Borrow Cheap, Buy High?

The Determinants of Leverage and Pricing in Buyouts

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Abstract

This paper provides an empirical analysis of the financial structure of large buyouts. We collect detailed information on the financing of 1157 worldwide private equity deals from 1980 to 2008. Buyout leverage is cross-sectionally unrelated to the leverage of matched public firms, and is largely driven by factors other than what explains leverage in public firms. In particular, the economy-wide cost of borrowing is the main driver of both the quantity and the composition of debt in these buyouts. Credit conditions also have a strong effect on prices paid in buyouts, even after controlling for prices of equivalent public market companies. Finally, we find evidence that highly leveraged transactions tend to be associated with lower fund returns, controlling for fund vintage and other relevant characteristics. The results are consistent with the view that the availability of financing impacts booms and busts in the private equity market, and that agency problems between private equity funds and their investors can affect buyout capital structures.

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I. Introduction

Understanding the financial structure of private equity firms is important not only for its own sake, but also for understanding the role that capital structure plays for corporations in general. In 1989, Michael Jensen famously predicted that the leveraged buyout would eclipse the public corporation and become the dominant corporate form because the governance and financing of leveraged buyouts was superior in dealing with agency problems and restructuring (see Jensen (1989)). Together with active boards, high-powered management compensation, and concentrated ownership, he considered leverage to be an essential part of this superior governance model. Unlike public firms, Jensen argued, private equity funds optimized the capital structure in companies they acquired, to take full advantage of the tax and incentive benefits of leverage (trading these benefits off against the costs of financial distress).[1]

As luck would have it, shortly after Michael Jensen's prediction, buyouts virtually disappeared in the wake of the collapse of the junk bond market in 1989. The dependence of buyout activity on credit market conditions has been evident ever since. Although buyout activity was very low in the early 1990's, it recovered in the later part of the 1990's and reached record volume during the credit boom in 2006-2007, only to come to an abrupt end with the credit crisis in late 2007. This boom and bust pattern underscores the importance of leverage to the private equity model. It is also consistent with a somewhat different view of buyouts from Jensen's: Instead of tailoring the capital structure optimally to the needs of the company, LBOs could simply be relying on cheap debt to take levered bets on firms. Indeed, critics of LBOs have argued that the high leverage used in buyouts could jeopardize the health of otherwise sound firms.[2]

In this paper, we empirically investigate the determinants of capital structure in LBOs, highlighting the crucial importance of debt markets in providing capital for the financing of buyouts. Our paper has two main goals: First, we want to understand how private equity funds determine the capital structures in the leveraged buyout transactions they undertake. In particular, can buyout capital structure be understood by the same models that explain capital structure of public corporations? Second, what are the consequences of buyouts adopting alternative capital structures? Does the financing of a buyout affect its pricing and eventual return?

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[1] This is the so-called "trade-off theory". See Myers (2001).

[2] For example, Poul Nyrup Rasmussen, one of the proponents of the Alternative Investment Fund Manager Directive for the regulation of hedge funds and private equity funds in the European Union, said that "in order to produce ever higher returns, private equity firms have increased the risk of bankruptcy, which always generate public costs" (speech at the Commision conference on hedge funds and private equity, Brussels February 26th 2009).

To study the factors affecting buyout capital structure, we construct a new dataset containing detailed information about the financing of a large international sample of buyouts. This sample contains 1157 buyouts, 694 of which were of North American firms and the remaining 463 of which were of firms from 24 different countries outside North America, mainly in Western Europe. For each buyout in our sample, we obtain detailed information about the financial structure of the transactions, including details on the securities issued in various tranches of senior and subordinated debt, payback schedules, and information on pricing. Unlike most previous work, our sample includes not only buyouts of public companies, so called "public-to-private" transactions, but also the much more frequently observed buyouts of private companies, such as family firms, corporate divisions, and companies already owned by other private equity firms.[3] Moreover, unlike most other studies, which have focussed on the buyout wave in the 1980's, our sample considers international buyout transactions from 1980 through 2008.[4] This sample allows a much longer temporal analysis, including the extraordinary credit market conditions prevailing in 2006/7. In terms of representativeness, our data includes deals from a total of 176 distinct private equity sponsors and incorporates practically all the major investors active in this market during our period of study. We do have a bias towards larger buyouts because of our reliance on the syndicated loan market for capital structure information.

We first provide a detailed description of the financial structure used in this sample of leveraged buyouts. Not surprisingly, our sample firms were highly leveraged as a result of the buyout transactions. Throughout most of the sample, the syndicated bank loan market provided the majority of the debt to fund the transactions, and this debt is typically divided into a number of tranches. In addition to the bank debt, there are often multiple layers of subordinated debt, in the form of mezzanine debt, 2nd lien debt etc., as well as different classes of corporate bonds. The different tranches and layers differ in seniority, maturity, repayment terms, and pricing. The level and the structure of debt vary significantly over time. Leverage in the LBO deals is pro-cyclical, with high leverage peaking in the late 1980's, the late 1990's, and 2006-2007, and dropping in the early 1990's, the early 2000's and in 2008. Similar changes are found in the structure of the debt, with high leverage periods being associated with longer repayment periods and a smaller Term Loan A tranche (the part of the debt traditionally held by banks instead of other institutional investors). In contrast to the procyclicality of

[3] An exception is Muscarella and Vetsuypens (1990), who look at the operating performance of LBOs that subsequently went public, including divisional buyouts as well as public-to-private transactions. Unlike their sample, we do not require that our LBOs subsequently exited through a public offering.

[4] One exception is the contemporaneous study of Guo, Hotchkiss, and Song (forthcoming), which analyzes U.S. public-to-private transactions from 1990 through 2006.

buyout leverage, we find that a matched set of public firms if anything exhibits *counter*cyclical leverage.

Theoretically, one approach to understanding buyout capital structures is to use the frameworks that have been developed for public company capital structures. Since the decision-makers in a buyout have much sharper incentives than managers of typical large publicly-traded firms, it is plausible that capital structure theories that assume a value-maximizing principal, such as the trade-off theory, should find more support if tested on a sample of buyouts than on public firms. Conversely, the strong cyclicality of buyouts together with the organizational structure of private equity, suggest that buyout financing could be driven by a different set of factors than those which affect capital structures of public corporations. For example, it is plausible that private equity sponsors are uniquely positioned to arbitrage debt markets versus equity markets due to superior access to debt financing, as suggested by Ivashina and Kovner (2008) and Demiroglu and James (forthcoming). By borrowing cheap and purchasing equity in firms, private equity sponsors can arbitrage the different conditions in the two markets. Alternatively, private equity sponsors have agency problems of their own, which could impact their choice of leverage in their portfolio companies. Axelson et al. (2009) present a model in which because of the option-like structure of compensation given to private equity sponsors, they have a tendency to overinvest, undertaking value-decreasing investments in addition to value-increasing ones. Making sponsors capital-constrained, so that they must raise external debt in order to complete deals, gives limited partners some protection against this tendency of general partners to overinvest. However, when access to debt is "easy", private equity funds will nonetheless have an incentive to lever up as much as possible and to overpay for deals. Consistent with this argument, Kaplan and Stein (1993) provide evidence suggesting that the booming junk bond markets of the late 1980s led to an overheated private equity market, with low private equity fund returns as a consequence.[5]

To evaluate these potential explanations for leverage in buyout transactions, we examine the determinants of cross-sectional variation in leverage across buyouts and the extent to which it is related to cross-sectional patterns of public firms' capital structures. We first test whether leverage in buyouts is correlated with leverage in similar public firms. Very surprisingly (at least to us), there appears to be absolutely no relation between leverage in buyout fims and leverage in comparable public firms, regardless of whether we measure leverage as the ratio of debt to enterprise value, debt as a multiple of

[5] Ljungqvist, Richardson, and Wolfenzon (2007) find that buyout funds accelerate their investment flows when credit market conditions loosen. They do not address how the leverage or pricing of individual deals vary with credit market conditions, however. More recently, Gorbenko and Malenko (2009) present evidence that financial buyers bid more aggressively in auctions for firms when credit conditions are stronger.

cash flow (as proxied by earnings before interest, taxes, depreciation and amortization (EBITDA)), or interest coverage.

There are two possible explanations for this lack of a relation. First, it could be that the choice of leverage in buyouts is driven by completely different considerations than the choice of leverage in similar public firms. Second, it is possible that our matching of buyouts to public firms is not accurate, for example because buyouts tend to be targeted at firms within the industry that have very unrepresentative characteristics. We perform a number of robustness checks to investigate the second explanation, such as matching our LBO sample to subsamples of public firms that have adjusted their leverage significantly over the last years, or are active debt issuers, but there nonetheless remains no relation between the capital structures of buyouts and comparable public firms. In addition, we consider the subsample of 142 public-to-private deals for which we have information about pre-LBO financials. In this subsample, there is no relationship between buyout leverage and pre-LBO leverage. However, there is a strong cross-sectional relation between pre-LBO leverage and that of public matching firms, indicating that firms targeted by LBO sponsors do not differ systematically from industry norms in their capital structure before the buyout. Finally, it could be that the LBO capital structures are intended to be temporary and that private equity funds over time pay down debt to approach a target capital structure that more closely resembles that of public firms. We address this possibility by comparing public leverage to predicted LBO leverage in five years, using amortization schedules, and still find no relationship. These findings suggest that selection bias or bad matching is not the explanation for the lack of a relation between buyout capital structure and that of comparable public firms.

Given that the amount of leverage used by buyouts and matched public firms have little or no relation, what does determine leverage in buyout firms? We first consider a number of factors known to affect the cross-sectional pattern of leverage in public firms, such as profitability, cash flow volatility, and growth opportunities. Similar to early studies, we find that for public firms, more profitable firms have lower leverage, firms with more variable cash flows have lower leverage, and firms with more growth opportunities have lower leverage. In contrast to the matched public firms, none of these firm-specific characteristics are consistently related to LBO leverage levels. Instead, the only robust predictor of LBO leverage we find is the prevailing condition of debt markets; the higher the credit risk premium of leveraged loans, measured as the market leveraged loan spread over LIBOR, the lower the leverage. One potential explanation for the strong relation between low spreads and high leverage for LBOs is that when rates are lower, firms can pay interest on a higher principal with the

same cash flows. But this explanation would apply to public firms as well, and public firm leverage is robustly *positively* related to the high-yield spread. It appears that, in contrast to public firms, the primary determinant of buyout leverage is not firm-specific, but rather the market-wide condition of the credit markets at the time of the buyout.

General partners of private equity firms often state that the availability of leverage allows them to pay higher purchase prices for the firms they acquire. We consider whether this prediction holds in our sample. Because the deals in our sample are of dramatically different size, we use as our measure of price the total enterprise value at the time of the deal as a multiple of EBITDA of the firm. Similar to the leverage equations, we control econometrically for market conditions using the pricing of public firms at the time of the buyout. Our results suggest that in contrast to the results for leverage, in which there was no relation between public firm and buyout firm leverage, there is a statistically significant, positive relationship between buyout pricing and the prices of comparable public firms. However, buyout pricing is also strongly negatively related to current market interest rates on leveraged loans, even after controlling for prices in public markets.

The finding that both leverage and pricing in buyouts are strongly dependent on credit market conditions could potentially be explained if variation in our high-yield spread variable simply picks up variation in the economy-wide discount rate. When discount rates are low, real interest rates are low, so for a given level of EBITDA firms should be able to take on more debt and still be able to meet interest payments. Similarly, when discount rates are low, price multiples should be high. However, the discount rate effect on price multiples should be similar for our matched public firms. Since the high-yield spread is an equally strong predictor of LBO prices after controlling for public firm multiples, we find a pure discount rate explanation implausible. Instead, the results are more consistent with stories in which the extra leverage that LBO funds take on when credit market conditions are good makes them willing to pay higher prices, over and above prevailing prices in public markets. As discussed above, this effect could either be due to private equity funds being particularly proficient at arbitraging cheap debt against equity, or to agency problems between private equity sponsors and their investors.

To distinguish between these explanations, we estimate equations measuring the impact of leverage on fund returns. We first replicate the findings in Kaplan and Schoar (2005) on our sample of funds and find, similar to Kaplan and Schoar, that the return of a particular fund (measured by IRR) is positively related to the return of the previous fund by the same sponsor. We then show that the leverage of deals in a particular fund is negatively related to the return of that fund, controlling for

other relevant factors, such as vintage year effects. The effect is nonlinear; for leverage levels below the median there is no relation between leverage and fund returns, while the relation is robustly negative for above median leverage levels. This finding is robust to controls for industry, region, and LBO type fixed effects, sponsor fixed effects, and LBO year fixed effects. It provides support for an agency story in which private equity funds overpay for deals when they can lever up a lot.

To evaluate whether funds make money by timing debt markets, we split leverage into the component of leverage explained by variation in debt markets and residual leverage. If funds were able to arbitrage debt markets against equity markets when debt is "cheap", we would expect the predicted component of leverage to have a positive impact on fund returns. However, we instead find that both components of leverage have a negative impact on returns, which is inconsistent with a market-timing story. Finally, also consistent with an agency story in which sponsor over-investment and risk-shifting hurts investors, we find that deals that are large relative to fund size predict negative fund returns.

Our findings contribute to both the private equity literature and the capital structure literature. First, our findings contribute to the literature on private equity fund returns, e.g. Kaplan and Schoar (2005), and Gottschalg and Phalippou (2009). Our contribution here is to document how excess leverage and deal size might have led to disappointing returns for many private equity funds.

Our paper also relates to the literature on LBO financial distress. Our results support the arguments of Kaplan and Stein (1993) that hot credit markets can lead to excess leverage, which can in turn lead to high subsequent default rates. Whether this imposes a major cost on the economy is an open question. Some evidence, e.g. Andrade and Kaplan (1998) and Bernstein et al. (2010), suggests that these costs may not be particularly high, but more research is needed here.

In terms of the broader capital structure literature, our paper is related to work by Berger et al. (1997) and others who analyze how the corporate governance of firms affects their capital structures. Our paper is also related to literature on market timing in capital structure (e.g. Baker and Wurgler (2002), and Welch (2004)), and to the recent literature emphasizing the importance of supply-effects for leverage (e.g. Leary (2009)). Our results suggest that taking advantage of market timing or excess supply of funds can actually be value-decreasing for firms when owners have agency issues of their own.

The remainder of the paper is structured as follows. In the next section we describe how a typical buyout is structured. Section III describes the theoretical frameworks we use for analyzing capital structure. Section IV describes our sample and the multiple sources from which we derive our data. Section V contains our empirical analysis, and Section VI concludes.

II. How are Private Equity Transactions Structured?

In a private equity transaction, the private equity firm forms a new company ("newco") to bid for a controlling stake in – and often majority ownership of – an existing company. The newco is established specifically for the purposes of the transaction and is usually just a shell company with nominal capital and temporary directors. The private equity sponsor lines up debt financing, which is raised by newco conditional on the acquisition being consummated, and is backed by the target firm's assets. This debt financing, together with equity that the private equity fund raises from its investors, allows the private equity firm to bid for, and if the bid is successful, to purchase the target firm.[6]

In principle, a private equity sponsor could finance a transaction entirely using the equity raised from investors in its own fund(s), similarly to the way in which early-stage venture capital investments are conducted. However, in practice, private equity buyouts are almost always financed predominately with debt rather than equity, giving rise to the moniker "Leverage Buyout". In recent years, this debt financing is typically provided through the syndicated loan market.[7] Given that in a private equity buyout, each bidder must have secured sufficient funds to complete the transaction within a few days if they successfully negotiate a deal, bond financing, involving a prospectus and various regulatory hurdles, usually takes too long to be a feasible as an initial source of capital.[8]

The debt structure in buyouts has become fairly standardized, yet is far more complicated than is typically described in academic discussions.[9] In Table 1 we present an example of one of the private equity transactions in our sample, the purchase of the U.K. tire and exhaust-fitting company Kwik-Fit in 2005. This transaction used a capital structure that was typical for buyouts conducted at that time and as such, we discuss this financial structure in some detail.

Kwik-Fit was bought by private equity house PAI for an enterprise value of £773.5m. The purchase was financed using £191m of equity (provided by funds advised by PAI) and £582.5m of debt. The initial debt/equity ratio of the newco was therefore 75% debt and 25% equity, which is typical for the buyouts in our sample. The debt was structured into senior and subordinated tranches. The senior debt was divided into three separate term loans of roughly equal sizes but with different maturities, payment schedules and seniorities. One tranche, called Term Loan A, had a 7-year maturity

[6] If the bid is unsuccessful, newco is disbanded and the debt is never issued.
[7] Reflecting a rather curious use of terminology, this market is increasingly known as the "leveraged loan" market.
[8] In some cases, however, syndicated loans are refinanced at a later stage using a public bond issue.
[9] A notable exception is Cotter and Peck (2001), who provide a detailed description of the debt structure of 64 U.S. public-to-private buyout transactions completed from 1984 to 1989.

and was amortizing, while Term Loans B and C were not amortizing, with the principal being repaid in a final "bullet" payment at the end of the term (or at redemption if earlier). In addition to the term loans, the company obtained a revolving credit facility and a capex facility both of which, if drawn, would rank as senior debt.

In addition to the senior debt and facilities, newco was financed with two tranches of subordinated debt: a 2nd lien tranche of £75m, which was senior to a mezzanine tranche of £97.5m. 2nd lien tranches started to appear in buyouts during 2004, and are now a very common feature of buyouts' capital structures. The interest payments on mezzanine debt include cash interest of 4.5%, together with "pay-in-kind" interest of an additional 5%.[10]

III. The Financial Structure and Pricing of LBOs and Public Firms: Theoretical Roadmap

In this section, we describe in more detail the theoretical frameworks that provide us with testable implications about the factors affecting leverage and pricing in buyouts *and* public firms.

A. The Trade-off and Pecking Order Theories of Capital Structure

Perhaps the most commonly used explanation for leverage is the trade-off theory, in which capital structure is chosen so that the tax and incentive advantages of debt exactly offset bankruptcy costs at the margin (see Myers (2001)). The trade-off theory is often augmented with some version of the pecking order theory of Myers and Majluf (1984), in which the issuance of securities is costly due to information asymmetries, leading firms to stray from the optimal target leverage suggested by the pure trade-off theory.

Both the trade-off and the pecking order theories suggest that the capital structure of a firm should be tailored to the characteristics of that firm's assets. For example, profitable firms with stable cashflows should have high leverage, since they are better at utilizing debt tax shields and have lower probabilities of financial distress, and costs of financial distress are likely to be higher for firms with more investment opportunities and more intangible assets.

The pecking order theory predicts that firms that have historically been more profitable, so that they have not needed to issue securities to finance investments, will end up with lower leverage, even if the pure tradeoff theory would suggest that more profitable firms should take advantage of debt tax

[10] Pay-in-kind interest means that instead of cash, the holders of the mezzanine debt are issued additional notes equal to the value of 5% of the outstanding principal each year.

shields and incentive benefits. The pecking order argument is less likely to explain leverage in buyouts than in public firms since buyout leverage is calculated at the time of the transaction, so there will have been no time for the firm to drift away from the target capital structure. Nonetheless, if both LBO sponsors and managers of public firms act according to the trade-off theory, we would expect that there should be a relation between LBO leverage and the leverage of public firms with similar characteristics. We test this idea below, and also relate LBO and public firm leverage to firm characteristics, the idea being that according to the tradeoff theory, the same firm-level factors determine leverage at the margin for both buyout and public firms, so changing one of these factors should have the same effect for both types of firms.

B. Market Timing

Baker and Wurgler (2002), among others, suggest that managers attempt to take advantage of mispricing in equity markets when issuing securities. Similarly, it is possible that debt markets periodically become "overheated", so that investors do not demand the full interest rate corresponding to the fundamental underlying risk of a firm. Managers aware of this market imperfection should take advantage of it, and issue more debt when the debt markets are overvalued.[11] The market-timing hypothesis is also consistent with the stated view of many private equity practitioners, who often argue that one of the ways in which private equity funds make money is by increasing leverage of deals in response to hot credit market conditions to arbitrage the conditions between debt and equity markets.[12] The market-timing story implies that buyout leverage should respond more to debt market conditions than to the firm characteristics suggested by the trade-off theory, and they should also be willing to pay higher prices when debt financing is "cheap". This pattern would also hold for public firms, unless private equity sponsors are better at timing debt markets than the managers of stand-alone firms. Importantly, to the extent that the competition for deals between buyout funds is not strong enough to pass on all the value increase from cheap debt to target shareholders, the market-timing hypothesis also predicts that fund returns should be higher when the private equity sponsors are able to use higher leverage to finance individual deals.

[11] Related to this argument, the results in Baker, Greenwood, and Wurgler (2003) suggest that public firms use debt market conditions in an effort to determine the lowest-cost maturity at which to borrow.

[12] For example, Guy Hands, a partner at Terra Firma, stated: "We buy stuff with cheap debt and arbitrage on the difference with equity markets". *Financial Times*, November 15, 2007.

C. GP-LP Agency Conflicts

Just as there are agency problems between CEOs and owners that can explain leverage choices for public firms, there are potential agency problems between the private equity fund managers (the "GPs") and the investors in the fund (the "LPs") that could explain leverage choices in buyouts. In particular, because of the limited liability of GPs and the option-like carry contract they hold on fund returns, GPs sometimes have an incentive to increase the riskiness of the fund by investing a large fraction of fund money in one big deal.[13] Axelson, Strömberg, and Weisbach (2009) provide a model in which these overinvestment tendencies of GPs are mitigated by capital constraints, so that it is optimal to require GPs to go to external capital markets and raise debt whenever they want to make an investment. When liquidity in debt markets is high and/or interest rates are low, GPs can add more leverage to their deals and invest more aggressively, increasing the value of their option and making them willing to overpay for deals relative to fundamental value. Similar to the market-timing theory, this agency story predicts that buyout leverage would be driven more by debt market conditions than by the characteristics of the underlying portfolio firm. In contrast to the market-timing story, however, the agency story predicts that increased leverage can harm investors in private equity funds, so that higher leverage should lead to lower fund returns on average.

Although Axelson et al. (2009) do not formally model GPs' reputations, an extension of their model would also imply that GPs with less reputational capital at stake should be more prone to overinvestment.[14] In the equations we estimate below, we therefore include proxies for GP reputation.

IV. Data Description

A. Data Sources and Sample Selection.

Our sample selection primarily relies on two commercial databases: Capital IQ and LPC/Dealscan. We use the Capital IQ database to construct a base sample of private equity transactions. The base sample contains all private placement and M&A transactions in Capital IQ in which the acquirer includes (at least) one investment firm that has a reported investment interest in one of the following stages: Seed/startup, Early venture, Emerging growth, Growth capital, Bridge, Turnaround, Middle market, Mature, Buyout, Mid-venture, Late venture, Industry consolidation, Mezzanine/subdebt, Incubation,

[13] The typical contract between GPs and LPs in a buyout fund is that GPs get a "carried interest" of 20% of all profits (after fees borne by investors) provided the rate of return (as measured by IRR on invested capital) exceeds a stipulated hurdle rate; but the GPs earn no carried interest if the fund does not exceed the hurdle rate.

[14] The model in Ljungqvist, Richardson, and Wolfenzon (2007) also has this prediction.

Recapitalization, or PIPES. From this sample, we select all M&A transactions classified as 'leveraged buyout,' 'management buyout,' or 'going private' that were announced between January 1986 and July 2008. Capital IQ contains information on the details of the transaction, such as the buyers and sellers, the target company identity, transaction size, and for a subset there is financial information such as EBITDA (primarily for public-to-private transactions and LBOs involving public bond issues).[15]

From the sample of Capital IQ buyouts we construct a list of all private equity firms that appear as acquirers in at least five LBO transactions. For each of these private equity firms we extract information from the LPC/Dealscan database on all syndicated loans for which one of these firms acts as a sponsor, producing a total of 5678 loans. From this list we exclude loans that did not back the original leveraged buyout transaction (i.e. refinancings and recapitalizations as well as loans financing subsequent add-on acquisitions by the LBO target), ending up with 2467 LBO loans.

Since Dealscan coverage improves substantially in the late 1990s, we are able to match a larger fraction of the recent deals than of earlier ones. In addition, there is likely a bias in our sample towards larger deals, which are more likely to use syndicated debt than are smaller deals. Dealscan provides information primarily on the bank loan portion of the capital structure, but using the deal descriptions provided by Dealscan and Capital IQ, we also find information on other types of debt such as vendor financing, assumed debt, bonds, as well as equity used in the deal. We also use Capital IQ, SDC, Mergent, and Edgar filings to track down additional public bond issues. In a handful of cases, we infer information about additional subordinated debt from the difference between total debt and senior debt ratios in Dealscan.

To calculate our capital structure variables we also require information on the EBITDA of the LBO target at the time of the buyout. For 649 observations this information is included in the Dealscan data, either explicitly or implicitly in terms of a multiple of total debt, or senior debt, to EBITDA. Using Capital IQ, Compustat, and Bureau Van Dyke's Amadeus database, we are able to find EBITDA information for another 425 observations.

Finally, we supplement our sample with the Kaplan (1989a, b) sample of 83 buyouts from the 1980s. These buyouts predated the development of the syndicated loan market, so would clearly not have entered our sample otherwise.[16] Through this process, we end up with a sample of 1157 buyouts occuring between 1980 and 2008.

[15] See Strömberg (2008) and Kaplan and Strömberg (2009) for more detail and descriptive statistics on Capital IQ.
[16] We are very grateful to Steve Kaplan for providing us with this data.

An important part of our analysis is to match these private equity buyouts with comparable publicly quoted companies. For public company financial information, we rely on the Compustat North America and Compustat Global databases to calculate matched median financial characteristics for public companies in the same year, region (North America, Western Europe, and Rest of World), and industry as the corresponding buyout transaction, using the Fama and French (1997) classification of firms into 49 industries. We date the buyout by the closing date of the syndicated loan package, as reported by Dealscan.

Our analysis also requires information about debt market conditions and other macroeconomic variables. Our debt market condition variables include the U.S. high-yield spread, defined as the U.S. high-yield rate for the corresponding month according to the Merrill Lynch High-Yield index (obtained through Datastream) minus U.S. LIBOR (obtained from the British Bankers' Association); the S&P Earnings/Price ratio (obtained from Compustat) minus the high-yield rate, and a credit tightening measure, obtained from the Federal Reserve.[17] We also obtain inflation and exchange rates from the IMF.[18]

Finally, we calculate various private equity sponsor characteristics, such as number of funds raised, fund sizes, and fund returns (IRRs). Data on a fund's inception date, size, and sequence number relative to other funds raised by the same sponsor are constructed by combining observations from Capital IQ and Preqin, both of which provide independently collected and somewhat non-overlapping data on these variables. Preqin has data on 9,523 buyout and venture funds as of June 2009, covering about 70% of all capital ever raised in the private equity industry and is also our source for fund returns. Traditional sources of data on private equity returns rely on self-reporting by GPs and/or LPs and are likely to suffer from sample selection biases. However, 85% of the data gathered by Preqin is collected via Freedom of Information Act requests and consequently should not be subject to such self-reporting biases.

Direct information about which exact fund each deal belongs to is only available in about a third of the cases (through Capital IQ). When this information is not available, we match a deal to the sponsor fund that was actively investing in the time period and region of the deal. We match 1099 out

[17] We use the Senior Loan Officer Opinion Survey on Bank Lending Practices survey, which is conducted quarterly by the US Federal Reserve Board (source: http://www.federalreserve.gov/boarddocs/SnloanSurvey/). We focus on the net percentage of domestic loan officers at medium and large banks reporting a tightening of standards for loans.

[18] We have also used average spreads on leveraged loans for the U.S. and European markets over LIBOR, obtained from Standard & Poor's. We were only able to obtain these from 1997 and onwards, but for this period the results are virtually identical to those using the spread variable based on the Merrill Lynch High-Yield Index.

of our 1157 deals to a particular fund. The unmatched deals are done by sponsors who do not use a fund structure for their investments.

B. Sample Characteristics and Representativeness

Table 2 provides descriptive statistics on our sample. Panel A indicates that the sample contains 1157 buyouts, of which 694 (60%) are of North American firms, 463 (39%) are of Western European firms, and 10 (1%) are of firms located in the rest of the world. In contrast to previous papers that have focused on U.S. deals, our sample is more representative of the universe of all buyouts. Still, our sample overweights U.S. buyouts relative to the rest of the world, as in the universe of buyouts reported in Capital IQ, 47% are from North America, 45% are from Western Europe, and 8% are from the rest of the world.[19] This bias is due to two reasons. First, our sample selection relies on Dealscan for capital structure information, which mainly covers syndicated bank loans. Deals outside of U.S. and Western Europe tend to be smaller and therefore rarely use syndicated loans. Second, our 1980s deals are taken from Kaplan (1989 a,b), whose sample is restricted to U.S. buyouts.

Unlike most previous research, our sample is not restricted to public-to-private deals. It does contain 368 (32%) public-to-private buyouts, but also contains 167 (14%) buyouts of independent companies, 320 (28%) divisional buyouts, and 293 (25%) buyouts of firms already owned by other private equity firms, called secondary buyouts (see Table 2, Panel A). Because our sampling procedure tends to overweight large deals relative to small ones, our sample is still somewhat biased towards public-to-private deals compared to the underlying population of buyouts according to Capital IQ, where public-to-private deals only account for 6.5% of transactions. Similarly, our procedure under-samples buyouts of (on average smaller) independent private companies, which make up just 14% of our sample compared to 46.8% of the deals on Capital IQ.

Panel A of Table 2 also reveals that around 75% of our sample transactions occurred between 2001 and 2008, compared to 63% in the Capital IQ population. Again, this is probably indicative of the syndicated bank loan market becoming significantly more active over the last decade.

Panels A and B of Appendix Table 1 contain detailed breakdowns of the sample by country, industry, and the identity of the sponsoring firm.[20] In addition to the U.S., the U.K. and France are the most common countries represented. The sample is widely distributed across industries, with no one

[19] The statistics on the universe of deals on Capital IQ are taken from Strömberg (2008).

[20] To be included in our analysis, we required private equity sponsors to have at least 5 transactions in the CapitalIQ database. However, the various data requirements – in particular the need for information on the debt structure and accounting returns – results in many private equity sponsors having less than 5 deals in the final sample.

industry representing more than 10%. It is also widely distributed in terms of the sponsoring buyout firm; KKR is the most common sponsor, with 61 deals, but still only represents 5.3% of the total sample.

Panel B of Table 2 examines the deals' size. As expected, our sample clearly contains very large deals; the average (median) LBO enterprise value is just over $1.6 billion 2008 U.S. dollars ($683 million) compared to an average (median) of $330 million ($63 million) for the entire Capital IQ sample. Public-to-private deals are the largest type, averaging over $2.5 billion in enterprise value, and include the sample's largest deal, KKR's buyout of RJR-Nabisco (enterprise value of $59.5 billion when measured in 2008 dollars). In contrast, independent private deals are the smallest type of deal in our sample, but still average over $600m in enterprise value.

To summarize, although our sample is more representative of the buyout population than samples used in other studies, it overweights large deals, public-to-private transactions, U.S. transactions, and more recent buyouts, because of our reliance on the syndicated bank loan market for capital structure information. In our tests, our main results are robust to controlling for region, buyout type, and size, and we cluster our standard errors by deal year in our regressions. Nonetheless, the extent to which our conclusions hold equally for smaller buyout transactions that do not rely on the syndicated loan market for debt financing is an issue we leave for future research.

V. Results

A. Leverage of buyout firms

Table 3 details the complicated debt structure found in our sample. Consistent with the Kwik-Fit deal analyzed earlier, bank debt is typically divided into amortizing Term Loan A, which is usually held by the originating bank, and bullet payment Term Loans B, C etc. that are often securitized or sold to institutional investors, such as hedge funds. In our sample, 62.2% of deals use amortizing debt (Term Loan A), while 89.3% use bullet debt (Term Loan B). The use of amortizing debt declined noticeably in the years leading up to the financial crisis as lenders were increasingly prepared to lend on a non-amortizing basis. Table 3 also presents the fraction of debt financing accounted for by each type; amortizing bank debt averages 23.4% of total debt while bullet debt comprises 46.2%. Other important sources of debt are mezzanine (9.9%) and junior bonds (9.3%).

In some transactions loans are provided by the private equity fund itself ("Sponsor loans"), or by the seller in the buyout transaction ("Vendor loans"), and existing loans are sometimes retained rather than refinanced ("Assumed debt"). As Table 3 shows, these loans are, on average, not a

particularly large part of the debt, representing in total around 2.5% of total debt financing. We also observe preferred equity in a few deals, which may have more or less debt-like features, but we do not include preferred equity in our definition of debt.

Throughout our analysis we distinguish between "regular" or non-contingent debt, and contingent debt, such as revolving credit facilities, capital expenditure and acquisition lines of credit, or stand-by letters of credit. Most of the contingent debt is not drawn at the time of the transaction, but rather intended for future funding of working capital, add-on acquisitions or other types of investment. We do not include contingent debt in our definition of total debt when calculating our leverage ratios (debt to enterprise value, debt to EBITDA, and interest coverage), since the draw-down of contingent debt would be concurrent with a subsequent investment in the firm, which in turn would involve a change in enterprise value and EBITDA. As is indicated in Table 3, buyouts use substantial quantities of contingent debt; these additional facilities amount to nearly 18% of the value of total (non-contingent) debt.

Table 3 also documents the spreads on the debt and the proportion of the debt that is due in less than 5 years. Not surprisingly, the senior debt (the term loans and revolving credit facilities) has a substantially smaller spread than the junior debt. Also, the effect of amortization is clear: the majority of the Term Loan A and the bridge loans have to be paid off in less than 5 years but a very small fraction of all the other types of debt are due that quickly. The maturity, and sometimes also the spread, is often missing for vendor and sponsor loans in our sample. When we need these to calculate leverage ratios we assume that (a) the interest rate on these loans equals the local LIBOR rate plus the U.S. high-yield spread over U.S. LIBOR, and (b) that the debt is non-amortizing. Although these assumptions are somewhat arbitrary, they have very little impact on our results given the small fraction of total debt these loans represent.

Table 4 documents the quantities of leverage used in the transactions as well as the pricing of the buyout deals. We use three different measures of leverage: total debt divided by earnings before interest and depreciation ("D/EBITDA"), total debt divided by enterprise value ("D/EV") and interest on debt divided by EBITDA ("I/EBITDA").[21,22] Our main measure of deal pricing is enterprise value

[21] As mentioned in Section IV, we obtain EBITDA either from Dealscan or from pre-LBO financial statements. One concern is that the former EBITDA numbers could sometimes be pro-forma numbers or forward-looking projections. We have re-run our analysis for the subsamples with different sources, and our results are qualitatively the same.

[22] The I/EBITDA measure is calculated using total interest expense, including non-cash Pay-In-Kind (PIK) interest. While it may make sense to use a measure based on cash interest only, the information on the amount of PIK interest is missing for a large fraction of our sample.

divided by EBITDA.[23] As expected, LBOs are indeed highly leveraged. The average deal in the sample raises 69% of its capital through debt of various forms and has ratios of debt to EBITDA and interest to EBITDA of 5.6 and 0.5 respectively. The EV/EBITDA-multiple paid is 8.2 for the average transaction. Public-to-private deals are the most highly levered, with 73% of capital raised through debt and a D/EBITDA ratio of 6.5. They are also the highest priced transactions, with an average 8.8 EV/EBITDA multiple. Table 4 also shows significant univariate variation for leverage and pricing across geographies and size groups, with U.S. deals and larger deals (measured by enterprise value in 2008 U.S. dollars) having higher leverage and pricing multiples.

Table 4 also reveals significant changes in capital structure across time. These time trends are illustrated graphically in Panel A of Figure 1. From the start of our sample in the early 1980's, debt and valuation levels peaked in the late 1980's, decreased until the mid-1990's, increased in the late 1990's, fell in the early 2000's, and increased again in the 2005-2007 period. Strikingly, leverage (especially D/EBITDA) and pricing multiples track each other very closely, as is particularly clear from the graph in Panel A of Figure 1. Also, the time periods when leverage and pricing drops most significantly coincide with the fall of the junk-bond market in 1989-1990 and the internet crash in 2000-2001, while leverage peaks at the top of the business cycles in 1988, 1998, and 2007.[24] This suggests that macro-economic conditions affect both leverage and pricing of LBOs in a highly pro-cyclical manner.

It is worth noting, however, that there is a decreasing trend in debt to enterprise value over our sample period, with an average D/EV of over 80% in each sub-period before 1994 and below 70% following 1995. One partial explanation for this trend is that many of the 1980s deals involved selling off parts of the acquired company, the proceeds of which could be used to repay some of the debt (see Kaplan, 1989b).

B. Comparisons with Public Companies

As noted earlier, the literature has devoted considerable attention to financing choices, but almost always in the context of publicly traded corporations. In Section III, we argued that factors that affect capital structure in public companies could potentially apply to LBOs as well. In addition, other theories such as the market timing or the GP-LP agency-based explanations described above suggest

[23] We have also used enterprise value divided by sales as an alternative pricing measure, with similar results. Sales numbers are missing for a large number of our observations, however.

[24] Note that we have very few observations, between 0 and 3 per year, for the 1990-1993 period. Hence, the large movements in leverage and pricing over this period are not statistically reliable.

that private equity firms could have different motivations for the choice of leverage in their portfolio companies than do publicly-traded companies.[25]

To evaluate the extent to which common theories explain leverage in public companies and LBOs, we compare leverage choices in the buyouts in our sample with those in similar public companies. If the same theories explain leverage in both types of organization, we should observe common factors predicting leverage in both.

To perform this comparison, we construct a sample of public companies that are as similar as possible to the sample of LBOs. For each LBO, we take as a matching characteristic the median industry value among the public companies in the Global Compustat database in the same year, same region (North America, Western Europe, Eastern Europe, Asia, or Australia) and same Fama-French industry (using their 49-industry classification) as the LBO.[26]

For the public companies we calculate the corresponding measures of leverage and pricing as we used for the buyouts, i.e. D/EV, D/EBITDA, I/EBITDA, and EV/EBITDA. For public company debt ("D") we use total long-term debt (including debt due within one year) minus cash and short-term investments. For enterprise value ("EV") we use market value of equity plus long-term debt minus cash and short-term investment. For interest ("I") we use interest expense minus interest income. We calculate matched medians for D/EBITDA and I/EBITDA for all public companies in the same industry and region using the fiscal year that precedes the closing date of the LBO syndicated loan. When calculating matched EV/EBITDA and D/EV, we use the market value of equity for the public companies in the matched industry-region for the month preceding the closing of the buyout loan, and use the blended averages of EBITDA, cash and long-term debt for the fiscal years preceding and following the buyout loan closing date.[27] We exclude public companies with negative EBITDA when calculating the industry-region-date median values of D/EBITDA, EV/EBITDA and I/EBITDA.

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[25] Indeed, if one asks practitioners how they make leverage choices, the typical answers will differ substantially. When asked about capital structure policy, a typical CFO of a public company will usually discuss the importance of maintaining financial flexibility and express concern over distress costs (see Graham and Harvey (2001)), while a partner of a buyout firm will often say that they inject as much debt into their LBOs as possible to maximize the expected return on their equity investment.

[26] The Fama-French industry classification was first introduced in Fama and French (1997) and has been updated in subsequent work. We used the most recent industry classification as of January 2009 according to Kenneth French's web site at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[27] For example, suppose a buyout closes in March 2000. For all publicly traded companies in the same industry and region, we first calculate the market value of equity at the end of February 2000. For simplicity assume that these publicly traded companies have fiscal years ending December 31. We then calculate blended values of long-term debt, cash, and EBITDA using a weight of 3/12 for the preceding fiscal year-end of December 31, 1999, and 9/12 for the following fiscal year-end of December 31, 2000. We then match the buyout with the median values of EV/EBITDA and D/EV across the publicly traded firms in this group.

Panel B of Figure 1 illustrates graphically the evolution of leverage and pricing over our sample period for the matched public company medians. The patterns for matched public companies show very little resemblance to the patterns documented for the LBO sample in Panel A. First, not surprisingly, public companies have significantly lower leverage, with a D/EV ranging between 30-50% for most years, compared to 65-90% for the buyouts. Second, the time series variation is strikingly different. The strong positive relation between D/EBITDA and EV/EBITDA that was seen for the buyouts is not observed for public companies. Furthermore, in contrast to the pro-cyclical pattern for buyouts, public company leverage appears counter-cyclical, peaking in the early 1990's recession and again after the internet crash in 2000-2001. The counter-cyclical leverage of public companies is consistent with earlier research, such as Korajczyk and Levy (2003).

Still, the lack of a relation in the time-series does not necessarily rule out a cross-sectional relation between public and buyout leverage. Panel A of Table 5 performs the following experiment: it sorts the matched public company median values into quartiles based on each of the three measures of leverage. It then presents the medians of the leverage measures for the corresponding buyouts in each of the public company quartiles. If the same factors determine leverage for both groups of companies, then the pattern of leverage across quartiles should be similar. Note that this approach focuses on the cross-sectional pattern of capital structures; even if the buyouts all have higher leverage, there should still be a positive cross-sectional relation, if factors related to industry and location have any effect on leverage choices.

By construction, leverage of the public companies increases with the quartile's rank. Public company D/EV ranges from a median value of 0.19 in the lowest quartile to 0.54 in the highest quartile. However, for the corresponding buyouts there is virtually no difference in leverage across the public company quartiles, with a range of 0.69 to 0.71. The lack of relationship also applies using the D/EBITDA measure of leverage. Whereas the public company medians increase across the quartiles from 2.7 to 5.2, for the buyouts leverage actually decreases, from a median of 5.4 in quartile one to 4.8 in quartile four, with the difference across quartiles being statistically significant. Finally, using the I/EBITDA measure, the first three quartiles of buyouts show little variation in terms of median leverage; only the group of buyouts corresponding to the most levered public companies have higher I/EBITDA.

Figure 2 illustrates the (lack of a) relationship between LBO and public company leverage by plotting LBO leverage for each transaction against the matched public company median leverage. Again, for D/EV there is basically no relation (with an R-squared of 0.004), for D/EBITDA the

relationship is slightly negative (with an R-squared of 0.005), and only for I/EBITDA do we see a slightly positive relationship (with a t-statistic of 1.78 and an R-squared of 0.021).

These results suggest that there is virtually no relation between leverage in buyouts and in matched public companies. However, it is possible that there is in fact such a relation in the data but our matching process is so inaccurate that we fail to detect it. We explore a number of possible hypotheses related to matching in Panels B through E in Table 5.

First, the leverage at the time of the LBO transaction could be unrepresentative of the firm's target capital structure. In a typical LBO, the excess cash flow that the firm is generating is used to pay down acquisition debt over time. Hence, it may be that private equity firms intend to reach the LBO's target at some point in the future, which implies that this future leverage is a better measure of the firm's optimal capital structure. To address this possibility, we estimate predicted debt and interest expense five years after the LBO transaction using debt amortization schedules. We then calculate D/EV, D/EBITDA, and I/EBITDA based on predicted D and I. Since we do not have predictions of future EV and EBITDA, we normalize with EV and EBITDA at the time of the transaction. We then compare these predicted leverage ratios to matched public company median leverage ratios. The results, displayed in Panel B in Table 5, show that there is virtually no relation between predicted LBO leverage and public leverage either and the results are very similar to those in panel A (although LBO leverage ratios are approximately 20% lower on average).

Second, it is possible that the median public companies are not at their optimal capital structure. If firms incur transaction costs when adjusting capital structures, they would only do such adjustments infrequently. Consequently, a randomly picked public company could have drifted away from its optimal capital structure at the time when the sample was performed.[28] To address this possibility, we consider an alternative set of matched firms, which are restricted to public companies that have adjusted their capital structures in a given year with a change in debt to book assets of more than ten percentage points in absolute value. For this "adjuster" sample we calculate matched industry-region-year median values of leverage as before. Panel C of Table 5 sorts buyouts using leverage quartiles for the adjuster sample. The results are very similar to those obtained before; there is no statistically significant relation between public company leverage and LBO leverage.

Third, we compare our buyouts to a sub-sample of public companies that actually use leverage. Starting with Jensen (1986), researchers have argued that managers are averse to debt and companies

[28] See e.g. Fisher et al (1989) and Strebulaev (2007) for theoretical models of costly adjustment, and Leary and Roberts (2005) for supporting empirical evidence for U.S. public companies.

with entrenched managers will therefore have lower leverage than what is optimal for shareholders.[29] Also, even absent agency problems, some companies within the same industry could actually have higher debt capacity (e.g. due to lower costs of financial distress) than others, and it may be that buyouts are more similar to this group. To investigate this, we calculate industry-region-year median leverage using the subset of public companies that have issued significant amounts of debt – the "issuer" sample – which we define as companies whose ratio of long-term debt to book assets has increased by more than ten percentage points in a given year.[30] Panel D of Table 5 sorts buyouts using leverage quartiles for the issuer sample. For D/EV and D/EBITDA there is again no relation between buyout leverage and public company leverage, although there is a significant positive relation for I/EBITDA. Overall, the relation between buyout and debt-issuing public company leverage is weak.

Finally, and related to the previous point, there may be significant heterogeneity in the debt capacity of companies even within an industry-region-year match. Given that LBO transactions rely on the ability of the company to take on debt, it is possible (or even likely) that private equity sponsors select targets within an industry and region that have particularly high debt capacity.[31] Unfortunately, we do not observe pre-LBO characteristics for the majority of firms in our sample since they were private at the time of the LBO. Of the firms that were publicly traded before the buyout, we were able to find pre-LBO financial information for a subsample of 166 firms that were purchased in public-to-private transactions. For this subsample, we calculate leverage ratios using the last financial statement available in Global Compustat before the LBO transaction date. The upper half of Panel E of Table 5 sorts buyouts according to quartiles of pre-LBO leverage. For D/EBITDA there is again no relation between pre-LBO and LBO leverage, and for I/EBITDA the result is very weak (and completely driven by the upper quartile of pre-LBO companies). There is, however, a positive (and statistically significant at the 5 percent level) relation for D/EV, although the LBO leverage distribution is much narrower (ranging from 0.63 to 0.77 across pre-LBO quartiles) than the pre-LBO leverage distribution (ranging from 0.11 to 0.97).

In contrast to the view that LBO targets are selected because of their debt capacity, pre-LBO companies have rather similar leverage to their public peers, indicating that selection issues may be minor. This comparison is presented in the lower half of Panel E, where pre-LBO leverage is sorted

[29] See Berger, Ofek and Yermack (1997) for evidence that firms with entrenched managers use less leverage.

[30] We have also used a match based on the 75% leverage percentile of matched public firms in the same industry-region-year with similar results.

[31] For a sample of U.S. 1980's public-to-private transactions Opler and Titman (1993) argue that LBO targets have worse investment opportunities and lower financial distress costs than other public firms. Stuart and Kim (forthcoming) confirm these findings using a more recent sample, and find in addition that companies that have directors with prior LBO experience are more likely to undergo an LBO transaction.

across matched public company industry-country-date median leverage quartiles. For all three leverage measures, there is a significant positive relation between pre-LBO and median industry leverage, and the inter-quartile ranges are of roughly similar magnitudes. Interestingly, LBO targets do not appear significantly more levered pre-LBO compared to their public peers (median D/EV is somewhat higher, while median D/EBITDA is somewhat lower and median I/EBITDA is identical). Although we cannot completely rule out selection based on unobserved factors, our results suggest that the failure to find a relation between LBO and public company leverage is not primarily due to private equity firms selecting targets with particularly high debt capacity.

C. LBO leverage and company characteristics.

The results so far suggest that there is no correlation between the leverage used in buyouts and that in comparable public companies. We now take the comparison to a more detailed level by investigating the extent to which firm-level characteristics are related to leverage in the two sets of firms. We focus on characteristics that are plausible proxies for factors suggested by the trade-off or pecking order theories, and that have been found in previous research to be associated with the cross-sectional variation in capital structure for public companies.[32] To proxy for investment opportunities, we use market-to-book ratios, R&D-to-sales ratios, and sales growth, all of which should be negatively related to leverage according to the trade-off theory. To proxy for profitability, we use return on invested capital (ROIC), which should be positively related to debt tax shields and incentive benefits of debt according to the trade-off theory, but negatively related to leverage according to the pecking order theory. To proxy for risk, we use volatility in ROIC, which should be negatively related to leverage since it decreases debt tax shields and increases costs of financial distress. To proxy for intangibility of assets, which should increase costs of financial distress, we use sales to property, plant and equipment (PPE) ratios. Finally, we relate leverage to statutory corporate tax rates, which should be positively related to the benefits of utilizing a debt tax shields.

Continuing the approach adopted in Table 5, in each case we sort the matched public company industry-region-date medians by the variable in question, then present median leverage by quartile for the public companies and their buyout matches. The results are presented in Table 6 and suggest, in general, that, consistent with previous research, these factors tend to be related to capital structure for public companies. For example, market-to-book and R&D-to-sales ratios are negatively related to leverage ratios, as most studies have found. Yet, for the corresponding buyouts, there is no such

[32] See e.g. Titman and Wessels (1988) and Shyam-Sunder and Myers (1999),

relation between leverage and the ranking of the public comparables for either of these ratios. If anything, if there is any relation between firm characteristics and LBO leverage, it tends to go in the opposite direction of public firms. This pattern holds for market-to-book ratios and for sales growth, both of which are positively correlated with LBO Debt/EBITDA and Interest/EBITDA ratios and negatively correlated with public firm leverage. The one variable for which buyouts and public companies' capital structures have a similar pattern is the corporate tax rate, which is weakly correlated with leverage.

None of these variables except sales growth remain robustly significant for explaining LBO leverage when we use them as controls in the regressions described in Subsection E below. LBO Debt/EBITDA does seem to go up with sales growth, which is not what the trade-off theory would predict if sales growth proxies for growth opportunities that can be lost in financial distress. We think it more likely that this relation occurs because sales growth is related to expected future growth in EBITDA, which can explain why the private equity sponsor is willing to take on relatively high debt levels compared to today's EBITDA.

D. LBO leverage and debt market conditions.

The variables used in Table 6 have been used in previous research to explain capital structure in public companies. Yet, they do not appear to explain capital structure in buyouts, at least not in the way a trade-off or pecking order theory would predict. We next examine whether debt market conditions help explain leverage in buyouts better, as suggested by either the market timing or the GP-LP agency stories outlined in Section III.

The patterns previously shown in Figure 1 seem broadly consistent with debt market conditions playing a different role for LBOs and public companies. In particular, LBO leverage appears to be pro-cyclical, while public company peer leverage is not. To examine this pattern in more detail, we continue our univariate approach of sorting the public companies on various measures – in this case on debt market conditions – and then considering leverage of both the buyouts and the matched public company industry-region-date medians.

The results are presented in Table 7. Using the high-yield spread as a measure of market conditions for lower-quality loans of the sort used in buyouts, all three measures of leverage decrease for buyouts as the spread increases. A lower spread is typically thought to be suggestive of better financial conditions and a hotter market for high-yield debt, so it is not surprising that buyout firms use more debt when this spread is lower. Yet, the relation goes the opposite way for the public companies,

for which each measure of leverage is increasing with the high-yield spread. In other words, leverage in public companies increases, if anything, when debt market conditions worsen.

We confirm these patterns using two alternative measures of debt market conditions. First, we calculate the difference between the earnings yield in the S&P 500 index and the high-yield rate at the time of the buyout, which Kaplan and Strömberg (2009) document to be positively related to private equity fundraising. Arguably, this measure captures the difference in relative pricing across public equity and debt markets, and a larger value of this variable indicates that equity is relatively "cheap" compared to high-yield bonds. Second, we use a measure of "credit tightening" according to a quarterly survey undertaken by the U.S. Federal Reserve. In particular, we use the net percentage of loan officers in medium and large U.S. banks reporting tightening standards for loans.[33] This measure captures non-price aspects of credit market conditions, such as debt covenants and quantity constraints. When we sort the LBO transactions across quartiles using these two debt market condition measures, we find a significantly positive relationship between leverage and the ease of debt market conditions for the LBOs, whereas the pattern for the public comparators usually goes in the opposite direction. Again, these patterns are strongly suggestive that the drivers of capital structures are different for LBOs and public companies.

In addition to the quantity of debt, we also examine the composition of debt as a function of debt market conditions. Table 8 considers the way in which the types of debt used in the sample of buyouts varies intertemporally and in relation to our measures of debt market conditions. It is evident that the proportion of amortizing Term Loan A debt, which is the tranche of the loan that is provided by banks as opposed to other financial institutions, has both declined over time and is countercyclical, with the fraction increasing after the internet bust of 2000-2001 and decreasing during the "credit bubble" in 2005-2007. This pattern is clear and statistically significant when sorting on debt market conditions. During very liquid credit markets, when buyout leverage is generally higher, banks hold a lower fraction of the buyout debt as opposed to hedge funds, collateralised loan obligations (CLOs) and other non-bank financial institutions. Table 8 also shows a similar pattern for the maturity of debt, measured as the proportion of total debt maturing in five years. Using high-yield spreads as a measure of credit conditions, the maturity increases from 9% of debt being due in five years for the median buyout in the lowest spread quartile, to 29% in the highest spread quartile. These finding are consistent

[33] See Lown, Morgan, and Rohatgi (2000) for more information about the survey. These authors document that the survey results are strongly related to loan growth, with tightening standards being associated with slower loan growth.

with the observations of Kaplan and Stein (1993) about the late-1980's LBO boom.[34] In addition, during hot credit market conditions, contingent debt commitments increase, while the fraction of "alternative debt" (defined as vendor, sponsor, and off-balance-sheet financing) decreases. It appears that when markets are hot, lenders are more willing to provide extra sources of finance such as lines of credit for capital expansion, while when times are tougher, buyout firms have to go to alternative sources such as vendor or self-provided debt for financing.

To summarize, these various univariate analyses suggest that debt market conditions, as opposed to firm-specific debt capacity, are the main determinants of buyout leverage. In the next section we evaluate whether these relations continue to hold controlling for other factors in a multivariate regression framework.

E. Multivariate analysis of buyout capital structures

The sorts reported in Tables 5-8 are suggestive that capital structures in LBOs are determined by debt market conditions rather than the theories of capital structure that have been developed and applied to publicly traded firms. To explore this issue more rigorously we present multivariate regressions modelling capital structure choices for both LBOs and public companies. Descriptive statistics for the regression variables are provided in Table 9.

Table 10 considers the impact of debt market conditions on leverage. The first six columns present regressions predicting the leverage for our sample of matched public companies, and for the subset that adjusted their capital structure. These first equations rely on a fairly parsimonious specification, including only the high-yield spread, plus regional dummies and industry fixed effects. We confirm the positive relationship found earlier between the credit spread and leverage for public companies; the results are particularly significant when leverage is measure by debt to enterprise value. Similar (unreported) results are obtained when we use our subsample of debt-issuing public companies.

In Columns 7-12, we predict comparable leverage levels for our sample of buyouts. In Columns 7-9 we first try to explain each measure of leverage using the median leverage for the matched public companies. If the same explanations for leverage hold for both sets of companies, we would expect positive and statistically significant coefficients on the public industry leverage variables. However, the only statistically significant coefficient is actually negative, while the other two coefficients are positive, small and not statistically significant.

[34] In recent work, Shivdasani and Wang (2009) find that during hot credit conditions, CDOs provide a higher fraction of LBO credit, suggesting that the supply of non-bank debt fuel LBO activity.

However, in Columns 10-12, when we add the credit spread to the equation, it is negative and highly statistically significant in each specification. Columns 13-18 replicate Columns 7-12, except that they add controls for deal location, deal type and deal size. The results in these columns are similar to those in Columns 7-12: leverage of public comparables does not explain buyout leverage but buyout leverage is strongly related to debt market conditions as measured by the yield spread. Deal size, however, is indeed another important determinant of LBO leverage. Larger deals (measured by enterprise value quartiles) are significantly more highly levered than smaller deals for all our three leverage measures, and public-to-private deals seem more highly levered than other LBO types.

Table 11 presents leverage regressions controlling for company characteristics. For public companies (Columns 1-3), more profitable industries (as measured by return on invested capital, ROIC) have lower leverage, industries with more variable cash flows (as measured by the standard deviation of ROIC) have lower leverage, and industries with more growth opportunities (proxied by R&D-to-sales and market-to-book ratios) have lower leverage. These results are broadly consistent with the earlier capital structure literature for public companies. In contrast, the regressions reported in columns 4-6 show that almost none of these company characteristics have any significant relationship with buyout leverage. The only exception is that when we measure leverage as Debt/EBITDA, LBOs matched to industries with high sales growth and low corporate tax rate tend to have higher leverage, although the economic significance is small. Note that this result is the opposite of what the trade-off theory would predict. In contrast to industry characteristics, the high-yield spread variable is still a strong determinant of buyout capital structure. It appears that the pattern is robust: public leverage is related to the factors from the trade-off and pecking order theories discussed in other work, while buyout leverage appears to be primarily a function of market conditions.

F. Pricing of Deals

To this point we have focused on the way in which capital structure differs between buyouts and public companies, and whether the determinants of leverage are similar in each group of companies. We now turn to the issue of the factors that affect buyout pricing. Our measure of price is enterprise value divided by EBITDA, which we refer to as the "EV multiple", which is the most commonly-used metric for price in the private equity sector.[35] Of particular interest, returning to the questions raised in the

[35] Clearly, many other possible metrics exist. In the private equity sector, enterprise value is often expressed as a multiple of EBITDA minus "normalised" capex (in an attempt to proxy free cash flow). In the public equity arena, share price to earnings (P/E) ratios are most typically employed. However, P/E ratios only measure equity valuation, and so are not suitable for comparing buyouts where debt forms a large, and variable, portion of the capital structure.

introduction, the evidence in Figure 1, and indeed the title of the paper, is whether conditions in the debt market not only affect capital structure but also the valuation of companies.

Table 12 examines the relation between pricing in buyouts and in public companies. It presents estimates of equations predicting EV multiples as a function of company and market characteristics. The first two columns consider the extent to which pricing in buyouts and in public firms are related to the high-yield spread. The spread has a negative and statistically significant impact on prices both of buyouts and public firms. Comparing the coefficients, however, the negative magnitude is significantly larger for the LBO multiple than the public company multiple, indicating that LBO pricing is more sensitive to debt market conditions.

The fact that public company valuations are related to the credit spread suggests that the spread not only proxies for debt market conditions, but also picks up changes in the economy-wide discount rate or risk premium. Hence, before we can conclude that debt market conditions drive LBO pricing, we need to control for changes in discount rates. In the third column we do so by controlling for the matched public company EV multiple in the equation predicting pricing in buyouts. Changes in the discount rate should be reflected in public company valuations. As expected (and in contrast to the leverage regressions) the coefficient on the median public company multiple is positive and statistically significant. Nonetheless, the credit-spread variable is negative and statistically significant as before, and the magnitude of the coefficient is the same as in the previous columns. The effect of credit market conditions on LBO pricing appears to be fairly orthogonal to general changes in economy-wide discount rates. The fourth column adds a number of deal-level controls and finds a similar effect; credit market conditions have a strong relation with buyout pricing. Buyout pricing and buyout leverage both appear to be determined in large part by debt market conditions; the results are consistent with easier availability of leverage driving up LBO transaction prices, as is commonly suggested by practitioners and by the financial press.

The final two columns try to get at this issue more directly by considering the relation directly between LBO EV multiples and LBO leverage. The evidence from Figure 1 suggests that, at least in a time-series aggregate, leverage and pricing in buyouts are highly correlated. This correlation does not necessarily imply that leverage has a causal impact on pricing, since both are likely to be functions of common, unobserved factors. In addition there are likely to be measurement error issues when our proxies for pricing (enterprise value) and leverage (total debt) are both normalised by EBITDA.

Still, we present some suggestive evidence on the relation between leverage and pricing by regressing price multiples on leverage, using high-yield spreads as an instrument for leverage in the

first stage in the fifth column. Although this approach addresses the measurement problem in EBITDA, one can question whether it controls adequately for endogeneity, since, as previously argued, spreads may be related to the cost of capital (although we control for public market pricing in the regression). As an alternative, we estimate this equation in the sixth column using the fraction of debt that is Term Loan A as an instrument for leverage, since this fraction is likely to be related to the amount of leverage available but not to the pricing of the deal (except through the leverage channel). Using either instrument, our estimates indicate that there is a statistically significant relationship between instrumented leverage and pricing in buyouts. This relation remains after controlling for pricing multiples prevailing in public markets.

We believe that our results on LBO leverage and pricing are unlikely to be driven by matching or measurement error. Apart from the robustness results discussed previously, we reestimate the regression analysis of leverage and pricing in Table A2 of the appendix for the subsample of public-to-private transactions, where we are able to control for pre-LBO firm characteristics rather than industry-region-level proxies. In these equations, we again find similar results to those in Table 12, with leverage strongly predicting the pricing of deals.

To summarize the results so far, our results suggest that (a) debt market conditions, rather than firm-specific factors, are the primary driver of leverage in buyouts, and (b) debt market conditions also drive the prices paid in these transactions, presumably through the leverage channel.

G. LBO transactions and Private Equity sponsor characteristics

Our results suggest that both buyout leverage and pricing are strongly related to debt market conditions. One possible explanation, along the lines of Jensen (1989), is that private equity funds choose leverage optimally to maximize the value of the LBO target firm, and the optimal leverage ratio is higher during hot credit market conditions. This explanation appears to be unlikely given our empirical results for several reasons: First, leverage in buyouts is essentially unrelated to comparable public company leverage and characteristics in the cross-section, even for subsamples of public firms that are more likely to adjust or increase leverage. Second, public firms across all subsamples decrease rather than increase their leverage in response to improving debt market conditions. In an optimal leverage story, we would expect that (a) at least some proxies for benefits and costs of leverage should have the same cross-sectional relation for public companies and buyouts, and (b) that at least some public companies (such as the ones that actively manage their capital structures) should increase their leverage as well in response to improving debt market conditions.

Consequently, it appears that the data are more consistent with the market timing or the GP-LP agency explanations discussed in Section III than with one based on portfolio company characteristics. To distinguish between the market timing and the agency stories, we first consider the manner in which LBO leverage and pricing are related to private equity fund characteristics. If buyout leverage is principally used to arbitrage debt and equity markets, then the more reputable firms, who have better access to debt markets, should be able to take advantage of these opportunities to a greater extent than less reputable firms. Other research, such as Demiroglu and James (forthcoming) and Ivashina and Kovner (2008) present evidence suggesting that more reputable private equity funds have easier and cheaper access to debt.

We evaluate this argument using three different measures of private equity fund reputation: the amount of capital raised by the sponsor, the number of past private equity funds raised by the sponsor, and the number of private equity transactions undertaken during the last three years. For every buyout deal, we calculate the relative ranking of the sponsor according to these three measures at the time of the deal, normalized between zero and one, in order to get a time-invariant measure (since LBO volume has increased over time).[36] Since the relation between these rankings and our dependent variables is unlikely to be linear, we use dummy variables for whether the sponsor was relatively highly ranked according to these measures.[37] We are able to find this information about the private equity firms, and their different funds, for about three-quarters of our overall sample of transactions. We also include controls for the deal size relative to the overall fund size, and whether the private equity firm is affiliated to a commercial or investment bank (which arguably could increase access to leverage).

Table 13 presents regressions of our various leverage measures for each LBO transaction on private equity firm- and fund-level characteristics, in addition to the debt market and public comparator variables discussed previously. Overall, the statistical significance of the reputation variables is weak and fairly inconsistent. While the number of past funds raised seems positively related to D/EBITDA and EV/EBITDA, other reputation variables are statistically insignificant and often enter with a negative sign. In addition, economic significance of these reputation variables is quite low (especially compared to the high-yield spread).[38] There is some weak evidence that deals that are large relative to the size of the fund (measured by EV/fund size) use more debt. Although there could be several explanations for this finding, it is broadly consistent with the agency story of Axelson et al. (2009), in

[36] The exact construction of these variables is explained in Appendix B.
[37] When we use the rankings themselves rather than the dummy variables, or the raw numbers for fundraising, number of funds, and number of transactions undertaken, the results are generally insignificant.
[38] One concern is that these reputation variables are correlated with each other, introducing multicollinearity problems in the regressions. In unreported regressions we enter the fund characteristics one at a time with very similar results.

which leverage can lead to overinvestment.[39] Also, it is worth noting that the coefficient on our measure of debt market conditions, the high-yield spread, is consistently negative and statistically significant in all leverage and pricing regressions.

The ultimate test of whether the willingness of private equity firms to take on leverage is good or bad for investors, however, is the question of whether deal leverage affects fund returns. Return data (measured as fund-level IRR) is available from Preqin for 185 private equity funds in our sample, which invested in 595 of our LBO deals. This means that we are able to match about one-half of our total sample of transactions to funds where we can observe their returns. Of course, our transactions are a relatively small subset of the total number of buyouts conducted by these funds, but for the remaining buyouts data was not available. Nonetheless, we have a reasonably large sample of fund returns, and, on average, detailed information on around three buyouts per fund.

Table 14 presents regressions of private equity fund-level IRRs on LBO deal-level leverage and a number of variables designed to control for other factors affecting returns, such as market fluctuations and risk factors. In our regressions we control for fund vintage year (i.e., the year the fund was raised), region and industry fixed effects, LBO type dummies, fund benchmark returns, and, in some specifications, LBO year. Taken together, these controls should absorb a major part of the effect of market return fluctuations and differences in risk premia across deals. Since we have several observations for any given fund, we cluster our standard errors both at the fund and vintage year levels. Finally, since previous research (notably Kaplan and Schoar (2005)) has found significant persistence in the performance across funds for a given private equity sponsor, we also control for the partnership's previous fund's IRR, as well as a dummy variable indicating whether this is a sponsor's first fund.

The first column estimates how a fund's IRR relates to private equity firm and fund characteristics. Kaplan and Schoar's (2005) persistence result holds for our sample as well, and this finding is robust to all alternative specifications that we have estimated. None of the other private equity firm/fund characteristics are statistically significant. In the remaining columns we introduce deal-level leverage and deal size variables. Overall, the results provide strong support for the agency story as opposed to the arbitrage story for leverage. In particular, deal-level leverage is always negatively related to fund returns, and statistically significantly so for our log D/EBITDA and I/EBITDA measures (see Columns 2-4). Hence, funds doing transactions with more leverage tend to underperform other funds, controlling for other factors affecting returns.

[39] Consistent with PE firms having overinvestment incentives, Lopez-de-Silanes et al. (2009) find that deals undertaken by funds with a large amount of fund capital or portfolio companies per investment professional produce lower IRRs at the deal level.

Of course the Modigliani-Miller theorem predicts that leverage should have a strong effect on returns. This effect, however, works in the opposite direction of what we find in the data. Modigliani-Miller logic implies that leverage should increase average (expected) equity returns, while the results presented in Table 14 suggest that the opposite is true in our sample and that funds with more levered deals have *lower* returns.

In Column 5 of Table 14 we consider whether there is any evidence that funds make money by timing debt markets, by splitting leverage into the component explained by variation in debt markets and residual leverage. We do this by first estimating a regression of log D/EBITDA on high-yield spreads and using the fitted values from this regression to calculate predicted leverage. We then calculate "residual" leverage as the difference between actual and predicted log D/EBITDA. If funds arbitrage debt markets against equity markets when debt is "cheap", we would expect the predicted component of leverage to have a positive impact on fund returns. However, we find that both components of leverage have a negative impact on returns, which is inconsistent with a market-timing story. In Column 6 we investigate whether the negative effect of leverage is driven by the relatively more levered deals by separating log D/EBITDA depending on whether this variable is below or above the sample median. As the table shows, the negative effect is driven by the deals with a D/EBITDA above the sample median, while the coefficient is smaller and insignificant when D/EBITDA is below the sample median. This suggests that low to moderate leverage levels do not significantly hurt returns, but high leverage levels do. Also consistent with an agency story in which sponsor overinvestment / risk shifting hurts investors, the results in Column 7 show that deals that are large relative to fund size are associated with negative fund returns. Finally, these results are not driven by the timing of transactions, even though (as Figure 1 shows) valuation multiples vary considerably over time. When, in column 7, transaction year fixed effects are included, the results are unaffected.

One alternative explanation for the negative relation between fund returns and leverage is that times of easy credit lead to a higher degree of competition in the market for LBOs, which in turn drives returns down. As long as returns are still above the cost of capital for investors, this explanation is perfectly compatible with alignment of interest between funds and their investors. However, any variation in the degree of competition in the market should be absorbed in our vintage year, industry, and transaction year fixed effects, which means that this cannot be a full explanation for our results.

Another possibility is that the causal relationship does not go from high leverage to low returns, but rather the other way around: A fund which is expecting to have low returns may have an incentive to engage in risky strategies such as unusually large or unusually leveraged transactions to gamble for

resurrection. Note, however, that this is just a variant of the same agency story. Given that we cannot identify returns for individual deals within the fund, we have no way of ruling out this type of reverse causality in the data.

To summarize these results, the evidence that fund-level returns tend to be negatively related to the transaction-level leverage suggests that private equity sponsors may be acting more in their own (carried!) interest than their investors' when they impose highly leveraged capital structures on their portfolio companies. Note that this does not necessarily imply that a highly levered capital structure imposes extra costs on the portfolio firm itself, as some critics of LBOs have argued. Instead, our data indicates that the prices private equity funds seem to be willing to pay for highly levered deals are not only high, but excessive.

VI. Conclusions

Private equity firms have become increasingly important as a source of capital and governance for companies. The majority of capital raised by private equity funds is used for leveraged buyouts, in which equity from limited partners is supplemented with additional deal-level debt financing. Each of these buyouts thus represents a capital structure decision; the total capital involved in these is enormous. Buyout financing represents an important yet largely unexplored issue, for which there are implications both for the study of private equity, and also for corporate finance more broadly. Are the theories that have been developed to explain capital structures of public firms applicable to buyout firms, or do completely different factors explain buyout capital structures than explain capital structure in public firms? What is the role of debt market conditions and do they explain the extreme cyclicality of the buyout industry? How does the availability and pricing of debt contribute to the quantity pricing and returns of buyouts observed in the economy?

To address these and related questions, this paper constructs a large, detailed, and geographically diverse sample of buyouts - to our knowledge the most complete such database yet assembled. Previous analyses have tended to focus on U.S. public-to-private transactions, which are a small subset of all private equity deals. Our sample of 1157 transactions includes the often-studied public-to-private deals, but the vast majority of the transactions are the more common deals involving the purchase of private companies, and divisions of public companies. Our sample also differs from most in that it includes a substantial number of non-U.S. deals. We combine detailed information on capital structure from the syndicated loan market, valuation metrics from accounting data, and detailed

information on private equity firm and fund characteristics to produce the first comprehensive analysis of the capital structure of buyouts.

We first characterize how buyouts are financed, and find that, to a first order, buyout capital structures appear to be "inverted" relative to comparable public companies. On average, debt comprises around 70 percent of enterprise value in buyouts, which is about the proportion of equity in public companies. This debt comes in many different forms; we document the use of each type and the extent to which this use varies over differing market conditions. Much of the debt employed in buyouts is non-amortizing, and it is common that for some tranches even interest payments are optional. Contingent credit facilities are widely used and provide additional financial flexibility that is critical for firms operating with such high leverage.

We next compare the capital structure of buyouts with a matched sample of public companies. Not surprisingly, leveraged buyouts employ more debt than do public companies, although the size of the difference is striking, and is strongly cyclical. More surprising is our finding that there is no cross-sectional relation whatsoever between the financial structure of buyouts and matched public firms. This finding is robust to a large number of alternative measures of leverage and control samples.

The lack of a relation between buyout financial structures and public company financial structures suggests that different factors determine capital structure decisions of public companies and private equity firms. We econometrically investigate the extent to which various possible factors affect capital structures of buyout and public companies. Variables suggested by previous research work well, and in accordance with theory, for the public companies. However, the factors that predict capital structure in public companies have no explanatory power for buyouts. Instead, the main factors that do affect the capital structure of buyouts are the price and availability of debt; when credit is abundant and cheap, buyouts become more leveraged. In contrast, no such effect is observed in the matched public companies. Our sample is particularly useful in this respect, since we include transactions from the 1980s through to the recent credit bubble, and even some transactions completed after the ensuing financial crisis. As a consequence we observe considerable time-series variation in debt market conditions.

Our results suggest that capital structure in buyouts requires a different explanation than in public firms. Private equity practitioners often state that they use as much leverage as they can to maximize the expected returns on each deal. The main constraint they face, of course, is the capital market, which limits at any particular time how much private equity sponsors can borrow for any particular deal. Axelson et al. (2009) formalize these ideas in their model, which suggests that the

higher leverage chosen by private equity funds during hot markets could plausibly not be in the interests of their investors.

An important issue is whether company valuations are related to leverage, since if private equity funds pay more for portfolio companies when higher leverage is available, then the higher leverage could drive pricing beyond what is in the interests of investors. We document a significant relation between leverage and valuation, which is consistent with the view that the prices that private equity funds are willing to pay increases with the leverage they employ. However, there are a number of alternative explanations for this finding. In particular, when credit conditions are favorable and interest rates and the cost of capital are low, and valuations and leverage could be high for simple discounting reasons. Distinguishing between these effects is difficult without a large panel of deal-level outcomes.

In the absence of these data, we perform two sets of tests. We first try to isolate the impact of leverage on pricing by controlling for general movements in valuation multiples in public companies, which will also be affected by economy-wide movements in interest rates. Even controlling for such movements, as well as a number of fund-level characteristics that potentially influence the bidding behavior of private equity firms, credit conditions appear to impact LBO pricing positively. The second set of tests utilizes fund-level returns data, to which we can match a significant subset of our buyouts. Although this data is one step removed from the deal level returns that we would ideally prefer, provided our sample of deals is representative of those undertaken by each fund, it nonetheless allows us to analyze whether highly leveraged deals are associated with higher or lower returns for investors. The regressions suggest that there are consistently negative relations between fund returns and our various leverage measures. We also confirm previous findings regarding the persistence of performance by private equity firms across successive funds.

Capital structures in public companies and private equity portfolio firms appear to be driven by different factors. Costs from the incentive contracts that are ubiquitous in private equity are important determinants of LBO capital structures. Given the increasing role of private equity in the economy and the importance of financial markets in these deals, understanding the mechanism through which financial conditions affect private equity transactions more completely seems like an increasingly important area of research.

References

Andrade, Gregor and Steven N. Kaplan (1998), How Costly is Financial (not Economic) Distress? Evidence from Highly Leveraged Transactions that Become Distressed, *Journal of Finance* 53, 1443-1493.

Axelson, U., Strömberg, P., and M. Weisbach (2009), "Why are buyouts levered? The financial structure of private equity firms," *Journal of Finance*, 64, 1549-1582.

Baker, M, and J. Wurgler (2002), "Market timing and capital structure," *Journal of Finance* 57, 1-32.

Baker, M, R. Greenwood, and J. Wurgler (2003), "The maturity of debt issues and predictable variation in bond returns," *Journal of Financial Economics* 70, 261-291.

Berger, P., E. Ofek, and D. Yermack (1997), "Managerial entrenchment and capital structure decisions," *Journal of Finance* 52(4), 1411-1438.

Bernstein, Shai, Josh Lerner, Morten Sørensen, and Per Strömberg (2010), "Private Equity, Industry Performance and Cyclicality" Working Paper, SIFR.

Cotter, J. F., and S. W. Peck (2001), "The structure of debt and active equity investors: the case of the buyout specialist," *Journal of Financial Economics* 59, 101-147.

Demiroglu, C. and C. James (forthcoming), "The role of private equity group reputation in LBO financing," *Journal of Financial Economics* (forthcoming).

Fama, E.F., and K.R. French (1997), "Industry costs of equity," *Journal of Financial Economics* 43, 153-193.

Fischer, Edwin O., Robert Heinkel, and Josef Zechner (1989), "Dynamic capital structure choice: Theory and tests," *Journal of Finance* 44, 19–40.

Gorbenko, A., and A. Malenko (2009), "Strategic and financial bidders in takeover auctions," working paper, Stanford University.

Gottschalg, O., and L. Phalippou (2009), "The performance of private equity funds," *Review of Financial Studies* 22(4): 1747-1776

Graham, J.R., and C.R. Harvey (2001), "The theory and practice of corporate finance: evidence from the field," *Journal of Financial Economics* 61, 187-243

Guo, S., E. Hotchkiss, and W. Song (2010), "Do Buyouts (Still) Create Value?" forthcoming, *Journal of Finance*.

Ivashina, V., and A. Kovner (2008), "The private equity advantage: Leveraged buyout firms and relationship banking," working paper, Harvard Business School.

Jensen, M. (1986), "Agency costs of free cash flows, corporate finance and takeovers," *American Economic Review* 76, 323-339

Jensen, M. (1989), "Eclipse of the Public Corporation," *Harvard Business Review*.

Kaplan, S.N. (1989a), "Management buyouts: evidence of taxes as a source of value," *Journal of Finance* 44, 611-632.

Kaplan, S.N. (1989b), "The effects of management buyouts on operating performance and value," *Journal of Financial Economics* 24, 217-254.

Kaplan, S.N., and A. Schoar (2005), "Private equity performance: Returns, persistence, and capital flows," *Journal of Finance* 60(4), 1791-1823 .

Kaplan, S. N., and J. Stein (1993), "The evolution of buyout pricing and financial structure in the 1980s," *Quarterly Journal of Economics* 108, 313-357.

Kaplan, S.N., and P. Strömberg (2009) "Leveraged buyouts and private equity", Journal of Economic Perspectives 23, 121-146.

Korajczyk, R. and A. Levy (2003), "Capital structure choice: Macroeconomic conditions and financial constraints," *Journal of Financial Economics* 68, 75-109.

Leary, M. (2009), "Bank Loan Supply, Lender Choice, and Corporate Capital Structure," *Journal of Finance* 64(3), 1143-1185.

Leary, M. and M. Roberts (2005), "Do firms rebalance their capital structures?" *Journal of Finance* 60(6), 2575-2619.

Ljungqvist, A., M. Richardson, and D. Wolfenzon (2007), "The investment behavior of buyout funds: theory and evidence," ECGI working paper 174/2007.

Lopez-de-Silanes, F., L. Phalippou, and O. Gottschalg (2009), "Giants at the gate: Diseconomies of scale in private equity," working paper, University of Amsterdam.

Lown, Cara S., Donald P. Morgan, and Sonali Rohatgi, 2000. Listening to loan officers: the impact of commercial credit standards on lending and output, *Economic Policy Review, Federal Reserve Bank of New York* Jul, 1-16.

Muscarella, C. J., and M. R. Vetsuypens (1990), "Efficiency and organizational structure: A study of reverse LBOs," *Journal of Financial Economics* 45, 1389-1413.

Myers, S. (1984) "The Capital structure puzzle," *Journal of Finance.*

Myers, S., and N. Majluf (1984), "Corporate financing and investment decisions when firms have Information that investors do not have," *Journal of Financial Economics* 13, 187-221

Opler, T., and S. Titman (1993), “The determinants of leveraged buyout activity: Free cash flow vs. financial distress costs,” *Journal of Finance* 48(5), 1985-1999.

Ross, S., Westerfield, R., and J. Jaffe (2008), *Corporate Finance*, 8th ed., McGraw-Hill.

Shivdasani, A., and Y. Wang (2009), “Did structured credit fuel the LBO boom?,“ Working paper, University of North Carolina.

Shyam-Sunder, L., and S. Myers (1999), “Testing static tradeoff against pecking order models of capital structure,” *Journal of Financial Economics* 51, 219-244.

Strebulaev, I. (2007), “Do tests of capital structure theory mean what they say?” *Journal of Finance* 62, 1747-1787.

Strömberg, P. (2008) “The new demography of private equity.” In *The Global Economic Impact of Private Equity Report 2008*, World Economic Forum, January 2008.

Stuart, T., and S. Kim, forthcoming, “Board interlocks and the propensity to be targeted in private equity transactions." *Journal of Financial Economics* (forthcoming).

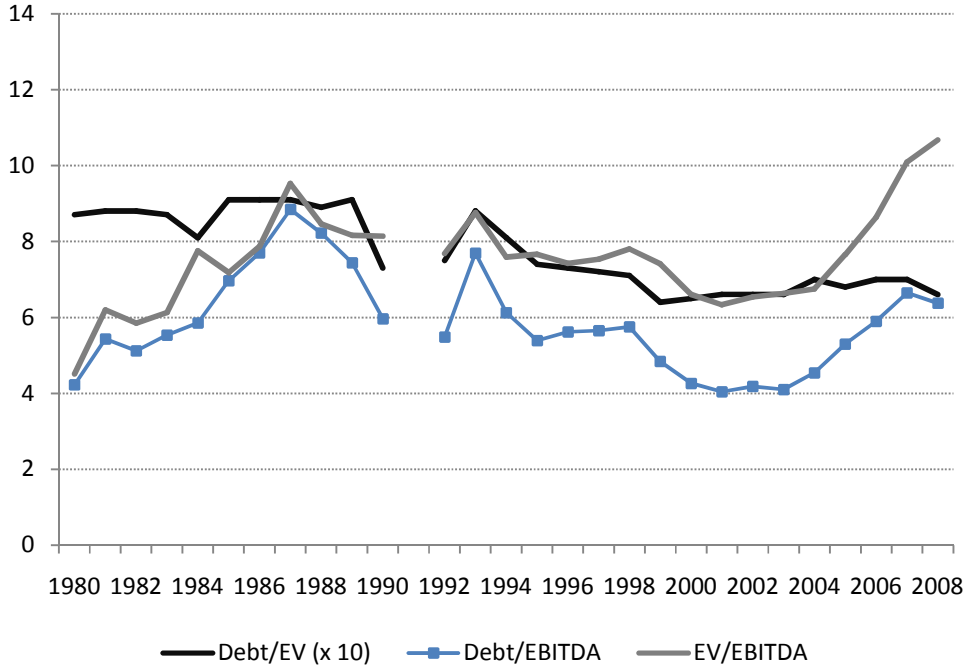
Titman, S., and R. Wessels (1988), “The determinants of capital structure choice,” *Journal of Finance* 43(1), 1-19.

Welch, I. (2004), “Capital structure and stock returns,” *Journal of Political Economy* 112(1), 106-130.

Figure 1: Market trends in leverage and pricing

The figure shows median values of Net Debt to Enterprise Value times 10, Net Debt to EBITDA, and Enterprise Value to EBITDA for a sample of 1157 leverage buyout transactions (Panel A) and the corresponding median values for matched public companies. Each leveraged buyout is matched to the median value for public firms in the same Fama-French 49 industry, month, and region (U.S., Western Europe, Eastern Europe, Asia, or Australia). See Table 5 for definitions of all variables. There were no buyouts in 1991.

Panel A: Leveraged buyouts



Panel B: Matched Public Companies

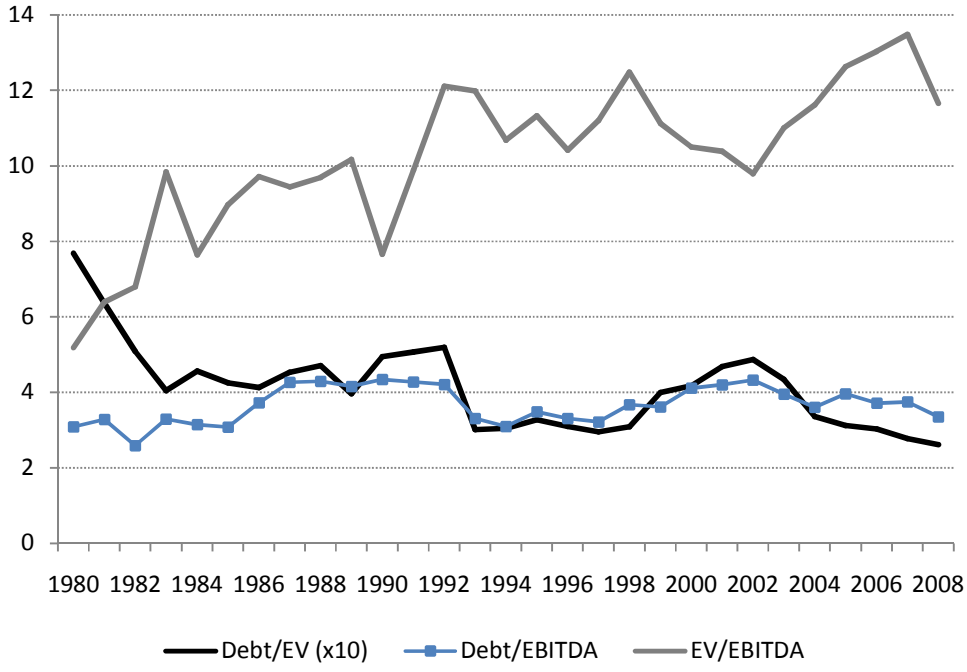


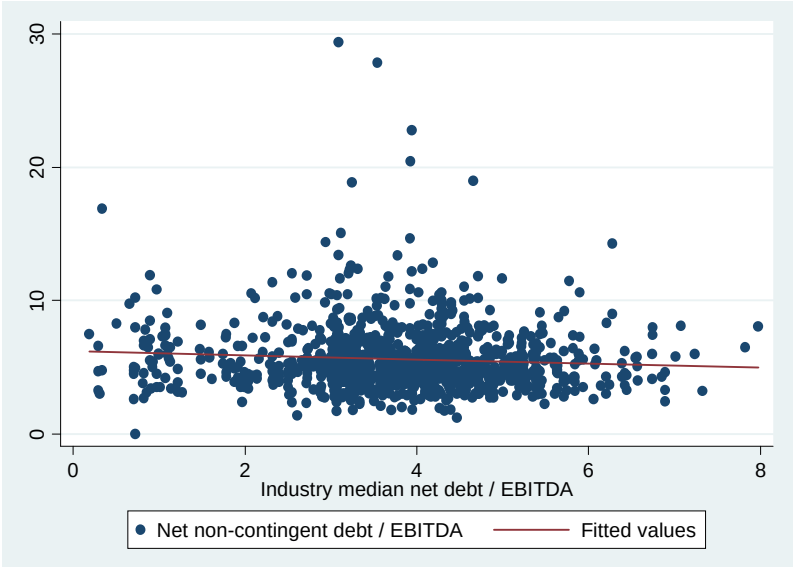
Figure 2: LBO Versus Public Market Leverage

This figure shows LBO leverage for the sample plotted against the median public company leverage in the same Fama-French 49 industry, year and month, and region (U.S., Western Europe, Eastern Europe, Asia, or Australia) as the LBO. The sample excludes LBOs in the banking and insurance industries (Fama-French industries 45 and 46). In addition, panels B and C exclude two LBOs with negative EBITDA at the time of the transaction and the industry median calculation excludes firms with negative EBITDA. Leverage is measured as net debt to enterprise value (market value of equity plus debt minus cash and short-term investments) in Panel A; net debt (i.e. debt minus cash and short-term investments) to EBITDA value in Panel B, and net interest expense over EBITDA in panel C, and excludes outliers where LBO I/EBITDA>8. Panel C excludes interest payments on vendor and sponsor loans. For the public companies, the net debt to EV is calculated using equity market value in the month preceding the date of the closing of the syndicated loan for the corresponding LBO. For the LBOs, the net debt does not include contingent debt such as lines of credit. For the t-statistics, standard errors are clustered by year.

Panel A: Debt / Enterprise Value

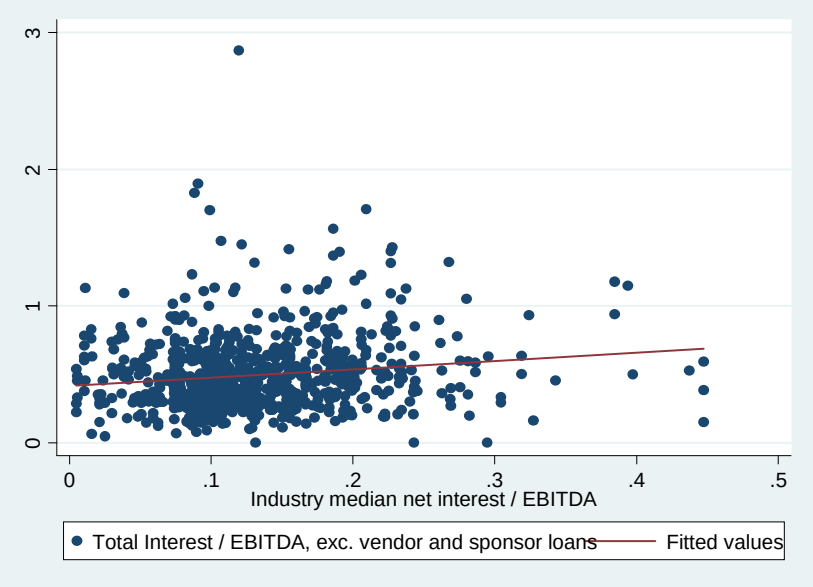
D/EV: Slope = 0.056, T-statistic = 1.71, R-squared=0.004, N=971

Panel B: Debt / EBITDA



D/EBITDA: Slope = -0.148, T-statistic = -2.28, R-squared=0.005, N=1117.

Panel C: Net Interest / EBITDA



I / EBITDA: Slope = 0.607, T-statistic = 1.78, R-squared=0.021, N=854

Table 1: A Typical Private Equity Buyout: the August 2005 Purchase of Kwik-Fit

Kwik-Fit is a leading tyre and exhaust fitting company, operating in the UK, Netherlands, France and Germany. Private equity funds were both the buyer and the seller: PAI bought KwiK-Fit from CVC. In private equity transactions the purchase price and level of debt are typically expressed in terms of multiples of earnings before interest, tax, depreciation and amortization (EBITDA), as shown in the last column. In this example, the estimated EBITDA for 2005 of £95.9m is the reference point. Pricing of the debt is expressed relative to the London Inter-bank Offered Rate (LIBOR). For the mezzanine debt, the return is split between cash interest payments and "payments in kind" (PIK).

	Amount (£m)	**Terms**	**Pricing (spread over LIBOR)**	**Multiple of EBITDA**
Enterprise Value	**773.5**			**8.1 x**
Equity	**191.0 (25%)**			**2.0 x**
Debt				
Term Loan A	140	7 year amortizing	2.25%	
Term Loan B	135	8 year bullet	2.50%	
Term Loan C	135	9 year bullet	3.00%	
Total Senior Debt	*410.0*			*4.3 x*
2nd Lien	75	9.5 year	5.00%	
Mezzanine	97.5	10 year	4.5% + 5% PIK	
Total Debt	**582.5 (75%)**			**6.1 x**
Revolving credit facility	40	7 year	2.25%	
Capex facility	50	7 year	2.25%	

Table 2: Sample Characteristics

This table shows the distribution of our sample companies according to various characteristics. In Panel A, LBOs are classified according to whether the transaction involved the buyout of a division of a larger company, whether the target was an independent private firm or was quoted on a stock exchange (public-to-private), whether it was a secondary transaction where the vendor was a private equity sponsor, or whether the acquisition was connected to a privatization or bankruptcy. Additional information on the distribution of our sample by country, industry and private equity sponsor is provided in the Appendix. In terms of geography, the companies are classified according to whether their head office is located in the US, Europe or Rest of the World. Panel B provides descriptive statistics on the size of the LBOs in our sample, according to enterprise value (EV), and earnings before interest, taxes, depreciation and amortization (EBITDA). The numbers of observations differ since data is not available for all measures for all companies. All values are in constant 2008 USD. Probability-values for rejecting the equality among groups using a Kruskal-Wallis test are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

Panel A: Distribution of the sample by status prior to the LBO and region

LBO year	Divisional	Private company	Privatization/ Bankruptcy	Public-to-private	Secondary	North America	Western Europe	Rest of World	Total by year	Year as % of total
1980	0	0	0	1	0	1	0	0	1	0.1%
1981	0	0	0	3	0	3	0	0	3	0.3%
1982	0	0	0	5	0	5	0	0	5	0.4%
1983	0	0	0	6	0	6	0	0	6	0.5%
1984	0	0	0	14	0	14	0	0	14	1.2%
1985	0	0	0	10	0	10	0	0	10	0.9%
1986	1	0	0	9	0	10	0	0	10	0.9%
1987	1	0	0	13	0	14	0	0	14	1.2%
1988	1	1	0	23	0	25	0	0	25	2.2%
1989	0	1	0	9	0	10	0	0	10	0.9%
1990	0	0	0	1	0	1	0	0	1	0.1%
1991	0	0	0	0	0	0	0	0	0	0.0%
1992	1	0	0	2	0	3	0	0	3	0.3%
1993	1	0	0	2	0	3	0	0	3	0.3%
1994	4	6	0	1	0	11	0	0	11	1.0%
1995	6	4	0	2	0	12	0	0	12	1.0%
1996	7	2	0	3	3	15	0	0	15	1.3%
1997	4	12	0	16	4	32	4	0	36	3.1%
1998	6	8	0	18	4	32	4	0	36	3.1%
1999	17	8	0	32	9	49	17	0	66	5.7%
2000	26	12	0	21	8	41	25	1	67	5.8%
2001	25	5	1	16	3	25	25	0	50	4.3%
2002	42	11	0	10	10	28	45	0	73	6.3%
2003	38	14	3	18	27	49	50	1	100	8.6%
2004	42	22	1	17	55	73	64	0	137	11.8%
2005	38	23	0	25	62	69	79	0	148	12.8%
2006	31	20	1	38	50	70	68	2	140	12.1%
2007	27	15	3	42	54	73	64	4	141	12.2%
2008	2	3	0	11	4	10	8	2	20	1.7%
Total	320	167	9	368	293	694	453	10	1,157	
as % of total	27.7%	14.4%	0.8%	31.8%	25.3%	60.0%	39.2%	0.9%	100.0%	

Panel B: Size of the LBOs in the sample

	Enterprise Value, million USD					EBITDA, million USD				
	N	Mean	Median	Min	Max	N	Mean	Median	Min	Max
Total sample	1033	1,602.8	683.2	18.9	59,509.5	1157	174.9	81.9	-16.2	6391.3
By type of LBO:										
Divisional	295	1,289.9	701.8	18.9	16,844.2	316	169.1	98.2	-16.2	2864.9
Private company	117	602.8	432.1	56.1	2,769.8	164	70.1	52.1	1.6	380.2
Privatization/Bankruptcy	6	1,383.4	1802.3	174.6	2,182.5	9	149.7	162.6	17.1	343.8
Public-to-private	375	2,566.9	848.2	43.5	59,509.5	378	275.9	104.4	-0.1	6391.3
Secondary	240	974.2	599.0	57.2	17,835.0	290	109.6	67.7	4.1	1598.1
KW test for difference between types	p-value	0.000***					0.000***			
By time period:										
1980-84	29	922.2	803.8	173.0	3,658.3	29	124.7	113.0	27.0	311.1
1985-89	78	3,895.9	935.6	43.5	59,509.5	79	442.4	101.8	-0.1	6391.3
1990-94	17	646.4	467.0	88.5	2,948.4	18	101.8	52.4	8.9	730.4
1995-99	158	774.5	589.0	72.0	3,745.9	163	91.9	69.9	-16.2	390.2
2000-04	387	886.7	519.1	18.9	8,533.9	422	123.1	72.4	4.5	1259.4
2005-08	364	2,331.3	922.9	56.1	50,037.7	446	213.1	89.1	1.6	5205.7
KW test for difference between periods	p-value	0.000***					0.000***			
By Region:										
North America	640	1,796.2	652.5	40.7	59,509.5	703	189.1	74.4	-16.2	6391.3
Western Europe	387	1,282.2	720.7	57.2	25,154.1	444	153.5	90.9	10.3	2160.7
Rest of World	6	1,659.5	1876.7	18.9	2,625.3	10	127.6	118.6	5.6	293.3
KW test for difference between regions	p-value	0.284					0.035**			

Table 3: The structure of LBO Debt

This table shows the structure of debt employed in LBOs. The reported figures, with the exception of the first column, represent mean values across our sample of buyouts. The main categorization is between senior secured bank debt, and subordinated debt. Senior debt is often split into separate tranches, with differing seniority, amortization, and interest rates (and sometimes currencies). Term Loan A is amortizing debt, while Term loans B, C, and higher (Term loan B,C,…) are typically non-amortizing. Subordinated debt can take a variety of forms including mezzanine and 2nd lien debt. Similarly, bonds can either be senior or high-yield junior bonds, which are more common given the highly leveraged structure of most LBOs. A variety of other debt is observed in our sample. Vendor loans refer to transactions where the vendor is prepared to accept some part of the total price as a loan note secured on the target company. In most LBOs the existing debt is paid off as part of the transactions, but in a minority of cases the new owners take on some of the existing debt. We refer to this as assumed debt. In a few cases we also observe loans from the private equity sponsor (Sponsor loans), and some explicit off-balance sheet financing; we categorize all these separately. Contingent debt refers to facilities that are put in place at the time of the LBO to fund working capital, capex, acquisitions etc., but are not drawn down at the time of the transaction. Some transactions involve preferred equity, which can be similar to low-seniority debt, although we neither include preferred equity nor contingent debt in our calculations of leverage in subsequent tables.

	Exists (% of LBOs)	**% of total debt (excluding contingent debt)**	**Basis points over LIBOR**	**Paydown within 5 years**
Senior bank debt				
Term loan A	62.2%	23.4%	276	68.0%
Term loan B,C, …	89.3%	46.2%	306	5.5%
Bridge loans	9.4%	2.9%	271	71.1%
Subordinated debt				
2nd lien	10.6%	2.5%	543	5.3%
Mezzanine	41.0%	9.9%	519	1.3%
Bonds				
Senior	7.1%	2.3%	485	4.7%
Junior	21.9%	9.3%	561	0.5%
Other debt				
Vendor loans	2.9%	0.5%	648	-
Assumed debt	2.6%	1.0%	-	-
Sponsor loans	1.0%	0.3%	761	-
Off balance sheet	1.8%	0.6%	-	-
Total debt		**100%**	**490**	**22.8%**
Contingent debt				
Revolver	92.1%	14.2%		
Other facilities	25.2%	3.7%		
Preferred equity	2.6%	0.5%	627	-

Table 4: Leverage and deal pricing

This table shows the amount of debt used and the transaction valuation paid in the acquisition in the sample of LBOs. Debt includes senior secured bank debt and all forms of subordinated debt (see Table 3 for details). Interest includes all the projected interest payments in the first year after the transaction. Measures are (1) debt divided by earnings before interest, taxes, depreciation and amortization (D/EBITDA), (2) debt divided by enterprise value (D/EV), (3) total interest divided by EBITDA (I/EBITDA), and (4) enterprise value divided by EBITDA (EV/EBITDA). Probability-values for rejecting equality among groups using a Kruskal-Wallis test are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

	D / EBITDA			**D / EV**			**I / EBITDA**			**EV / EBITDA**		
	N	Mean	Median	N	Mean	Median	N	Mean	Median	N	Mean	Median
All LBO transactions	1142	5.6	5.2	1002	0.69	0.70	873	0.50	0.45	1009	8.2	7.6
Divisional	315	5.0	4.7	289	0.69	0.70	238	0.43	0.39	290	7.4	6.8
Private company	163	4.9	4.7	115	0.64	0.65	139	0.44	0.42	114	7.8	7.4
Public-to-private	366	6.5	5.8	354	0.73	0.73	253	0.62	0.57	362	8.8	8.0
Secondary	289	5.6	5.3	238	0.66	0.68	237	0.50	0.43	237	8.5	7.9
Privatization/Bankruptcy	9	4.0	3.7	6	0.51	0.60	6	0.43	0.42	6	8.8	8.6
Kruskal-Wallis p-value		0.000***			0.000***			0.000***			0.000***	
1980-84	29	6.3	5.5	29	0.84	0.87	0			29	7.15	6.33
1985-89	68	8.0	7.8	64	0.89	0.91	41	0.98	0.93	67	8.55	8.24
1990-94	18	6.5	6.1	17	0.80	0.81	16	0.62	0.59	17	7.67	7.68
1995-99	161	5.5	5.1	158	0.68	0.69	148	0.64	0.55	154	8.44	7.53
2000-04	421	4.4	4.3	379	0.65	0.67	325	0.35	0.33	382	6.91	6.63
2005-08	445	6.3	5.8	355	0.68	0.69	343	0.53	0.5	360	9.54	8.81
Kruskal-Wallis p-value		0.000***			0.000***			0.000***			0.000***	
North America	689	5.8	5.3	619	0.70	0.70	587	0.55	0.49	625	8.46	7.68
Western Europe	443	5.3	4.9	377	0.68	0.68	283	0.42	0.38	378	7.79	7.38
Rest of World	10	5.7	5.5	6	0.70	0.68	3	0.53	0.59	6	8.48	8.9
Kruskal-Wallis p-value		0.000***			0.056*			0.000***			0.002***	
EV quartile 1 (smallest)	250	4.6	4.3	246	0.66	0.66	185	0.45	0.37	249	6.92	6.62
EV quartile 2	252	5.2	5.0	251	0.68	0.69	200	0.47	0.43	252	7.68	7.29
EV quartile 3	253	6.1	5.5	252	0.70	0.70	195	0.54	0.47	254	8.7	7.72
EV quartile 4 (largest)	255	6.9	6.4	253	0.72	0.72	195	0.6	0.55	254	9.51	9.06
Kruskal-Wallis p-value		0.000***			0.000***			0.000***			0.000***	

Table 5: Leverage of LBOs versus Public Companies

This table shows the median values of Net Debt (i.e. debt net of cash) to Enterprise Value (D/EV), Net Debt to earnings before interest, taxes, depreciation and amortization (D/EBITDA), and Net interest expense to EBITDA (I/EBITDA) for the sample of 1157 LBO transactions and matched public companies split into subgroups according to the quartiles of the corresponding debt measure for matched publicly traded companies. In Panel A, each LBO is matched to the public companies in the same Fama-French 49 industry, year and month, and region (U.S., Western Europe, Eastern Europe, Asia, or Australia). In Panel B, the predicted leverage of the LBO 5 years after the transaction, based on amortization schedules, is matched to the public companies in the same Fama-French 49 industry, year and month, and region. In Panel C, each LBO is matched to the public companies in the same industry, date, and region whose long-term debt to capital ratio (debt divided by debt plus book equity) changed by more than 10 percentage points in absolute value in the year of the LBO ("capital structure adjusters"). In Panel D, each LBO is matched to the public companies in the same industry, date, and region whose long-term debt increased by more than 10 percentage points of this year's total book assets in the year of the LBO ("debt issuers"). Panel E focuses on a subsample of public-to-private LBOs where leverage can be observed prior to the buyout. Probability-values for rejecting the equality among groups using a Kruskal-Wallis test are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

Panel A: LBO versus public company median leverage

	D/EV		D/EBITDA		I/EBITDA	
	LBO	Matched public	LBO	Matched public	LBO	Matched public
Whole sample	0.70	0.35	5.1	3.8	0.45	0.12
Leverage						
Public quartile 1 (lowest)	0.69	0.19	5.4	2.7	0.43	0.07
Public quartile 2	0.69	0.31	5.3	3.5	0.42	0.10
Public quartile 3	0.71	0.40	5.2	4.2	0.42	0.13
Public quartile 4 (highest)	0.70	0.54	4.8	5.2	0.53	0.20
Kruskal-Wallis p-value	0.08*	-	0.00***	-	0.00***	-

Panel B: Predicted LBO leverage in 5 years versus public company median leverage

	D/EV		D/EBITDA		I/EBITDA	
	Pred. LBO leverage in 5 yrs	Matched public	Pred. LBO leverage in 5 yrs	Matched public	Pred. LBO leverage in 5 yrs	Matched public
Whole sample	0.55	0.35	4.2	3.8	0.35	0.12
Leverage						
Public quartile 1 (lowest)	0.58	0.19	4.4	2.7	0.33	0.07
Public quartile 2	0.54	0.31	4.4	3.5	0.34	0.10
Public quartile 3	0.55	0.40	4.3	4.2	0.32	0.13
Public quartile 4 (highest)	0.53	0.54	3.7	5.2	0.41	0.20
Kruskal-Wallis p-value	0.18	-	0.00***	-	0.02**	-

Panel C: LBO versus public company capital structure adjusters' median leverage

	D/EV		D/EBITDA		I/EBITDA	
	LBO	Matched public	LBO	Matched public	LBO	Matched public
Whole sample	0.70	0.33	5.1	4.2	0.45	0.15
Leverage						
Adjuster quartile 1 (lowest)	0.69	0.16	5.3	2.6	0.44	0.09
Adjuster quartile 2	0.70	0.28	5.3	3.7	0.45	0.13
Adjuster quartile 3	0.70	0.39	5.4	4.6	0.44	0.18
Adjuster quartile 4 (highest)	0.70	0.55	4.7	6.2	0.46	0.29
Kruskal-Wallis p-value	0.71	-	0.02**	-	0.77	-

Panel D: LBO versus public company debt issuers' median leverage

	D/EV		D/EBITDA		I/EBITDA	
	LBO	Matched public	LBO	Matched public	LBO	Matched public
Whole sample	0.70	0.33	5.1	4.7	0.45	0.13
Leverage						
Debt issuer quartile 1 (lowest)	0.68	0.17	5.3	3.4	0.38	0.08
Debt issuer quartile 2	0.70	0.29	5.1	4.4	0.43	0.11
Debt issuer quartile 3	0.70	0.37	5.2	5.2	0.45	0.16
Debt issuer quartile 4 (highest)	0.71	0.51	5.0	6.5	0.55	0.24
Kruskal-Wallis p-value	0.13	-	0.59	-	0.00***	-

Panel E: Pre-LBO leverage

	D/EV		D/EBITDA		I/EBITDA	
	LBO	Pre-LBO	LBO	Pre-LBO	LBO	Pre-LBO
Whole sample	0.70	0.38	5.6	3.2	0.54	0.11
Leverage						
Pre-LBO quartile 1 (lowest)	0.63	0.11	6.1	0.4	0.48	0.01
Pre-LBO quartile 2	0.69	0.28	5.4	2.6	0.53	0.07
Pre-LBO quartile 3	0.77	0.52	5.4	3.8	0.51	0.18
Pre-LBO quartile 4 (highest)	0.75	0.97	6.0	5.9	0.61	0.33
Kruskal-Wallis p-value	0.02***	-	0.18	-	0.08*	-
Observations	115		160		159	
	Pre-LBO	Matched public	Pre-LBO	Matched Public	Pre-LBO	Matched Public
Whole sample	0.38	0.29	3.2	3.5	0.11	0.11
Leverage						
Public quartile 1 (lowest)	0.28	0.11	2.1	2.3	0.06	0.06
Public quartile 2	0.39	0.27	3.0	3.1	0.08	0.09
Public quartile 3	0.46	0.37	3.4	3.8	0.10	0.13
Public quartile 4 (highest)	0.45	0.49	3.8	4.9	0.19	0.21
Kruskal-Wallis p-value	0.03**	-	0.003***	-	0.00***	-
Observations	113		166		166	

Table 6: Leverage of LBOs versus Public Companies

This table shows the median values of Net Debt (i.e. net of cash) to Enterprise Value (D/EV), Net Debt to EBITDA (D / EBITDA), and Net interest expense to EBITDA for a sample of 1157 LBO transactions and matched public companies split into subgroups according to quartiles of the corresponding financial characteristic for matched public companies. Each LBO is matched to the public companies in the same Fama-French 49 industry, year and month, and region (U.S., Western Europe, Eastern Europe, Asia, or Australia). The definitions of the public company characteristics are: Market-to-book = [market value of equity + book value of long-term debt] / [book value of equiy + book value of long-term debt]; Return on Invested Capital = EBITDA / [book value of equity + book value of long-term debt]; Volatility in ROIC = the standard deviation of return on invested capital over the last five years; Sales-to-PPE = Sales / Property, plant and equipment; tax rate is the statutory corporate tax rate for the corresponding country and year. Probability-values for rejecting the equality among groups using a Kruskal-Wallis test are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

	D/EV		**D/EBITDA**		**I/EBITDA**	
	LBO	Matched public	LBO	Matched public	LBO	Matched public
Market-to-book						
Public quartile 1 (lowest)	0.69	0.52	4.5	4.4	0.36	0.13
Public quartile 2	0.71	0.41	5.2	4.2	0.46	0.14
Public quartile 3	0.70	0.31	5.4	3.5	0.46	0.11
Public quartile 4 (highest)	0.69	0.21	5.6	3.1	0.52	0.09
Kruskal-Wallis p-value	0.39	0.00***	0.00***	0.00***	0.00***	0.00***
R&D-to-sales						
Zero	0.69	0.37	5.1	4.0	0.44	0.12
Positive	0.71	0.28	5.1	3.2	0.49	0.10
Kruskal-Wallis p-value	0.31	0.00***	0.59	0.00***	0.06*	0.00***
Sales growth						
Public quartile 1 (lowest)	0.69	0.41	4.7	4.0	0.37	0.12
Public quartile 2	0.70	0.36	5.2	3.8	0.46	0.12
Public quartile 3	0.69	0.32	5.3	3.7	0.46	0.11
Public quartile 4 (highest)	0.70	0.33	5.5	3.6	0.49	0.11
Kruskal-Wallis p-value	0.19	0.00***	0.00***	0.00***	0.00***	0.21

Table 6: Leverage of LBOs versus Public Companies (continued)

	D/EV		D/EBITDA		I/EBITDA	
	LBO	Matched public	LBO	Matched public	LBO	Matched public
ROIC						
Public quartile 1 (lowest)	0.68	0.34	5.0	3.7	0.44	0.10
Public quartile 2	0.69	0.33	5.3	4.3	0.44	0.12
Public quartile 3	0.72	0.39	5.1	4.0	0.44	0.13
Public quartile 4 (highest)	0.70	0.34	5.4	3.4	0.47	0.12
Kruskal-Wallis p-value	0.00***	0.00***	0.10*	0.00***	0.66	0.00***
Volatility in ROIC						
Public quartile 1 (lowest)	0.70	0.46	5.0	4.5	0.39	0.13
Public quartile 2	0.70	0.39	5.0	4.1	0.45	0.14
Public quartile 3	0.72	0.34	5.3	3.6	0.48	0.12
Public quartile 4 (highest)	0.68	0.21	5.4	3.0	0.46	0.08
Kruskal-Wallis p-value	0.04*	0.00***	0.05*	0.00***	0.01**	0.00***
Sales-to-PPE						
Public quartile 1 (lowest)	0.71	0.38	4.8	4.2	0.42	0.16
Public quartile 2	0.69	0.39	5.0	3.8	0.44	0.12
Public quartile 3	0.70	0.29	5.4	3.6	0.51	0.10
Public quartile 4 (highest)	0.68	0.35	5.3	3.7	0.45	0.09
Kruskal-Wallis p-value	0.12	0.00***	0.02**	0.00***	0.01***	0.00***
Tax rate						
Low	0.70	0.39	5.3	4.2	0.43	0.11
Medium	0.68	0.32	5.0	3.5	0.47	0.12
High	0.83	0.44	5.4	3.4	0.36	0.16
Kruskal-Wallis p-value	0.00***	0.00***	0.22	0.00***	0.02**	0.00***

Table 7: Leverage of LBOs and debt market conditions

This table shows median values of Net Debt (i.e. net of cash) to Enterprise Value (D/EV), Net Debt to EBITDA (D / EBITDA), and Net interest expense to EBITDA (I/EBITDA) for a sample of 1157 LBO transactions and matched public companies. Each LBO is matched to the public companies in the same Fama-French 49 industry, year and month, and region (U.S., Western Europe, Eastern Europe, Asia, or Australia), and values for "matched public" is the median value among the public companies in this industry-year-region group. "U.S. high-yield spread" is the U.S high-yield rate minus U.S. Libor. "S&P E/P minus High-Yield-rate" is the S&P earnings divided by price minus the U.S high-yield rate. "Credit Tightening" is the net percentage of loan officers in medium and large banks reporting tightening standards for loans. All variables are measured at the end of the month of the LBO, except for credit tightening which is measured for the quarter of the buyout. Probability-values for rejecting the equality among groups using a Kruskal-Wallis test are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

	D/EV		**D/EBITDA**		**I/EBITDA**	
	LBO	Matched public	LBO	Matched public	LBO	Matched public
US high-yield spread						
Public quartile 1 (lowest)	0.70	0.29	6.1	3.7	0.56	0.11
Public quartile 2	0.70	0.33	5.6	3.8	0.49	0.11
Public quartile 3	0.70	0.37	4.8	3.8	0.39	0.12
Public quartile 4 (highest)	0.66	0.44	4.2	4.2	0.31	0.13
Kruskal-Wallis p-value	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
S&P E/P minus High-Yield-rate						
Public quartile 1 (lowest)	0.66	0.45	4.3	4.2	0.40	0.15
Public quartile 2	0.73	0.36	5.6	3.6	0.56	0.13
Public quartile 3	0.69	0.32	5.0	3.8	0.38	0.10
Public quartile 4 (highest)	0.70	0.30	5.9	3.8	0.50	0.10
Kruskal-Wallis p-value	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
Credit Tightening						
Quartile 1 (easy)	0.70	0.33	5.0	3.8	0.36	0.10
Quartile 2	0.70	0.30	5.4	3.6	0.47	0.10
Quartile 3	0.69	0.33	5.4	3.8	0.53	0.11
Quartile 4 (tight)	0.65	0.42	4.4	4.2	0.37	0.13
Kruskal-Wallis p-value	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***

Table 8: Debt structure and debt market conditions

This table shows the mean and median values of various debt structure characteristics for a sample of 1157 LBO transactions. See Tables 3 and 4 for debt structure and leverage definitions and Table 7 for definitions of the credit conditions variables. "Contingent debt except revolver" refers to facilities that are put in place at the time of the LBO to fund capex, acquisitions, etc. which are not drawn down at the time of the transaction, excluding regular lines of credit. "Alternative funding" includes vendor loans, loans by the LBO sponsor, and off-balance-sheet financing. Probability-values for rejecting the equality among groups using a Kruskal-Wallis test are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

	% of debt maturing within 5 years		**% Term Loan A / Total Debt**		**% Term Loan A / Total Bank Debt**		**% Contingent debt exc. revolver / Total Debt**		**% Alternative funding / Total Debt**	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Whole sample	0.22	0.18	0.26	0.24	0.37	0.36	0.03	0	0.03	0
Time periods										
1980-84	0.07	0.05	0.69	0.73	0.93	1.00			0.11	0.08
1985-89	0.18	0.08	0.42	0.44	0.88	1.00			0.13	0.06
1990-94	0.28	0.25	0.17	0.21	0.64	0.69	0	0	0.03	0
1995-99	0.24	0.19	0.27	0.23	0.45	0.44	0.03	0	0.03	0
2000-04	0.29	0.27	0.31	0.31	0.40	0.46	0.03	0	0.03	0
2005-08	0.17	0.13	0.16	0.04	0.20	0.12	0.05	0	0.02	0
KW p-value	0.00***		0.00***		0.00***		0.00***		0.00***	
US High-Yield Spread										
Quartile 1	0.14	0.09	0.13	0	0.18	0	0.05	0	0.01	0
Quartile 2	0.23	0.18	0.26	0.25	0.39	0.38	0.04	0	0.03	0
Quartile 3	0.24	0.22	0.29	0.27	0.44	0.46	0.02	0	0.03	0
Quartile 4	0.31	0.29	0.3	0.3	0.41	0.47	0.03	0	0.04	0
KW p-value	0.00***		0.00***		0.00***		0.00***		0.01***	
S&P E/P minus High-Yield-rate										
Quartile 1	0.31	0.29	0.34	0.32	0.47	0.49	0.02	0	0.04	0
Quartile 2	0.23	0.19	0.29	0.27	0.52	0.5	0.03	0	0.05	0
Quartile 3	0.21	0.19	0.21	0.19	0.27	0.27	0.04	0	0.02	0
Quartile 4	0.16	0.14	0.15	0.05	0.19	0.12	0.04	0	0.02	0
KW p-value	0.00***		0.00***		0.00***		0.00***		0.01***	
Credit Tightening										
Quartile 1 (easy)	0.23	0.21	0.22	0.24	0.3	0.33	0.03	0	0.01	0
Quartile 2	0.23	0.19	0.23	0.22	0.34	0.35	0.03	0	0.03	0
Quartile 3	0.19	0.13	0.19	0.14	0.27	0.22	0.05	0	0.02	0
Quartile 4 (tight)	0.29	0.26	0.31	0.29	0.42	0.43	0.03	0	0.04	0
KW p-value	0.00***		0.00***		0.00***		0.06*		0.01**	

Table 9: Descriptive statistics for regression variables

This table shows descriptive statistics for the variables used in the regression analyses in Tables 10-14. "Public" variables are median values for all public companies in COMPUSTAT and Global COMPUSTAT in the same region, Fama-French 49 industry, and month as the corresponding LBO transaction. "Adjuster" variables are median values for public companies whose debt to book capital changed by more than 10 percentage points in absolute value in the year of the LBO. "Issuer" variables are median values for public companies whose long-term debt increased by more than 10 percentage points of this year's total book assets in the year of the LBO. Fund characteristics are calculated using data from Capital IQ and Preqin. "EV / fund size" is the enterprise value of the LBO transaction divided by the fund size of the acquiring PE fund. Sponsor rankings are explained in Appendix B. "Bank affiliated" means that the PE sponsor was a subsidiary of a commercial bank, investment bank, or insurance company. Fund return data is from Preqin by June 2009. "Preqin fund benchmark IRR" are average fund returns for funds of the same vintage, region, and market segment.

	N	Mean	Min	25th %tile	Median	75th %tile	Max
LBO characteristics							
LBO D/EV	1002	0.69	0.00	0.61	0.70	0.78	0.99
LBO log D/EBITDA	1143	1.66	0.18	1.44	1.65	1.86	3.82
LBO I/EBITDA	873	0.50	0.00	0.32	0.45	0.61	8.06
LBO log EV/EBITDA	1009	2.04	-0.01	1.81	2.02	2.25	3.63
Macro variables							
Corp. tax rate in country and year	1153	37.2	10.0	34.5	39.3	39.3	56.8
US high-yield spread	1118	5.53	2.23	3.46	5.01	6.74	12.31
Public …							
D/EV	1131	0.36	-0.11	0.26	0.35	0.47	0.85
log D/EBITDA	1149	1.28	-1.67	1.14	1.34	1.52	3.64
I/EBITDA	1149	0.13	-2.65	0.09	0.12	0.16	0.45
log EV/EBITDA	1130	2.48	1.65	2.29	2.45	2.62	3.90
M/B ratio	1131	1.57	0.62	1.18	1.44	1.74	6.14
sales growth	1147	1.33	0.17	0.95	1.08	1.17	95.82
ROIC	1149	0.10	-0.25	0.09	0.11	0.12	0.24
Volatility in ROIC	1149	0.05	0.00	0.04	0.05	0.06	0.24
Public adjuster …							
D/EV	1033	0.35	-0.09	0.23	0.33	0.46	1.09
log D/EBITDA	1125	1.40	-0.95	1.17	1.43	1.67	4.71
I/EBITDA	1127	0.18	0.00	0.10	0.15	0.22	4.06
Public debt issuer …							
D/EV	1041	0.34	-0.09	0.24	0.33	0.44	0.98
log D/EBITDA	1130	1.57	-0.04	1.38	1.55	1.74	3.67
I/EBITDA	1130	0.15	-2.68	0.10	0.13	0.18	0.56
Private equity sponsor/fund							
Sponsor top decile in fundraising	1049	0.32	0	0	0	1	1
Sponsor top decile in no. of funds	1157	0.30	0	0	0	1	1
Sponsor top 2% in deals last 3 yrs.	1126	0.74	0	0	1	1	1
Fund size, 2008 USD millions	1059	3773	17	1092	2395	4861	23047
Log Fund size	1059	7.71	2.83	6.99	7.78	8.49	10.05
EV / fund size	930	0.72	0.01	0.16	0.28	0.60	32.84
Bank affiliated sponsor (dummy)	1157	0.15					
Fund IRR (%)	610	21.4	-17.1	11.2	19.6	28.9	109.9
First-time fund (dummy)	1079	0.09					
IRR in previous fund (%)	620	22.6	-18.3	11.5	22.1	28.9	109.9
Preqin fund benchmark IRR (%)	643	20.0	3.0	10.2	16.5	30.7	38.9

Table 10: LBO vs. Public Company Median Leverage and Debt Market Conditions

This table shows the results from OLS regressions of LBO and matched public company median leverage on the U.S. high-yield bond spread over LIBOR ("High-yield spread") and various other controls. "Public" variables are median values for all public companies in COMPUSTAT (or Global COMPUSTAT for non-U.S. deals) in the same region, Fama-French 49 industry, and month as the corresponding LBO transaction. "Adjuster" variables are median values for public companies whose debt-to-book capital ratio changed by more than 10 percentage points in absolute value in the year of the LBO. OLS regression coefficients and t-statistics using standard errors clustered at the LBO deal-year level are displayed in the table. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	Public	Public	Public	Adjuster	Adjuster	Adjuster
VARIABLES	**D/EV**	**log D/EBITDA**	**I/EBITDA**	**D/EV**	**log D/EBITDA**	**I/EBITDA**
High-yield spread	0.017***	0.005	0.003*	0.022***	0.023***	0.010***
	11.261	1.667	1.992	9.865	6.549	3.981
Western Europe	0.035***	0.121***	-0.030***	0.033*	0.007	-0.067***
	3.159	4.521	-4.346	1.798	0.177	-5.659
Rest of World	-0.055*	-0.346**	-0.058***	0.036	-0.784***	-0.095***
	-2.009	-2.42	-4.25	0.595	-4.302	-4.965
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.187***	1.088***	0.130***	0.203***	1.406***	0.227**
	4.4	7.776	9.497	3.084	7.485	2.241
Observations	1092	1110	1110	995	1087	1089
R-squared	0.7	0.759	0.897	0.419	0.458	0.295

	(7)	(8)	(9)	(10)	(11)	(12)
	LBO	LBO	LBO	LBO	LBO	LBO
VARIABLES	**D / EV**	**log D/EBITDA**	**I/EBITDA**	**D / EV**	**log D/EBITDA**	**I/EBITDA**
Public D/EV	0.040			0.072*		
	1.306			1.971		
Public log D/EBITDA		-0.081***			-0.044	
		-3.077			-1.591	
Public I/EBITDA			0.208			0.302
			1.233			1.622
High-yield spread				-0.010***	-0.059***	-0.043***
				-3.409	-7.938	-6.209
Constant	0.676***	1.760***	0.478***	0.716***	2.034***	0.698***
	72.136	33.019	9.531	55.234	44.037	15.564
Observations	983	1136	871	944	1097	871
R-squared	0.002	0.010	0.004	0.033	0.161	0.081

Table 10: LBO vs. Public Company Median Leverage and Debt Market Conditions (continued)

VARIABLES	(13) LBO D/EV	(14) LBO log D/EBITDA	(15) LBO I/EBITDA	(16) LBO D/EV	(17) LBO log D/EBITDA	(18) LBO I/EBITDA
Public D/EV	0.040			0.070*		
	1.251			2.040		
Public log D/EBITDA		-0.048**			-0.022	
		-2.315			-1.283	
Public I/EBITDA			0.121			0.202*
			1.202			1.824
High-yield spread				-0.009***	-0.050***	-0.038***
				-3.845	-7.705	-5.000
Private company	-0.038**	0.045	0.031	-0.042**	0.007	-0.000
	-2.444	1.321	0.986	-2.717	0.217	-0.010
Privatization/Bankruptcy	-0.178***	-0.308***	0.018	-0.179***	-0.303***	0.008
	-3.767	-3.326	0.220	-3.807	-4.779	0.112
Public-to-private	0.037*	0.197***	0.166***	0.012	0.138***	0.119***
	1.769	5.416	4.159	0.626	3.680	3.146
Secondary	-0.022**	0.143***	0.102**	-0.032***	0.081***	0.060
	-2.741	4.049	2.112	-5.103	3.061	1.287
Western Europe	-0.009	-0.076**	-0.119***	-0.003	-0.060**	-0.119***
	-0.580	-2.501	-3.102	-0.167	-2.160	-3.096
Rest of World	0.012	-0.074	-0.106**	0.012	-0.100	-0.183***
	0.255	-0.543	-2.232	0.258	-0.758	-4.478
Enterprise value quartile 2	0.023*	0.110***	0.022	0.019*	0.092**	-0.008
	2.026	2.852	0.453	1.819	2.484	-0.176
Enterprise value quartile 3	0.041***	0.251***	0.105**	0.039***	0.234***	0.070
	4.118	9.394	2.131	3.882	10.229	1.442
Enterprise value quartile 4	0.047***	0.368***	0.131***	0.044***	0.323***	0.084**
	4.273	8.652	2.929	4.718	11.008	2.150
Constant	0.649***	1.468***	0.390***	0.697***	1.766***	0.648***
	44.446	48.558	6.301	41.787	35.888	8.910
Observations	983	1005	773	944	966	773
R-squared	0.081	0.223	0.084	0.089	0.319	0.137

Table 11: Leverage and company characteristics

This table shows the results from OLS regressions of LBO and matched public company median leverage on the U.S. high-yield bond spread over LIBOR ("High-yield spread") and various other controls. "Public" variables are median values for all public companies in COMPUSTAT (or Global COMPUSTAT for non-U.S. deals) in the same region, Fama-French 49 industry, and month as the corresponding LBO transaction. OLS regression coefficients and T -statistics using standard errors clustered at the LBO deal-year level are displayed in the table. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

VARIABLES	(1) Public D / EV	(2) Public log D/EBITDA	(3) Public I/EBITDA	(4) LBO D/EV	(5) LBO log D/EBITDA	(6) LBO I/EBITDA
High-yield spread	0.012***	-0.006	0.005	-0.009***	-0.049***	-0.038***
	5.878	-1.458	1.286	-4.344	-7.274	-4.796
Public Market / Book	-0.099***	-0.154***	-0.012	-0.021**	0.010	-0.004
	-5.542	-4.898	-1.163	-2.488	0.493	-0.205
Public sales growth	-0.001***	0.001	-0.001**	-0.000	0.003***	-0.000
	-5.319	1.327	-2.476	-0.727	4.540	-0.185
Public ROIC	-0.290***	-2.676***	0.456	0.151	-0.024	0.002
	-5.245	-6.661	0.833	1.224	-0.079	0.006
Public ROIC volatility	-2.931***	-14.155***	0.104	0.092	0.629	-0.043
	-13.045	-15.566	0.123	0.406	1.415	-0.179
Corporate tax rate	-0.001	-0.004	-0.000	0.002	-0.006*	-0.005**
	-0.632	-1.668	-0.854	0.693	-2.060	-2.132
Western Europe	-0.022	0.013	-0.037***	-0.009	-0.109	-0.306***
	-0.806	0.144	-3.403	-0.163	-0.666	-3.453
Rest of World	0.022	0.068	-0.020	0.013	-0.098***	-0.151***
	1.621	1.527	-1.343	0.552	-3.388	-3.886
Private company				-0.043**	-0.001	-0.004
				-2.654	-0.024	-0.135
Privatization/Bankruptcy				-0.177***	-0.323***	0.000
				-3.718	-5.332	0.002
Public-to-private				0.015	0.125***	0.122***
				0.751	3.389	3.117
Secondary				-0.032***	0.071**	0.058
				-5.449	2.788	1.186
EV quartile 2				0.020*	0.084**	-0.005
				1.964	2.242	-0.103
EV quartile 3				0.040***	0.227***	0.074
				4.237	10.183	1.445
EV quartile 4				0.045***	0.313***	0.087**
				4.851	11.107	2.190
Constant	0.650***	2.702***	0.092	0.660***	1.922***	0.867***
	8.929	22.156	0.643	6.417	14.788	7.961
Observations	1087	1087	1087	939	948	761
R-squared	0.584	0.582	0.045	0.099	0.322	0.133

Table 12: Determinants of LBO Pricing

This table shows the results from OLS regressions of LBO and matched public company valuations, as measured by the logarithm of Enterprise Value divided by EBITDA ("EV multiple"), on the U.S. high-yield bond spread over LIBOR ("High-yield spread") and various other controls. "Public" variables are median values for all public companies in COMPUSTAT (or Global COMPUSTAT for non-U.S. deals) in the same region, Fama-French 49 industry, and month as the corresponding LBO transaction. Specifications (5) and (6) are 2SLS regressions where LBO leverage is instrumented with the U.S. High-yield spread and the fraction of Term Loan A to total debt, respectively. Regression coefficients and t-statistics using standard errors clustered at the LBO deal-year level are displayed in the table. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

VARIABLES	**(1)** LBO log EV multiple	**(2)** Public log EV multiple	**(3)** LBO log EV multiple	**(4)** LBO log EV multiple	**(5)** LBO log EV multiple IV HiYld	**(6)** LBO log EV multiple IV TermA
High-yield spread	-0.048***	-0.026***	-0.045***	-0.034***		
	-6.863	-6.070	-6.063	-5.972		
Log LBO D/EBITDA					0.656***	0.808*
					8.676	1.926
Public EV multiple			0.106**	0.104**	0.126***	0.130***
			2.234	2.468	6.183	3.063
Western Europe				-0.074***	-0.034	-0.015
				-2.900	-1.486	-0.341
Rest of World				-0.097	-0.039	-0.023
				-0.798	-0.562	-0.291
Private company				0.075**	0.071**	0.070**
				2.238	2.656	2.317
Privatization/Bankruptcy				0.158	0.354***	0.397**
				1.233	2.854	2.264
Public-to-private				0.107***	0.025	-0.020
				3.964	0.971	-0.214
Secondary				0.116***	0.071***	0.052
				6.046	6.688	1.067
EV quartile 2				0.092**	0.022	0.002
				2.328	1.182	0.036
EV quartile 3				0.200***	0.041*	0.000
				7.845	2.057	0.001
EV quartile 4				0.276***	0.063**	0.012
				10.412	2.345	0.080
Constant	2.433***	2.728***	2.028***	1.789***	0.589***	0.363
	27.587	22.561	19.495	18.092	4.907	0.715
Industry and country fixed effects	Yes	Yes	No	No	No	No
Observations	970	1091	951	951	949	985
R-squared	0.233	0.612	0.123	0.235	0.631	0.631

Table 13: Leverage, pricing and fund characteristics

This table shows the results from OLS regressions of leverage and valuation for a sub-sample of LBO transactions for which we can obtain details about the private equity sponsor and the fund used for the transaction. See previous tables of definitions of the leverage, valuation, and debt market variables. The size of the transaction relative to the fund is measured by the LBO enterprise value over the fund size. Measures of reputation of the PE sponsor include whether the fund sponsor was in the top 10% based on amount of funds raised at the time of the deal (among the sponsors in our sample), whether the fund sponsor was in the top 10% based on amount of number of funds raised at the time of the deal (among the sponsors in our sample), and whether the fund sponsor was among the 2% most active at the time of the deal based on number of transactions undertaken during the previous 3 years (using all PE transactions in Capital IQ). We also control for whether the fund is affiliated to a bank. Regression coefficients and T -statistics using standard errors clustered at the LBO deal-year level are displayed in the table. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

VARIABLES	(1) D/EV	(2) log D/EBITDA	(3) I/EBITDA	(4) log EV multiple	(5) D/EV	(6) log D/EBITDA	(7) I/EBITDA	(8) log EV multiple
High-yield bond spread over LIBOR	-0.010***	-0.050***	-0.040***	-0.033***	-0.010***	-0.050***	-0.040***	-0.033***
	-4.224	-6.809	-4.752	-5.001	-4.071	-6.930	-4.766	-4.958
Industry median net debt / EV	0.060*				0.060*			
	1.829				1.874			
Industry median log net debt / EBITDA		-0.027				-0.026		
		-1.526				-1.458		
Industry median net interest / EBITDA			0.167*				0.159*	
			1.864				1.950	
Log industry median EV/EBITDA				0.098**				0.094**
				2.378				2.298
EV / Fund Size					0.010***	0.008	0.010*	-0.007
					2.871	1.416	1.913	-1.659
Sponsor in top decile in fundraising	-0.008	-0.008	0.028	-0.003	-0.005	-0.011	0.026	-0.010
	-0.798	-0.173	0.868	-0.067	-0.561	-0.235	0.815	-0.259
Sponsor in top decile in number of funds raised	0.009	0.062***	0.013	0.054**	0.010	0.066***	0.015	0.059**
	0.849	2.897	0.508	2.214	0.915	3.168	0.596	2.427
Sponsor 3 year-deal activity in top 2%	-0.021	0.005	-0.055	0.035*	-0.015	0.016	-0.041	0.034
	-1.601	0.164	-1.133	1.857	-1.140	0.468	-0.815	1.645
Bank affiliated	0.012	0.048	0.007	-0.002	0.004	0.031	-0.021	-0.005
	0.786	0.876	0.172	-0.043	0.223	0.578	-0.518	-0.139
LBO type and region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EV quartile dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	857	879	706	864	846	866	696	851
R-squared	0.093	0.327	0.127	0.251	0.102	0.325	0.125	0.244

Table 14: Leverage and fund returns

This table shows the results from OLS regressions of the acquiring private equity fund's IRR (according to Preqin) on LBO deal leverage and various deal and fund characteristics. Regression coefficients and T -statistics displayed in the table. Vintage year refers to the year when the acquiring private equity fund was raised. T-statistics are clustered both at the vintage year as well as fund level using the method of Thompson (2006) and Petersen (2009) (using Mitchell Petersen's "cluster2"-command in STATA). Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Dependent variable: fund level IRR			
Deal Log D / EBITDA		-6.596**					-6.213**
		-2.042					-2.360
Deal D / EV			-2.232				
			-0.472				
Deal Interest / EBITDA				-4.116**			
				-2.285			
Deal Log D/EBITDA, predicted					-9.656**		
					-2.029		
Deal Log D/EBITDA, residual					-6.279*		
					-1.946		
Dummy for D/EBITDA below sample median						-7.174	
						-0.999	
Log D / EBITDA * (D/EBITDA below median)						-3.088	
						-1.237	
Log D / EBITDA * (D/EBITDA above median)						-8.013***	
						-2.751	
Deal EV / Fund Size							-3.148**
							-2.036
Log Fund Size, 2008 USD	2.219	2.635*	2.328	2.157	2.649*	2.734*	1.690*
	1.401	1.713	1.527	1.299	1.922	1.852	1.695
Log fund sequence number	-0.273	0.261	-0.737	2.002			
	-0.130	0.123	-0.347	0.657			
First-time fund	5.234	5.661	2.771	6.570	5.312	5.524	1.352
	0.986	1.026	0.517	0.836	1.180	1.210	0.345
IRR in previous fund	0.363**	0.366**	0.347**	0.367*	0.359**	0.364**	0.259*
	2.099	2.149	2.136	1.937	2.133	2.232	1.781
Fund benchmark IRR							0.139
							1.464
Vintage year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry, region, LBO type and year fixed effects	No	No	No	No	No	No	Yes
Number of LBO deals	515	513	458	407	505	513	450
Number of funds	154	154	142	144	152	154	139
Number of vintage years	19	19	19	19	19	19	16
R-squared	0.390	0.408	0.428	0.380	0.397	0.409	0.600

Appendix A: Additional tables

Table A1: Additional Sample Characteristics

Panel A: LBO Targets by Country and Primary Fama-French Industry

	Number of transactions	% of total	Industry	Number of transactions	Industry	Number of transactions
USA	683	59.0%	Rtail	102	Insur	16
UK	138	11.9%	BusSv	91	Txtls	16
France	101	8.7%	Whlsl	72	ElcEq	14
Germany	69	6.0%	Telcm	60	LabEq	14
Netherlands	39	3.4%	Hlth	48	Util	14
Italy	22	1.9%	BldMt	46	Oil	13
Sweden	19	1.6%	Mach	46	Boxes	12
Spain	14	1.2%	Fun	42	Clths	11
Canada	11	1.0%	Books	40	Steel	11
Belgium	8	0.7%	Hshld	39	Toys	10
Denmark	8	0.7%	Chems	37	Agric	9
Switzerland	8	0.7%	Food	36	Soda	8
Finland	6	0.5%	Autos	34	Fin	7
Ireland	6	0.5%	Trans	32	Other	7
Norway	5	0.4%	Cnstr	31	Banks	4
Australia	4	0.3%	PerSv	31	Beer	4
Luxembourg	4	0.3%	Meals	30	Guns	3
Austria	2	0.2%	Chips	27	Hardw	3
Bermuda	2	0.2%	MedEq	23	Mines	3
Czech	2	0.2%	Paper	19	RlEst	3
Greece	2	0.2%	Rubbr	19	Ships	3
Hungary	1	0.1%	Softw	18	Coal	0
Philippines	1	0.1%	Drugs	17	Gold	0
Poland	1	0.1%	Aero	16	Smoke	0
Turkey	1	0.1%	FabPr	16		
Total	1157	100.0%				

Panel B: Transactions by Main LBO Sponsor

Private Equity firm	Deals	Private Equity Firm	Deals	Private Equity Firm	Deals
Kohlberg Kravis Roberts & Co	61	Odyssey Investment Partners LLC	7	Heartland Industrial Partners	2
Bain Capital	43	PPM Capital Ltd	7	KRG Capital Partners LLC	2
Carlyle Group	40	Behrman Capital	6	LGV Capital Limited	2
Blackstone Group	38	DB Capital Partners	6	Lehman Brothers Merchant Banking	2
Apax Partners	35	HgCapital	6	Littlejohn	2
CVC Capital Partners	26	Metalmark Capital LLC	6	Monitor Clipper Partners	2
Candover Partners Ltd	21	MidOcean Partners LLP	6	Nautic Partners	2
Cinven	20	Sterling Group	6	Parthenon Capital Inc	2
Permira Advisers Ltd	20	Willis Stein & Partners	6	Quad C	2
BC Partners Inc	19	AXA Private Equity SA	5	Questor Partners Fund LP	2
3i Group Plc	18	Bear Stearns Merchant Banking Partners	5	Saratoga Partners	2
Bridgepoint Capital Ltd	18	Bruckmann Rosser & Sherrell	5	Silver Lake Partners LP	2
Madison Dearborn Partners	18	Calera Capital	5	Stonington Partners	2
GTCR Golder Rauner LLC	17	Cerberus Partners	5	Summit Partners LP	2
INVESTCORP	17	Fenway Partners	5	Thoma Cressey Equity Partners	2
Kelso & Co	17	Oaktree Capital Management	5	Weiss Peck & Greer Investments	2
Texas Pacific Group Inc	16	Providence Equity Partners	5	Yucaipa Cos	2
Warburg Pincus & Co	16	Royal Bank Private Equity	5	Lazard Asset Management LLC	2
Court Square Capital Partners	15	Wellspring Capital Management	5	Allied Capital Corp	1
DLJ Merchant Banking	15	Wind Point Partners	5	Audax Group LP	1
EQT Scandinavia BV	15	ABRY Capital Partners	4	Bessemer Capital Partners	1
Goldman Sachs Capital Partners	15	Allianz Capital Partners	4	Brockway Moran & Partners Inc	1
Thomas H Lee Partners	15	Francisco Partners	4	CDC Entreprises	1
Vestar Capital Partners	15	Harvest Partners	4	Close Brothers Private Equity	1
ABN AMRO	14	Kohlberg & Co	4	Colony Capital LLC	1
PAI [Paribas Affaires Industrielles]	14	Onex Corp	4	Cornerstone Equity Investors	1
Clayton Dubilier & Rice Inc	13	Ripplewood Holdings LLC	4	Deutsche Beteiligungs AG	1
HM Capital Partners LLC	13	Trivest Partners	4	Drexel Burnham Lambert	1
JW Childs Associates	13	21 Centrale Partners	3	E.F. Hutton LBO Inc.	1
Advent International Corp	12	Alpinvest Partners	3	Equita Management GmbH	1
Leonard Green & Partners	12	American Capital Strategies Ltd	3	First Atlantic Capital Corp	1
Welsh Carson Anderson & Stowe	12	Arcapita Inc	3	General Atlantic LLC	1
Doughty Hanson & Co	11	Astorg Partners	3	Great Hill Partners	1
IK Investment Partners	11	Brentwood Associates	3	Gresham Partners	1
AEA Investors Inc	10	Butler Capital	3	Gresham Private Equity	1
Berkshire Partners	10	Centre Partners	3	Henderson Private Equity	1
Boston Ventures Management	10	Genstar Capital Corp	3	Kirtland Capital Partners II LP	1
Castle Harlan	10	Golden Gate Capital Inc	3	Liberty Partners	1
Cypress Group LLC	10	JLL Partners	3	Morgan Lewis Githens & Ahn	1
Hellman & Friedman LLC	10	Lindsay Goldberg & Bessemer	3	Nordic Capital	1
Merrill Lynch Capital Partners	10	McCown De Leeuw & Co	3	North Castle Partners	1
Cognetas/Electra Partners Europe	9	Oak Hill Capital Partners	3	Olympus Partners	1
First Reserve Corp	9	TA Associates Inc	3	Palamon Capital Partners	1
Gilde Investments	9	Terra Firma Capital Partners Ltd	3	Phildrew Ventures	1
LBO France	9	UBS Capital	3	Phoenix Equity Partners	1
Montagu / HSBC Private Equity	9	Veritas Capital	3	Platinum Equity LLC	1
Charterhouse Development Capital	8	Veronis Suhler Stevenson	3	Saunders Karp & Megrue	1
Forstmann Little & Co	8	Gibbons Goodwin & Van Amerongen	3	Sentinel Capital Partners	1
Freeman Spogli	8	American Securities Capital Partners	2	Stonebridge Partners	1
One Equity Partners LLC	8	AtriA Capital Partenaires	2	Sun Capital Partners Inc	1
Alchemy Partners	7	Bridgepoint Capital Ltd [ex-Natwest]	2	TDR Capital LLP	1
Barclays Private Equity	7	Chequers Capital	2	Thayer Capital Partners	1
Code Hennessy & Simmons	7	Cravey Green & Wahlen	2	Waterland Private Equity	1
Duke Street Capital	7	Eurazeo SA	2	Watermill Ventures Ltd	1
JP Morgan Partners	7	Fox Paine Capital LLC	2	Weston Presidio Capital	1
Jordan Co	7	HIG Capital	2	Windward Capital	1

Table A2: Leverage and pricing determinants in the public-to-private subsample

This table shows the results from OLS regressions of LBO and pre-LBO leverage and valuations on the U.S. high-yield bond spread over LIBOR ("High-yield spread"), pre-LBO characteristics, and other controls for the subsample where pre-LBO financial information was available. "Public" variables are median values for all publicly traded firms in COMPUSTAT (or Global COMPUSTAT for non-U.S. deals) in the same region, Fama-French 49 industry, and month as the corresponding LBO. Pre-LBO characteristics are taken from the closest financial statement before the LBO closing date. Pre-LBO market values are calculated using stock prices 12 months before the LBO closing date. In the regressions where pre-LBO leverage is the dependent variable, all independent pre-LBO characteristics are lagged one year. t-statistics use standard errors clustered at the LBO deal-year level. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

VARIABLES	**(1)** LBO **log D/EBITDA**	**(2)** LBO **log D/EBITDA**	**(3)** LBO **D/EV**	**(4)** LBO **D/EV**	**(5)** LBO **I/ EBITDA**	**(6)** LBO **I/EBITDA**
Pre-LBO log D/EBITDA	0.015	0.024				
	0.324	0.745				
Pre-LBO Net debt / EV			0.081	0.089*		
			1.583	1.886		
Pre-LBO I/EBITDA					0.136	0.166
					0.936	1.568
High-yield spread		-0.086***		-0.007		-0.047***
		-5.608		-1.025		-8.001
Observations	142	134	97	91	99	99
R-squared	0.002	0.267	0.027	0.028	0.011	0.297

VARIABLES	**(7)** Pre-LBO **log D/EBITDA**	**(8)** LBO **log D/EBITDA**	**(9)** Pre-LBO **D/EV**	**(10)** LBO **D/EV**	**(11)** Pre-LBO **I/EBITDA**	**(12)** LBO **I/ EBITDA**
Pre-LBO M/B	0.167	0.088**	-0.139***	-0.002	0.015	0.038
	0.867	2.396	-5.512	-0.151	0.734	1.217
Pre-LBO sales growth	0.387	-0.101	0.027	-0.218*	0.026	0.099
	0.903	-0.535	0.449	-1.986	0.292	1.058
Pre-LBO ROIC	-4.124**	-0.974*	-0.038	-0.012	-0.758*	-0.070
	-2.447	-2.102	-0.099	-0.066	-1.994	-0.463
Public ROIC volatility	-7.447**	1.366*	-2.290***	-0.680	-0.678*	-0.342
	-2.928	1.760	-3.516	-1.567	-1.831	-0.569
Pre-LBO ln(sales)	0.102*	0.033	0.010	0.006	-0.009	-0.007
	2.118	1.616	0.940	0.773	-1.084	-0.609
High-yield spread	0.040	-0.066***	0.043***	-0.001	0.014**	-0.039***
	0.765	-4.542	3.292	-0.154	2.276	-5.079
North America	0.043	0.191	-0.051	0.005	0.053	0.089**
	0.159	1.733	-0.815	0.159	1.667	2.270
Constant	0.773	1.643***	0.529**	0.741***	0.218*	0.675***
	1.138	5.751	2.760	8.348	2.051	4.344
Observations	89	100	86	99	96	75
R-squared	0.135	0.305	0.476	0.156	0.215	0.310

Table A2: Leverage and pricing determinants in the public-to-private subsample (continued)

VARIABLES	(13) Pre-LBO Log D/EV	(14) Pre-LBO Log D/EBITDA	(15) Pre-LBO I/EBITDA	(16) LBO log EV/EBITDA	(17) Pre-LBO log EV/EBITDA	(18) LBO log EV/EBITDA
Public net debt/EV	0.552**					
	2.43					
Public D/EBITDA		0.323*				
		1.87				
Public I/EBITDA			0.333**			
			2.15			
Pre-LBO log EV/EBITDA						0.114***
						3.716
High-yield spread				-0.071***	-0.063	-0.070***
				-3.924	-0.854	-4.434
Public log EV/EBITDA				0.199	0.388	0.170
				1.473	1.417	1.403
North America				0.063	0.292	0.155
				1.276	1.038	1.718
Constant	0.213***	0.550***	0.116***	1.938***	1.144	1.670***
	3.23	4.54	3.96	5.729	1.166	4.948
Observations	98	144	153	148	97	99
R-squared	0.106	0.017	0.019	0.264	0.049	0.331

Appendix B: Definition of Fund Ranking Variables

"Fund Raising" and "Number of Funds Raised" Ranks: For the deals in our data set, we managed to identify 188 sponsors for which we had information about fund structure and fund raising from CIQ and Preqin. For each of these sponsors, we constructed a yearly observation of how many funds and how much total money (in 2008 USD) the sponsor had raised since inception. For each year, we then ranked these 188 sponsors relative to each other according to number of funds raised and dollars raised. If in a given year, a sponsor had not yet raised any fund, that sponsor was excluded from the ranking in that year. From the ranking we calculated a percentile for each year and sponsor from 0 to 1. For example, Hellman & Friedman had a fundraising rank of 0.13 in 2005, meaning that up to and including 2005, they had raised more money than 87% of the 188 sponsors. In the regressions, we use dummy variables for whether a deal was done by a sponsor in the top decile according to these measures.

"Number of Deals in Last Three Years" Rank: For this variable, we started with the universe of all buyout deals in CIQ (around 19800 deals from 1969 to 2008), and matched them to buying sponsors uniquely identified in CIQ. Each deal is matched to between 1 and 12 sponsors, depending on how many sponsors participated in the deal. There is a total of around 6300 unique sponsors that have participated as buyers in at least one LBO deal in CIQ. For each month, we calculated how many CIQ deals they had participated in for the last three years. For each month, we then ranked the total universe of sponsors relative to each other according to number of deals done in the last three years. If in a given month, a sponsor had not yet participated in any deal, that sponsor was excluded from the ranking in that month. From the ranking we calculated a percentile for each month and sponsor from 0 to 1. For example, Hellman & Friedman had a deal rank of 0.043 in January of 2005, meaning that from February 2002 to January 2005, they participated in more deals than 95.7% of all sponsors active in CIQ up to that date. In the regressions, we use a dummy variable for whether the sponsor was in the top two percentiles according to this measure.