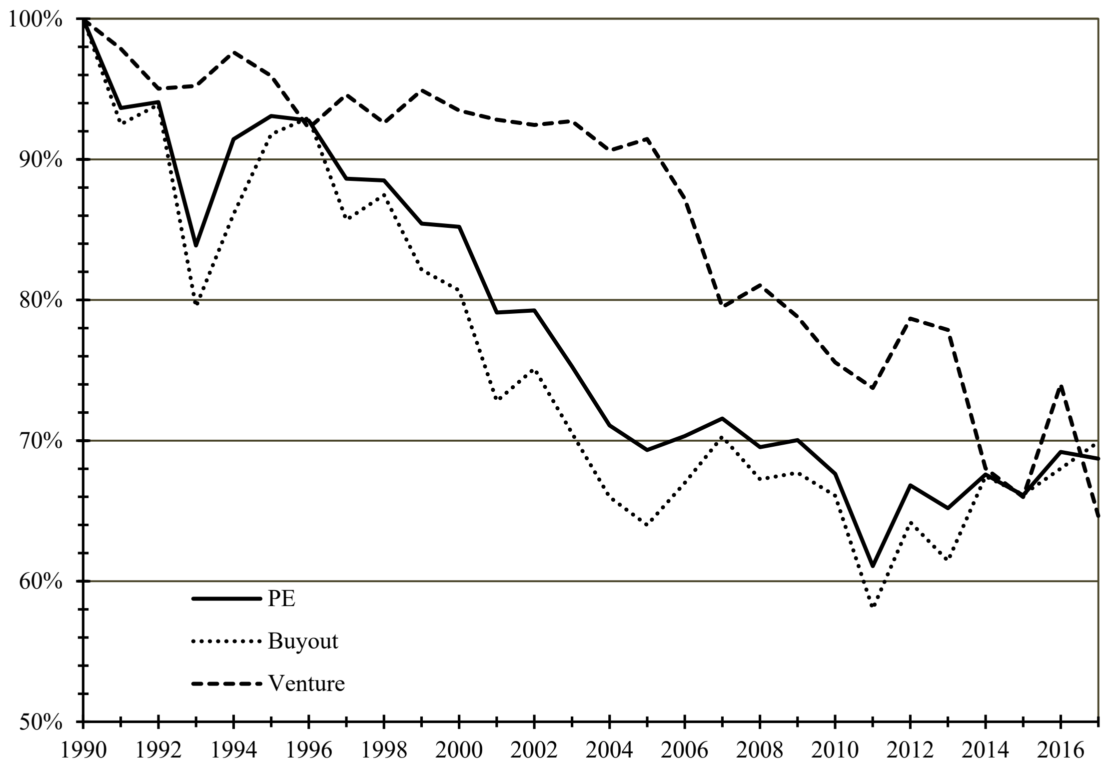
This figure plots industry employment, sales, and capex for the Thailand Food and Beverage Industry around 1999. The industry received $29 million PE capital in 1999. Employment is the total number of employees for all public companies in the industry. Sales is the total sales for all the public companies in the industry. Capex is the total capital expenditures for all public companies in the industry.

Figure 2: Time-series of Total PE Capital Invested Globally between 1990 and 2017



This figure plots the total amount of PE capital invested in 50 countries between 1990 and 2017. The solid line plots the total of buyout and venture capital. The dotted line plots buyout capital and the dashed line plots venture capital. Amounts are in 2017 billion dollars.

Figure 3: U.S. and U.K.'s Share of the Total PE Capital Invested Globally, 1990 – 2017



This figure plots the share across the U.S. and U.K. out of the total amount of global PE capital invested between 1990 and 2017. The solid line plots their share out of the total of buyout and venture capital invested. The dotted line plots their share out of buyout capital and the dashed line plots their share out of venture capital.

TABLE 1: PE Investments around the Globe

This table presents the distribution of PE capital invested among the 52 countries in the sample between 1990 and 2017. The first, second, and third columns show the total amount of PE capital, buyout capital, and venture capital, respectively. Panel A presents the countries ranked by the total amount of capital received and Panel B presents the countries ranked by the total amount of capital received as a percentage of GDP. Amounts in Panel A are in 2017 million dollars. Panel B reports averages of the ratios across years.

Panel A: Distribution of PE Capital Invested Globally

Country	PE Capital Invested	Buyout Capital Invested	Venture Capital Invested
United States	1,193,806	882,597	311,210
United Kingdom	146,686	138,401	8,285
China	72,005	32,698	39,307
Germany	61,084	57,582	3,502
France	46,771	44,498	2,273
Italy	32,383	32,049	334
Australia	28,160	27,251	908
India	26,777	15,194	11,583
Sweden	26,129	24,987	1,142
Canada	25,934	21,310	4,624
Netherlands	22,975	22,296	678
Spain	19,790	19,430	360
Brazil	16,254	15,090	1,164
Japan	15,111	14,499	612
South Korea	14,978	14,232	746
Norway	10,830	10,612	218
Denmark	10,428	9,961	467
Switzerland	9,797	8,567	1,229
Hong Kong	7,951	6,329	1,622
Poland	7,871	7,610	260
Belgium	7,588	7,352	236
Israel	6,899	3,318	3,580
Indonesia	5,915	4,677	1,239
Singapore	5,802	4,760	1,042
Finland	5,082	4,604	478
Argentina	4,488	4,181	307
Ireland	4,295	3,524	771
Turkey	4,112	3,987	125
Austria	3,432	3,180	252
Czech Republic	3,361	3,273	88
Luxembourg	3,233	3,089	145
South Africa	3,086	2,827	259
New Zealand	3,051	2,937	114
Russia	2,905	2,536	369
Mexico	1,953	1,866	87

Greece	1,534	1,534	0
United Arab Emirates	1,373	1,226	148
Malaysia	1,360	1,303	57
Hungary	1,291	1,275	16
Romania	1,105	1,052	53
Peru	1,064	1,048	17
Portugal	1,013	1,010	3
Thailand	1,011	944	67
Colombia	769	707	62
Nigeria	749	702	47
Chile	713	687	26
Egypt	659	642	18
Bulgaria	621	610	12
Slovenia	326	320	6
Philippines	315	237	78
Cyprus	286	277	9
Jordan	120	61	60

Panel B: PE Capital Received as a % of GDP

Country	**PE Capital Invested as a % of GDP**	**Buyout Capital Invested as a % of GDP**	**Venture Capital Invested as a % of GDP**
United States	0.233%	0.172%	0.062%
Luxembourg	0.232%	0.224%	0.008%
United Kingdom	0.168%	0.158%	0.009%
Sweden	0.159%	0.151%	0.007%
Denmark	0.103%	0.099%	0.005%
Israel	0.094%	0.044%	0.050%
Hong Kong	0.094%	0.075%	0.019%
Singapore	0.088%	0.072%	0.016%
Netherlands	0.088%	0.085%	0.003%
Norway	0.080%	0.078%	0.002%
Australia	0.075%	0.073%	0.003%
Ireland	0.066%	0.056%	0.010%
Finland	0.065%	0.059%	0.006%
New Zealand	0.064%	0.062%	0.002%
Canada	0.056%	0.046%	0.010%
France	0.056%	0.053%	0.003%
Switzerland	0.055%	0.049%	0.007%
Germany	0.055%	0.052%	0.003%
Poland	0.053%	0.050%	0.003%
Czech Republic	0.053%	0.051%	0.001%
Belgium	0.050%	0.049%	0.002%

Italy	0.049%	0.049%	0.000%
India	0.048%	0.028%	0.020%
Spain	0.045%	0.044%	0.001%
Cyprus	0.043%	0.042%	0.001%
Bulgaria	0.040%	0.040%	0.001%
Argentina	0.038%	0.036%	0.002%
South Korea	0.038%	0.036%	0.002%
Hungary	0.033%	0.032%	0.000%
South Africa	0.031%	0.029%	0.002%
Slovenia	0.030%	0.030%	0.001%
China	0.030%	0.015%	0.015%
Brazil	0.029%	0.028%	0.002%
Austria	0.028%	0.026%	0.002%
Indonesia	0.026%	0.020%	0.006%
Romania	0.025%	0.023%	0.002%
Greece	0.016%	0.016%	0.000%
Turkey	0.016%	0.015%	0.000%
Jordan	0.015%	0.006%	0.009%
Peru	0.015%	0.015%	0.000%
Malaysia	0.014%	0.013%	0.001%
Portugal	0.014%	0.014%	0.000%
United Arab Emirates	0.012%	0.011%	0.002%
Chile	0.012%	0.012%	0.000%
Thailand	0.011%	0.010%	0.001%
Egypt	0.011%	0.011%	0.000%
Japan	0.009%	0.008%	0.000%
Colombia	0.009%	0.008%	0.000%
Russia	0.007%	0.006%	0.001%
Philippines	0.006%	0.005%	0.002%
Mexico	0.006%	0.006%	0.000%
Nigeria	0.006%	0.005%	0.000%

TABLE 2: Industry Distribution of Total PE Capital Invested Globally, 1990 - 2017

This table presents the industry distribution of total PE capital invested globally between 1990 and 2017. Industry classifications are at Industry Classification Benchmark's super-sector level. Column 1 reports values for total PE, Column 2 for buyout and Column 3 for venture capital. Amounts are in 2017 billion dollars, and provide the total amount of capital invested into a specific industry over the sample period.

	1	2	3
Industry	**PE Capital Invested ($bn)**	**Buyout Capital Invested ($bn)**	**Venture Capital Invested ($bn)**
Technology	380.66	176.08	204.58
Industrial Goods & Services	281.14	260.41	20.74
Health Care	251.12	158.63	92.50
Retail	171.54	146.11	25.43
Media	119.15	110.20	8.95
Travel & Leisure	95.65	91.64	4.01
Personal & HH Goods	88.73	81.48	7.25
Financial Services	83.08	74.09	8.99
Oil & Gas	67.90	63.74	4.16
Telecommunications	63.33	51.85	11.49
Food & Beverage	57.68	54.78	2.90
Insurance	42.24	40.04	2.20
Construction & Materials	38.74	37.71	1.03
Chemicals	34.42	32.37	2.05
Automobiles & Parts	32.30	30.62	1.68
Real Estate	26.67	25.48	1.19
Utilities	21.89	20.40	1.50
Banks	18.98	18.53	0.45
Basic Resources	15.77	15.04	0.73

TABLE 3: Descriptive Statistics

This table presents summary statistics for the industry and country-level variables in Panel A and B, respectively. Variable definitions are in *Table A1*. PE, buyout, and venture capital invested are measured *as a percentage of industry sales*. PE, buyout, and venture capital invested with a plus provide summary statistics for the PE variables excluding the country-industry-years with no investment. Growth variables are measured as log differences. Industry growth variables are winsorized at the bottom and top 5% of the distribution. Summary statistics are in percentages.

Panel A: Industry-level

Variable	**N**	**Mean**	**Median**	**Std. Dev.**
PE Capital Invested	17,179	0.91	0.00	6.93
Buyout Capital Invested	17,179	0.67	0.00	5.41
Venture Capital Invested	17,179	0.23	0.00	3.52
PE Capital Invested^{+}	5,757	2.72	0.21	11.80
Buyout Capital Invested^{+}	5,007	2.30	0.21	9.84
Venture Capital Invested^{+}	2,740	1.47	0.04	8.71
Employment Growth	17,179	5.89	1.82	14.04
Profit Margin Growth	17,179	0.26	0.83	41.72
Productivity Growth	17,179	4.18	4.54	19.21
CAPEX Growth	16,682	9.10	7.48	44.96
Industry Returns	16,725	8.53	10.13	32.16
Debt Growth	13,036	10.63	5.97	40.98

Panel B: Country-level

Variable	**N**	**Mean**	**Median**	**Std. Dev.**
GDP Growth	1,686	2.10	2.19	3.55
Public Market	1,449	39.75	15.34	69.99
Credit Market	1,453	77.65	66.59	50.55

TABLE 4: Univariate Comparisons

This table shows that public companies in country-industries with more PE investments on average have higher growth. The table presents mean (median) comparisons. Columns 1 and 2 present means (medians), and Column 3 presents *p*-values for the difference in means (medians) using a *t*-test (Wilcoxon rank-sum test) in both Panels. Panel A compares means (medians) of country-industry-years with and without PE capital. Panel B compares means (medians) for country-industry-years with high versus low amounts of PE capital among the country-industry-years with non-zero PE investments. Employment growth is the log difference in industry-level employment for public firms between time t and t-1. Profit margin growth is the log difference in industry-level net profits over sales for public firms between time t and t-1. Productivity growth is the log difference in industry-level sales per employee for public firms between time t and t-1. CAPEX growth is the log difference in industry-level capital expenditures for public firms between time t and t-1. Industry returns is the log difference in the value of the industry stock return index between time t and t-1. Debt growth is the log difference in industry-level net debt for public firms between time t and t-1. Stocks traded to GDP is the total value of stocks traded in the country as a percentage of GDP. Private credit to GDP is the total credit in the country as a percentage of GDP.

Panel A: PE versus NON-PE Country-Industries-Years

	1	2	3
Variable	**PE**	**NON-PE**	**P-Value Mean (Median) Difference**
Employment Growth (%)	6.34 (3.02)	5.67 (1.11)	0.00 (0.00)
Profit Margin Growth (%)	0.31 (0.00)	-0.03 (0.00)	0.69 (0.85)
Productivity Growth (%)	3.37 (3.39)	4.58 (5.24)	0.00 (0.00)
CAPEX Growth (%)	8.63 (6.94)	9.34 (7.78)	0.33 (0.55)
Industry Returns (%)	8.21 (10.64)	8.69 (9.69)	0.36 (0.66)
Debt Growth (%)	10.55 (5.86)	10.67 (6.04)	0.88 (0.96)
GDP Growth (%)	1.94 (1.70)	2.06 (2.17)	0.01 (0.00)

Panel B: HIGH-PE versus LOW-PE Country-Industry-Years

	1	2	3
Variable	**HIGH PE**	**LOW PE**	**P-Value Mean (Median) Difference**
Employment Growth (%)	7.49 (3.72)	5.19 (2.40)	0.00 (0.00)
Profit Margin Growth (%)	1.19 (0.05)	-0.57 (0.00)	0.22 (0.15)
Productivity Growth (%)	3.32 (3.16)	3.43 (3.55)	0.82 (0.68)
CAPEX Growth (%)	10.12 (7.94)	7.14 (6.29)	0.00 (0.01)
Industry Returns (%)	9.30 (11.67)	7.14 (9.89)	0.01 (0.01)
Debt Growth (%)	12.24 (6.74)	9.05 (4.97)	0.01 (0.03)
GDP Growth (%)	2.16 (1.81)	1.70 (1.57)	0.00 (0.00)

TABLE 5: PE and the Real Economy

This table shows that following PE investments employment, profitability, and labor productivity increase for public companies in the same country and industry. The table presents the results from the panel-VAR estimation of equation 1 from Section 4, where the X vector consists of PE capital invested, industry-level employment growth, labor productivity growth, and profitability growth. The system is estimated with GMM. Employment growth is the log difference in industry-level employment for public firms between time t and t-1. Productivity growth is the log difference in industry-level sales per employee for public firms between time t and t-1. Profitability growth is the log difference in industry-level net profits over sales for public firms between time t and t-1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.3347***	0.0914**	0.1154**	0.4223***
	(0.0595)	(0.0428)	(0.0557)	(0.1556)
Employment Growth (t-1)	-0.0029	0.1414***	-0.0154	-0.1325
	(0.0024)	(0.0115)	(0.0136)	(0.1359)
Productivity Growth (t-1)	0.0012	0.0737***	-0.0718***	-0.0166
	(0.0016)	(0.0083)	(0.0113)	(0.0274)
Profitability Growth (t-1)	0.0002	0.0047**	0.0026	-0.2329***
	(0.0005)	(0.0021)	(0.0028)	(0.0101)
N Obs.	15,611			

TABLE 6: Buyout versus Venture Capital

This table shows that buyout investments lead to higher profitability and employment, while venture capital leads to higher productivity. The table repeats the estimation presented in Table 5, separately for buyout and venture capital, and results are presented in Panel A and B, respectively. Employment growth is the log difference in industry-level employment for public firms between time t and t-1. Productivity growth is the log difference in industry-level sales per employee for public firms between time t and t-1. Profitability growth is the log difference in industry-level net profits over sales for public firms between time t and t-1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Buyout

	Buyout Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
Buyout Capital Invested (t-1)	0.1999***	0.1021**	0.1019	0.3969***
	(0.0641)	(0.0492)	(0.1280)	(0.1465)
Employment Growth (t-1)	-0.0007	0.1415***	-0.0155	-0.1325
	(0.0020)	(0.0115)	(0.0136)	(0.1360)
Productivity Growth (t-1)	-0.0018	0.0737***	-0.0718***	-0.0167
	(0.0014)	(0.0082)	(0.0113)	(0.0275)
Profitability Growth (t-1)	-0.0001	0.0047**	0.0026	-0.2329***
	(0.0004)	(0.0021)	(0.0028)	(0.0101)
N Obs.	15,611			

Panel B: Venture Capital

	Venture Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
Venture Capital Invested (t-1)	0.5407***	0.1064	0.6301***	0.5226
	(0.0788)	(0.1045)	(0.1597)	(0.4454)
Employment Growth (t-1)	0.0015	0.1411***	-0.0149	-0.1311
	(0.0011)	(0.0115)	(0.0136)	(0.1358)
Productivity Growth(t-1)	0.0011	0.0734***	-0.0713***	-0.0155
	(0.0008)	(0.0083)	(0.0113)	(0.0273)
Profitability Growth (t-1)	0.0000	0.0047**	0.0026	-0.2331***
	(0.0002)	(0.0021)	(0.0028)	(0.0101)
N Obs.	15,611			

Table 7: PE and Investment

This table shows that capital expenditures of public firms increase following PE investments into the industry. The table presents the results of the four-variable panel-VAR estimation with GMM as in equation 1, where the X vector consists of PE capital invested, industry-level cash flow growth, capital expenditures growth, and market-to-book growth, similar to Love and Zicchino (2006). Cash flow growth is the log difference in industry-level free cash flows for public firms between time t and t-1. Capex growth is the log difference in industry-level capital expenditures for public firms between time t and t-1. Market-to-book growth is log difference in the price-to-book index of an industry between time t and t-1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

	PE Capital Invested	Cash Flow Growth	Capex Growth	Market-to-book Growth
PE Capital Invested (t-1)	0.3567***	0.5101	0.5083***	0.0032
	(0.0615)	(0.3957)	(0.1729)	(0.0512)
Cash Flow Growth (t-1)	0.0003	-0.3062***	0.0017	0.0026
	(0.0004)	(0.0128)	(0.0005)	(0.0019)
Capex Growth (t-1)	-0.0014	0.0747	-0.0005***	-0.0062
	(0.0011)	(0.0794)	(0.0119)	(0.0038)
Market-to-book Growth (t-1)	-0.0001	0.0579	0.1731***	-0.0659***
	(0.0023)	(0.0477)	(0.0267)	(0.0115)
N Obs.	12,310			

Table 8: Industry Spillovers from PE and Industry Competitiveness

This table shows that the positive effects reported in Table 5 are concentrated in more competitive country-industries. The table repeats the analysis presented in Table 5 for subsamples of country-industries created based on the level of competition. Panel A vs. B and C vs. D present the results for the subsamples of country-industries with low versus high levels of competition, measured by the industry-level gross margins and asset turnover ratios, respectively. Low (high) competition country-industries have gross margins above (below) the median of the sample distribution. Low (high) competition country-industries have asset turnover ratios below (above) the median of the sample distribution. The coefficients for the PE variable are presented only, but the estimation is identical to the panel-VAR in Table 5. Variable definitions are in Table A1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lag of the row variable. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Low Competition – High Margin

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.3866***	-0.0816	0.1284	-0.0569
	(0.1037)	(0.0888)	(0.1035)	(0.3465)
N Obs.	7,973			

Panel B: High Competition – Low Margin

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.3072***	0.1972**	0.2089***	0.6763***
	(0.0987)	(0.0751)	(0.0623)	(0.2115)
N Obs.	7,638			

Panel C: Low Competition – Low Asset Turnover

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.2467***	-0.0523	0.1203	0.1866
	(0.0726)	(0.0549)	(0.1726)	(0.2448)
N Obs.	7,827			

Panel D: High Competition – High Asset Turnover

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.4548***	0.1466**	0.2115***	0.7457**
	(0.1453)	(0.0659)	(0.0819)	(0.3253)
N Obs.	7,784			

Table 9: Industry Spillovers from PE and Legal Strength

This table shows that the positive effects reported in Table 5 are concentrated in countries with a stronger legal environment. The table repeats the analysis presented in Table 5 for subsamples of countries created based on the level of legal strength. Panel A and B present the results for the subsamples of countries with weak versus strong legal institutions, respectively. Panel C and D present the results for the subsamples of countries with weak versus strong intellectual property rights, respectively. The coefficients for the PE variable are presented only, but the estimation is identical to the panel-VAR in Table 5. Variable definitions are in Table A1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Low Institutional Quality

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.2899***	0.0283	0.0636	0.2610
	(0.0858)	(0.0713)	(0.0915)	(0.3496)
N Obs.	7,584			

Panel B: High Institutional Quality

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.3673***	0.1803***	0.1519**	0.4574**
	(0.1135)	(0.0515)	(0.0661)	(0.1985)
N Obs.	8,027			

Panel C: Weak Intellectual Property Rights

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.2901***	0.0288	0.0606	0.2581
	(0.0858)	(0.0713)	(0.0916)	(0.2622)
N Obs.	7,369			

Panel D: Strong Intellectual Property Rights

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.3672***	0.1806***	0.1841**	0.4565**
	(0.1135)	(0.0515)	(0.0660)	(0.1987)
N Obs.	8,242			

Table 10: Industry Spillovers from PE and Innovative Capacity

This table shows that the positive effects reported in Table 5 are concentrated in countries with moderate levels of innovative capacities. The table repeats the analysis presented in Table 5 for three subsamples of countries created based on a measure of innovative capacity. Panel A, B, and C present the results for the subsamples of countries with lowest, highest, and moderate levels of innovative capacities. The subsample of countries with the lowest (highest) innovative capacities includes the countries in the bottom (top) 25th percentile. The subsample of countries with moderate innovative capacities includes the countries that are in between the 25th and 75th percentile of the distribution. The coefficients for the PE variable are presented only, but the estimation is identical to the panel-VAR in Table 5. Variable definitions are in Table A1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Lowest Innovative Capacity

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.0377	-0.0211	0.1412	0.0988
	(0.0413)	(0.1121)	(0.1568)	(0.2940)
N Obs.	3,930			

Panel B: Highest Innovative Capacity

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.2151	0.0156	0.0861	0.2913
	(0.1382)	(0.0217)	(0.0676)	(0.4760)
N Obs.	4,113			

Panel C: Moderate Innovative Capacity

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.4315***	0.1430***	0.2274**	0.4391**
	(0.0632)	(0.0511)	(0.1104)	(0.1757)
N Obs.	8,307			

Table 11: PE and the Financial Economy

Panel A of this table shows that buyout investments lead to higher debt growth and lower stock returns among the public companies in the same country and industry. Panel B of this table shows that venture capital investments are not significantly related to debt growth or stock returns among the public companies in the same country and industry. The table presents the results from the panel-VAR estimation of equation 1 from Section 4, separately for buyout and venture capital, where the X vector consists of PE capital invested, industry-level debt growth, and industry returns. The system is estimated with GMM. Panel A and B present the results for buyout and venture capital, respectively. Industry returns is the log difference in the value of the industry stock return index between time t and t-1. Debt growth is the log difference in industry-level net debt for public firms between time t and t-1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Buyout

	Buyout Capital Invested	Debt Growth	Industry Returns
Buyout Capital Invested (t-1)	0.0798**	-0.2476	0.0185
	(0.0308)	(0.2789)	(0.1602)
Debt Growth (t-1)	0.0001	-0.0012	-0.0200***
	(0.0006)	(0.0126)	(0.0064)
Industry Returns (t-1)	0.0005	-0.0255	0.0379***
	(0.0008)	(0.0169)	(0.0135)
N Obs.	10,689		

Panel B: Venture Capital

	Venture Capital Invested	Debt Growth	Industry Returns
Venture Capital Invested (t-1)	0.7409***	-0.4869	-0.6673
	(0.2661)	(1.0080)	(0.5378)
Debt Growth (t-1)	-0.0001	-0.0014	-0.0199***
	(0.0001)	(0.0126)	(0.0064)
Industry Returns (t-1)	-0.0001	-0.0252	0.0382***
	(0.0003)	(0.0169)	(0.0135)
N Obs.	10,691		

APPENDIX

Table A1: Data Sources and Variable Definitions

This table provides descriptions of data sources and variable definitions used in the paper. Panel A defines the data sources, and Panel B presents the variable definitions with the data source for the variable in parenthesis.

Panel A: Data Sources	
Burgiss	The Burgiss Group is a software company that provides data record keeping and performance analysis services to the largest institutional investors in the PE universe. Burgiss data is aggregated at the industry-level using actual fund investments into portfolio companies.
DataStream	DataStream's Global Equity Indices provide industry indices aggregated from financial statements of publicly listed companies across 53 countries and 170 sectors worldwide.
World Development Indicators (WDI)	The development indicators are from World Bank's primary database. It presents the most current and accurate global development data available, and includes national, regional and global estimates.
World Economic Forum's Global Competitiveness Index (GCI)	GCI assesses the competitiveness landscape of 144 economies, providing insight into the drivers of their productivity and prosperity. It provides different indices on a country's legal environment, as well as financial and technological development.
Panel B: Variable Definitions	
PE Capital Invested	$ Amount of PE capital invested, normalized by industry sales, and logged. (BURGISS)
Buyout Capital Invested	$ Amount of buyout capital invested, normalized by industry sales, and logged. (BURGISS)
Venture Capital Invested	$ Amount of venture capital invested, normalized by industry sales, and logged. (BURGISS)
Employment Growth	Log difference in industry employment between time t and t-1. (DATASTREAM)
Profitability Growth	Log difference in industry profit margins, net profit over sales, between time t and t-1. (DATASTREAM)
Labor Productivity Growth	Log difference in industry sales per employee between time t and t-1. (DATASTREAM)
CAPEX Growth	Log difference in industry capital expenditures between time t and t-1. Capital expenditures include, but are not limited to, additions to property, plant and equipment as well as investments in machinery and equipment.
Cash Flow Growth	Log difference in industry free cash flow between time t and t-1. Free cash flow is the sum of funds from operations, funds from/used for other operating activities and extraordinary items.
Industry Returns	Log difference in the value of the industry return index retrieved from DataStream Global Equity Indices between time t and t-1. (DATASTREAM)
Debt Growth	Log difference in industry debt, total debt net of cash and cash equivalents, between time t and t-1. (DATASTREAM)
Market-to-book Growth	Log difference in the price-to-book index of an industry between time t and t-1. (DATASTREAM)
Stocks Traded to GDP	Total value of stocks traded over GDP. (WDI)
Private Credit to GDP	Total amount of private credit over GDP. (WDI)
Institutional Quality Score	Measures the institutional quality of a country. It is a combination of scores on legal institutions, property rights, investor protection as well as judicial efficiency. (GCI)
Intellectual Property Rights	Measures the strength of intellectual property protection in a country. (GCI)
Innovative Capacity	Measures a country's capacity to innovate and adapt to new technologies. (GCI)

The Buyout of Hertz Corporation

The buyout of the car rental company Hertz Corporation in 2005 was one of the biggest buyout transactions in history. The company was acquired for $14 billion by a PE consortium consisting of the Carlyle group, Merrill Lynch's private investments arm, and Clayton Dubilier & Rice. After the buyout, significant changes were made at the company to cut costs and improve operational efficiency. For example, before the buyout a returned car was being cleaned and refueled at different work stations. The new management realized this created unnecessary idle time. To increase efficiency, cleaning stations were moved to where the cars were refueled resulting in a large increase in the number of cars that could be processed every hour. In addition to operational changes, the PE group also changed the governance structure of the company and more closely monitored management.[34]

During the period after the buyout, the two biggest competitors of Hertz, Avis-Budget and Dollar-Thrifty, also experienced significant efficiency gains. For example, in 2006 Avis-Budget introduced a process improvement initiative called "Performance Excellence", designed to make the vehicle rental process easier, cut costs, and enhance the customer rental experience. Similarly, Dollar-Thrifty announced the implementation of several cost-saving initiatives, including some information technology outsourcing and new investment into existing IT systems to increase efficiency. Given the timing of these changes, it is plausible that they were made in response to the competitive pressure from Hertz. During the 2006 to 2007 period, at Avis-Budget and Dollar-Thrifty profit margins increased by 10% and 7%, while labor productivity, measured by sales per employee, also increased by 5% and 6%, respectively. This specific example suggests that practices and technologies causing efficiency gains at a PE-backed company might quickly spill over onto other companies within the same industry.

[34] The New York Times article "Is Private Equity Giving Hertz a Boost?" published on September 23, 2007 discusses the Hertz buyout and talks about the operational changes at Hertz following the buyout.