Debt and Leverage in Private Equity: A Survey of Existing Results and New Findings*

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Abstract

This paper examines leverage and debt financing in the private equity buyout market. We provide an overview of how debt is utilized in buyout investment structures and a review of existing theoretical and empirical academic literature. The analysis also includes results from new data sources with information on deal structure and performance since the global financial crisis (GFC). We document that leverage ratios (Net Debt / EBITDA) have increased substantially in recent years and the increase is even more pronounced after unwinding EBITDA "adjustments" which have become increasingly large. Despite the increase in leverage ratios post-GFC, debt as a percentage of total enterprise value (D/V) declined in the 2010s relative to prior decades. These opposing trends are indicative of buyout deals with higher valuations and more focused on growth (which we also document). Related to this, a main conclusion of our analysis is that leverage ratios and D/V measure different aspects of capital structure. In addition, there is a risk-return trade-off related to debt evident in the data. Specifically, deals with high D/V ratios tend to have above average returns and also higher risk.

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1 Introduction

Private equity buyout transactions depend on debt financing. In fact, the practitioner and academic research literature generally refers to buyouts as levered buyouts, or LBOs, precisely because of the importance of debt in such transactions. However, few large-scale empirical studies examine how leverage affects risk, return, incentives and other basic characteristics of buyout transactions. This compares to thousands of empirical papers over more than half a century that have focused on the capital structure of public companies. The relative dearth of research on private equity capital structure is primarily due to the lack of widely available financial data on buyout deals, and so most past studies have relied on comparably small proprietary datasets or special transactions with more transparency (e.g., public-to-private buyouts).

With this in mind, the goal of this white paper is to provide an overview of institutional detail on debt in buyout transactions, summarize existing literature on PE capital structure, and provide some current insights with newly available data sources. The project is a collaboration between the *Private Equity Research Consortium* (PERC) which is an assemblage of academics and practitioners dedicated to advancing research on private equity and the *Research Advisory Council* of the Institute for Private Capital (the parent organization of PERC) which is an advisory board comprised of industry leaders in private market investing. This paper seeks to understand the current state of knowledge from both a theoretical and empirical perspective to assist academics, practitioners, and policymakers.[1] Many people have been involved with the effort beyond just the IPC and PERC advisory board members, and we are appreciative of all who have contributed.

While leverage has always been central to private equity, the growth of private markets, and the recent economic shock from the COVID-19 pandemic, have added relevance and urgency to understanding how debt affects investors and companies. We deliberately take a broad view of the various ways in which debt financing can impact the various stakeholders of buyout deals. The paper is organized as follows: Section 2 provides a definitional overview of the many ways debt can enter into the financing of a buyout transaction (e.g., at the company, fund, and investor levels). Section 3 provides a very brief overview of capital structure theory. Section 4 is the most important section and uses the existing literature and new data analysis to address several specific questions of importance to both practitioners and policymakers. These questions cover fundamental issues like what drives the cyclical nature of private equity, what is the relation between leverage and deal returns, and how does leverage affect the LP-GP agency relationship? Section 5 concludes and also identifies several areas for future research.

Before turning to the detailed analysis, we provide a summary of key take-aways:

- Debt can enter into the private equity buyout ecosystem in a variety of ways. First, and foremost is at the individual company targeted in the buyout (which we will also refer to

[1] We plan to update this work periodically and encourage readers to send us any studies we have omitted.

as the *transaction* or *deal*). There are a variety of complex structures for deal-level debt, but in almost all cases limited liability is preserved at the company level. Increasingly, funds are borrowing by using limited partner (LP) fund commitments as collateral. In addition, private equity general partners (GPs) and LPs may utilize debt independent of the fund or deal.

- Leverage decisions made as part of private equity buyout deals depend on the characteristics of those deals. In particular, financial theory predicts that the deal partners (typically employed by the GP) will trade-off the benefits of debt with the costs of debt. Potential benefits include higher equity returns, a greater debt tax shield, and more aligned management incentives. Potential costs include increased financial risk (including the risk of bankruptcy) as well as other operating and financial frictions. In practice, it is hard to determine empirically if buyout transactions are done with an optimal capital structure (on average).
- Previous research provides explanations for the highly cyclical nature of private equity activity and suggests that institutional features combined with macroeconomic cycles are to some degree hardwired into the industry. Whether this persists in times of unconventional monetary policy remains uncertain.
- There are two distinct facets of leverage that must be examined separately to fully understand how debt enters into the risk and return of individual deals:
    - First is the ratio of net debt (D) to total enterprise value which we denote as the **D/V ratio**. High D/V deals tend to be larger, established companies with low growth rates that can provide predictable cash flows to service debt. Entry EBITDA multiples are low and the companies pay down more debt than average. These deals perform significantly better than low D/V deals but also have higher risk.
    - Second is the **leverage ratio** which is defined as net debt divided by EBITDA. In contrast to high D/V transactions, deals with high leverage ratios tend to be for companies with faster growing earnings and higher operating margins. High leverage ratios are associated with above average entry EBITDA multiples and somewhat lower returns. They do not appear to be riskier than low leverage ratio deals. Deals with high leverage have become increasingly common after the global financial crisis (post-GFC).
- Characteristics of deals vary across industry sectors and years, but likely less than most people believe. There is a wide range of characteristics and outcomes in almost all years and sectors. This suggests deal specifics are more important than indicated by prior research.

2 Overview of Private Equity and the Use of Debt

Private equity 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 whom have certain rights and responsibilities as governed by their partnership agreement. The limited partners are institutional and high-net-worth individual investors who provide the majority of the capital to the partnership. The general partner manages the capital, deciding when the capital is called, what it is used for, how it is used, and when it is returned to investors subject to provisions in the partnership agreement. The general partners typically charge a management fee on the committed / invested capital and earn a share of the profits, known as the carry (or promote), often only after a preferred return (or hurdle rate) is realized by the limited partners. The limited partner liability risk is limited to the capital they contribute. The general partner role is typically managed by professional private equity fund managers. These managers protect themselves from liability, at least partially, by not serving directly as the general partners, but rather as shareholders of a corporation (firm) that serves as the general partner.[2]

As the private equity industry has evolved over the last half century, so too has the use of debt. Since the earliest days of leveraged buyouts, private equity managers have used debt financing, multiple arbitrage and operational improvements, as the primary drivers of value creation. Private equity's cost of equity capital is higher than traditional corporations because the general partners compensation also comes out of the returns.[3] As a result, private equity GPs attempt to utilize leverage to optimize their blended cost of capital in order to better compete for assets and more efficiently finance their operations.[4] Typical uses of debt proceeds by private equity-backed companies are similar to other borrowers and include i) funding merger and acquisition related transactions, ii) refinancing existing indebtedness, iii) backing the recapitalization of a company's balance sheet, and iv) funding general corporate purposes. Traditional private equity financings have most frequently included issuances in both the syndicated bond and bank markets. However, as financing alternatives evolve, private equity remains at the vanguard pursuing investment opportunities where traditional sources of capital may have at one time been too cost prohibitive.

In the 1970's and 1980's, private equity-backed companies were some of the earliest and most frequent issuers of high yield bonds to fund their takeover efforts. High yield bonds are debt securities issued by corporations with non-investment grade ratings. Non-investment grade ratings (determined by rating agencies) suggest a higher chance of issuer default. High-yield bonds offer higher interest rates and sometimes investor-friendly structural features to compensate the bondholder for the incremental risk. Until the 1980's, traded high yield bonds were simply the outstanding bonds of "fallen angels", previously investment grade companies that experienced credit rating downgrades as a result of weak performance. Investment banks

[2] See Lerner, Leamon, and Hardymon (2012).

[3] Anecdotal evidence suggests that while the gross internal rate of return private equity managers typically underwrite to varies depending on 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.

[4] The next section reviews the theoretical literature which can justify this approach.

launched the modern high yield market in the 1980's 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, high yield bonds typically take the role of junior debt capital, subordinate to senior secured loan debt but senior to the private equity fund's equity investment, in a private equity-backed capital structure. High yield bond investors include mutual funds, pension funds, insurance companies and arrangers of instruments that pool debt securities (Collateralized Debt Obligations, or CDO's). High yield bonds offer investors the potential for diversification, enhanced current income, capital appreciation and duration. The size of the global high yield corporate bond market was in excess of $2.8 trillion as of December 2019 with U.S. high yield, excluding financials, making up $2.5 trillion.[5]

With the advent of market flex language in the syndicated loan market during the Russian debt crisis of the late 1990's, loan syndications emerged as a full-fledged capital markets alternative for private equity financings.[6] Leveraged loans are loans with non-investment grade ratings. These loans are typically senior secured debt instruments, either first or second lien, provide floating rate coupons, that may or may not have covenant provisions and usually have shorter duration than bonds. The syndicated leveraged loan market developed as an offshoot to the investment grade loan market and is an efficient way for borrowers to access banks and other institutional capital providers of loans in a less expensive and more efficient format than traditional bilateral credit lines. As a result, private equity-backed companies frequently borrower in the leveraged loan market to fund their portfolio companies. Levered loan investors include banks, finance companies, institutional investors (typically via structured vehicles such as collateralized loan obligations, or CLOs), loan mutual funds and ETFs. The Bank of England estimates the global leveraged loan market is more than $2 trillion, a rise of more than 100% since 2007. U.S. leveraged loans outstanding as of December 2019 total more than $1.2 trillion, with the remainder mostly denominated in Euros.[7]

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 de-lever along with higher capital reserve requirements and increased regulation forcing many banks to curtail traditional bank 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 a historically low interest rate environment, institutional investors have increased allocations to private credit.[8] Private credit assets under management (AUM) exceeded $767 billion in 2018, more than three times the amount in 2008. Much of the expansion can be attributed to supply-side growth driven by PE-backed borrowers. While typically more expensive than a bank or

[5] U.S. Corporate Debt Market: The State Of Play In 2019, S&P Global Market Intelligence.
[6] Leveraged Commentary & Data (LCD): Leveraged Loan Primer, S&P Market Intelligence.
[7] U.S. Corporate Debt Market: The State Of Play In 2019, S&P Global Market Intelligence.
[8] Performance of Private Credit Funds: A First Look. Munday, Hu, True and Zhang.

syndicated loan alternative, private credit capital has certain advantages over traditional market alternatives. These include i) quick and efficient access for middle-market companies where banks are lending less ii) fewer counterparties, iii) less regulation and potentially higher leverage levels, iv) tendency for lenders to hold the loans until maturity and v) less public visibility, among others. Despite the emergence and significant growth of private credit in the post-financial crisis decade, the syndicated bank and bond market continue to be the largest component of private equity debt financing, particularly for the biggest, most complex and / or multi-national financings where the size, liquidity and sophistication of the syndicated markets relative to other alternatives persists.

As the depth and breadth of credit markets expand with investor appetite, innovations follow. The emergence of holding company debt in the early 2000's was one such innovation. Holding company (HoldCo) debt, issued above the operating company (OpCo) level, is junior in right 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. HoldCo debt provides a mechanism for incremental debt in a transaction beyond that which is accessible at the OpCo. From the "bottom-up" perspective of OpCo creditors, HoldCo debt behaves essentially like equity and has minimal impact on the cash flow and credit worthiness 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. From the "top-down" perspective of private equity, HoldCo debt behaves very similarly to OpCo debt—it can reduce the size of the equity investment while increasing the risk of the residual equity. While more expensive and riskier than OpCo debt, it is cheaper than equity capital. Not all market conditions support HoldCo debt financings; it is an issuance phenomena that manifests when investor risk appetites are high and credit markets are frothy.

Securitized markets have also developed over the last two decades spurring further innovation and access to capital for private equity.[9] Securitized debt is a form of financing commonly used by companies to raise debt proceeds from illiquid assets on their balance sheet. Securitized financing requires the creation of a special purpose vehicle (SPV), effectively a trust, separated from the operating company. The SPV provides legal isolation of the assets from the original holder of the assets, the operating company. The holder of the assets conveys the assets to the SPV. 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 receipt of 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

[9] See Shivdasani and Wang (2011).

originator to be turned into cash. Although securitized financings are commonplace for financial institutions (used to finance mortgages or credit card receivables), this form of financing was first used by private equity to finance the buyout of Hertz in 2005 by The Carlyle Group. In the case of buyout transactions, the private equity backer is able to raise more debt at cheaper 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.[10] Whole business securitization structures have also been utilized as well in the case of franchise business to finance private-equity backed acquisitions.[11]

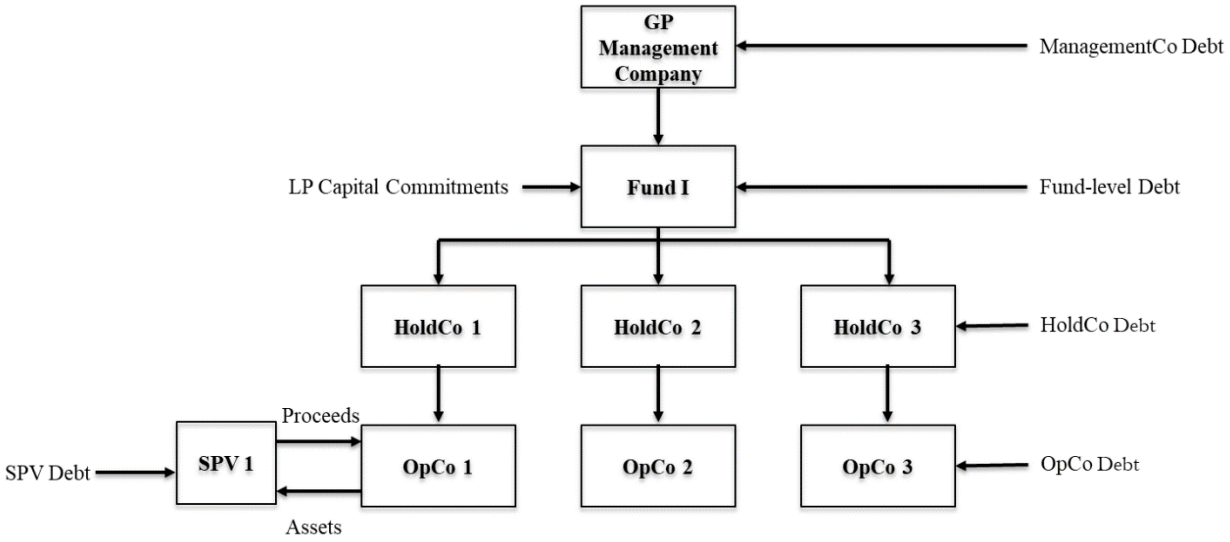
More recently the advent of fund-level debt has been adopted by private equity. Fund level debt is debt issuance at the fund level, above the individual company level. Lenders to the fund can either look to the unfunded capital commitments of limited partners or to the underlying equity collateral invested in companies across the fund's portfolio for collateral. In the case of unfunded capital commitment, lenders underwrite the limited partner credit risk, which in many cases is considered investment grade. In the case of fund level loans with pledges of collateral from unfunded commitments, the risk of illiquid equity investments in private companies is often considered non-investment grade and 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 limited partner returns. Business Development Companies (BDCs) have for many years benefited from access to SBIC-guaranteed debt at the fund-level. Other private credit funds have access to loans at the fund level, oftentimes in the form of subscription lines (i.e., capital call facilities). Private equity managers can use 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 re-borrowed. Some private equity fund managers use fund level leverage to act as incremental leverage to limited partners, thereby increasing internal rates of return at the expense of a reduction in multiples of invested capital. While the effects of fund level leverage are straight forward to understand when fully disclosed, some ambiguity exists in reporting standards as result of the less than consistent disclosure of fund level returns on both a before- and after- fund level leverage effects basis.[12]

More recently, general partner management companies 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. Lenders and creditors will 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 fund 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

[10] For example, the Toys R Us LBO of 2006.
[11] For example, the Dunkin' Donuts LBO, 2007.
[12] See Albertus and Denes (2020).

by the management companies as well. ManagementCo debt effectively acts like any other corporate debt of a financial services company.

Figure 1. Overview of Debt in Private Equity



We provide here a summary of debt's structural variations and use by private equity:

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 LP's and GP's 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 form 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.

3 Capital Structure Theory: A Very Brief Review

Perhaps the most basic question about leverage in private equity revolves around "Why is private equity different?" More precisely, it is widely observed that companies involved in PE buyouts have substantially higher leverage than similar public companies, so what drives this difference? If the optimal (i.e., value-maximizing) capital structure is indeed a higher level of debt, why don't public companies have higher debt levels? Or alternatively, if public company capital structure is on average optimal, then are private equity deals excessively risky? To provide a framework for answering these and other related questions, we start with an overview of capital structure theory from the traditional literature focused on public companies. This serves as a basis for understanding what may be relevant differences for private companies and, in particular, the private equity buyout transactions that we focus on subsequently. We then turn to a very brief overview of capital structure theory related specifically to private equity.

3.1 Classic capital structure theory

In the classic trade-off theory of capital structure, firms 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 benefits of higher debt are just off-set by the marginal expected costs of greater frictions.[13] The trade-off theory predicts that the optimal capital structure decision should be the same for private and public companies with similar firm characteristics and financial conditions. Consequently, the trade-off theory can only explain changes in optimal capital structure to the extent that the difference in ownership structure (i.e., PE or not) affect the tax shield or financial frictions associated with debt.

While higher debt levels result in a greater tax shield, PE-backed companies face largely the same tax policies as public companies, and large public companies often have more sophisticated tax avoidance opportunities (e.g., through global operations) that may be unavailable to smaller private companies. If anything, this suggests tax policy promotes the acquisition of small and mid-sized firms by larger public firms. In short, tax policy is likely to be important for determining optimal capital structure, but unlikely to explain why PE buyouts have more debt. This implies that if trade-off theory is to explain why buyout deals have high leverage, there

[13] Modigliani and Miller (1963); see Myers (2001) for a detailed discussion.

must be differences in other frictions related to debt. As discussed subsequently, there are various mechanisms that may lower the expected costs of financial distress for private-equity owned firms.

Related to the static trade-off theory is the so-called "pecking order" theory that predicts firms will choose internal capital over external capital, and then debt over equity because of information asymmetries between managers and the market. In particular, outside investors worry about a lemons problem and so price-protect themselves. Because the lemons problem is greater for equityholders than lenders, issuing equity is the least desirable way to raise capital. The pecking order theory suggests that while firms may temporarily stray from the optimal target leverage, in the long run, firms will make capital structure decisions according to the trade-off theory.[14]

Other research suggests more complicated factors determine optimal capital structure. In seminal work, Jensen and Meckling (1976) provide the theoretical basis for capital structure affecting the agency relationship between owners and managers. In fact, information asymmetry and the resulting agency issues between managers and owners is a fundamental difference between private and public ownership. Because buyout investors typically take a controlling interest in a company, they fully control the board and have unfettered authority to hire and fire management (which they often do). This effectively eliminates the agency conflict between managers and owners. However, the structure of PE funds generates a new agency relationship between GPs and LPs. These insights are the foundation for capital structure theory related directly to private equity buyouts.

3.2 Capital structure in private equity

Jensen (1986) makes the case that portfolio company leverage can mitigate the managerial agency problems and posits that private equity firms are more likely to reduce agency conflicts by using leverage. Jensen (1989) goes further and proposes private equity as a superior form of corporate ownership because of the incentive alignment between owners and managers including the benefits of additional leverage.[15] The crux of Jensen's argument is that debt serves as a control mechanism to focus the efforts of managers and owners on generating firm value. The discipline of having to service debt payments ensures that decisions maximize free cash flow which in turn maximizes firm value. While this model is appropriate for mature companies with stable lines of business, it is less appropriate for companies requiring significant capital investment or in early stages of development (e.g., firms backed by venture capital). Nonetheless, concentrated ownership structure and high leverage go hand-in-hand in the Jensen framework as agency costs of debt are reduced.

[14] Myers and Majluf (1984). For a concise tutorial see corporatefinanceinstitute.com.
[15] For a more thorough review of the historical literature supporting the private equity ownership model, see Brown et al. (2020) and Brown, Carnelli Dompé, and Kenyon (2020).

In the context of the pecking-order theory, the information asymmetry between managers and equityholders is reduced which would suggest less of a lemons problem and thus potentially more (not less) equity as a share of invested capital. However, information asymmetries between lenders and buyout firms could also be mitigated through reputational considerations and reduced contracting frictions (e.g., lenders ability to negotiate with a single owner instead of a large group of shareholders with different preferences). Theory predicts that the relationship between PE investors with bank and other lenders facilitates more frequent repeated interactions where banks can gain valuable information. Banks are able to use this investor-specific information to reduce future transaction screening and monitoring costs, thereby reducing overall information asymmetry costs. In turn, compared to traditional corporate borrowers, GPs with better reputations are able to secure preferred lending terms.[16] If the expected costs of financial distress are much lower for PE-backed companies then trade-off theory would allow for a much higher optimal level of debt. However, theory does not provide a clean prediction on whether financial distress costs should be lower or higher for private companies.

A major question then becomes what new frictions might a private ownership structure create that are not present in a public ownership model? In many ways the principle-agent relationship between private equity GPs and LPs adds complexity that could be important for understanding optimal capital structure. Due to the nature of the GP-LP partnership, potential agency conflicts are a consideration of PE capital structure and center around the contractual aspects of delegated asset management in a typical PE fund structure. For example, a GP's limited liability and the option-like carried-interest provisions can incentivize GPs to overinvest and potentially take more-leveraged, and thus riskier, positions in portfolio companies than the LPs would like.[17] LPs recognizing this, may not want to give full control to the GP by limiting the amount of funds available and putting limitations on the investment decisions of the GP. In addition, fund-level debt may benefit the GP in ways the provide no benefit, or even additional costs for the LP. For example, many LPs are not taxable entities and so would not benefit from any sort of tax shield potentially generated by borrowing at the fund level. In addition, many LPs can dial up (or down) effective fund leverage with their own borrowing (or lending), presumably at a lower cost.

Theory also suggests that the agency relationship between LPs and GPs, overlaid with changing market conditions, can result in a predictable pattern of procyclical LBO leverage. During recessions, when fewer investment opportunities may be available, LPs provide less capital to GPs.[18] The general pull back of capital is due to the agency conflict and the fear that GPs, if provided excessive capital, will invest in bad deals. Therefore, it is more difficult for the investment opportunities that do exist during a recession (and soon after) to become financed.

[16] The theoretical framework provided by Malenko and Malenko (2015) highlights the impact of reputation in securing capital.
[17] Here overinvest means investment that reduces expected economic profits. See Axelson, Stromberg, and Weisbach (2009).
[18] These and similar results are predicted by the theoretical frameworks of Axelson, Stromberg, and Weisbach (2009) and Ljungqvist, Richardson, and Wolfenzon (2019).

During boom times, however, LPs will provide more capital because there are perceived to be more opportunities. While this results in more overall deals, both good and bad projects will increase, and late-cycle returns will suffer. Like the agency conflict seen in the relationship between GPs and LPs, a similar agency problem is present in the relationship between banks (lenders) and GPs. This tension also potentially effects the cyclicality of LBO leverage.

Regardless of the framework being considered, a fundamental and crucial feature of capital structure theory is that the level of debt is a choice. In economics lingo, debt is an *endogenous* variable and will be determined jointly with other factors that are both exogenous (e.g., macro factors like market interest rates) and endogenous (e.g., dividend/payout policies, capital investment, compensation contracts of managers). For this reason, there is not a clear theoretical prediction on the relation between debt and other variables of interest like the amount of risk born by investors. For example, two companies with very different risk levels from underlying operations might have identical levels of risk born by equityholders because the company with riskier fundamentals takes on substantially less debt (i.e., more conservative capital structure). For this reason, the relations (if any) between characteristics such as leverage, risk, and return are ultimately empirical questions.

4 Existing and New Evidence on Debt and Leverage in LBO Transactions

This section examines evidence related to several fundamental questions concerning leverage in buyout transactions. We summarize existing empirical work and supplement these findings with analysis of more current data provided by Burgiss, StepStone, and a global commercial bank that prefers to remain anonymous (henceforth, "bank-data").

Empirical evidence suggests the private equity model is different from leveraged public companies in part because of capital structure. Nonetheless, recent empirical work that has focused on whether firm characteristics determine leverage has produced conflicting results. There is some evidence to suggest that firm characteristics are less important for determining leverage in buyouts. Axelson, Jenkinson, Strömberg, and Weisbach (2013) find that leverage decisions at portfolio companies are largely unrelated to the target firm's previous leverage and the industry average leverage ratio at the time of the transaction.[19] Similarly, De Maeseneire and Brinkhuis (2012) find that although classical capital structure determinants (firm size, collateral value of assets, profitability, growth potential and tax rates) explain leverage in public firms, they do not explain leverage in comparable LBOs.

In contrast, other evidence indicates that firm characteristics are important in determining PE leverage. Demiroglu and James (2010) find that at least part of cross-sectional variation in deal

[19]Axelson, Jenkinson, Strömberg, and Weisbach (2013) use a data sample of 694 North American firms and 463 firms from 24 countries outside North America.

structure is related to the fundamentals of the target companies: leverage and the proportion of bank debt used is related to borrower risk and the target firm's growth prospects.[20]

4.1 Why is the leveraged buyout market so cyclical?

We start with one of the most basic questions about private equity and associated credit markets—specifically, what drives the historically strong cyclical behavior of LBOs. As the literature has expanded, several explanations for the procyclical pattern in LBO leverage level have emerged such as market timing, GP-LP agency conflicts, agency problems between banks (lenders) and PE investors, aggregate risk premia, and subscription lines of credit.

Consistent with theory, empirical evidence suggests that GP-LP agency conflicts are an important factor in the procyclical pattern seen in LBO leverage levels. Specifically, evidence supports the predictions from agency theory that:

1) LBOs respond more to debt market conditions than private companies, and
2) Fund returns should be lower when the private equity sponsors are able to use higher leverage to finance individual deals.

Various studies document pro-cyclical PE investment patterns and countercyclical investment performance for buyout and venture capital.[21] Axelson, Jenkinson, Strömberg, and Weisbach (2013) find that debt market conditions predict LBO leverage. Since LBO leverage is procyclical, leverage peaks when debt is cheap during "hot" credit markets. In comparison, during the same market conditions, public firms exhibited a countercyclical leverage pattern. Ljungqvist, Richardson, and Wolfenzon (2019) find funds accelerate their investment flows and earn higher returns when investment opportunities improve, competition for deal flow eases, and credit market conditions loosen.

Research also has explored if private equity investors have superior timing ability in debt market issuance and can arbitrage the conditions between debt and equity markets by increasing the leverage of deals in response to cheap credit. Results support the assertion that market-timing is a relevant component of the pro-cyclical pattern observed in buyout activity. Demiroglu and James (2010) find that the frequency of reputable PE firm participation in LBO transactions is negatively related to credit risk spreads and lending standards. Work by Shivdasani and Wang (2011) suggests that the introduction of structured credit improved buyout investors' access to capital. De Maeseneire and Brinkhuis (2012) determine that when debt market liquidity is high (low credit spreads and leveraged loan spreads), LBOs have higher leverage. Comparing PE to strategic buyers, Martos-Vila, Rhodes-Kropf, and Harford (2019) show that misvaluation in the credit market can lead to increased leverage of PE funds. These authors also show that during periods of overvalued debt markets, the price-to-earnings ratios paid by strategic buyers are higher and leverage for PE funds is higher on average due to increased ease of winning targets.

[20] Borrower risk is measured by the volatility of the borrower's underlying operating margins. Growth prospects is measured by the industry median enterprise value relative to EBITDA.
[21] See Gompers, Kovner, Lerner, and Scharfstein (2008), and Kaplan and Stein (1993).

However, these papers do not find that a hot credit market is associated with better PE fund performance.

Because banks have a unique position both as expert lenders and providers of cross-product financial services, their actions may increase the cyclicality of lending. In the model of Fang, Ivashina, and Lerner (2013), if banks can observe time-varying deal prospects better than the market as a whole, then they are likely to allocate capital and services in a more pro-cyclical manner than other participants. In addition, banks can invest in private equity through two mechanisms: either "bank-affiliated" deals, where the bank acts as the equity investor, or "parent-financed" deals, where the bank is both the equity and debt investor. Consequently, time-variation in the levels and mix of investments by banks also exacerbates private equity credit cycles. Since the mid-1980s, syndicated loans have been the primary structure for debt financing in private equity deals. While these loans originate in a bank, a syndicate of lenders act as the funders and the originating bank only owns a portion of the loan. Fang, Ivashina, and Lerner (2013) emphasize this structural change, and highlight the market-timing distortion risks due to this structural change.[22] In addition to the effects on cyclicality, the authors find that banks are not better equity investors than other LPs. When compared to stand alone deals, bank-affiliated deals had worse financing terms and worse *ex post* outcomes (more debt downgrades and fewer upgrades). While parent-financed deals had significantly better financing terms, they did not show better *ex ante* characteristics and *ex post* outcomes.[23] 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 evidence indicates that macroeconomic conditions have an effect on LBO leverage levels and that during bust periods investors demand a higher liquidity premium.[26] Davis et al. (2014) show that during downturns the relative rates of productivity growth by private equity is lower. Emphasizing the importance of the risk premium, Haddad, Loualiche, and Plosser (2017) find that 30% of total variation in buyout activity can be attributed to the aggregate risk premium

[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 Franzoni, Nowak and Phalippou (2012) and Haddad, Loualiche and Plosser (2017).

while only 10% can be attributed to credit market conditions, which is consistent with a theory of the tradeoff between performance gains and the cost of providing incentives.[27] In addition, the authors note several firm-level differences. These include "i) 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; ii) Firms with poor corporate governance and in less competitive industries are more sensitive to changes in the risk premium; iii) more liquid industries (easier for acquirers to exit) are less sensitive to movements in the risk premium.

4.2 Current data summary

Before continuing our analysis we describe some current data sources referenced below. First, Burgiss fund-level and deal level data are available to academics through the partnership between Burgiss and PERC. As of 2020:Q2 Burgiss provides data for over 10,000 private funds including 2,451 buyout funds and funds-of-funds with about 3.0 trillion USD in committed capital. Burgiss also tracks over 1,000 debt funds with about 850 billion USD in committed capital. Burgiss has recently provided access to data on over 45,000 individual fund deals including about 15,000 buyout transactions. However, access to detailed financials for these deals remains limited. We also utilize a new proprietary dataset of individual buyout deals provided by the StepStone Group. These data are derived from StepStone's investment due diligence process and monitoring of its clients' private market portfolios. The master dataset covers over 150,000 private transactions, but we focus on a subset of about 6,000 buyout transactions from 1984 through 2020 with sufficient performance and financial accounting data. While this is a small subset of total transactions, they are among the largest and together represent about 1.3 trillion USD in combined equity investments and about 4.5 trillion USD in total enterprise value (TEV). By our estimates, these transactions cover about half of the value of all (global) historical buyout activity with a PE fund sponsor.[28] Finally, we supplement our analysis with the recent bank-data for large LBOs that provide a granular view of deal structure and will provide insight into important issues such as the effects of adjustments to EBITDA on leverage estimates and deal outcomes.

Table 1 summarizes the deal-level buyout data we utilize from Burgiss, StepStone, and Bank-data. While Burgiss has more buyout deals, the median StepStone equity value is twice as large. Deal performance based on total value multiple (TVM) and PMEs show that deals in the StepStone database perform somewhat better. This likely stems from Burgiss tracking all deals in portfolios held by clients whereas StepStone sometimes acquires access to information based on

[27] Buyout activity is negatively related to the market-wide risk premium after controlling for credit market conditions.

[28] Stepstone has data on about another 5,000 deals including about another 3,000 in private equity, however, not all fields necessary for our analysis are available. To prevent confounding the analysis with substantially shifting sample composition, we limit the set of deals to those with most fields available for the full analysis. Appendix B provides additional details on the StepStone and bank-data.

the potential of investing in a fund, and therefore is likely screening to some degree on past fund performance. Both databases contain a wide range of deal performance. Average holding period and industry composition are similar across the two sources whereas the Burgiss data have more deals outside of North America and Western Europe. Figure 2 shows the distribution of deals by entry year for the StepStone data as well as the composition of fully-exited and not fully-exited deals. As should be expected, 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. The transactions from the bank-data tend to be much larger and more recent as well as concentrated in the U.S.

Table 2 provides summary statistics for the StepStone deals. Values are provided for all transactions for brevity, but most characteristics are similar for subgroups of fully-exited deals and not full-exited deals. The typical deal is done in a fund with an average size of about 2.6 billion USD but there is a wide range of fund sizes to which deals belong. The typical deal is held for about 4.6 years with an interquartile range of 2.3 to 6.5 years. Investors usually take a majority stake in the buyout transaction. Values for entry TEV, Net Debt, Equity, and Revenue show that size is quite skewed with a relatively large number of small and mid-sized transactions in the dataset and a few much larger deals. For example, the mean entry TEV is greater than the 75th percentile breakpoint. TEV, net debt, equity, revenue, and EBITDA all tend to grow over a deal's life. These features are expected given the known composition of PE buyout transactions. The mean entry EBITDA multiple is 10.77 with an interquartile range of 7.65 to 12.48. Over the life of the typical deal, the multiple increases about 0.5 per year, or by about 1.0 to 3.0 from entry to exit. We present the changes in EBITDA multiples as annualized values because about half of the sample is not fully-exited.

We now examine our two primary variables describing portfolio company capital structure. First, the entry leverage ratio is defined as entry Net Debt divided by entry EBITDA and characterizes the ability of the firm's cash flows to service the debt. The mean entry leverage ratio is 4.2 with an interquartile range of 2.8 to 5.4. Over the life of a deal the leverage ratio declines slightly for the typical firm (about -0.05 per year) though more than a quarter of firms experience increasing leverage ratios. Second, the entry Debt-to-TEV (D/V) ratio measures the fraction of total firm value financed with debt. The average entry D/V is 0.49 and the interquartile range is 0.37 to 0.62. D/V values tend to decline relatively more than leverage ratios over the life of a deal (and rarely increase).

4.3 What are post-GFC trends in buyout characteristics and leverage?

While the data cover a 30-year history, we focus on transactions post-GFC because less is known about this period and it is most relevant for current practice and policy. Figure 3 plots deal characteristics by entry year as well as for major industry sectors.[29] Panel A plots (the log of) TEV and reveals both cyclical variation in deal size as well as a long-run trend toward larger

[29] We combine years prior to 1993 as well as some industries (real estate, energy, utilities, and unspecified) because there are relatively few deals in the groupings.

deals. Deal size dropped during 2008-2009, but has grown significantly in the last decade so that by 2019 the median deal was as large as the median in 2007 (the previous peak). Nonetheless, there is a wide range of deal sizes in every year. Deal sizes by sector also overlap substantially with communication services having the largest average size. In addition to the trend toward larger deals, TEV growth during a typical deal's lifetime has also grown significantly post-GFC. Panel B of Figure 3 shows average annual growth rates in TEV by deal entry year for fully-exited deals.[30] The large majority of firms grow in value while owned by PE firms and growth is quite cyclical with deals done in the 1997-2001 and 2006-2008 periods growing much less than average. However, TEV growth has become much more pronounced since the GFC—the annual medians from 2013 onward are higher than in any previous period. In fact, for recent deals the 25th percentile of TEV growth is higher than the 75th percentile of TEV growth for transactions done in 2006-2008.

The growth in TEV during a transaction can derive from two general sources: growth in operating performance and changes in valuations. The data allow for gauging the relative importance of these. Panel C of Figure 3 shows average annual revenue growth over deal life and reveals very similar patterns to TEV growth. Revenue growth is highly cyclical and was low for deals done in 2007-2008. Since 2009 revenue growth has accelerated and has been at a historical high for transactions in the last five years. The patterns for revenue growth rates by industry closely mirror the TEV growth rates. While not plotted for brevity, the patterns in EBITDA growth follow a similar pattern to revenue growth. However, average annual growth rates for revenue (11.6%) and EBITDA (12.3%) are not as high as TEV growth rates (19.0%). These results indicate that revenue and profitability growth explain some, but not all, of recent TEV growth and is consistent with widely reported evidence of expanding valuation ratios.[31]

Panel D of Figure 3 shows that entry EBITDA multiples are both very cyclical and have steadily increased to record levels in recent years. Entry EBITDA multiples vary significantly across sectors both in levels and in the range of values; for example, multiples in the IT sector are both more variable and higher on average than for other sectors. Panel E of Figure 3 shows that for the large majority of deals the EBITDA multiple increases, multiple expansion is very cyclical by entry year, and multiple expansion has reached a record high in recent years. For example, multiples expand for only about half of the deals entered into in 2007, whereas the vast majority of deals in recent years experience expansion. The magnitude of multiple expansion has grown to historically high levels post-GFC and the median deal has an average annual expansion of more than 1.0. Panel E also shows that multiple expansion is the norm across all sectors. Together this evidence confirms the post-GFC trends toward larger deals, higher valuations, and higher growth rates.

[30] For plots with only fully-exited deals we combine observations in 2015-2019 because of the small number of observations.
[31] See, for example, Figures 1.6 and 1.7 in Bain & Company's *Global Private Equity Report 2020*.

Figure 4 provides plots by year and sector for our primary measures of debt. Panel A shows that entry leverage ratios exhibit considerable cyclicality with values well above average during the lead-up to the GFC and then plummeting in 2008 and 2009. However, by 2018 both the level and interquartile range of leverage ratios had returned to pre-GFC levels. Leverage ratios also vary by sector with IT and communication services showing somewhat higher and more variable ratios. Despite the strong cyclicality, there is generally more variation within years than across years--only in a few years (e.g., 2009) is the median entry leverage ratio above or below the interquartile range of other years and similarly, there is a wide range of values within every industry. Panel B of Figure 4 shows the (average annualized) changes in leverage ratios and indicates that regardless of deal year or industry, leverage ratios decline on average during a deals life. That said, there is a wide range of outcomes and for more than a quarter of transactions leverage ratios increase. Panel C of Figure 4 plots D/V ratios and reveals a decidedly different trend in debt financing. In contrast to leverage ratios, the average D/V ratio declined significantly around the GFC and has not increased subsequently. Between 2007 and 2009 the typical deal shifted from being financed with a majority debt to a majority equity. In fact, the average D/V ratio since 2015 is the lower than at any other time during our sample period. Panel C also shows that the D/V ratio varies some by industry, but the majority of transactions are financed with 40% to 60% debt for all industries. Panel D of Figure 4 plots the average annual changes in D/V over deal lifetime and shows that D/V declines for vast majority of cases and that these declines occur almost regardless of entry year. Yet post-GFC, average annual declines in D/V ratios during a deal's lifetime have grown to about -7% (for deals done since 2014) from -3% for 2017 deals.

In sum, the growth in leverage ratios and decline in D/V ratios post-GFC is driven by the confluence of trends. First, higher expected revenue and profitability growth justify (at least partially) 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. However, a modest decline in D/V ratios post-GFC tempers the increase in leverage ratios slightly. Realized high growth in EBITDA post-GFC, combined with record multiple expansion, have resulted in more rapid declines in both the leverage ratio and D/V ratio over a typical deals lifetime.

4.4 How do buyout deals perform?

Extending public market return analysis to private markets is challenging due to the irregularity of cash-flows, infrequent appraisal-based valuations, and the heterogeneity of investments within private market funds.[32] The most common method in academic studies is to compare the returns of private equity investments to comparable public market returns. Kaplan and Schoar (2005) develop the public market equivalent (PME) which is effectively a market-adjusted money multiple. Gredil, Griffiths, and Stucke (2014) propose the direct alpha (DA) method which

[32] See, Goetzmann et al. (2018).

provides estimates of annualized excess returns in percent over a public benchmark.

Most analysis for buyout funds has been conducted at the fund level. There are many recent studies examining large samples of fund returns. Using data from Burgiss, L'Her et. al. (2016) find private equity buyout funds outperform before risk adjustments but the outperformance becomes insignificant after adjusting the benchmark based on systematic risks of buyout portfolio companies. Brown and Kaplan (2019) find that private equity returns have exceeded a wide range of public market indexes on average over a variety of horizons and using a number of benchmarks. In contrast, Phalippou (2020) claims that recent returns to buyout funds have only been on par with public market returns. Korteweg (2019) provides an extensive review of risk and return estimates for buyout funds and shows that estimates vary substantially by method, time period, and data source. However, the results in Korteweg (2019) suggest that more 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. PE funds may also provide diversification benefits to LPs. Goetzmann et. al. (2018) present a methodology to build factors in illiquid markets and find that their private factors are only partly spanned by public factors.[33] Their results suggest that private markets provide exposures that public markets do not, thereby offering an additional source of factor risk premia and value-added diversification. While these studies often provide estimates of fund-level risk, they do not examine portfolio company or fund capital structure.

As would be expected given the general outperformance of PE funds, evidence suggests average outperformance of portfolio companies. While that does not have to be the case, in so far as returns could be driven by a small number of exceptional deal returns (as is typical for venture capital funds), in fact, the majority of buyout deals are profitable. As shown in Table 1 and Brown et al. (2020b) using portfolio company data from Burgiss, the median gross TVM for buyouts is 1.55 and the median gross PME is 1.07. These values are significantly higher when considering only fully-exited deals. Furthermore, the Burgiss data shows that deals are generally profitable through time, across industry sectors, and in all major geographies. The bottom of Table 2 shows performance metrics for the StepStone sample and finds similar, but stronger, results. The median gross TVM is 1.84 with an interquartile range of 1.07 to 3.07. Deal gross IRRs have a median of 21.0% and an interquartile range of 4% to 43%. Median gross PMEs and direct alphas show performance better than public market returns, but lower quartile gross performance of buyout deals is generally inferior to market returns.

[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, US non-small Real Estate funds, US non-small Distressed Debt funds, Energy (Oil&Gas) 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 5-factor model that includes the US market equity factor, the size factor [SMB] of Fama and French (2015), the alternative value factor [HMLd] of Asness and Frazzini(2013), the quality of earnings factor [QMJ] of Asness, Frazzini, and Pedersen(2018), and the low-beta factor [BAB] of Frazzini and Pedersen(2014).

Figure 5 plots performance measures over time. All of the measures show similar trends and cycles, so we discuss them as a group.[34] Gross deal-level performance has been quite cyclical with high returns from deals closed in the mid-1990s, early 2000s, and post-GFC. Likewise, gross returns were relatively weak for deals closed in the late 1990s and leading up to the GFC. These trends closely map into returns for funds of those vintages in Burgiss data as shown in Brown et al. (2020b). Examining deal returns by sector reveals surprisingly small differences across sectors. In almost all sectors the vast majority of deals are profitable (gross of fees) on both a nominal and market-adjusted basis.

4.5 How does leverage relate to performance?

A fundamental question in private equity has always been how dependent returns are on high leverage and whether the investment returns represent appropriate compensation for the risk born by investors. While the fund-level analysis discussed above suggests that in aggregate, funds generate superior risk-adjusted returns, it is difficult to accurately characterize risk in private investments. For example, Czasonis et. al. (2020) dispute the widespread belief that PE investments have higher volatility than public equity due to higher leverage. Their results suggest that private equity volatility is similar to public equity volatility despite its higher leverage. They 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.

Braun, Crain, and Gerl (2017) provide further evidence that the negative relationship between deal leverage and return is due to high 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. The higher price translates to a lower deal surplus on exit. The effect is stronger for funds with poor interim performance (low reputation funds). Martos-Vila, Rhodes-Kropf, and Harford (2019) 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.[35]

Ivashina and Kovner (2011) find evidence that the close relationships of banks and lenders with PE investors reduces information asymmetry costs. The authors show that this relationship leads to more favorable loan interest rates and covenant structure. In addition, the findings suggest that the potential of cross-sell fee business services is associated with the better loan terms. Like

[34] We note however that TVM and PMEs are nominal ratios over the life of a transaction (i.e., not annualized) and so will naturally converge to 1.0 as the deal dates approaches the present.

[35] 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." See Martos-Vila, Rhodes-Kropf, and Harford (2019)

Ivashina and Kovner (2011), Achleitner et. al. (2012) show that LBO covenants become more restrictive as information asymmetry costs increase.

The StepStone data allow us to look closely at the relationship between leverage and performance at the deal level. As noted above, the D/V ratio and the leverage ratio represent distinct characteristics of capital structure at the deal level. To demonstrate this, Table 3 reports summary statistics for quartile sorts on D/V and the leverage ratio separately.

We first examine the results of sorting deals on D/V (first 4 columns of Table 3). High D/V deals tend to be larger companies with lower EBITDA and TEV growth as well as lower operating margins. In essence, high D/V deals are more likely to be done with more established companies that are in the "cash cow" stage of the corporate lifecycle. This is also evident from the entry EBITDA multiple which decreases across D/V quartiles from 10.6 for low D/V deals to 7.6 for high D/V deals. While high D/V deals also have high entry leverage ratios, over the deal life, high D/V deals experience a drop in net debt outstanding accompanied by large declines in 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 for high D/V deals and the variation in multiple expansion is half that of 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). For example, the direct alpha of high D/V deals (25.8%) is more than twice that of low D/V deals (10.6%). One caveat to these findings is that high D/V deals are older on average than other deals and thus timing could affect these results. We address this issue subsequently in the regression analysis that controls for deal year.

We now turn to examining deals sorted on the entry leverage ratio (last 4 columns of Table 3). Deals with high leverage ratios share some characteristics with high D/V deals but are also fundamentally different in important ways. Like high D/V deals, those 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 (not lower) 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 (12.2) versus those with low leverage ratios (7.3) which is consistent with the valuation trends discussed in Section 4.3. Over the life of the typical high leverage ratio 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). Overall, it appears that deals with high leverage ratios are expected to grow profitability to accommodate higher leverage. In contrast to high D/V transactions, the performance of high leverage ratio deals is inferior to low leverage ratio deals.

The analysis above makes it clear that D/V and leverage ratio measure distinct characteristics of buyout capital structure. To better understand these differences, we conduct a two-way sort on D/V and leverage ratios and report the results in Table 4 (where Panel A reports subsample

means and Panel B reports subsample medians). We sort into 3x3 groups based on low, middle, and high values. The results of this analysis are notable. 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 addition, the direct alphas are generally lower when the leverage ratios and D/V are high. In contrast, there is a strong positive relation between D/V and performance regardless of the entry leverage ratio. For example, looking at just the middle range of leverage ratio, mean performance as measured by direct alpha is almost 4 times better for deals with high D/V (33.0%) than for deals with low D/V (8.5%).

Why do high D/V deals perform better while high leverage ratio deals perform worse? One possible explanation is that the deals are not comparable in other dimensions such as entry year, geography, industry, size and expected growth. For example, the high D/V deals are more likely to have occurred early in the sample period and the high leverage ratio deals are clustered in the 2010s, so the differences could be the result of timing. To investigate the relation between leverage and performance controlling for other factors, we estimate linear regressions with direct alpha as the dependent variable. We include dummy variables for each deal entry year, sector, and region as well as control variables for some ex ante observable characteristics such as deal size (log of entry TEV), ownership percent, and the percent of the fund invested in the deal. The results of the analysis are reported in Table 5. The first two columns report results separately for leverage ratio and D/V.[36] The findings are consistent with the quartile sorts in Table 4 and 3x3 sort in Table 5. Specifically, there is a (marginally significant) *negative* relationship between deal performance and leverage ratios and a statistically significant *positive* relationship between deal performance and D/V. These relationships are robust to including the entry EBITDA multiple and other characteristics of the deal over its life such as EBITDA growth and the change in EBITDA multiple. Because of the substantial change in deal characteristics around GFC, we also split the sample in 2008 and do estimations separately for the two sub-periods. The results in the post-GFC period are very similar to the pre-GFC period. We also estimate regressions separately for fully-exited and not fully-exited subsamples and find very similar results.

By examining the coefficients in specification 3 of Table 4 we can estimate the change in direct alpha for a given increase in net debt. However, we must examine the effects together because an increase in net debt mechanically increases both the leverage ratio and D/V. A one standard deviation increase in D/V for a typical firms implies a implies about a 7% lower direct alpha related to the leverage ratio and 13% higher direct alpha related to D/V for a net increase in direct alpha of about 6%.[37]

[36] Because the variables are mechanically related (both are constructed with Net Debt) and positively correlated we are concerned about multicollinearity affecting coefficient estimates.

[37] This approximate marginal effect is calculated using a 700MM USD TEV deal and comparing net debt of 350MM USD to 483MM USD which is a one standard deviation increase in D/V. A future draft will provide more specific information on this and we thank Nick Crain for working out the exact relation in the general case.

4.6 Does more debt imply higher risk?

The previous result indicates that deals with higher debt levels are associated with higher returns after controlling for entry year, sector, geography, size, and several other factors. A logical next question is whether the higher average return is compensation for riskier returns as would be expected in a rational economic setting. Leverage and risk are intrinsically linked, and as discussed already, hot credit markets can lead to high leverage which might ultimately increase default rates.[38] However, estimates of the impacts of leverage on distress vary. A study by the Private Equity Council (2010) shows that when compared to similar firms, PE-backed firms had a default rate of 2.8% while similar firms had a rate of 6.2% during the 2008-2009 recession.[39] In contrast, Ayash and Rastad (2019) document a much higher bankruptcy rate for public-to-private buyouts than for a matched sample of firms that remain public. Stafford (2017), argues that outside equity investors apparently do not benefit from the attractive long-term debt terms after adjusting for risk.

Hotchkiss, Strömberg, Smith (2010) examine 2,156 firms that obtained leveraged loan financing between 1997 and 2010. While PE-backed firms are no more likely to default than other firms with similar leverage characteristics, PE-backed firms appear to be more capable of dealing with financial distress. "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, compared to financially distressed peers that are not backed by a private equity investor." Andrade and Kaplan (1998) estimate financial distress costs for a set of LBOs that entered bankruptcy and find a typical decline in firm value of between 10-20%. If we combine these estimates with ex post unconditional probabilities of bankruptcy for buyouts of around 5%, it suggests that expected financial distress costs for LBOs average about 0.5% to 1% of firm value.

There are many reasons why GPs may generate different levels of risk through time and across deals. These might include varying credit market conditions, industry factors, LP clientele effects (e.g., risk preferences), and GP incentives. Deal risk is a latent variable, and especially difficult to measure in private equity because of the lack of observed prices that can be used to calculate standard deviations or other common risk measures. Instead, we can try to infer risk levels with the StepStone data by looking at the dispersion of return metrics and ex post loss ratios.[40]

Returning to Table 3, the first four columns report the standard deviation of the return metrics for the quartile sort on D/V. Consistent with a risk-return relation, deals with higher D/V tend to have higher (within-quartile) standard deviations of returns. This is apparent for all four performance metrics. Similarly, the mean loss ratio for high D/V deals is 11.3% compared to 9.7% for low D/V deals.

[38] See Kaplan and Stein (1993) and AJSW (2013) for supporting evidence.
[39] See Private Equity Council (2010).
[40] The loss ratio is defined as the percentage loss of equity when there is a loss and zero if there is no loss of equity.

The last four columns of Table 3 show that deals with the highest leverage ratios have lower (within-quartile) standard deviations of returns. Both returns and return variation are similar across the other three quartiles. However, deals with high leverage ratios do not have significantly different loss ratios. These results, combined with the finding that there are lower returns for deals with high leverage ratios, also suggest a possible risk-return trade-off, though the finding of lower risk from high leverage ratios is somewhat counter-intuitive.

The two-way sort reported in Table 4 provides additional insight into the possible risk-return trade-off related to debt. The standard deviation of direct alphas is lowest for deals with low returns (e.g., low D/V and high leverage ratios). Likewise, the highest standard deviation of returns is for the highest returning deals (high D/V and mid leverage ratio). Loss ratios provide some additional evidence of a risk return trade-off especially for low D/V deals. Figure 5 plots the mean direct alphas and their standard deviations from the 3x3 sort and shows a strong risk return trade-off across these portfolios.

In summary, these findings, combined with the results of the regression analysis in Table 5, provide strong evidence in support of a risk-return trade-off associated with the buyout capital structure. Furthermore, the evidence suggests that the D/V ratio is superior to the leverage ratio as a measure of risk related to deal-level debt.

4.7 How have EBITDA "adjustments" affected leverage ratios?

One possible explanation for the stronger relation between D/V ratios and risk is that, while debt and TEV are absolute, EBITDA is not. EBITDA, by market convention, is used as a proxy for free cash flow to determine the profitability and credit quality of a company, but EBITDA is not a defined term under U.S. GAAP. As a consequence, its definition becomes subject to interpretation. Most market participants agree that certain extraordinary, one-time or non-recurring cash charges and certain non-cash charges may be reasonable adjustments to EBITDA to get a better representation of the free cash flow potential of a business. However, in the post-GFC period, the definition of EBITDA appears to be changing. Increased oversight and regulation from the Federal Reserve and Office of the Comptroller of the Currency have served to significantly limit leverage in transactions with Debt / EBITDA ratios above 6.0x. The market appears to have responded in part to the constraint by defining EBITDA more liberally, resulting in higher absolute debt in transactions than would otherwise be reflected in the Debt / EBITDA ratio. It may also skew our analysis of leverage.

According to a Senior Covenant Officer at Moody's Investors Services, "One third of the loans we reviewed in 2019 provide for virtually uncapped EBITDA 'add-backs' for restructuring charges, cost savings and other synergies before they have been achieved."[41] When EBITDA is inflated, Debt / EBITDA and interest coverage ratios, commonly used metrics for credit

[41] Leveraged Loans and Collateralized Loan Obligations are Riskier Than Many Want to Admit. Mayra Valladares, Senior Contributor, Forbes, September 22, 2019.

assessment, become less meaningful when compared to historical periods. As companies, private equity, and investment banks become more creative in what qualifies as an add-back and the market is willing to accept a looser definition of EBITDA, companies are able to borrow more debt than might otherwise be possible (or prudent). Importantly, even the ratings agencies may not be capturing the full picture with regards to adjustments to EBITDA.

Panel A of Figure 6 plots S&P data for average Debt / Adjusted EBITDA ratios from 2002 through 2019. As expected in the pre-crisis period, Debt / Adjusted EBITDA ratios rise from 4.0x to 6.2x, then dramatically decline in the immediate post-crisis period (mimicking trends shown in Panel A of Figure 4). Since 2009 Debt / Adjusted EBITDA ratios have increased but remained below 6.0x until 2019. Panel A also includes bank-data on large LBO Debt / Adjusted EBITDA and Debt / Unadjusted EBITDA (blue bars). Bank-data indicate Debt / Adjusted EBITDA levels in-line, although modestly higher than S&P. However, on an unadjusted basis, Debt / Unadjusted EBITDA (green bars) has increased dramatically reaching a high of 8.9x in 2018 with a modest decline to 8.0x in 2019. Panel B of Figure 6 includes historical differences in adjustments to EBITDA as a percentage of unadjusted EBITDA. The S&P data indicate a decline in adjustments to EBITDA since 2002. However, bank-data indicate the opposite with adjustments of around 30% in 2018 and 2019. Panel C of Figure 6 reports the differences in Debt / EBITDA ratios as a result of adjustments to EBITDA. Again, the S&P data indicate a flat trend, while the bank-data are indicative of dramatic increases in debt levels relative to unadjusted EBITDA.

To better understand the magnitude of the adjustments to EBITDA, Table 6 provides an example of a typical quality of earnings (QoE) report from a 2018 buyout. All transaction specific information and numbers related to the company have been anonymized, but the magnitude of adjustments is indicative of the actual transaction. For the LTM period, EBITDA was reported at $128,932. This EBITDA would be observable from the company's income and cash flow statements (Operating Income from the P&L plus Depreciation and Amortization as reported in the Cash Flow from Operations.) The company then reports adjustments to EBITDA to obtain an Adjusted EBITDA of $224,267. The auditor involved in preparing the QoE then reverses some of the adjustments represented by the seller to get to a further adjusted EBITDA of $206,089; in effect reducing the representation of cash flow by the seller by amounts deemed to be excessive or incorrect. Finally, run-rate adjustments are added to the further adjusted EBITDA in order to arrive at a fully-adjusted EBITDA (titled Pro-Forma Run-Rate Adjusted EBITDA) of $251,374. The net impact of all the adjustments is a 95% increase in the EBITDA as reported on the financial statements for purposes of marketing the transaction.

Differences in Debt / Adjusted EBITDA ratios between S&P and bank-data may be explained by the underlying deal sets. In the case of S&P, the data include all deals S&P has rated above $50 million of EBITDA. As shown above, smaller deals are typically less levered than larger deals. The bank-data includes only a subset of the largest transactions above $500 million TEV. However, the bank-data would point towards a dramatic increase in adjustments to EBITDA

relative to prior historical periods. If the definition of EBITDA changes over time relative to the adjustments accepted by the market, this may explain why leverage ratios are less indicative of performance outcomes and risk than D/V.

4.8 How do PE firms add value through leverage?

As discussed previously, the potential gains from higher leverage are likely to be obtained through several channels but can be related back to a fundamental trade-off between benefits coming from tax shield, better operations (via incentive effects of debt, lower agency costs), and improved contracting and costs associated with a higher probability of financial distress.

Jenkinson and Stucke (2011) find that the estimated tax savings from higher debt in public-to-private LBOs are positively related to acquisition premiums and these premiums are around twice the size of the tax savings. Thus, tax savings from increasing financial leverage accrue to the previous shareholders (transaction targets and public equity investors) rather than the private equity fund sponsoring the LBO transaction. These results again suggest that it is unlikely that tax savings are an important source of returns for private equity funds. The authors argue that this is presumably due to the competitiveness of bidders; a result that is confirmed empirically by Braun, Crain, and Gerl (2017). Cohn, Mills, and Towery (2014) examine confidential corporate tax returns for 317 public-to-private LBOs and find more room for value creation from the debt tax shield. Specifically, they document that debt levels remain high for several years after acquisitions and that EBITDA grows such that the value of the tax shield is more durable than assumed in other analyses. They conclude that "the value of the tax shield is likely to be at the high end of the previous range of estimates." In contrast, a recent study by Ivanov, Pettit, and Whited (2020) looks at the relation between corporate taxes and leverage for a large sample of U.S. public and private firms and finds a negative relation between tax rates and leverage. This suggests that the tax shield is not a primary driver of leverage decisions.[42]

Public companies are acutely aware of the effects of financial distress and the importance of maintaining financial flexibility (Graham and Harvey, 2001; Giroud and Mueller; 2015). However, Bernstein, Lerner, and Mezzanotti (2019) find "that private equity firms can help relax the financial constraints of portfolio companies."[43] As noted already, evidence suggests this derives from the strong ties between GPs and the banking industry which may allow PE investors to gain preferred access to credit during economic downturns (Ivashina and Kovner 2011). Capital commitments with long-term holding periods provide PE investors another source of capital during economic downturns. As noted already, Demiroglu and James (2010) find that

[42] 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 offsets the decline in value of the tax shield. Consequently, lower taxes incentivize higher debt levels.

[43] 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 Bernstein, Lerner, and Mezzanotti (2019).

buyouts sponsored by high reputation PEs are less likely to experience financial distress during the 5 years after the transaction.

Leverage trade-offs have been studied in other asset classes as well. For example, Van der Spek and Hoorenman (2011) investigate the optimal fund level leverage in real estate find that the advantages include tax shield, ability to purchase more properties, liquidity and flexibility, and increase in return on invested equity. The authors document disadvantages which include eliminating 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.

Jensen (1989) famously claimed the superiority in corporate governance structure of PE-owned firms over the publicly-traded firm. Jensen maintains that combined "with active boards, high-powered management compensation, and concentrated ownership" the leverage component is critical to the success of PE governance. In addition to Jensen's work, a growing literature investigates effects of private equity ownership on firm productivity, product quality, employment, and related dimensions during normal times where they find positive and substantial effects on the operations of the firms in which they invest.[44] In addition to direct value creation, anticipation of these improvements may allow for higher leverage at the time of the buyout transaction which in turn generates value from the debt tax shield. In support of this hypothesis, Guo, Hotchkiss, and Song (2007) demonstrate performance post-buyout is positively related to the level of bank financing. In contrast, Cohn, Mills, and Towery (2014) find weaker support for this channel and conclude, "Overall, our … results appear inconsistent with the view that LBOs lead to improvements in operating performance … through the disciplining effects of leverage and concentrated ownership."

4.9 Lending Markets: Collateralized Loan Obligations, Direct Lending & Venture Debt

The analysis so far has focused on leverage and debt from the perspective of the portfolio company, GP or LP—essentially from the borrower's perspective. Of course, for every borrower there is a lender and research has examined how debt markets provide capital to the private equity industry.

After the financial crisis, several studies examined the market for collateralized loan obligations (CLOs) which are effectively collateralized debt obligations backed by corporate debt. Benmelch et. al. (2012) provide evidence that adverse selection is not an inevitable consequence of securitization of corporate loans.[45] The authors show no consistent evidence that securitized corporate loans are riskier than similar non-securitized loans. This holds true for the 2005-2007 period before the financial crisis and for the subset of loans purchased by the CLO from its

[44] Examples include Bernstein et al. (2016), Bernstein and Sheen (2016), Boucly, Sraer, and Thesmar (2011), Davis et al. (2014), John, Lang and Netter (1992), Kaplan (1989), Lichtenberg and Siegel (1990), and Stafford (2017).
[45] 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 Keys et al. (2010).

underwriters.[46] The authors argue that the larger loan size and the syndication process make corporate loans less prone to adverse selection than mortgages when securitized. Corporate loans, at origination, are funded by a group of banks and institutional investors who are concerned about their reputation and thus screen quality more seriously.[47]

Covenants are an important channel in allocating control rights between firms and their investors. Becker and Ivashina (2016) provide evidence that the coordination costs among investors are related to the rising number of covenant-light (cov-lite) leveraged loans. Contrary to what their name might suggest, cov-lite loans do not have fewer covenants, but weaker enforcement, which makes 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.[48] 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. Contradicting the view that the rising use of cov-lite loans is due to the need of borrowers (firms), Becker and Ivashina (2016) provide evidence that while cov-lite volumes have expanded, cov-lite pricing has contracted.[49]

Recently, academic interest has expanded to direct lending of nonbank creditors. Munday et. al. (2018) provides a first look at the risks and returns of private credit funds. The authors find positive returns for the top three quartiles in terms of IRR and better excess returns (in terms of PME) relative to leveraged-loan, high-yield and BDC indexes. Direct lending funds (who undertake bilateral origination of a loan between a single borrower and narrow group of lenders) have relatively low beta and positive alpha compared to the leveraged loan and high yield indices suggesting diversification benefits relative to other credit strategies.

Irani et al. (2019) examines the impact of bank regulatory capital position changes on the entry of nonbank lenders. They show that undercapitalized banks remove loans from the balance sheet, especially loans with higher capital requirements and at times when bank capital is scarce a significant portion of this credit is reallocated to nonbanks. This credit reallocation amplified the negative impacts of the 2008 crisis: loans funded by nonbanks experience both a sizable reduction in credit availability and greater price volatility in the secondary market.

Chernenko et al. (2019) investigates non-bank financial institutions lenders, 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, Chernenko et al. (2019) focuses on the direct negotiation process between

[46] 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).

[47]"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.

[48] Traditional lenders like banks and finance companies account for about 10-15% of loan origination.

[49]If the rising of cov-lite loans is driven by demand shock from the borrowers, the price would be expected to rise.

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), they find that non-bank lending is widespread (32% of the market), and these institutions fund less profitable, more levered, and more volatile firms. In particular, private equity (including venture capital) firms are especially likely to lend to faster growing, R&D-intensive firms. 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.

Loumioti (2019) also examines the growth in direct lending and the potential extent of adverse selection costs. The analysis examines data from 2003-2016 and documents how institutional investors have aggressively entered the market, accounting for about 80% of the direct loan volume in 2016. Direct lending is more active when banks face tighter capital constraints and have higher litigation risk, i.e., more regulatory constraints and is more prevalent among borrowers with limited credit history. However, direct loans are of similar quality to bank-originated loans. In addition, direct loans issued by private equity or investment management firms exhibit significantly better performance than other institutional loans. These findings indicate that direct lending does not give rise to higher adverse selection costs.

Albertus and Denes (2020) provide evidence on the use of subscription lines of credit (SLCs) by private equity funds. SLCs affect both fund-level capital deployment and performance. Funds who use SLCs reduce the relative amount of equity deployed and delay capital calls. The authors show that funds using SLCs have substantial distortions in performance measures sensitive to cash flow timing.[50] The increase in IRR-based performance is attributed to the reduction in the amount of time that capital is provided to a fund.[51] These findings add to the concerns about using IRR as a primary performance measure.[52]

Davydiuk, Marchuk, and Rosen (2020) study another type of non-bank lending: business development companies (BDCs) which specialize in financing middle-market companies credit rationed after the Great Recession. They document that BDC financing is a substitute for bank loans and is complementary to funding from private equity firms. In addition, the authors show that that firms financed with BDC capital are associated with higher employment and revenue growth, potentially due to the value enhancement from BDC's managerial assistance to company boards.

Increasingly, young firms backed by venture capital are entering debt markets as a source of external capital. Because young firms are unlikely to possess tangible assets and positive cash flows, it is difficult for start-ups to secure traditional bank lending. To fill the gap, so-called

[50] IRR and PME appear to increase due to the shorter time frame in which capital is provided. The decrease in TVPI is believed to be due to the funds' payments of interest expense and fees to the bank for the SLC. See Albertus and Denes (2020).
[51] The performance distortion impact is larger for younger funds.
[52] See, for example, Phalippou (2008).

"venture debt" is increasingly popular as start-up financing that can "extend the runway" between venture rounds and reduce equity dilution (i.e., ownership and control for the entrepreneur). Rassenfosse and Fischer (2016) provide an empirical analysis based on a discrete choice experiment using 55 senior U.S. venture debt lenders. The analysis finds 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 which can help overcome the agency problems; 3) VC backing can substitute for positive cash flow but only for early-stage ventures. Davis, Morse, and Wang (2018) also find 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. Gonzalez-Uribe and Mann (2017) confirm that start-ups use venture debt as an intermediate financing tool between equity rounds to avoid dilution and extend the runway. The transitory nature of venture debt makes default risk low while the prepayment risk is high. Both Davis, Morse, and Wang (2018) and Gonzalez-Uribe and Mann (2017) emphasize the anti-dilution benefit of venture debt, as opposed to reduction in control rights from the perspective of entrepreneurs due to venture equity. Hochberg, Serrano, and Ziedonis (2018) also find that patents can serve as collateral for venture debt and reduce information frictions between lenders and start-ups.

4.10 Some other common questions about private equity and leverage

Is there a difference in leverage at the company level and the portfolio level?

Yes. Debt at the portfolio level generally does not provide benefits from the debt tax shield or managerial incentive effects of debt. In other words, portfolio level debt does not interact with the underlying corporate financial or operating aspects of a firm in the way described by capital structure theory and instead represents pure investment leverage. Nonetheless, fund-level debt may provide added performance incentives for GPs to undertake active management of portfolio company financial policy.

Is PE simply a levered version of public equity?

No. In the spirit of Modigliani and Miller (1958), an outside investor interested in a more levered equity return of a firm can manufacture this by borrowing on their own account. However, as noted above, the portfolio leverage will not generate the incentive and tax effects that increased leverage at the firm-level can produce. This also speaks to the active management aspect of PE owners mitigating financial risk by changing the cost profile of the firm, delaying investments, or even changing management. These options, which an active shareholder can use to mitigate financial risk, are not readily available to investors in public equities where there may be agency issues with management that hinder active financial management. In addition, Ewens, Jones, and Rhodes-Kropf (2013) and Goetzmann, Gourier, and Palippou (2018) emphasize the role of diversification in private equity investments. In contrast, Stafford (2017) shows the mean returns exhibited by private equity can be achieved by leveraging a carefully selected portfolio of public firms that share the characteristics of firms taken private in public-to-private transactions. However, these returns are substantially more volatile than returns of private equity funds estimated by other

research and summarized in Korteweg (2019). Replicating strategies with public equity are also subject to a gamblers ruin problem (e.g., margin calls) in the absence of sufficient external collateral. In general, the extant literature finds excess returns from private equity buyout funds even after adjusting for their greater risk from higher leverage.

How do behaviors change with significant leverage?

As discussed above, agency theory (e.g., Jenson, 1986, 1989) suggests that high levels of debt align incentives of managers and equityholders though the empirical evidence supporting this theory is mixed. On the other hand, high leverage can generate a debt overhang problem (Myers, 1977) where owners with excessive amounts of debt underinvest because future gains accrue disproportionately to creditors. In a broader context, high levels of debt have been shown to have an adverse effect on firm investment and growth because of limitations on financial flexibility.[53] As discussed above, private equity backed firms are less likely than public companies to suffer from debt overhang and financial flexibility frictions because of reduced agency problems between equityholders and creditors. However, the literature directly examining incentive effects of debt in buyout transactions is sparse.

Should LPs demand compensation for "renting" their credit quality to fund-level facilities?

The increase in fund-level debt has raised questions about who benefits from this additional debt. Many LPs believe that fund-level credit facilities are useful in managing capital calls, but that there is little economic purpose for facilities with terms longer than 90-days. To the extent that subscription lines of credit (SLC) rely on the capital commitments of LPs for collateral, the economics could work against the LPs who should generally be able to borrow more cheaply on their own. As discussed above, Albertus and Denes (2020) find positive effects on fund IRRs from SLCs but the effects on fund investment multiples are small on average (which is consistent with SLCs only having a material effect on cash flow timing). Yet, Albertus and Denes (2020) show that in some cases fund-level debt generates agency costs and additional carried interest, and LPs may consider how to obtain compensation for the drag on economic returns or, alternatively, contract ex ante to avoid these distortions.

5 Conclusions

This paper has provided an overview of previous research on the capital structure of private equity buyouts as well as an analysis of recent data. Several main take-aways are worth reiterating. First, understanding capital structure is complicated by the fact that debt is a choice variable that will depend on market and deal characteristics. Consequently, it is not necessarily the case that measures of leverage are positively associated with returns or risk. For example, we find a strong positive relation between returns and the D/V ratio and a weak negative relation between returns and the leverage ratio. We also find a strong risk-return trade-off for the D/V

[53] See Myers and Majluf (1984); Pinegar and Wilbricht (1989); Graham and Harvey (2001); Bancel and Mittoo (2004); Brounen et al. (2004); Gamba and Triantis (2008); Marchica and Mura (2007); Stulz (1990); Smith and Watts (1992); Denis and Denis (1993); Lang et al. (1996); Peyer and Shivdasani (2001); Ahn et al. (2006).

ratio and a weak relation, if any, for the leverage ratio, suggesting that D/V ratios are generally more informative than leverage ratios. This result derives from the fact that growth expectations and valuation ratios play a more important role in determining leverage ratios. We also provide evidence that leverage ratios can be badly distorted by EBITDA "adjustments" which could also affect their usefulness as measures of deal capital structure.

Finally, our analysis has also identified several important areas for future research:

- Understanding of buyout capital structure would benefit from theory that explicitly takes into account the structure of buyout deals and potential for leverage at different level, i.e., the operating company (OpCo), the fund, and the GP. Each type of debt provides different potential benefits and costs as well as agency problems. For example, theory could explore the effects of funds as finite-lived entities and GPs and LPs as longer-lived entities interacting in a repeated game. How does this structure affect incentives and trade-offs in determining optimal capital structure across all entities?
- What are the empirical determinants of buyout capital structure and how have these changed post-GFC? Our largely descriptive empirical analysis reveals major trends in the buyout market that appear distinct from previous cycles. What is driving these trends, and can they be fully explained by observable market and deal characteristics? For example, how has the changing nature of PE industry changed optimal capital structure? Given increasing focus on growth and lower D/V, what other metrics might be more informative about leverage (e.g., a growth-adjusted leverage ratio). Can an empirical model of optimal PE capital structure reliably identify over/under-levered deals?
- We document a positive risk-return relation for the D/V ratio. Historically, has this been a fair trade-off compared to the risk-return relation in public markets?
- How important are differences in capital structure for explaining differences in returns across time, industries, and geographies?

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Appendix A. Common Terminology

Condensed from: Standard & Poor's Guide To The Loan Market: A Syndicated Loan Primer, by Steven Miller (2006) available at https://studylib.net/doc/8135189/a-syndicated-loan-primer

Seniority: Where an instrument ranks in priority of payment is referred to as seniority. Based on this ranking, an issuer will direct payments with the senior-most creditors paid first and the most junior equityholders last. In a typical structure, senior secured and unsecured creditors will be first in right of payment—although in bankruptcy, secured instruments typically move to the front of the line—followed by subordinate bondholders, junior bondholders, preferred shareholders, and common shareholders. Leveraged loans are typically senior secured instruments and rank highest in the capital structure.

First Lien Loans: the claims on collateral of a first-lien loan is senior in right of repayment to any other obligation of the borrower, it is secured by a pledge of specific collateral with a perfected interest and, typically, the collateral or enterprise value securing the loan exceeds the outstanding balance on the loan.

Second Lien Loans: As their name implies, the claims on collateral of second-lien loans are junior to those of first-lien loans. Second-lien loans also typically have less restrictive covenant packages, in which maintenance covenant levels are set wide of the first-lien loans. For these reasons, second-lien loans are priced at a premium to first-lien loans. This premium typically starts at 200 bps when the collateral coverage goes far beyond the claims of both the first- and second-lien loans, to more than 1,000 bps for less generous collateral.

Covenant-Lite Loans: Like second-lien loans, covenant-lite loans are a particular kind of syndicated loan facility. At the most basic level, covenant-lite loans are loans that have bond-like financial incurrence covenants instead of maintenance covenants that are typical of a loan agreement.

Incurrence Covenants: Incurrence covenants generally require that if an issuer takes an action (paying a dividend, making an acquisition, issuing more debt), it would need to still be in compliance. So, for instance, an issuer that has an incurrence test that limits its debt to 5x cash flow would only be able to take on more debt if, on a pro forma basis, it was still within this constraint. If not, then it would have breached the covenant and be in technical default on the loan. If, on the other hand, an issuer found itself above this 5x threshold simply because its earnings had deteriorated, it would not violate the covenant.

Maintenance Covenants: Maintenance covenants are far more restrictive. This is because they require an issuer to meet certain financial tests every quarter whether or not it takes an action. So, in the case above, had the 5x leverage maximum been a maintenance rather than incurrence test, the issuer would need to pass it each quarter and would be in violation if either its earnings eroded or its debt level increased. For lenders, clearly, maintenance tests are preferable because it allows them to take action earlier if an issuer experiences financial distress. What's more, the

lenders may be able to wrest some concessions from an issuer that is in violation of covenants (a fee, incremental spread, or additional collateral) in exchange for a waiver. Conversely, issuers prefer incurrence covenants precisely because they are less stringent.

Collateral: In the leveraged market, collateral usually includes all the tangible and intangible assets of the borrower and, in some cases, specific assets that back a loan. Virtually all leveraged loans and some of the shakier investment-grade credits are backed by pledges of collateral. In the leveraged market, some loans are backed by capital stock of operating units. In this structure, the assets of the issuer tend to be at the operating-company level and are unencumbered by liens, but the holding company pledges the stock of the operating companies to the lenders. This effectively gives lenders control of these subsidiaries and their assets if the company de-faults. The risk to lenders in this situation, simply put, is that a bankruptcy court collapses the holding company with the operating companies and effectively renders the stock worthless. In these cases, which happened on a few occasions to lenders to retail companies in the early 1990s, loan holders become unsecured lenders of the company and are put back on the same level with other senior unsecured creditors.

Subsidiary Guarantee: Although not collateral in the strict sense of the word, most leveraged loans are backed by subsidiary guarantees so that if an issuer goes into bankruptcy all of its units are on the hook to repay the loan. This is often the case, too, for unsecured investment-grade loans.

Appendix B. Additional Details on Data

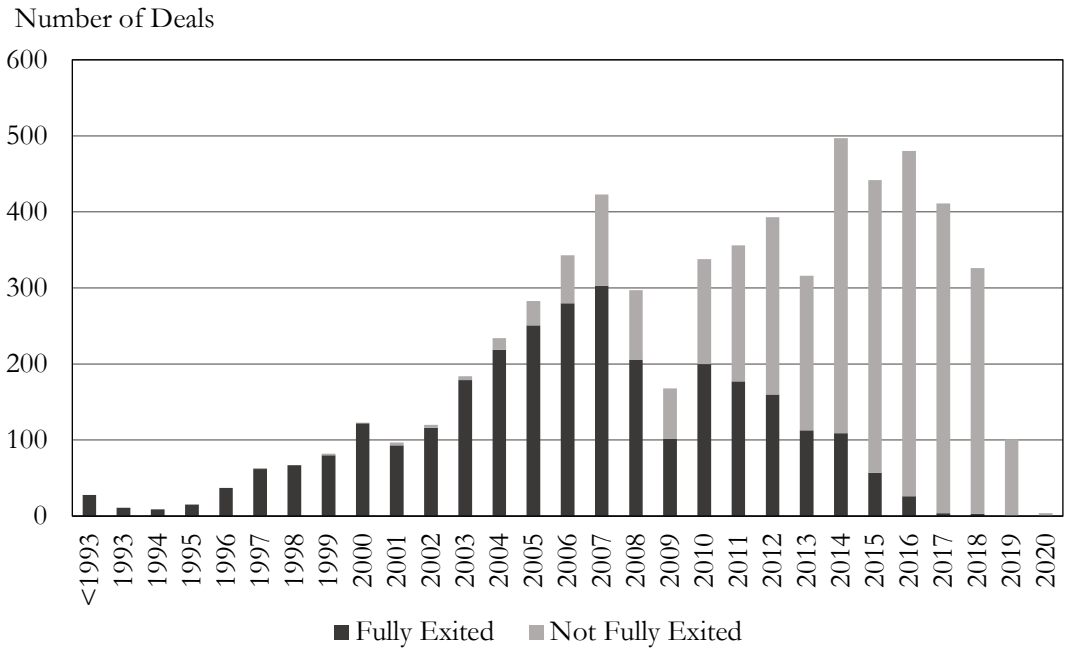
StepStone's proprietary database is derived from its investment due diligence processes and monitoring of its clients' private market portfolios. As of Fall 2020, the database includes deal-level performance information on over 158,000 private equity, real estate, infrastructure/real assets, and private debt investments, of which over 25,000 investments have operating metrics (e.g., revenue, EBITDA, total enterprise value, net debt, etc.). For buyouts investments, StepStone has over 28,000 investments with performance information, of which over 13,000 investments have operating metrics.

The dataset StepStone supplied for this analysis is subset to the due diligence side, excluding data derived from client reporting. It was filtered using consistency checks on three distinct data types: deal operating metrics, deal cash flows, and reported deal performance. It was further subset to unique M&A activity. In effect, consortium deals are only represented once in the dataset; they are not repeated for each GP or Fund that participated. This process resulted in a dataset of 10,861 deals across Buyouts, Corporate Lending, and Infrastructure with entry dates from 1984 to 2020. Data available on individual deals includes a variety of characteristics ranging from performance measures (PME, IRR, Direct Alpha, and TVM) to leverage, revenue, EBITDA multiple etc. both at deal entry and exit. Of the 10,861 deals, 6,203 are not fully exited and 4,658 are fully exited.

We limit our analysis to buyout transactions. We also drop deals when fund size is smaller than 10 million USD, and when entry total enterprise value (TEV), TEV, and entry equity are less than or equal to 5 million USD. Furthermore, we drop deals representing more than 50% of a fund’s investment. We require all deals to have both an entry leverage ratio and an entry Debt / TEV value. This results in a final sample size of 6,248 deals with 3,029 fully exited deals and 3,219 not exited deals.

We calculate annual change and growth variables for certain variables. These change variables include net debt to TEV ratio (D/V), the leverage ratio, EBITDA multiple, and ownership percentage in the fund. Growth variables include TEV, revenue, EBITDA, net debt, and equity. Both changes and growth rates are annualized so that values are comparable across fully exited and not fully-exited deals. Because of extreme skewness in certain variables, we Winsorize some values at the 99% level. These variables included: direct alpha, IRR, TVM, PME, TEV, the change in debt to TEV, the growth in revenue, growth in EBITDA, growth in net debt, change in EBITDA multiple, change in leverage ratio, and growth in equity. Our qualitative results hold if we do not transform the data.

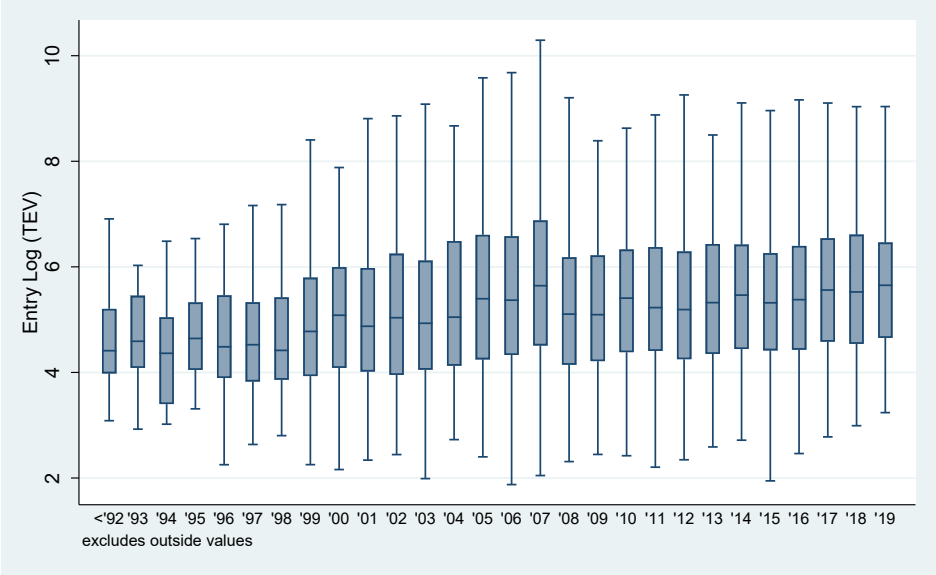
Figure 2. StepStone Sample by Deal Year and Exit Status

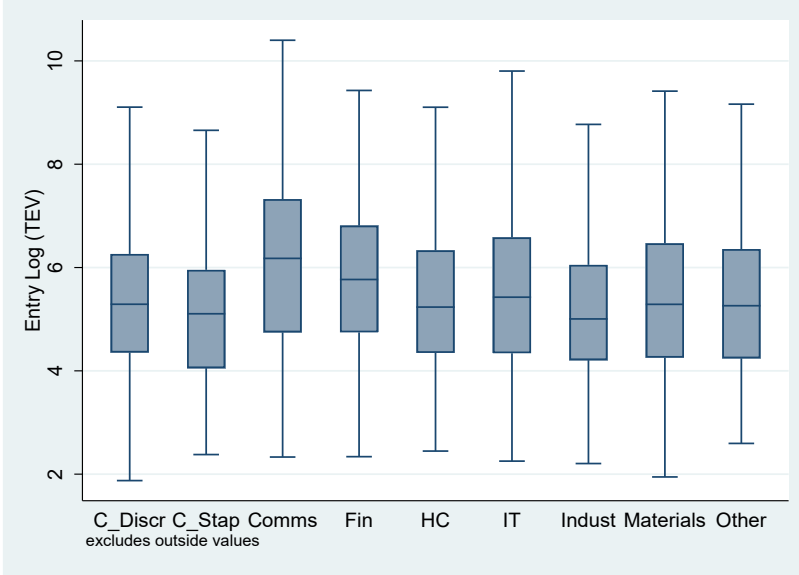


This figure plots a histogram of the number of deals in the StepStone dataset by deal entry year used for the subsequent analysis. The values for of fully-exited deals are represented by dark bars and the values for not fully-exited deals are represented by stacked light bars so that the total number of observations for each deal entry year is represented by the top of the light bar. Additional details for the dataset are presented in Appendix B.

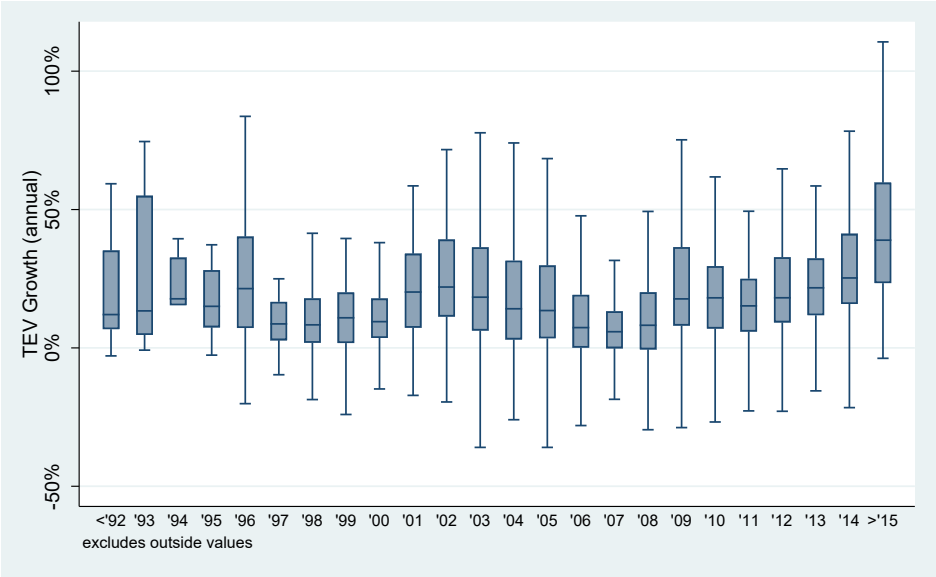
Figure 3. Deal Characteristics Year and Sector

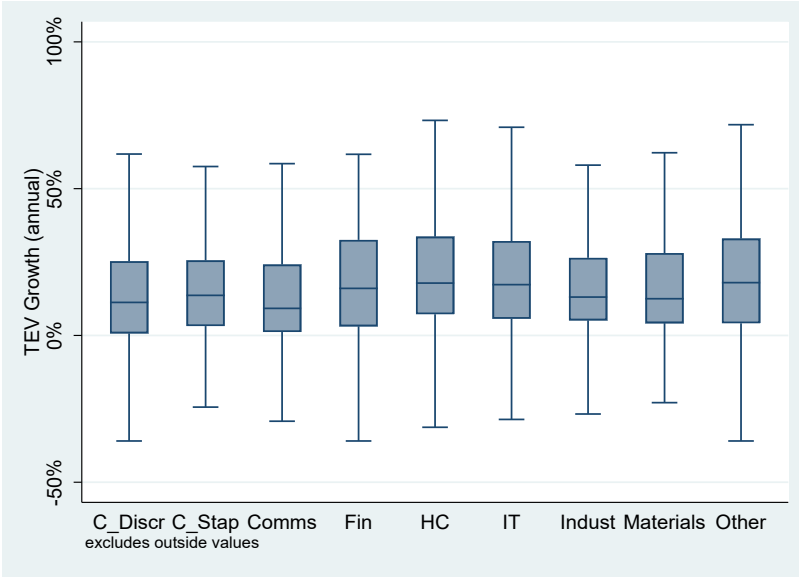
Panel A: Entry Log (TEV) – All Deals



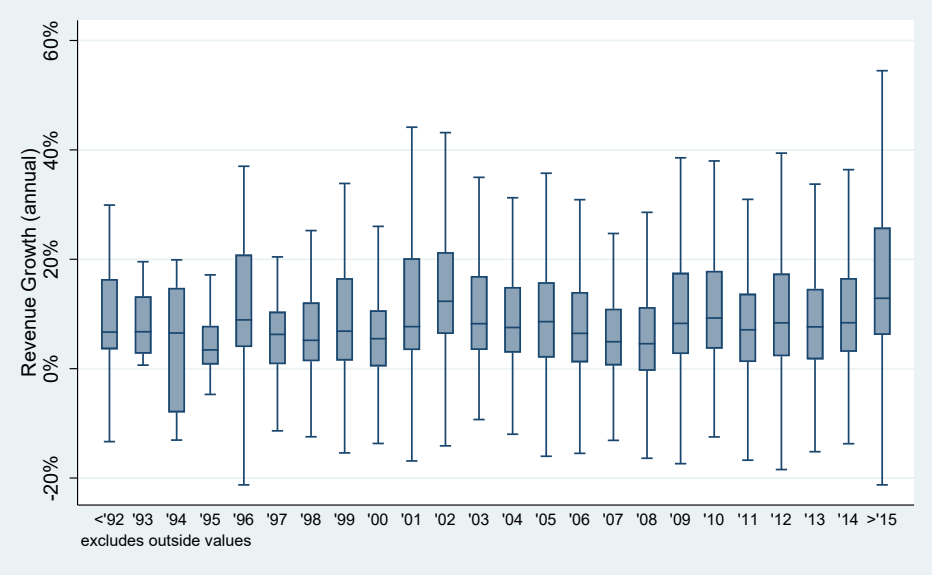


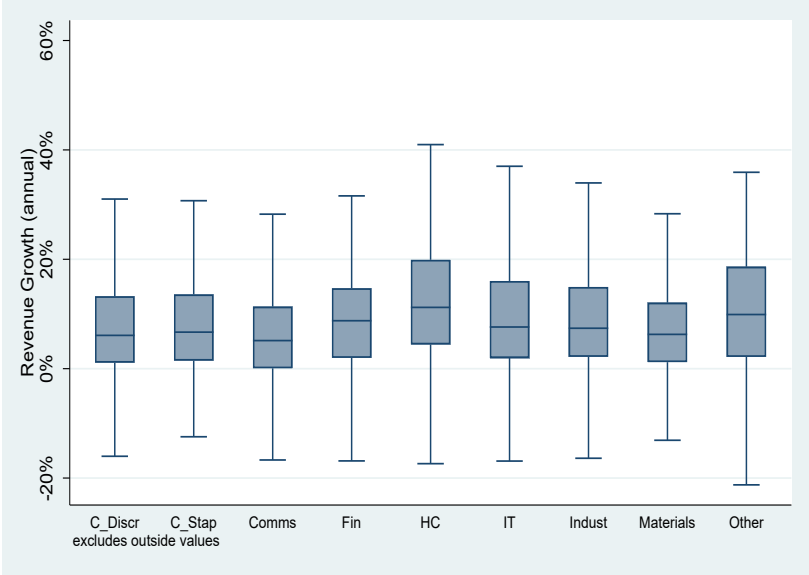
Panel B: Change in TEV (annual rate) – Fully-exited Deals Only



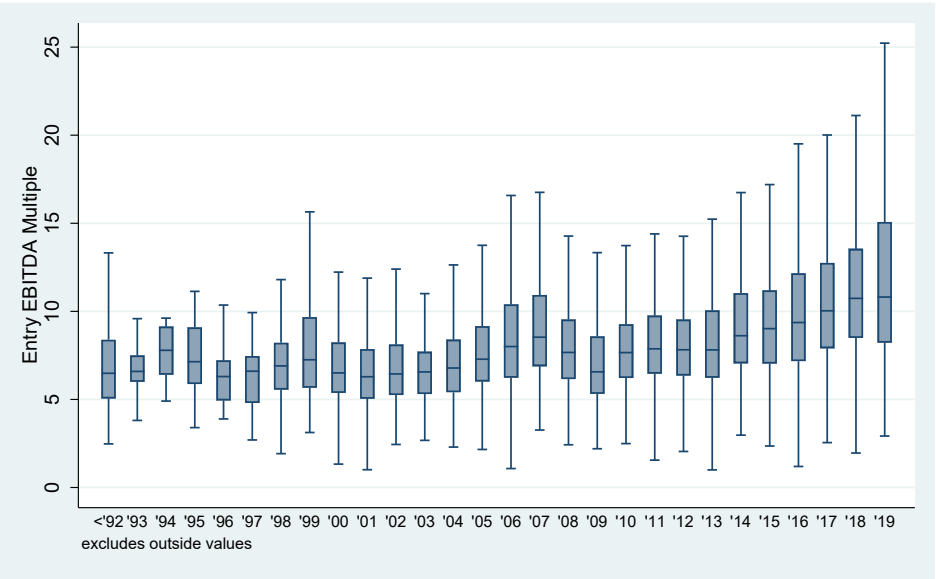


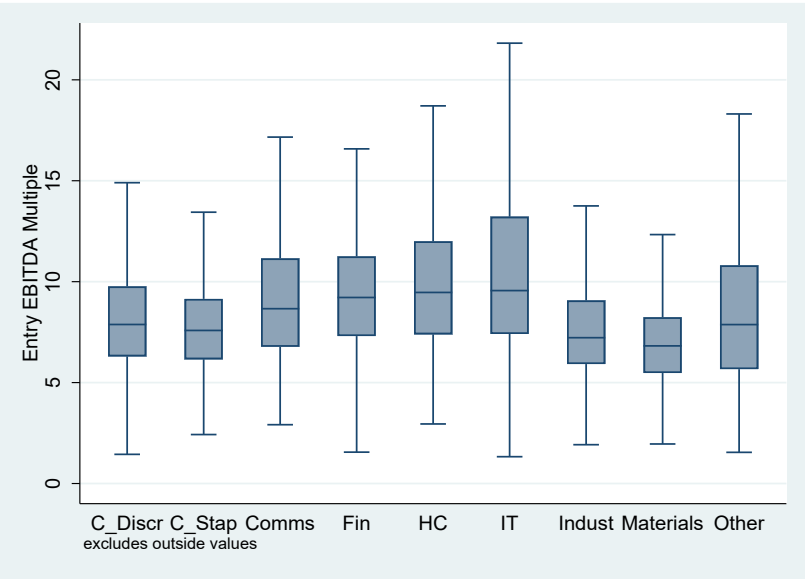
Panel C: Change in Revenue (annual rate)– Fully-exited Deals



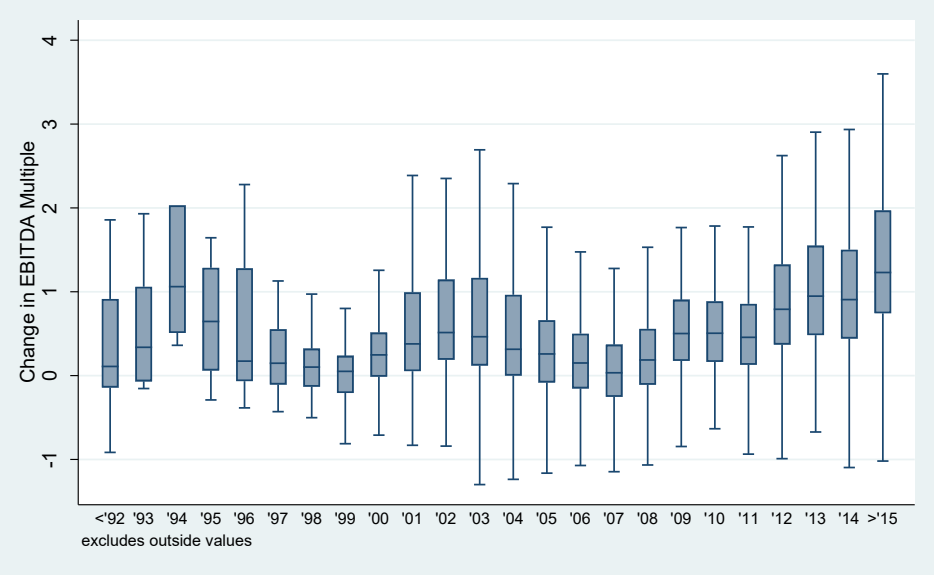


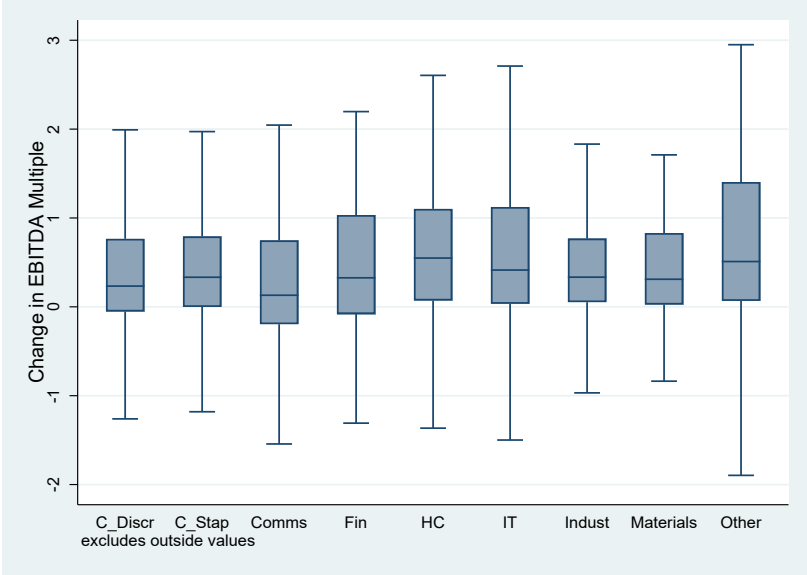
Panel D: Entry EBITDA Multiple – All Deals





Panel E: Change in EBITDA Multiple (per year) – Fully-exited Deals Only

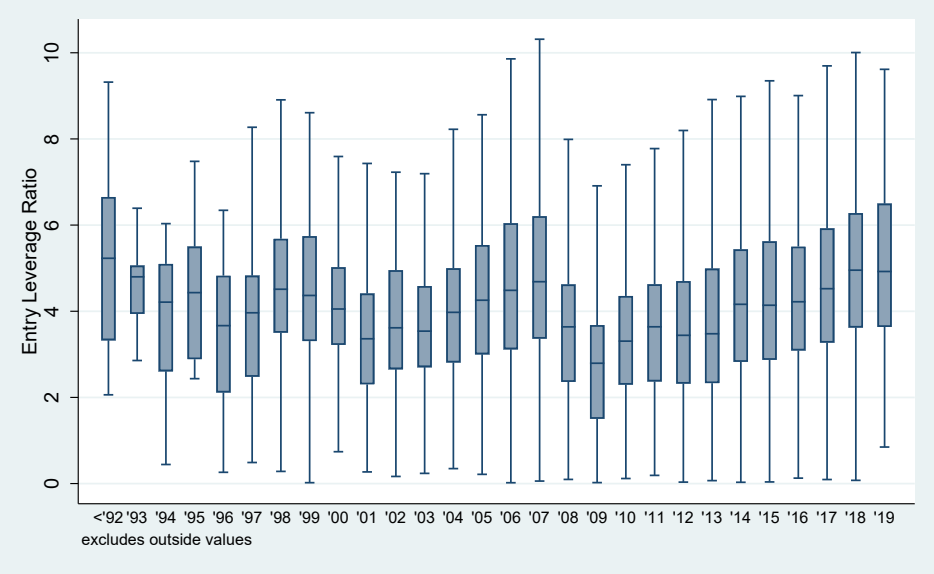


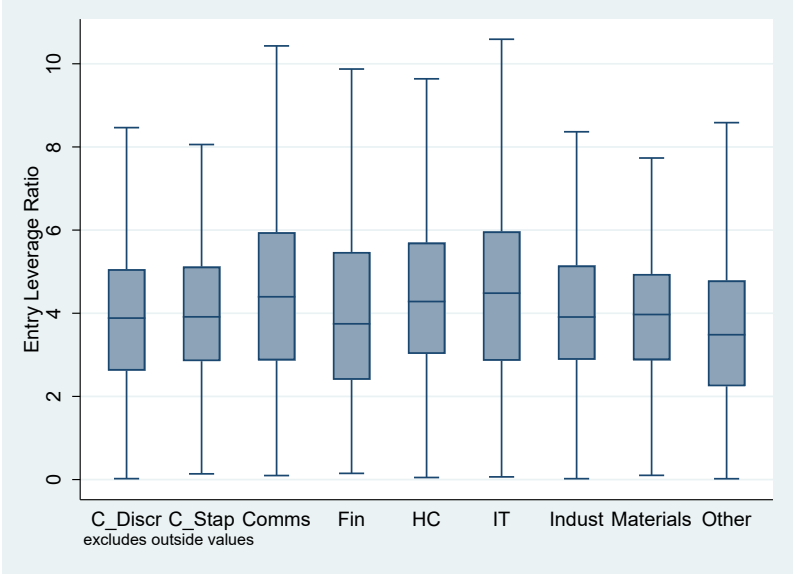


This figure plots deal-level characteristics for the StepStone dataset by year of deal entry and by industry. The solid area of each bar (box) represents the interquartile range (IQR) for each category. The thin lines in each plot (whiskers) represent the lower and upper adjacent values (1st quartile -1.5 IQR and 3rd quartile + IQR, respectively) for each category. Outside values are not plotted. For variables measured at deal entry the full sample is used. For values that rely on characteristics after the entry date (e.g., growth rates and changes over deal life), only fully-exited deals are included. Because there are relatively few fully-exited deals in the latter part of the sample, these plots combine data for 2015-2020.

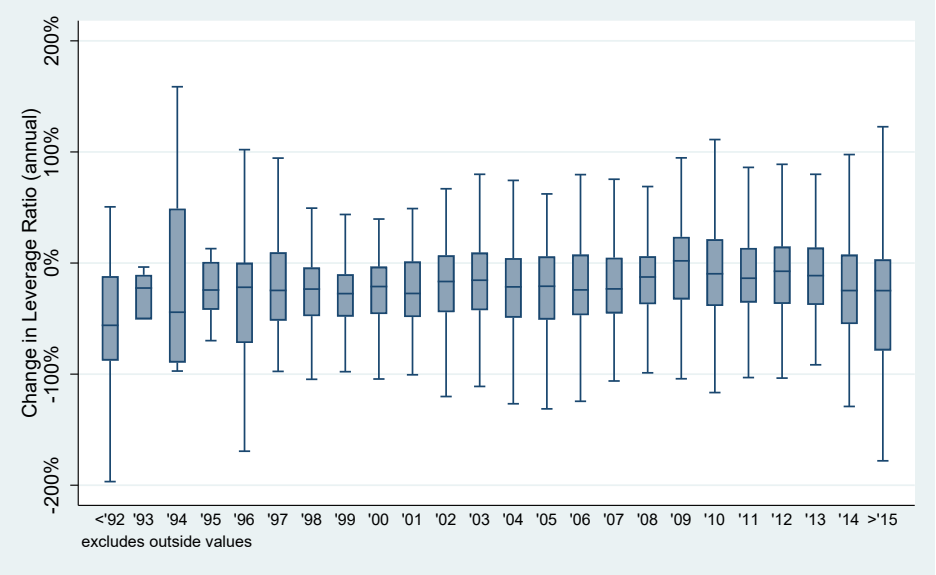
Figure 4. Debt and Leverage Characteristics by Year and Sector

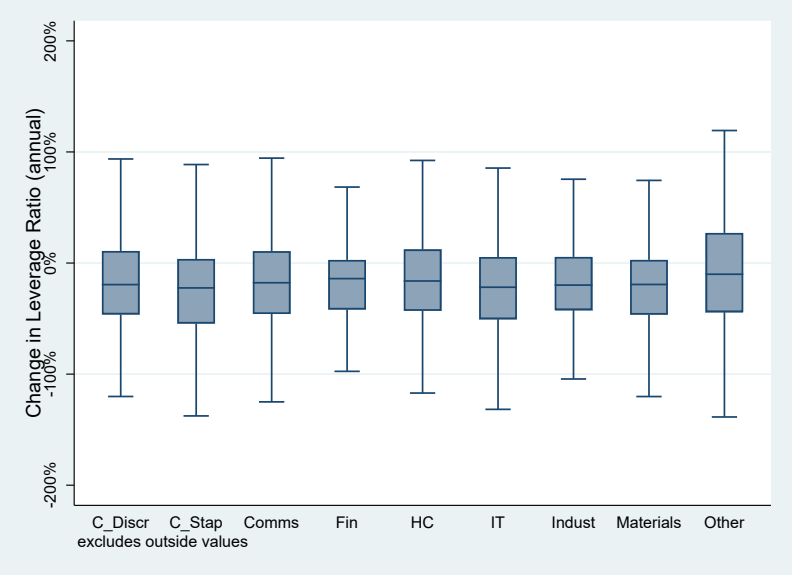
Panel A: Entry leverage ratio– All Deals



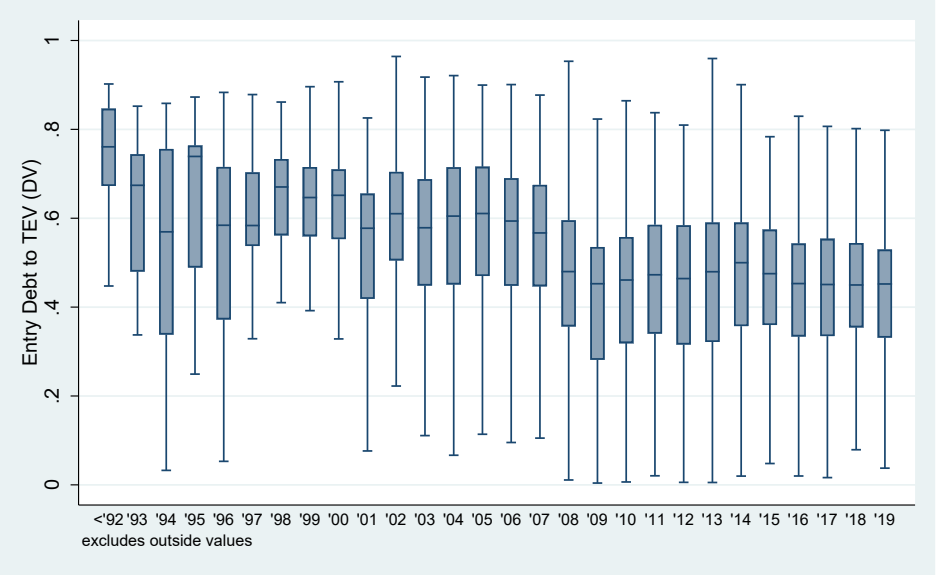


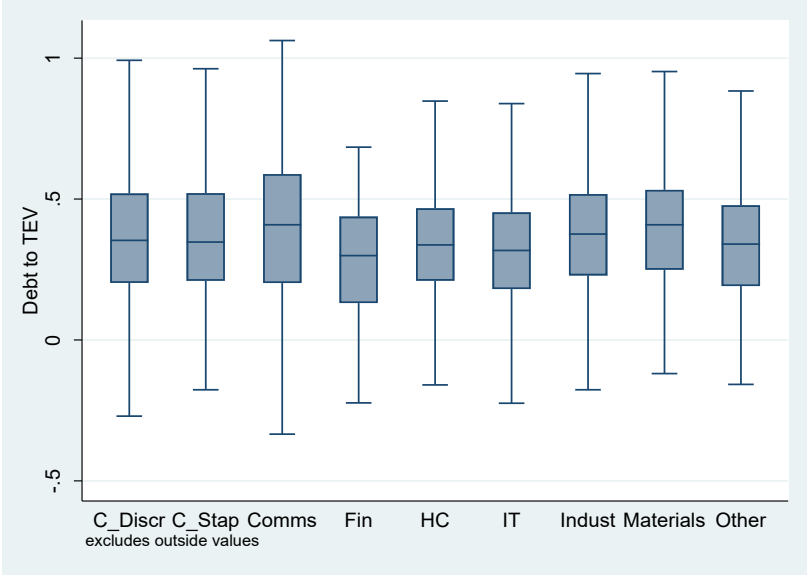
Panel B: Change in leverage ratio – Fully-exited Deals Only



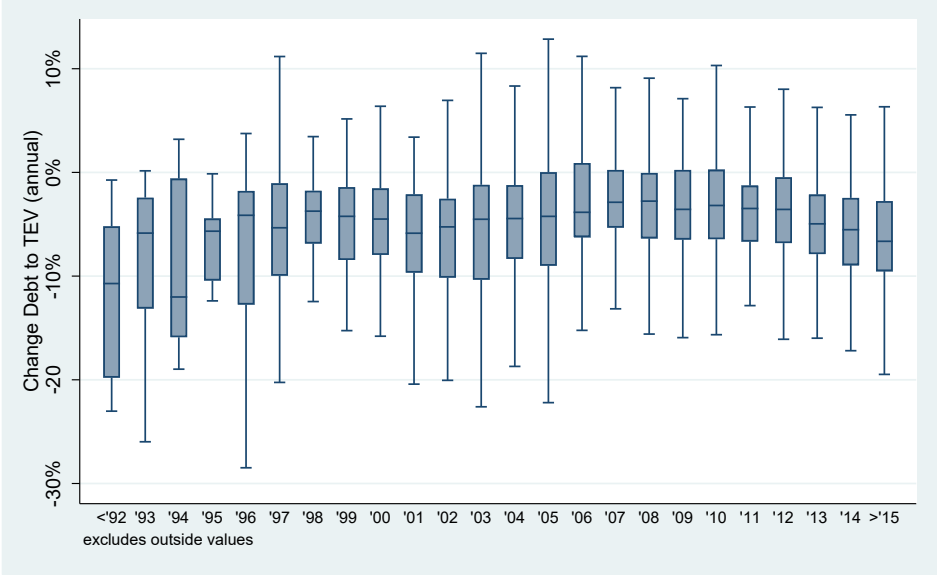


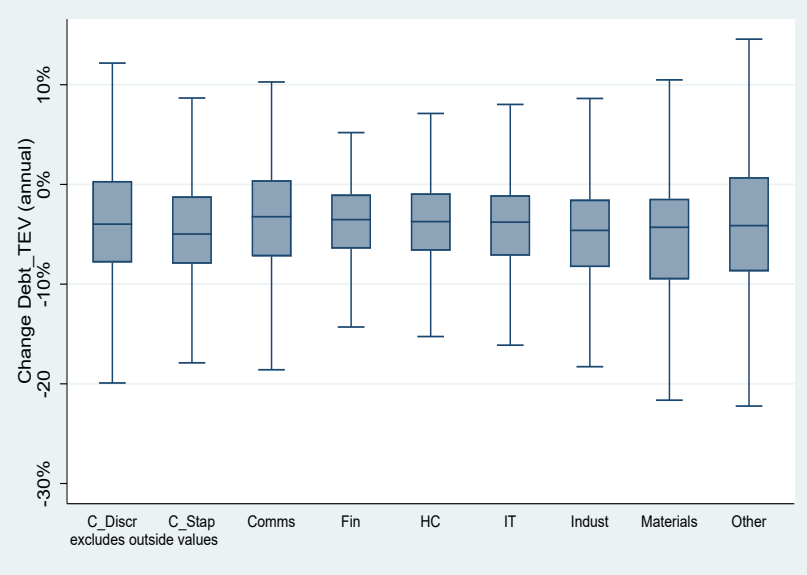
Panel C: Entry Net Debt/TEV (D/V) – All Deals





Panel D: Changes in Debt/TEV (D/V) – Fully-exited Deals Only

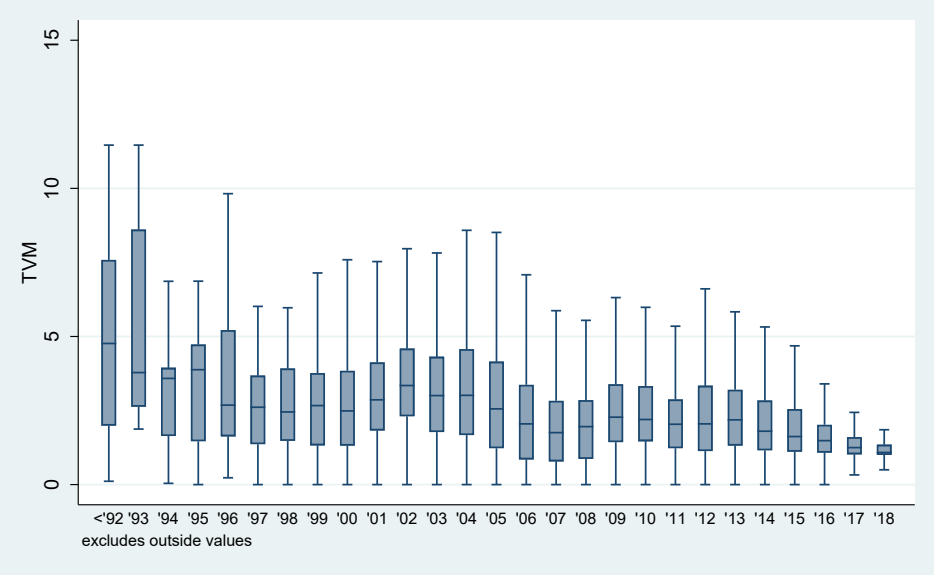


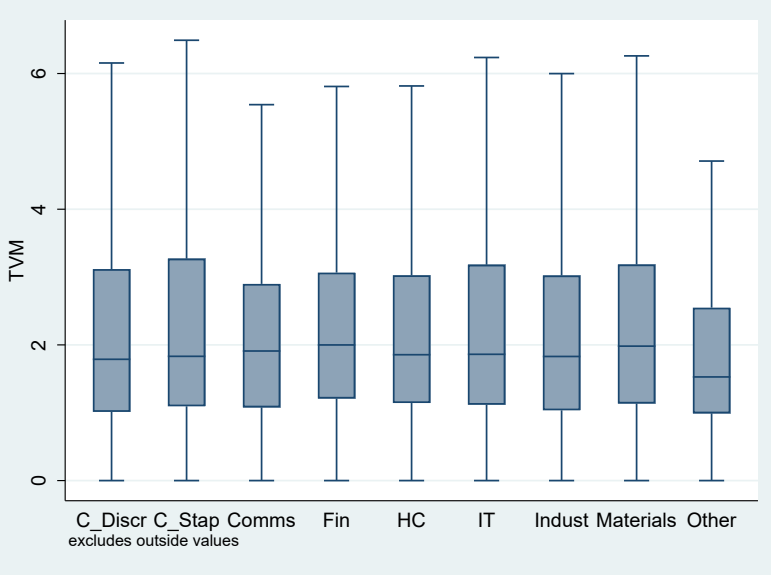


This figure plots deal-level debt and leverage characteristics for the StepStone dataset by year of deal entry and by industry. The solid area of each bar (box) represents the interquartile range (IQR) for each category. The thin lines in each plot (whiskers) represent the lower and upper adjacent values (1st quartile -1.5 IQR and 3rd quartile + IQR, respectively) for each category. Outside values are not plotted. For variables measured at deal entry the full sample is used. For values that rely on characteristics after the entry date (e.g., growth rates and changes over deal life), only fully-exited deals are included. Because there are relatively few fully-exited deals in the latter part of the sample, these plots combine data for 2015-2020.

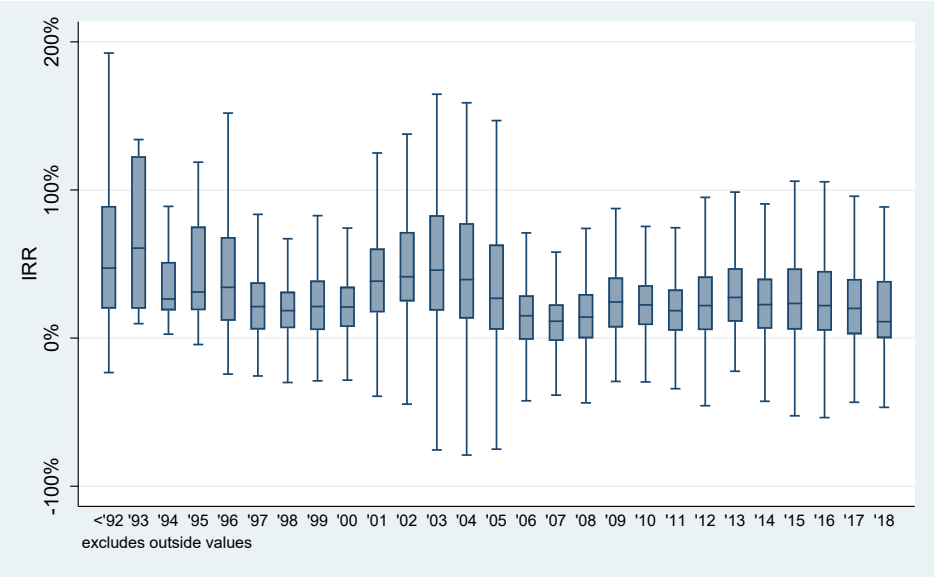
Figure 5. Deal Performance by Year and Sector

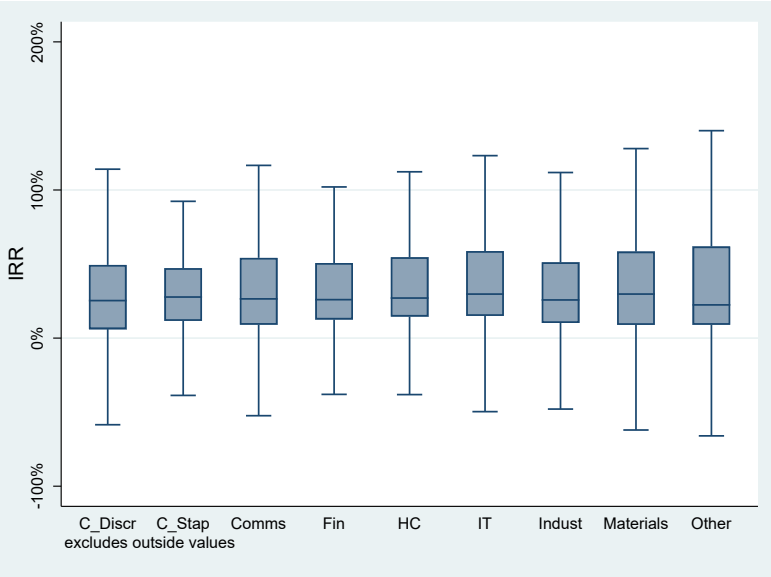
Panel A: TVM – All Deals



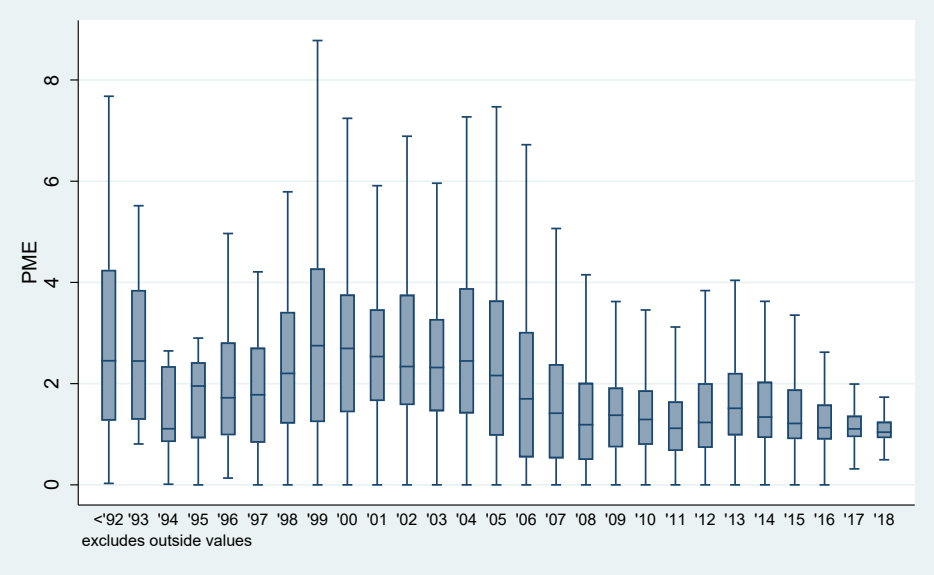


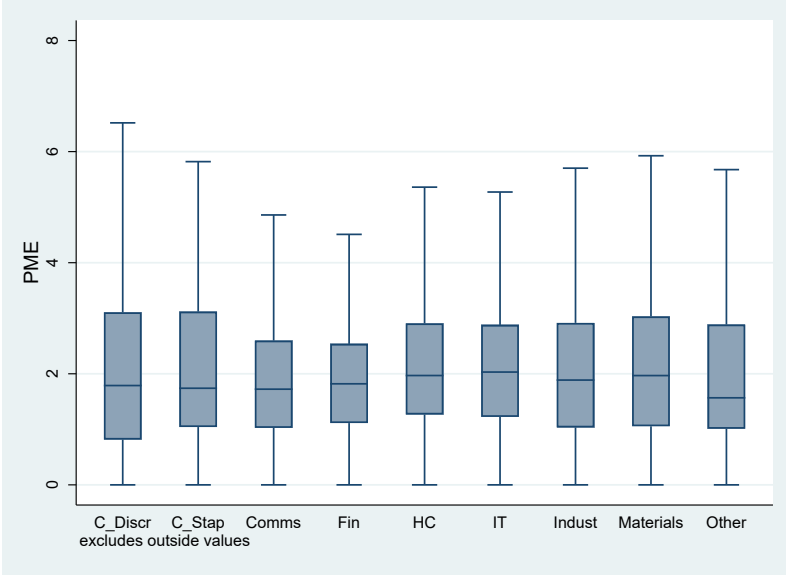
Panel B: IRR – All Deals



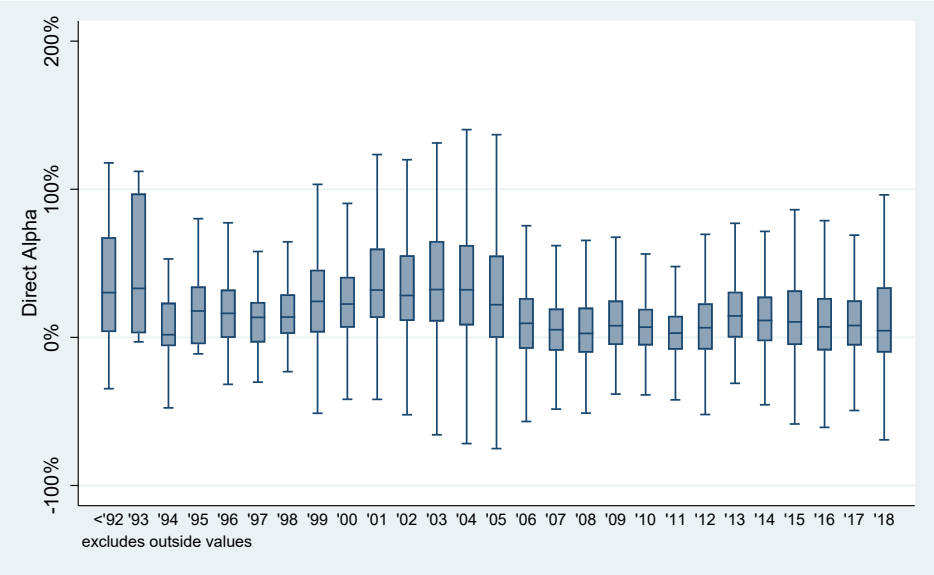


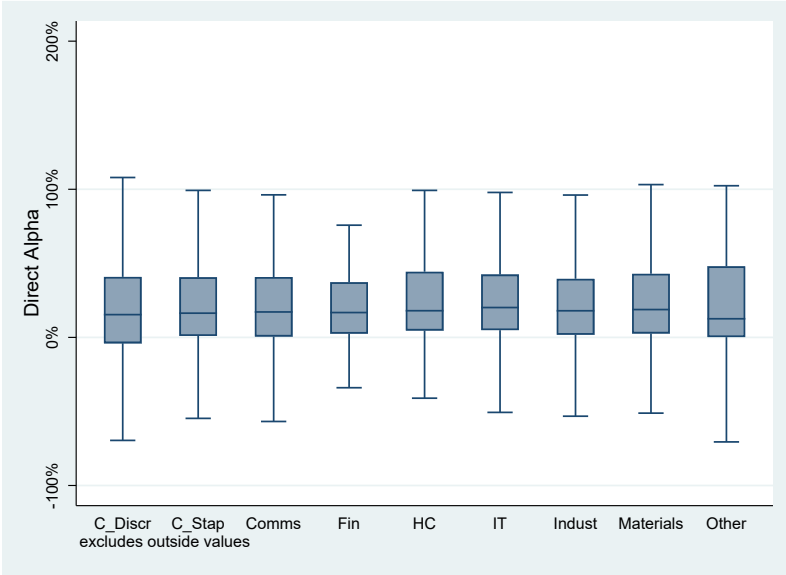
Panel C: PME – All Deals



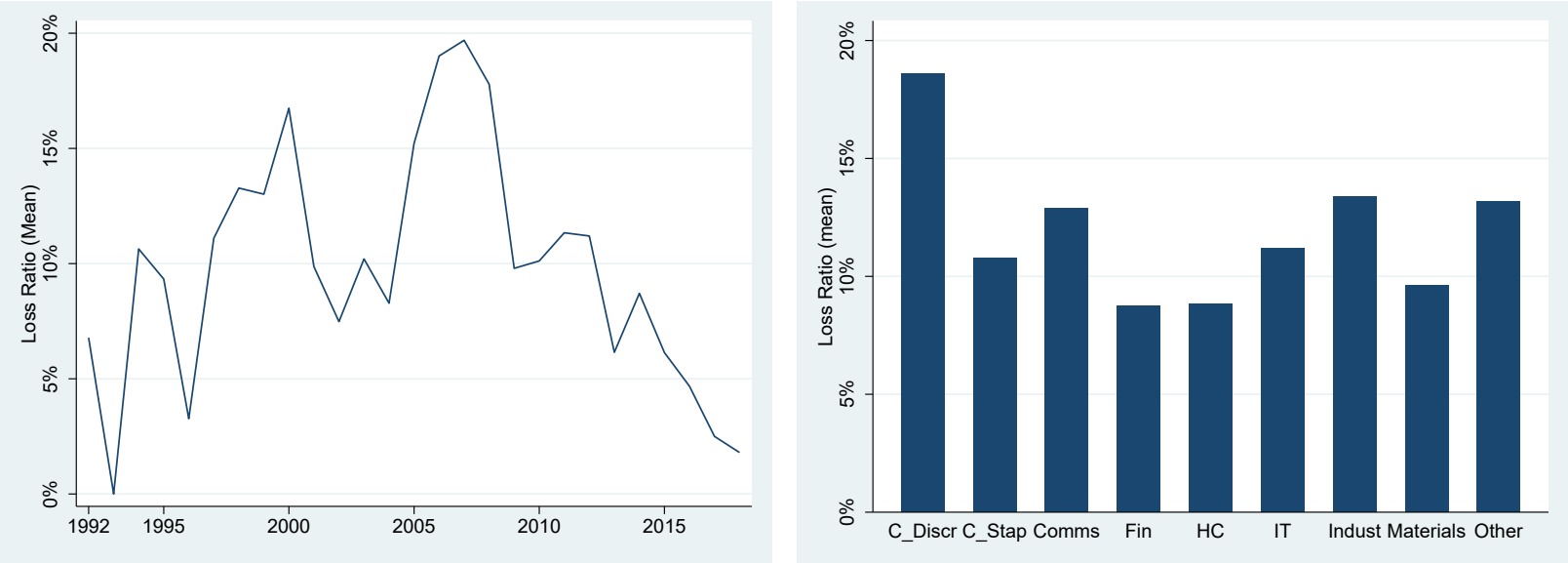


Panel D: Direct Alpha – All Deals





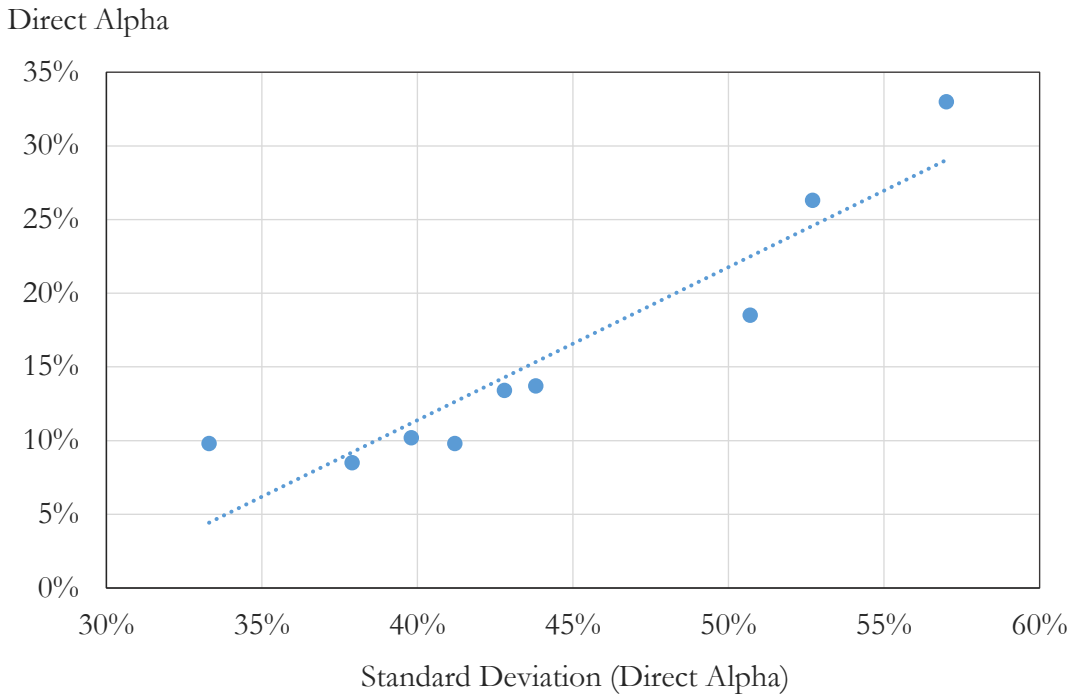
Panel E: Loss Ratios by Year of Deal Entry – Time-Series of Annual Averages



*Because of sparse data at the beginning and end of the sample, value for 1992 is average across 1984-1992.

This figure plots deal-level performance metrics for the StepStone dataset by year of deal entry and by industry. The solid area of each bar (box) represents the interquartile range (IQR) for each category. The thin lines in each plot (whiskers) represent the lower and upper adjacent values (1st quartile -1.5 IQR and 3rd quartile + IQR, respectively) for each category. Outside values are not plotted. For variables measured at deal entry the full sample is used. For values that rely on characteristics after the entry date (e.g., growth rates and changes over deal life), only fully-exited deals are included. Because there are relatively few fully-exited deals in the latter part of the sample, these plots combine data for 2015-2020.

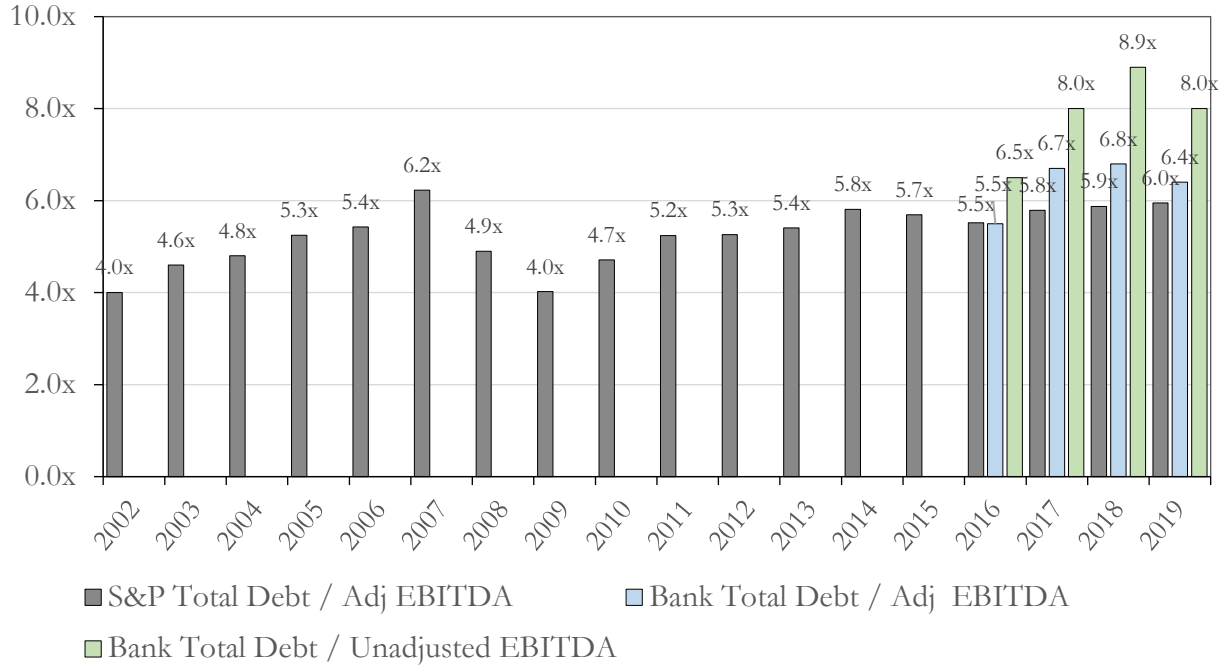
Figure 5. Risk-Return Trade-off Based on Means of 3x3 Sort



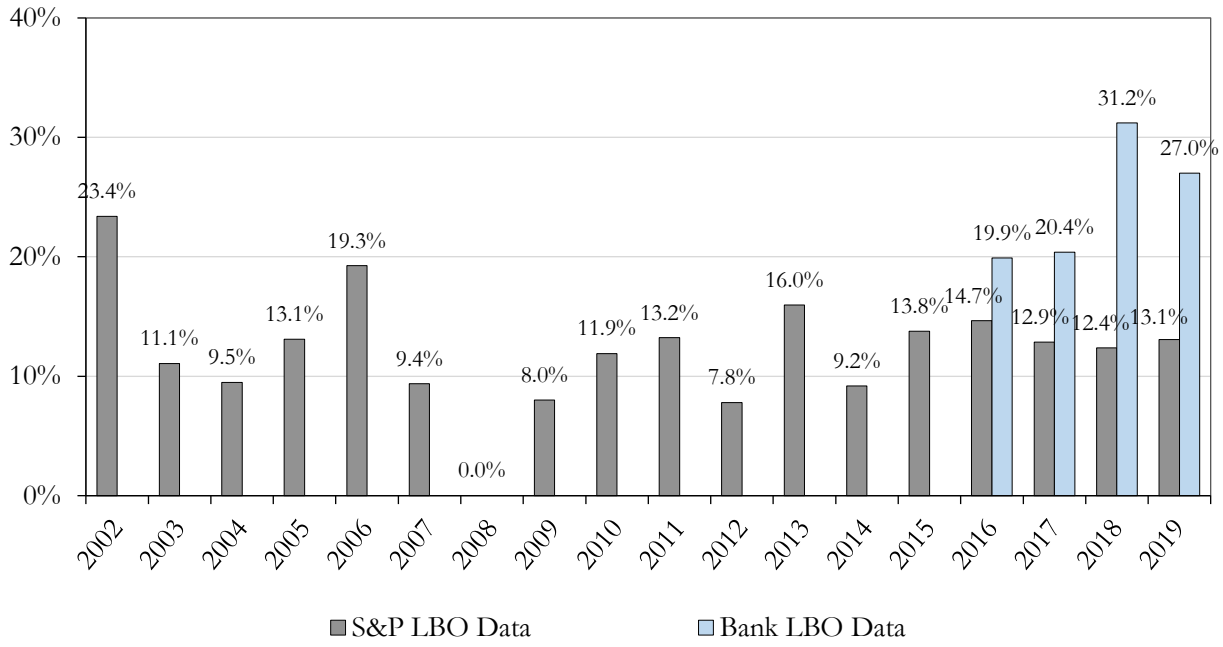
This figure plots the mean (return) and standard deviation (risk) pairs of deal-level direct alpha for the 3x3 sort in Panel A of Table 4. The dashed line represents the ordinary least squares fit to these observations and shows a strong positive relation between risk and return for these portfolios.

Figure 6. Effects from Recent EBITDA Adjustments

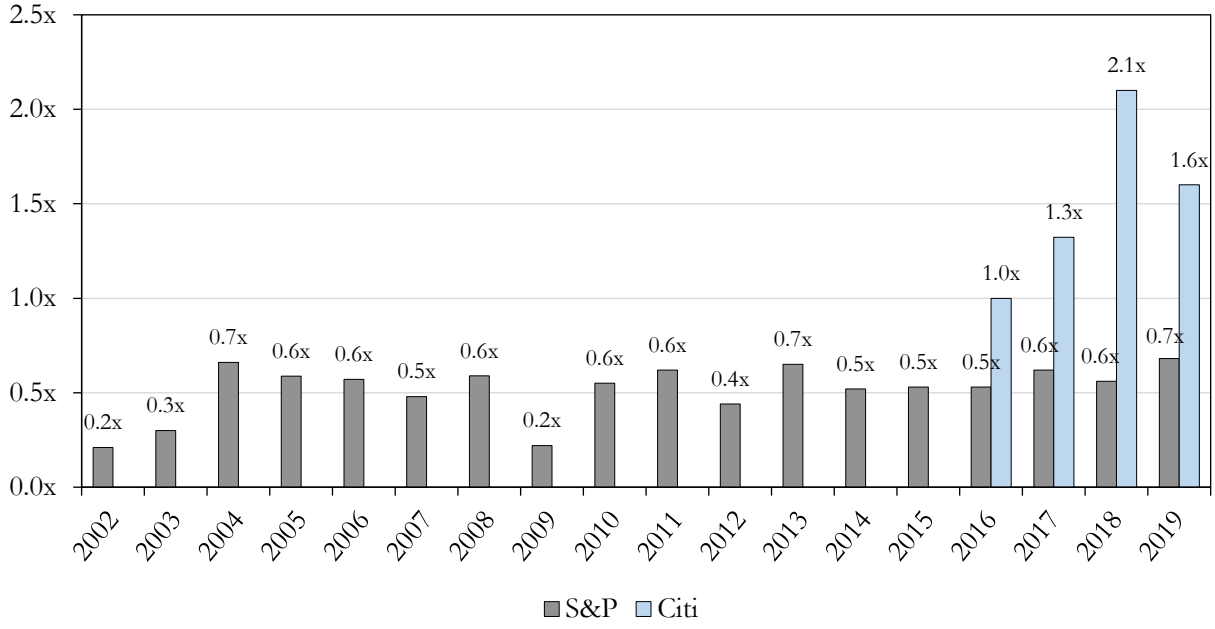
Panel A: Average Debt / EBITDA of LBO Loans: S&P vs. Bank-data



Panel B: Adjustments as a Percent of Unadjusted EBITDA: S&P vs. Bank-data



Panel C: Difference in Debt / Adjusted EBITDA vs. Debt / EBITDA: S&P vs. Bank-data



Sourced from S&P Global Market Intelligence and proprietary data collected by a global commercial bank (bank-data). S&P data includes all deals rated by S&P with EBITDA >$50 million. Bank-data includes tracked transactions with both Adjusted EBITDA and full run-rate adjusted Marketed EBITDA as presented to potential creditors. Bank-data deals include only large market (>$500 million TEV). For the bank-data data, calculations are made using the following number of annual observations (N): (2016: N=16), (2017: N=37), (2018: N=56), (2019: N=40). Media and telecom loans prior to 2011 are excluded. EBITDA adjusted for prospective cost savings or synergies.

Table 1. New Data Sample Characteristics

(See Appendix B for additional details on StepStone data)

	Burgiss	Stepstone	Bank-data
Years (Entry Date)	1983-2018	1984-2020	2010-2018
Number of Deals	15,095	6,248	1,054
Entry Equity Value (USD million, Median)	52	95	442
TVM - Fully Exited (Median)	2.10	2.53	2.75
TVM - All Deals (Median)	1.55	1.84	2.7
PME - Fully Exited (Median)	1.35	1.85	--
PME - All Deals (Median)	1.07	1.33	--
Holding Period - Fully Exited (years)	5	5	--
Industry			
Communications	9.1%	6.9%	0%
Consumer Goods	26.4%	27.1%	13.4%
Financials	6.7%	4.3%	7.3%
Health Care	10.9%	13.6%	12.5%
Industrials	20.1%	21.7%	18.1%
Information Technology	15.0%	14.3%	23.2%
Other	11.7%	12.1%	25.4%
Geography			
North America	47.9%	58.7%	97.5%
Western Europe	22.2%	32.0%	1.5%
Other	29.9%	9.3%	1.0%

Table 2. StepStone Data Summary Statistics

(See Appendix B for data description)

	All Deals					
	Obs	**Mean**	**StdDev**	**25%**	**Median**	**75%**
Deal Entry Year	6,248	2010	5.8	2006	2011	2015
Fund Size	6,248	2,636	3,706	420	1,100	3,397
Holding Period	6,248	4.64	3.01	2.25	4.00	6.50
Entry Ownership Percentage	5,548	61%	26%	43%	65%	83%
Entry TEV	6,248	717.8	2,713.4	75.0	195.4	595.8
TEV Growth (annual)	5,925	19.0%	28.0%	3.0%	13.0%	27.0%
Entry Net Debt	6,248	382.4	1,332.9	30.0	86.0	289.2
Net Debt Growth (annual)	5,863	8.0%	39.5%	-6.2%	2.2%	15.0%
Entry Equity	6,248	335.4	1,831.1	37.0	95.0	268.1
Equity Growth (annual)	5,768	28.0%	47.0%	7.0%	21.0%	41.0%
Entry Revenue	6,120	464.2	1,891.1	51.6	127.1	361.6
Revenue Growth (annual)	5.925	11.6%	17.2%	1.8%	7.9%	17.2%
Entry EBITDA	6,248	80.5	303.6	10.0	23.3	63.7
EBITDA Growth (annual)	5,974	12.3%	25.1%	0.0%	8.0%	19.0%
Operating Margin (EBITDA/Revenue)	6,118	22.0%	25.0%	12.0%	19.0%	28.0%
Entry EBITDA Multiple	5,769	10.77	5.35	7.65	9.77	12.48
EBITDA Multiple Change (annual)	5,736	0.54	1.50	-0.01	0.33	0.90
Entry leverage ratio	6,248	4.15	2.15	2.78	4.02	5.36
Exit leverage ratio	5,658	4.13	3.12	2.17	3.66	5.32
leverage ratio Change (annual)	5,622	-0.05	0.83	-0.42	-0.12	0.18
Entry Debt/TEV (D/V)	6,248	0.49	0.19	0.37	0.51	0.62
Exit Debt/TEV	5,898	0.39	0.39	0.21	0.35	0.50
Debt/TEV Change (annual)	5,866	-0.03	0.08	-0.07	-0.03	0.00
TVM	6,248	2.39	2.04	1.07	1.84	3.07
IRR	6,120	27.0%	49.0%	4.0%	21.0%	43.0%
PME	6,120	1.77	1.53	0.88	1.33	2.25
Direct Alpha	6,113	16.0%	46.0%	-6.0%	10.0%	31.0%
Loss Ratio	6,248	10.0%	26.0%	0.0%	0.0%	0.0%

Table 3. Quartile Analysis of Leverage

(See Appendix B for data description)

	Sorted on Debt/TEV				Sorted on leverage ratio			
	Low			High	Low			High
	Q4	Q3	Q2	Q1	Q4	Q3	Q2	Q1
Deal and Fund Characteristics								
Deal Entry Year	2006	2010	2011	2011	2010	2010	2009	2009
Fund Size	2,680.1	2,489.7	2,626.2	2,749.3	2,031.2	1,818.5	2,430.1	4,265.4
Entry Ownership Percentage	51.2%	64.6%	66.9%	63.0%	53.2%	64.8%	66.4%	61.2%
Percent of Fund Invested	6.15%	6.87%	7.48%	7.51%	6.23%	7.00%	7.43%	7.34%
Holding Period	4.34	4.16	4.55	5.53	4.80	4.63	4.50	4.64
Entry TEV	594.1	534.0	617.4	1,126.0	480.1	362.8	597.1	1,431.4
TEV Growth (annual)	21.8%	19.6%	18.1%	14.9%	22.4%	19.6%	17.6%	14.9%
Entry Net Debt	111.7	238.6	349.6	829.8	93.3	171.7	332.1	932.7
Net Debt Growth (annual)	22.5%	7.1%	5.1%	-0.2%	18.3%	5.1%	5.3%	5.5%
Entry Revenue	306.7	349.3	387.0	816.1	343.4	347.0	446.4	720.3
Entry EBITDA	59.4	56.5	73.0	133.3	68.6	49.8	71.5	132.1
EBITDA Growth (annual)	14.7%	12.8%	11.3%	7.7%	10.5%	11.0%	11.7%	13.0%
Operating Margin	23.7%	23.1%	21.8%	20.3%	23.0%	20.3%	21.1%	24.7%
Entry EBITDA Mult.	10.55	9.43	8.38	7.58	7.32	7.54	8.84	12.23
Exit EBITDA Mult.	12.60	11.20	10.21	9.17	10.15	9.64	10.61	12.62
Change EBITDA Mult. (annual)	0.64	0.53	0.53	0.47	0.84	0.62	0.52	0.21
Change EBITDA Mult. (StdDev)	2.11	1.51	1.17	1.03	1.57	1.28	1.27	1.78
Entry leverage ratio	2.34	4.17	4.72	5.37	1.71	3.43	4.64	6.81
Exit leverage ratio	3.29	4.07	4.45	4.59	2.68	3.53	4.35	5.67
Change in leverage ratio (annual)	0.19	-0.07	-0.12	-0.18	0.22	-0.01	-0.11	-0.27
Entry Debt/TEV	0.23	0.44	0.56	0.71	0.28	0.50	0.56	0.60
Exit Debt/TEV	0.25	0.38	0.45	0.49	0.26	0.39	0.44	0.47
Change Debt/TEV (annual)	0.00	-0.03	-0.04	-0.06	-0.01	-0.04	-0.04	-0.03
Performance and Risk Metrics								
Mean TVM	2.11	2.15	2.32	2.97	2.46	2.53	2.47	2.09
StdDev TVM	1.82	1.77	1.90	2.46	2.15	2.17	2.10	1.66
Mean IRR	22.3%	24.6%	26.3%	36.2%	28.1%	29.7%	29.0%	22.6%
StdDev IRR	43.7%	42.9%	48.0%	58.8%	50.7%	51.6%	49.3%	43.9%
Mean PME	1.52	1.56	1.69	2.32	1.78	1.84	1.87	1.60
StdDev PME	1.34	1.25	1.35	1.95	1.62	1.58	1.60	1.28
Mean Direct Alpha	10.6%	12.8%	14.4%	25.8%	16.0%	17.5%	17.4%	12.6%
StdDev Direct Alpha	41.1%	39.7%	44.1%	54.5%	47.4%	47.6%	46.2%	40.8%
Mean Loss Ratio	9.7%	8.4%	10.2%	11.3%	10.3%	10.3%	8.6%	10.4%
StdDev Loss Ratio	25.0%	23.6%	26.5%	28.8%	26.3%	26.4%	24.8%	26.7%

Table 4. Double Sorts on Debt/TEV and leverage ratio

Panel A: Means (See Appendix B for data description)

			Entry leverage ratio		
			Low	**Mid**	**High**
Entry Debt/TEV	**Low**	Entry TEV	781.1	634.5	835.2
		Deal Entry Year	2011	2013	2014
		Operating Margin	25.3%	22.7%	27.0%
		EBITDA Growth	15.1%	14.3%	19.4%
		Entry EBITDA Multiple	9.9	10.7	15.2
		Change in EBITDA Multiple (annual)	0.72	0.48	0.15
		Change in leverage ratio (annual)	0.37	0.01	-0.25
		Change in Debt/Tev (annual)	0.01	-0.02	-0.02
		Direct Alpha (Mean)	9.8%	8.5%	9.8%
		Direct Alpha (StdDev)	41.2%	37.9%	33.3%
		Loss Ratio (Mean)	10.6%	8.5%	6.4%
		Loss Ratio (StdDev)	25.9%	23.1%	19.4%
	Mid	Entry TEV	283.1	312.0	1,001.1
		Deal Entry Year	2011	2010	2012
		Operating Margin	21.1%	20.0%	23.1%
		EBITDA Growth	9.8%	10.8%	12.5%
		Entry EBITDA Multiple	7.1	7.4	10.5
		Change in EBITDA Multiple (annual)	0.89	0.61	0.33
		Change in leverage ratio (annual)	0.14	-0.08	-0.19
		Change in Debt/TEV (annual)	-0.02	-0.04	-0.03
		Direct Alpha (Mean)	13.7%	13.4%	10.2%
		Direct Alpha (StdDev)	43.8%	42.8%	39.8.%
		Loss Ratio (Mean)	9.8%	10.9%	10.6%
		Loss Ratio (StdDev)	25.7%	27.2%	27.3%
	High	Entry TEV	277.9	506.8	1,829.6
		Deal Entry Year	2008	2007	2007
		Operating Margin	20.0%	19.1%	21.8%
		EBITDA Growth	7.3%	8.8%	6.4%
		Entry EBITDA Multiple	5.1	6.1	9.0
		Change in EBITDA Multiple (annual)	0.74	0.62	0.36
		Change in leverage ratio (annual)	-0.01	-0.12	-0.24
		Change in Debt/TEV (annual)	-0.05	-0.06	-0.05
		Direct Alpha (Mean)	26.3%	33.0%	18.5%
		Direct Alpha (StdDev)	52.7%	57.0%	50.7%
		Loss Ratio (Mean)	9.9%	9.3%	13.3%
		Loss Ratio (StdDev)	26.9%	26.1%	31.0%

Table 4b. Double Sorts on Debt/TEV and leverage ratio

Panel B: Medians (See Appendix B for data description)

			Entry Leverage Ratio		
			Low	**Mid**	**High**
Entry Debt/TEV	**Low**	Entry TEV	123.70	190.97	390.00
		Deal Entry Year	2011	2014	2016
		Operating Margin	19.0%	21.0%	25.0%
		EBITDA Growth	9.0%	10.0%	13.0%
		Entry EBITDA Multiple	8.68	9.89	13.08
		Change in EBITDA Multiple (annual)	0.40	0.27	0.13
		Change in Leverage Ratio (annual)	0.15	-0.09	-0.26
		Change in Debt/Tev (annual)	0.00	-0.02	-0.02
		Direct Alpha (Median)	5.0%	5.0%	6.0%
		Direct Alpha (StdDev)	41.2%	42.8%	33.3%
		Loss Ratio (Median)	0.0%	0.0%	0.0%
		Loss Ratio (StdDev)	25.9%	23.1%	19.4%
	Mid	Entry TEV	86.31	130.07	600.72
		Deal Entry Year	2011	2011	2012
		Operating Margin	18.0%	17.0%	20.0%
		EBITDA Growth	8.0%	8.0%	9.0%
		Entry EBITDA Multiple	7.08	7.37	9.98
		Change in EBITDA Multiple (annual)	0.50	0.37	0.17
		Change in Leverage Ratio (annual)	-0.02	-0.15	-0.21
		Change in Debt/TEV (annual)	-0.02	-0.04	-0.03
		Direct Alpha (Median)	9.0%	11.0%	9.0%
		Direct Alpha (StdDev)	43.8%	37.9%	39.8%
		Loss Ratio (Median)	0.0%	0.0%	0.0%
		Loss Ratio (StdDev)	25.7%	27.2%	27.3%
	High	Entry TEV	62.90	170.00	713.66
		Deal Entry Year	2009	2006	2006
		Operating Margin	16.0%	16.0%	18.0%
		EBITDA Growth	6.0%	7.0%	5.0%
		Entry EBITDA Multiple	5.06	6.14	8.32
		Change in EBITDA Multiple (annual)	0.46	0.38	0.16
		Change in Leverage Ratio (annual)	-0.10	-0.19	-0.25
		Change in Debt/TEV (annual)	-0.05	-0.05	-0.04
		Direct Alpha (Median)	19.0%	23.0%	13.0%
		Direct Alpha (StdDev)	52.7%	57.0%	50.7%
		Loss Ratio (Median)	0.0%	0.0%	0.0%
		Loss Ratio (StdDev)	26.9%	26.1%	31.0%

Table 5. Performance Regressions (Dependent Variable: Direct Alpha)

This table provides coefficient estimates, *p*-values, and other statistics for OLS regressions of deal performance (direct alpha) on deal characteristics. Results for all deals with sufficient data in the StepStone database. Results with subsets of just fully-exited and not fully-exited are qualitatively very similar. Likewise results using TVM, IRR, or PME as the dependent variable provide similar findings. Coefficients significant at the 5% level are displayed in **bold** text.

Independent Variables	(1)	(2)	(3)	(4)
Entry leverage ratio	-0.006		**-0.045**	**-0.049**
	(0.070)		(0.000)	(0.000)
Entry Debt/TEV (D/V)		**0.362**	**0.688**	**0.679**
		(0.000)	(0.000)	(0.000)
Entry EBITDA Multiple			**0.006**	**0.006**
			(0.022)	(0.007)
Entry TEV (log)	-0.012	**-0.034**	**-0.019**	0.008
	(0.020)	(0.000)	(0.000)	(0.052)
Entry Ownership Percent	-0.018	**-0.112**	**-0.096**	-0.038
	(0.488)	(0.005)	(0.000)	(0.077)
Percent of Fund Invested	**-0.433**	**-0.540**	**-0.501**	**-0.326**
	(0.000)	(0.000)	(0.000)	(0.002)
Holding Period				**-0.026**
				(0.000)
EBITDA Growth				**1.223**
				(0.000)
Change in EBITDA Multiple				**0.103**
				(0.000)
Entry Year Dummies	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes
Region Dummies	Yes	Yes	Yes	Yes
Number of Observations	5,424	5,424	5,424	4,956
Adjusted R-squared	0.067	0.081	0.093	0.434

Table 6: Example Quality of Earnings (QoE) Adjustments to EBITDA

	FY 2016	FY 2017	LTM 2018	Adjustment as % of EBITDA
EBITDA	$106,760	$73,700	$128,932	0%
Sellside Adjustments				
Start-up costs	$27,973	$50,903	$42,285	33%
Refinancing costs	103	39,748	665	1%
Non-recurring and non-cash items	22,635	17,989	16,413	13%
Stock-based compensation	731	12,175	10,498	8%
Restructuring run-rate		9,681	8,065	6%
Customer sign-on amortization	3,738	4,978	3,744	3%
Sponsor management fees	2,865	2,689	2,642	2%
Deal-related costs	2,910	2,551	4,408	3%
Accounting items	1,450	493	4,519	4%
Run-rate cost savings	10,433	292		0%
FX (gain) / loss	3,028	-2,541	1,325	1%
	$75,866	$138,958	$95,335	74%
Sell-side Adjusted EBITDA	$182,626	$212,658	$224,267	174%
Further adjustments				
Start-up labor	-$8,553	-$14,403	-$10,953	-8%
Start-up commisions	-281	-941	-1,040	-1%
Cash vs. GAAP expense	-76	-988	-258	0%
Severance expense	-1,987	-2,023	-1,998	-2%
Exclude one-time health costs	-509			0%
Restructuring costs	-277	441	-185	0%
Customer sign-on amortization adj.	-3,739	-5,001	-3,744	-3%
	-$15,422	-$22,915	-$18,178	-14%
Diligence Adjusted EBITDA	$167,204	$189,743	$206,089	160%
Pro-forma adjustments				
Technology savings			$4,950	4%
Run-rate restructuring savings			1,785	1%
One-time customer acquisition costs			38,550	30%
			$45,285	35%
Pro-forma Run-rate Adjusted EBITDA			$251,374	195%