

**Borrow Cheap, Buy High? The Determinants
of Leverage and Pricing in Buyouts**

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Borrow Cheap, Buy High?

The Determinants of Leverage and Pricing in Buyouts

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Abstract

Private equity sponsors pay special attention to designing capital structure, making buyouts an interesting setting for examining capital structure theories. In a detailed international sample of buyouts, we find that buyout leverage is unrelated to factors that drive public firm leverage, such as industry factors and other cross-sectional characteristics, contrary to what standard capital structure theories suggest. Instead, variation in economy-wide credit conditions is the main driver of leverage and pricing in buyouts, while having little impact on public firms. Higher deal leverage is associated with lower buyout fund returns, suggesting that acquirers overpay when access to credit is easier.

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Private equity investors are expert, repeat, and largely financially motivated players in capital markets. Throughout a career of making leveraged buyouts (LBOs), they arguably make more decisions about firm capital structure than any other agents in the economy.¹ Hence, private equity investors' financing choices are potentially informative about theories of optimal capital structure. Yet, unlike publicly-traded firms, we know little about what determines leverage and pricing in these buyouts. Our goal in this paper is to fill this gap by documenting the factors that affect the financial structure of private equity backed buyout firms in detail, and to contrast these factors with those related to the capital structure of a matched set of publicly traded firms. In doing so, we shed light on both the particular functionings of the increasingly important private equity market, and also on capital structure questions more broadly.

A useful simplification for thinking about buyout capital structure is to contrast two broad views that have been expressed in both academic literature and the popular press. In the first view, most famously put forth by Michael Jensen (1989), private equity backed firms have superior governance to publicly traded firms. Together with active boards, high-powered management compensation, and concentrated ownership, Jensen argued that leverage is an essential part of the private equity governance model. Unlike public firms, private equity funds optimize the capital structure in companies they acquire, to take full advantage of the tax and incentive benefits of leverage, trading these benefits off against the costs of financial distress. An implication of this view is that characteristics related to the debt capacity of a given firm, such as its industry, the tangibility of its assets, and the volatility of its cash flows, should explain capital structure in buyouts.

A second view is that the most important factor in buyout capital structures is the ability of buyout sponsors to use cheap debt to take levered bets on firms. Private equity sponsors are uniquely positioned to time the market by arbitraging debt versus equity when leverage is relatively cheap, due to superior access to debt financing (as suggested by Ivashina and Kovner (2011) and Demiroglu and James (2010)). In addition, private equity sponsors have agency problems of their own that are likely to affect their choice of leverage in their portfolio companies. Axelson et al. (2009) present a model in which private equity sponsors tend to overinvest, undertaking value-decreasing investments in addition to value-increasing ones, because of their option-like compensation. If sponsors are capital-constrained, so that they must

¹ See Kaplan and Strömberg (2009) for an overview of the private equity market.

raise external debt in order to complete deals, limited partners have some protection against this tendency of general partners to overinvest. However, the model predicts that 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.² Both the market timing and the agency stories share the common prediction that time-series variables measuring economy-wide debt market conditions should explain buyout leverage better than cross-sectional firm characteristics.

To study the factors affecting buyout capital structure, we construct a new database containing detailed information about the financing of a large 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 the sample, we obtain detailed information about the financial structure of the transactions. Unlike most previous work, our sample include buyouts of private companies, such as family firms, corporate divisions, and companies acquired from other private equity firms, in addition to buyouts of publicly-traded firms. The sample covers the period from 1980 through 2008, which allows a much longer temporal analysis than in most previous studies.³ Our data includes deals from a total of 176 distinct private equity sponsors and incorporates practically all the major investors active in the market during our period of study.

We first consider the issue of whether buyout leverage appears to be determined by the same factors as comparable publicly-traded firms using a matched sample of buyouts and public firms in the same industry, region, and time period. Very surprisingly (at least to the authors), there appears to be absolutely no relation between leverage in buyout firms and median leverage of public firms in the same industry-region-year, regardless of what leverage measure we use. This result holds when we match our LBO sample to subsamples of public firms that have adjusted their leverage significantly over the last years, or when we consider long-run LBO leverage using repayment schedules, alleviating concerns that the lack of relationship is due to an unrepresentative matching procedure. Furthermore, when we restrict our analysis to the

² 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. Ljungqvist, Richardson, and Wolfenzon (2007) find that buyout funds accelerate their investment flows when credit market conditions loosen, but do not address how the leverage or pricing of individual deals vary with credit market conditions. More recently, Gorbenko and Malenko (2009) present evidence that financial buyers bid more aggressively in auctions for firms when credit conditions are stronger.

³ Guo, Hotchkiss, and Song (2011) study a sample of U.S. public-to-private transactions from 1990 through 2006. Some recent studies have considered the motives of other kinds of buyouts: Boucly, Sraer and Thesmar (2011) and Chung (2011) examine the performance of buyouts of private companies, while Wang (2011) and Jenkinson and Sousa (2011) study secondary buyouts.

subsample of 142 public-to-private deals for which we have information about pre-LBO financials, we also find that there is no relationship between buyout leverage and pre-LBO leverage.

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? Cross-sectional characteristics such as industry fixed effects or variables such as profitability, earnings volatility, and growth opportunities, which explain most of the variation in public company leverage, have little explanatory power for buyout leverage. Instead, most of the variation in buyout leverage is explained by time-series effects. The one 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 high-yield spread over LIBOR, the lower the leverage used in the buyout transactions. As a consequence, leverage in the LBO deals is pro-cyclical, with leverage peaking during "hot" credit market conditions, such as in 2006-2007, and falling when debt markets deteriorate, such as in 2008-2009. In contrast to the procyclicality of buyout leverage, we find that a matched set of public firms exhibits *countercyclical* leverage.

We then examine whether the availability of leverage leads private equity funds to pay higher purchase price multiples for the firms they acquire. We find that this is indeed the case, with buyout pricing being strongly negatively related to current market interest rates on leveraged loans, even after controlling for pricing in public markets. We also show that the impact of debt markets conditions on buyout leverage and pricing holds in a time-series regression, controlling for a large set of macroeconomic variables, and using several alternative measures of debt market conditions.

The finding that both leverage and pricing in buyouts are strongly dependent on credit market conditions could potentially be explained because variation in our high-yield spread reflects variation in the economy-wide discount rate. When discount rates are low, real interest rates are low, so, for a given level of cash flow, 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 both LBOs and matched public firms. Since the high-yield spread is a 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. This effect could occur either because private equity funds are particularly proficient at arbitraging cheap debt against equity, or because of 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. Contrary to the basic cost of capital prediction that, holding other factors constant, returns to equity should increase with leverage, we document that the leverage of the deals in a particular fund is *negatively* related to the return of that fund (measured relative to returns on public stock markets), controlling for other relevant factors. This finding is consistent with an agency story in which private equity funds overpay for deals at times when leverage is cheap.

As an additional test between the agency explanation and the story in which leverage occurs because of arbitrage between debt and equity 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 and in favor of the agency story.

Our findings contribute to the literatures on both private equity literature and capital structure. First, our findings contribute to the literature on private equity fund returns, e.g. Kaplan and Schoar (2005), and Gottschalg and Phalippou (2009). In particular, we document how excess leverage could 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), Bernstein et al. (2010), and Hotchkiss et al (2011) suggests that these costs are not likely to be particularly large, 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 the theoretical frameworks we use for analyzing capital structure. Section II describes our sample and the multiple sources from which we derive our data. Section III contains our empirical analysis, and Section IV concludes.

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

In this section, to motivate our empirical tests, we describe in more detail the theoretical frameworks that provide us with testable implications about the factors affecting leverage. While most theories of capital structure were designed to explain financing in public firms, they could, in principle, apply to buyouts as well. We also discuss reasons why leverage could be chosen differently in buyouts than in public firms.

A. View 1: Leverage is driven by firm characteristics

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) for a detailed discussion). 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.

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 cash flows 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 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.

If both LBO sponsors and managers of public firms act according to the trade-off theory, 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 industry characteristics, the idea being that, according to the trade-off theory, the same industry-level factors determine leverage at the margin for both buyout and public firms. Therefore, changing one of these factors should have a qualitatively similar effect for both types of firms.

B. View 2: Leverage is driven by market-wide time-series characteristics

(i) Market Timing

Baker and Wurgler (2002), among others, suggest that managers take advantage of mispricing in equity markets when issuing securities, so that they issue much more when equity markets are overpriced than when they are underpriced. Similarly, it is possible that debt markets periodically become “overheated”, leading investors not to receive 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.⁴ 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.⁵ In contrast, a CFO of a public company when asked the same question will usually discuss the importance of maintaining financial flexibility and express concern over distress costs (see Graham and Harvey (2001)). 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 should 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 private equity funds is not strong enough to pass on all the value increase from cheap debt to target

⁴ 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.

⁵ For example, Guy Hands, founder of private equity firm Terra Firma, stated: “We buy stuff with cheap debt and arbitrage on the difference with equity markets”. *Financial Times*, November 15, 2007.

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.

(ii) 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 are prone to overinvestment, and potentially will be willing to gamble by taking big levered stakes in portfolio firms.⁶ 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.

II. Data Description

A. *Data Sources and Sample Selection.*

Our sample selection relies primarily 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,

⁶ 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.

Industry consolidation, Mezzanine/subdebt, Incubation, 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 accounting information (primarily for public-to-private transactions and LBOs involving public bond issues).⁷

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 obtain loans for a larger fraction of the recent deals than of earlier ones. In addition, our sample probably oversamples 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 earnings (before interest, taxes, depreciation and amortization - or 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 Dijk’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

⁷ See Strömberg (2008) and Kaplan and Strömberg (2009) for more detail and descriptive statistics on Capital IQ.

clearly not have entered our sample otherwise.⁸ Through this process, we end up with a sample of 1157 buyouts occurring between 1980 and 2008.

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.⁹ We also obtain inflation and exchange rates from the IMF.¹⁰

Finally, we calculate various private equity sponsor characteristics, such as number of funds raised, fund sizes, and fund returns (public market equivalent measures, described below). Data on each 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

⁸ We are grateful to Steve Kaplan for providing us with this data.

⁹ 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. Lown, Morgan, and Rohatgi (2000) document that these survey results are strongly related to loan growth, with tightening standards being associated with slower loan growth.

¹⁰ 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.

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 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

Out of our sample of 1157 buyouts, 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 for two reasons.¹¹ 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. Because our sampling procedure tends to overweight large deals relative to small ones, our sample is still somewhat biased towards public-to-private deals (which tend to be larger) and against independent private companies (which tend to be smaller).

Around 75% of our sample transactions occurred between 2001 and 2008, compared to 63% in the Capital IQ population. This oversampling of deals for this period is probably indicative of the syndicated bank loan market becoming increasingly important over the last decade.

¹¹ Strömberg (2008) presents data on the universe of buyouts reported in Capital IQ, where 47% are from North America, 45% are from Western Europe, and 8% are from the rest of the world. Also, 46.8% of the transactions in Capital IQ are independent private companies, while public to private transactions only account for 6.5% of the transactions.

Further information on the sample is contained in the Internet Appendix. Table IA.I provides breakdowns of the sample across region, time and type of LBO. Table IA.II provides breakdowns of the sample by country and industry. 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 industry representing more than 10%. Table IA.III shows that the sample is spread across a wide range of buyout firms. KKR is the most common sponsor, with 61 deals, but still represents only 5.3% of the total sample.

To summarize, although our sample is more representative of the buyout population than samples used in other studies, because it is constructed through information gathered through the syndicated loan market, the sample overweights larger deals, public-to-private transactions, U.S. transactions, and more recent buyouts. In our formal tests, we control for region, buyout type, and size, and we cluster our standard errors by deal year in our regressions.

III. Results

A. Descriptive statistics on leverage and valuation in buyout transactions

In Table I we present an example of a buyout capital structure using one of the 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 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 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, the transaction 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% (i.e. instead of cash, the holders are issued additional notes equal to the value of 5% of the outstanding principal each year).

In practice, Term Loan A and the revolving facilities are usually kept on the balance sheet of the originating bank after the transaction, while bullet payment Term Loans B, C etc. as well as the subordinated tranches are often securitized or sold to institutional investors, such as hedge funds.

Table II details the debt structure for the whole sample. 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 II 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 II 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 can have "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, 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 (EV) and EBITDA. As is indicated in Table II, buyouts use substantial quantities of contingent debt; these additional facilities amount to nearly 18% of the value of total (non-contingent) debt.

Table II 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 III documents the size of the buyout transactions, as well as the leverage and pricing of the buyout deals. As expected, our sample clearly contains very large deals; the average (median) LBO enterprise value is just over \$1.5 billion 2008 U.S. dollars (\$677 million) compared to an average (median) of \$330 million (\$63 million) for the entire Capital IQ sample (as documented by Strömberg (2008)). Public-to-private deals are the largest type, averaging over \$2.3 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.

We use two different measures of leverage: total debt divided by earnings before interest and depreciation ("D/EBITDA") and total debt divided by enterprise value ("D/EV").¹² Our main measure of deal pricing is enterprise value divided by EBITDA. 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 a ratio of debt to EBITDA of 5.6. 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 III also shows significant univariate variation for leverage and pricing across geographies, with U.S. deals (measured by enterprise value in 2008 U.S. dollars) having higher leverage and pricing multiples.

¹² As noted earlier, 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.

B. Univariate comparisons with Public Companies

As discussed earlier, the literature has devoted considerable attention to financing choices, but almost always in the context of publicly traded corporations. In Section I, 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 suggest that private equity firms could have different motivations for the choice of leverage in their portfolio companies than do publicly-traded companies.

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.¹³

For the public companies we calculate the corresponding measures of leverage and pricing as we used for the buyouts. For public company debt we use total long-term debt (including debt due within one year) minus cash and short-term investments. We estimate enterprise value as the market value of equity plus long-term debt minus cash and short-term investment. We calculate the matched median for D/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.¹⁴ We exclude public

¹³ 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.

¹⁴ 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.

companies with negative EBITDA when calculating the industry-region-date median values of D/EBITDA and EV/EBITDA.

Panel A of Table IV performs results from the following experiment: It sorts the matched public company median values into quartiles based on our two 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. 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.

Figure 1 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) and for D/EBITDA the relationship is slightly negative (with an R-squared of 0.005).

These results suggest that there is virtually no relation between leverage in our sample of buyouts and in the matched public companies. However, it is possible that there is in fact such a relation in the data but we fail to detect it because our matching process is inaccurate. We explore several reasons for potential mismatching in Panels B through D of Table IV.

First, in a typical LBO, the excess cash flow that the firm is generating is used to pay down acquisition debt over time. Hence, it could be that private equity firms choose a higher leverage than their intended target at the time of the deal with the goal of paying down debt and reaching the appropriate target at some point in the future. The implication of this logic is that expected future leverage is a better measure of the firm's optimal capital structure than leverage at the time of the buyout. 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, and D/EBITDA based on predicted debt levels (and EV and EBITDA at the time of the transaction) and compare these to matched public company median ratios. The results, presented in Panel B in Table IV, 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 10-20% lower on average).

Second, it is possible that the matched public companies are not at their optimal capital structure at the time we measure it. Given that firms incur transaction costs when adjusting capital structures, they should only do so infrequently. Consequently, a randomly picked public company could have drifted away from its optimal capital structure at the time when the sample's capital structure was measured.¹⁵ To address this possibility, we consider an alternative set of matched firms, that 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 IV sorts buyouts using leverage quartiles for the adjuster sample. The results are very similar to those obtained before; as in the previous panels, there is no relation between public company leverage and LBO leverage.¹⁶

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 likely that private equity sponsors select targets within an industry and region that have particularly high debt capacity.¹⁷ 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 prior to 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.

¹⁵ 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.

¹⁶ Another potential reason for the lack of a relation could be that public companies are averse against taking on debt, e.g. because of agency problems (see Berger et al, 1997). To address this potential explanation we have also matched LBO leverage to that of public debt issuers, by restricting the sample of public firms to those that have issued debt of more than 10% of assets in a given year. Again, we fail to find any positive relation between buyout and public leverage (see internet appendix Table IA.IV, which makes similar comparisons using other variables, such as market-to-book ratios, sales growth, R&D-to-sales, profitability etc.)

¹⁷ 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 (2010) 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.

Panel D of Table IV sorts buyouts according to quartiles of pre-LBO leverage. For D/EBITDA there is again no relation between pre-LBO and LBO leverage, while there is a slightly positive and marginally statistically significant for D/EV. The LBO D/EV distribution is much narrower than the pre-LBO leverage, however, and does not increase monotonically across pre-LBO quartiles.

To summarize, there does not appear to be any relation between LBO leverage and the leverage of comparable public companies. This lack of a relation does not appear to be due to measurement or matching issues; rather, buyout leverage appears to be determined by different factors than that of public companies.

C. LBO leverage and debt market conditions.

The market timing and agency stories suggest that buyout leverage should primarily be determined by time-series variation in debt market conditions. Figure 2 plots the time-series of valuation multiples and leverage for both LBOs and the matched public companies. Panel A clearly indicates that buyout leverage, especially D/EBITDA, exhibits a strong cyclicality. The periods in which leverage drops the most 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 2007.¹⁸ This pattern suggests that macro-economic conditions affect LBO leverage in a highly pro-cyclical manner. In addition, there appears to be a strong relationship between leverage (especially D/EBITDA) and transaction prices (i.e. EV/EBITDA).

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 immediately selling off parts of the acquired company, the proceeds of which could be used to repay some of the debt (see Kaplan (1989b)).

Panel B of Figure 2 illustrates graphically the evolution of leverage and pricing over our sample period for the matched public company medians. In contrast to the pro-cyclical pattern for buyouts, public company leverage is 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). In addition, the strong

¹⁸We have very few observations, between 0 and 3 per year, for the 1990-1993 period. Therefore, the large movements in leverage and pricing over this period are not statistically reliable.

positive relation between D/EBITDA and EV/EBITDA that is present in the buyout sample is not observed for public companies.

To explore the impact of debt market conditions further, we examine the relationship between leverage and the high-yield spread. Panel E of Table IV sorts leverage into quartiles based on the size of this spread, since a lower spread is likely to be indicative of better financial conditions and a more liquid market for high-yield debt. Consistent with procyclicality, buyout leverage decreases significantly as the high-yield spread increases. The relation is particularly pronounced for D/EBITDA, which decreases from six to four times EBITDA between the lowest and highest spread quartiles. Yet, the relation goes the opposite way for the public companies, for which each measure of leverage increases with the high-yield spread.

The relation between debt market conditions and leverage is shown graphically in Figure 3. Panel A plots annual time series of median D/EBITDA for our LBO deals, corresponding median D/EBITDA for the matched public companies, and the high-yield spread. When debt market conditions improve, as indicated by a decrease in the high-yield spread, buyout leverage increases. In contrast, public company leverage does not exhibit this pattern, and actually appears to decrease when high-yield spreads decrease.

In addition to the quantity of debt, we also examine the composition of debt as a function of debt market conditions. Panel B presents two measures of debt structure: the fraction of debt maturing in 5 years, and the fraction total debt that is made up of Term Loan A tranches (amortizing debt held by banks). We restrict the sample to deals from after 1994, since data on debt structure is scarce before 1994. This figure indicates that both the fraction of debt maturing in 5 years and the proportion of amortizing Term Loan A debt is countercyclical. 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.¹⁹ A very similar pattern is found for the maturity of debt, measured as the proportion of total debt maturing in five years, with maturities being shortened when debt market conditions improve.

¹⁹Consistent with this finding, Shivdasani and Wang (2011) 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.

D. *Cross-sectional vs. time-series determinants of leverage*

The univariate analyses suggest that debt market conditions affect buyouts capital structures very differently from the way they affect public companies' capital structures. Moreover, the capital structures of buyouts and comparable public firms have little relation to each other, suggesting that different forces explain financing decisions in buyouts than in publicly-traded firms. In particular, buyout capital structures appear to be primarily driven by time-series variation in credit availability, as suggested by the agency or market timing explanations of buyout leverage, rather than by buyout firms optimizing leverage as a function of firm- or industry-specific characteristics.

We next examine this idea using an econometric approach that allows for direct measurement of the effect of cross-sectional and time series factors on leverage ratios. In particular, we estimate equations, predicting buyout and public company leverage, measured as the log of D/EBITDA, on industry, region, and year fixed effects. We present estimates of these models in Table V.

Specifications (1) through (5) of Table V present estimates of the factors affecting buyout leverage. We first estimate buyout leverage as a function of only the Fama-French 49-industry dummies, yielding a very low adjusted R-squared of 0.03 (model 1). In contrast, a comparable equation estimating buyout leverage as a function of year fixed effects leads to an adjusted R-squared of 0.25 (model 2). Adding the full set of dummy variables (industry, country, and year) only increases R-squared marginally, to 0.29 (model 3). In other words, time-series effects have almost an order of magnitude larger explanatory power than cross-sectional industry effects. Models (4) and (5) include our main measure of debt market conditions, the high-yield spread, which is significantly negatively related to buyout leverage, and in itself accounts for a large part of the time-series variation.

Specifications (6) through (10) present the same analysis estimating matched public industry-region-year median D/EBITDA. In the estimates of these equations, in contrast to those for the buyouts, industry dummies explain the bulk of the variation (R-squared of 0.71), while year dummies explain very little (R-squared of 0.02). Including the high-yield spread now yields a *positive* and significant coefficient, but a very low R-squared (less than 0.01). Hence, public leverage seems to largely be driven by cross-sectional variation rather than time-series effects.²⁰

²⁰We also considered whether the lack of time series variation in the estimates for public firms is due to inertia by re-estimating the equations using only public firms that actively adjust their capital structure. These results are

In addition, public firms' leverage ratios are positively related to the high-yield spread for public firms, in contrast to the negative relation between buyout leverage ratios and the high-yield spread.

These results confirm the hypothesis that buyout leverage is primarily driven by time-series variation in debt market conditions, while public leverage is explained by cross-sectional characteristics to a larger extent. To explore this issue more rigorously, we estimate multivariate equations explaining capital structure choices for both LBOs and public companies. Descriptive statistics for the variables used in these equations are provided in Table VI.

Table VII presents estimates of these equations. The first two specifications of Table VII confirm the univariate findings that public and buyout leverage are largely unrelated. In regressions of LBO log D/EBITDA, public matched leverage is insignificant, while for LBO D/EV the public leverage is only marginally significant and with a very low coefficient (0.07). In contrast, the high-yield spread is consistently negative and statistically significant.²¹

In Specifications (3) and (4) we estimate both buyout and matched public leverage as a function of a number of characteristics that have been shown to explain capital structure in previous empirical work. Specifically, we estimate leverage as a function of the market-to-book ratio (typically thought of proxying for growth opportunities); sales divided by property, plant, and equipment (measuring asset turnover); R&D expense divided by sales (proxying for intangible assets); return on invested capital or ROIC, calculated as EBIT divided by the sum of book equity and long-term debt (as a measure of profitability); and earnings volatility, measured as the standard deviation of ROIC using five years of annual data (measuring operating risk). All these variables are measured as the median value among public firms in the corresponding Fama-French 49 industry, region and year (i.e. in the same way as the construction of the matched public leverage ratios). When estimating matched public leverage as a function of these characteristics (model 3), all industry characteristics are significant, and results are consistent with the findings in previous literature: public leverage decreases in operating risk, growth opportunities, and asset intangibility, consistent with the trade-off theory. Also consistent with

presented in the Internet Appendix Table IA.V. We have also performed this analysis on the full set of public company region-year-industry median D/EBITDA, instead of restricting the sample to industry-region-years where a buyout occurs in our sample. In other words, we estimated median D/EBITDA in a panel of industry-region-year observations containing all Fama-French 49 industries in U.S. and Western Europe over the full sample period 1980-2008, or a total of 3822 observations. The results are very similar: estimating public leverage as a function of year dummies only leads to an R-squared of 0.04, while estimating it as a function of industry dummies only has an R-squared of 0.61.

²¹ Replacing matched public medians with adjuster medians gives the same result.

previous literature public leverage is decreasing in profitability, which is inconsistent with the trade-off theory, but usually interpreted in favor of the pecking-order theory. The high-yield spread is not significant in the public leverage regression. In contrast, when using LBO leverage as the dependent variable (model 4), these industry characteristics have no explanatory power for buyout leverage, and the only significant determinant of leverage is the high-yield spread. 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.

One concern may be that the firms targeted for leveraged buyouts are different from the rest of the industry, and that they have very different characteristics than the median industry firm. To address this concern we have undertaken the same analysis on the subsample of public-to-private deals, where we estimate buyout leverage as a function of the firms' own pre-LBO characteristics (market-to-book, profitability, etc.) rather than industry medians. The results of this analysis can be found in Table IA.VI of the internet appendix. Again, these estimates fail to provide any consistent evidence that firm characteristics affect buyout leverage in the way they do for public firms, and the high-yield spread is the only consistent predictor of buyout leverage. Additionally, the results suggest that the public-to-private target firms are representative of their industry before they are purchased, in that industry median leverage is a significant predictor of pre-LBO leverage.

The final specification in Table VII estimates buyout leverage as a function of a number of buyout and PE fund characteristics in addition to the high-yield spread. The characteristics include dummies for deal region, deal type (independent private, privatization/distress, public-to-private, and secondary, with divisional as the omitted category) and deal size measured by quartiles of transaction value (EV). Also, previous research, such as Demiroglu and James (2010) and Ivashina and Kovner (2011) present evidence suggesting that more reputable private equity funds have easier and cheaper access to debt. To account for this possibility, we include two measures of private equity fund reputation: the age of the PE firm and the number of private equity transactions undertaken during the last three years. 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. Since some of our PE investors do not use fund structures (e.g. such as evergreen funds and publicly traded PE firms) we also include a dummy for whether the PE invests through a fund. Finally, we include fund size and a variable indicating whether the private

equity firm is affiliated to a commercial or investment bank (which arguably could increase access to leverage) as additional controls.

The estimates in this equation indicate that none of the PE variables are statistically significant, with the exception of the dummy for whether the PE firm invests through a fund, which is weakly negatively related to leverage. Hence, we are unable to replicate the results of Demiroglu and James (2010) and Ivashina and Kovner (2011) in our sample.²² Deal size, however, is an important determinant of LBO leverage. Larger deals (measured by enterprise value quartiles) are significantly more highly levered than smaller deals. Moreover, public-to-privates (which tend to be larger than other transactions) and secondary buyouts tend to be more highly levered than other LBO types. Most importantly, debt market conditions, as measured by the high-yield spread, are consistently negatively related to leverage, and the coefficient is essentially unaltered across specifications.

Finally, we note that one potential explanation for the strong relation between low spreads and high leverage for LBOs could be 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.

E. Pricing of Deals

The results so far suggest that debt market conditions have a major effect on buyout leverage. An implication of the arbitrage and the agency explanations for buyout leverage is that buyers will pay more for deals when debt markets conditions are favourable, which we examine in this subsection.

Our measure of deal pricing is enterprise value divided by EBITDA, which we refer to as the “EV multiple”. In addition to being a natural valuation measure, it is also the most commonly-used metric for price in the private equity sector. As is shown in Panel A of Figure 2, deal pricing varies positively with leverage. Annual median EV multiples closely track median D/EBITDA ratios, and when leverage levels peak (as in the late 1980's, in the late 1990's, or in 2006-2007), pricing multiples peak as well. Panel B of Figure 2 shows that this positive relation

²² We have tried a number of different ways of measuring reputation, none of which seem to have much explanatory power. For example, instead of using the absolute measures above we have calculate the relative ranking of the sponsor according to these 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). Since the relation between these rankings and our dependent variables is unlikely to be linear, we have also tried using dummy variables for whether the sponsor was relatively highly ranked according to these measures.

between leverage and valuation multiples is not present among public companies, where the correlation between EV multiples and D/EBITDA is, if anything, negative.

Table VIII estimates the relation between pricing in buyouts and in public companies in a multivariate setting. It presents estimates of equations predicting EV multiples as a function of company and market characteristics. The first two models consider the extent to which pricing in buyouts and in public firms are related to the high-yield spread. The results in these columns indicate that 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 than public company pricing.

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, it is important to control for changes in discount rates. In the model (3) we do so by including 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 approximately the same as in the previous columns. This result implies that the effect of credit market conditions on LBO pricing is fairly orthogonal to general changes in economy-wide discount rates. Model (4) 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. These results are consistent with easier availability of leverage driving up LBO transaction prices.

The final two columns of Table VIII address this issue more directly by estimating the relation between LBO EV multiples and LBO leverage. Although Figure 2 documents that leverage and pricing in buyouts are positively correlated in our sample, 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, measurement error by itself could lead to a positive correlation between our proxies for pricing (enterprise value) and leverage (total debt), since both are normalized by EBITDA.

In model (5) we estimate an equation predicting the pricing of individual deals as a function of leverage, as well as other potentially relevant variables, using high-yield spreads as an instrument for leverage in the first stage. This approach addresses concerns about measurement issues in EBITDA, but one could question whether it controls adequately for endogeneity, since, as previously argued, spreads are likely to be related to the cost of capital (although we control for public market pricing directly in the equation). As an alternative, we estimate this equation in the model (6) 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 relation between instrumented leverage and pricing in buyouts. This relation remains after controlling for pricing multiples prevailing in public markets.

As we did for leverage, we also reestimate the regression analysis of pricing in Internet Appendix Table IA.VI for the subsample of public-to-private transactions, where we are able to control for pre-LBO firm characteristics (such as pre-LBO EV multiples) rather than industry-region-level proxies. In these equations, we again find that high-yield spreads strongly predict the pricing of deals. These results imply that one reason for the higher pricing of buyouts during periods of strong credit market conditions is the direct effect of leverage on pricing.

F. Time-series regressions of leverage

Our results to this point suggest that time-series variation in debt-market conditions affect both leverage and pricing in buyouts. One potential concern when drawing this conclusion is that other macroeconomic variables could potentially be correlated with the high-yield spread, and could be the true underlying factors determining leverage and pricing. For example, the high-yield spread could reflect real economic conditions or changes in aggregate risk premia. In addition, since the relations between high-yield spreads, leverage, and pricing are essentially time-series results, there are potential concerns about auto-correlated errors, as well as double-counting of observations when multiple buyouts occur within the same time period (although we do calculate standard errors clustering by year).

To address these issues, in Table IX we estimate time-series equations predicting median log D/EBITDA and log EV/EBITDA using quarterly data on a number of different macroeconomic variables, as well as alternative measures of debt market conditions. To estimate these equations, we need an uninterrupted time-series of leverage observations, so we drop observations

before fourth quarter of 1993, leading to 59 quarterly observations. We control for autocorrelation using the Newey and West (1987) correction with 12 quarterly lags.

In the first two regressions we use a parsimonious specification where we estimate buyout and public leverage, respectively, using the high-yield spread alone as an independent variable. Consistent with earlier results, the high-yield spread is significantly negatively related to buyout leverage, and positively related to public leverage, with the magnitude of the coefficients being almost identical to the equations estimated using panel data reported above.

In regressions (3) and (4) we add a number of additional macroeconomic variables in addition to the high-yield spread, each measured at the quarterly frequency: the U.S LIBOR rate, U.S. inflation over the previous 12-months, the U.S. term spread (the 10 year treasury bond rate minus the corresponding 3-month T-bill), and U.S. GDP growth.²³ In this equation, the only statistically significant variable predicting buyout leverage is the high-yield spread, and the negative coefficient is slightly larger in absolute magnitude than in the earlier specifications. This result suggests that it is indeed debt market conditions, rather than the general macroeconomic and interest rate environment, that cause buyout leverage levels to fluctuate. In contrast, in addition to the positive relation with the high-yield spread, public leverage appears to be affected negatively by the LIBOR rate, the term premium, and the GDP growth rate.

Regressions (5) and (6) consider two alternative measures of debt market conditions. First, we use a measure of “credit tightening” according to a quarterly survey undertaken by the U.S. Federal Reserve. The particular variable we use is the net percentage of loan officers in medium and large U.S. banks reporting tightening standards for loans. This measure captures non-price aspects of credit market conditions, such as debt covenants and quantity constraints. Model (5) shows that buyout leverage decreases when credit conditions tighten according to this measure. Second, 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. This measure is likely to capture 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. Consistent with this interpretation, Model (6) shows that fluctuations in this measure is significantly positively related to changes in buyout leverage levels. Model (7) splits this measure into its two parts, the

²³ We have also estimated these equations separately for U.S. and Europe, using European macroeconomic variables for the latter, with very similar results.

S&P earnings-to-price ratio and the high-yield spread, and in this equation that both of these variables are statistically significant predictors of leverage levels. These results suggest that both equity market and debt market conditions independently affect the use of leverage in buyouts.

Finally, model (8) repeats the equation estimating the effect of leverage on buyout EV multiples in the time-series context, controlling for other macroeconomic factors as well as public EV multiples. In this equation, buyout leverage is significantly positively related to buyout EV multiples, providing further support to the pattern documented in Figure 2. Other macroeconomic variables, such as LIBOR, inflation, term spreads, and public valuations are also significantly related to valuations, as expected given previous findings in the asset pricing literature.

G. LBO transactions and Private Equity returns

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. If the explanation for buyouts were that they were better at optimizing leverage in a world in which something like the tradeoff theory held, we would expect that at least some proxies for benefits and costs of leverage should have the same cross-sectional relation for public companies and buyouts, and, additionally, 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 above than with one based on portfolio company characteristics. 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. According to the market timing story, private equity sponsors use cheap debt to arbitrage between debt and equity markets, suggesting a positive relation between fund performance and leverage that is larger than one predicted by mechanical Miller-Modigliani

arguments. The agency story, in contrast, predicts that private equity sponsors will overinvest more and overpay for deals when debt is more accessible, leading to a negative relation between fund performance and leverage.

We measure fund performance using the public market equivalent (PME) measure suggested by Kaplan and Schoar (2005). The PME compares an investment in a private equity fund to an investment in a broad stock market index made during the same time period. We use the CRSP NYSE/Amex/NASDAQ Value-Weighted Market Index as the benchmark public index. We implement the PME calculation by discounting (or investing) all cash outflows of the fund using the CRSP index total return and comparing the resulting value to the discounted value of the cash inflows (all net of fees) to the fund, again using the total return to the CRSP index. Using this approach, a fund with a PME greater than one has outperformed the CRSP index. The PME measures risk-adjusted excess return to a buyout fund investment under the assumption that the market beta of the fund is 1; this is clearly a simplification but roughly in line with estimates of the beta of private equity investments.^{24 25}

Fund cash flow data necessary to calculate PMEs is available from Preqin for 648 private equity funds in total over our time period, and for 156 of the funds in our sample, which invested in 505 of our LBO deals. These data allow us to match about one-half of our total sample of transactions to funds for which we can observe returns. Our transactions comprise a relatively small subset of the total number of buyouts conducted by these funds, but for the remaining buyouts, deal-level data is not available. Nonetheless, we have a reasonably large sample of fund returns, and, on average, detailed information on around three deals per fund.

Figure 4 plots average value-weighted vintage year PMEs in the Preqin universe and the median leverage in our sample for a given vintage year. Value-weighting is done by funds raised, and vintage year refers to the particular year a fund was raised.²⁶ LBO leverage and subsequent fund returns are found to be negatively correlated; high leverage for funds in a given vintage years predicts low fund returns. This result holds in all our subsequent tests below.

The usual relation between leverage and returns comes from the Modigliani-Miller theorem, which predicts that leverage should have a strong effect on returns. This effect,

²⁴ Alphas and betas for private equity investments are difficult to estimate given the lack of objective interim market values and infrequent return observations. See Cochrane (2005), Driessen et al (2008), and Korteweg and Sorensen (2010) for a discussion of the issues involved.

²⁵ The results are similar if we measure returns as IRRs instead of PMEs.

²⁶ Because the leverage series in Figure 4 is by fund vintage years instead of LBO deal years, it is somewhat different to the leverage series plotted in other figures in the paper.

however, works in the opposite direction of the one we find in the data. Modigliani-Miller logic implies that leverage should increase average (expected) equity returns, while the results presented in Figure 4 and subsequent tests suggest that the opposite is true in our sample, and that funds with more levered deals have *lower* returns.

Table X analyses this issue in a time-series context using annual (fund vintage year) data, where the dependent variable is the average value-weighted vintage year PME in the Preqin universe. The first model confirms two results documented in previous studies. First, as in Kaplan and Strömberg (2009), private equity returns are negatively related to the amount of money flowing into the PE industry (as measured by aggregate US fundraising in a given vintage year from Private Equity Analyst divided by US stock market capitalization). Second, as in Kaplan and Schoar (2005), previous fund returns by the same private equity sponsor predict future fund returns. For a given vintage year average PME, we calculate the previous fund PME index by taking each fund in a given vintage year, finding the PME for the previous fund made by the same sponsor, and taking the value-weighted average of all the previous fund PMEs.

Model 2 introduces median leverage, as measured by the log of debt to EBITDA, for deals in our dataset that can be attributed to funds of a given vintage year. Higher leverage is associated with significantly lower PMEs: the estimates imply that an increase in leverage from the 25th percentile to the 75th percentile (going from log of debt to EBITDA of 1.44 to 1.86) leads to a reduction in PME of about 0.1, or 10 percentage points reduction in return over the life of the fund. Models 3 and 4 document that higher median deal pricing and lower high-yield spreads for a given vintage year are associated with lower fund returns.

These results are consistent with the view that lax credit conditions make it easier for sponsors to raise money through leverage, which in turn make them prone to overpay for deals. Model 5 shows that high leverage appears to be more important than high pricing in explaining low fund returns; although coefficients on both leverage and pricing become insignificant when they are introduced simultaneously in the regression, the coefficient on leverage is large and negative and almost significant while the coefficient on pricing switches sign. Finally, model 6 suggests that leverage has an independent negative effect on returns, even after introducing the high-yield credit spread into the equation.

While Table X establishes the aggregate patterns relating deal leverage and fund returns in the time series, Table XI studies the determinants of individual fund PMEs using panel data on fund-level returns. This approach allows us to control for a number of individual fund

characteristics that could be related to risk factors and hence returns. Since we have several observations for any given fund, we cluster our standard errors both at the fund and vintage year levels.

The first specification estimates the way in which a fund's PME is related to private equity firm and fund characteristics, as well as market conditions measured by aggregate capital commitments into private equity funds relative to total stock market capitalization. Again, the results imply that more capital committed in a given vintage year leads to lower fund returns, while PME of the previous fund raised by the sponsor is positively related to fund PMEs. As in Kaplan and Schoar (2005), we also control for whether a fund is a first time fund, the size of the fund, and the sequence number of the fund (i.e. number of funds raised previously by the same sponsor). Sequence number and fund size are not significant in any specification.²⁷ In model 2 we introduce deal-level leverage, which is again significantly negatively related to fund returns. In model 3, we include deal pricing, and in model 4 we add the high-yield spread to the equation, but in each case deal leverage remains an important predictor of returns.

In model 5 we consider whether funds appear to 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 and equity markets, the predicted component of leverage should have a positive impact on fund returns when debt is "cheap". However, we find that both components of leverage have a negative impact on returns, which is inconsistent with a market-timing story. Model 6 shows that these results are robust to the introduction of industry, region, and LBO type fixed effects. Finally, the results are not driven by the timing of transactions, even though (as is seen in Figure 2) leverage and valuation multiples vary considerably over time. When, in model 7, transaction year fixed effects are included, the results are weaker but qualitatively similar.

We interpret these results as providing evidence against the market timing hypothesis and for the GP-LP agency story. 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

²⁷ The coefficient on the first-time fund dummy is hard to interpret, because when no previous fund exists we set the "PME in previous fund" variable to zero, while other funds get an average contribution to their PMEs of about 0.3 from this variable. Hence, the fact that the first-time fund dummy is significantly positive does not mean that first-time funds perform better than other funds.

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 compatible with alignment of interest between funds and their investors. Although this channel probably contributes to explaining the negative effect of leverage on returns, the fact that the effect remains after controlling for fund raising in the market, and deal-year fixed effects, suggests that it is not the major explanation.

Another possible explanation for the negative relation between leverage and returns is that there is a time-varying illiquidity discount on non-traded assets such as private equity funds that covaries negatively with leverage, so that leverage is high when investors demand a low illiquidity discount which is also reflected in a lower PME. However, any such effect should be absorbed in the deal-year fixed effects in model 7 of Table XI. The fact that the negative relation between leverage and fund returns remains suggests that time varying illiquidity discounts is not the full story.

Finally, it is possible that the causal relationship does not go from high leverage to low returns, but rather the other way around: a fund that is expecting low returns has an incentive to engage in risky strategies – such as unusually large or unusually leveraged transactions – to gamble for resurrection. This argument, however, is just a variant of the agency story suggested by Axelson et al. (2009). Given that we cannot identify returns for individual deals within the fund, we have no way of ruling out this type of explanation.

To summarize, the evidence that fund-level returns are 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. This argument 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 possibly excessive.

IV. Conclusions

This paper constructs a large, detailed, and geographically diverse sample of 1157 buyouts to study the determinants of financial structure in these increasingly important transactions and compare their capital structure to a matched sample of public companies. In this sample, 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 document that buyout leverage is almost purely driven by time-series variation relating to debt market conditions. In contrast, public company leverage is mostly driven by differences in the characteristics of the firms. The standard trade-off theory factors that predict capital structure in public companies have no explanatory power for buyouts. Instead, the main factors that affect the capital structure of buyouts are the price and availability of debt; when credit is abundant and cheap, buyouts become more leveraged. No such effect is observed in the matched public companies.

Our results suggest that the capital structure of buyouts requires a different explanation to that for public firms. Private equity practitioners often state that they use as much leverage as they can. This claim appears to be consistent with the data. Market conditions are important determinants of the level of leverage in buyouts, the structure of that leverage, the pricing of deals, and even the returns of the private equity funds making the investments. The main constraint private equity sponsors face is the capital market, which limits the quantity they 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 is potentially not in the interests of their investors. Our empirical results, which document a negative relation between fund returns and leverage, are consistent with the logic of this model.

However, although potential conflicts of interest between general partners and their investors appear to be an important explanation for the patterns we observe, there is undoubtedly much more to the story. More generally, the striking differences we document between private equity and public firm's capital structures highlight the fundamental link between the contractual structure of an organization and the way it raises capital. Understanding the way in which the design of an organization affects both the way in which it raises capital and its ability to raise capital in different types of financial conditions, is an important topic for future research.

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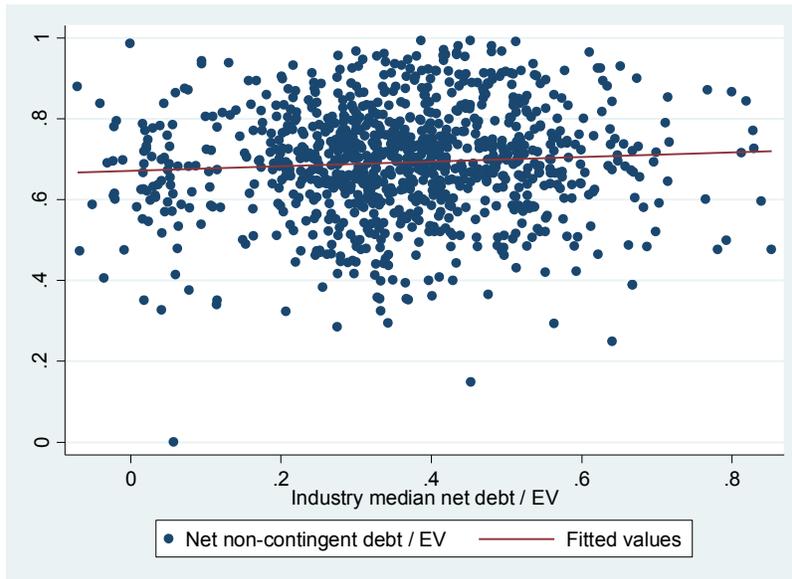
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Figure 1: LBO versus public market leverage

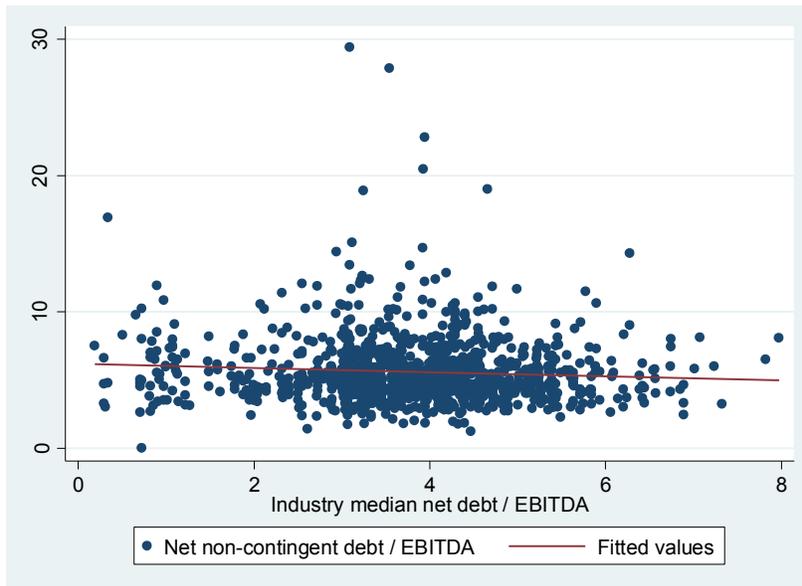
This figure shows LBO leverage for the sample plotted against the median public company leverage in the same Fama-French 49 industry, year and month, and region (U.S., Western Europe, Eastern Europe, Asia, or Australia) as the LBO. The sample excludes LBOs in the banking and insurance industries (Fama-French 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

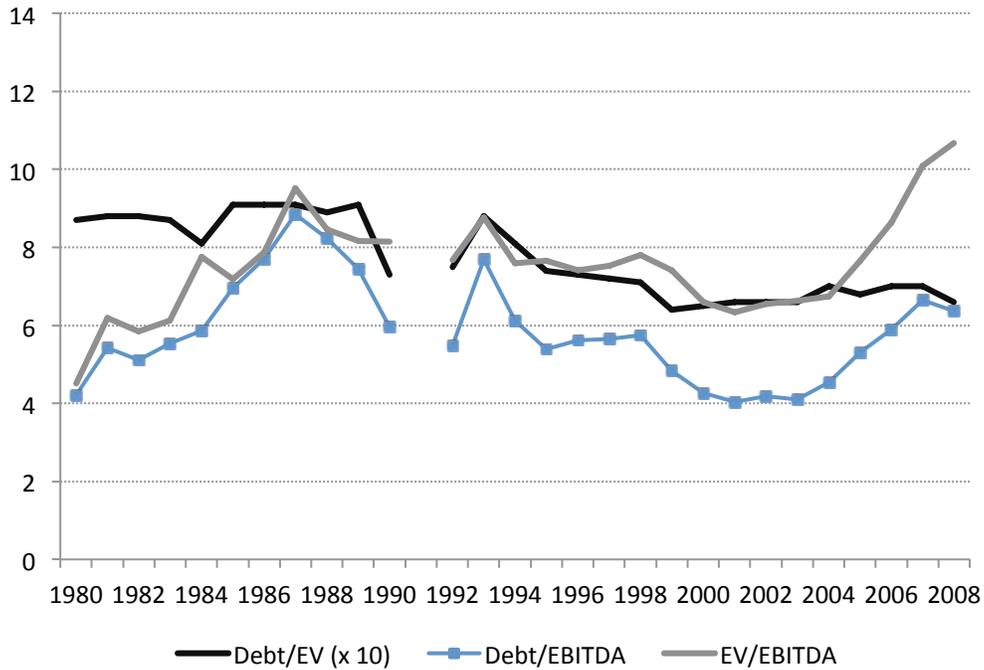


D/EBITDA: Slope = -0.148, T-statistic = -2.28, R-squared=0.005, N=1117

Figure 2: 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 V for definitions of all variables. There were no buyouts in 1991.

Panel A: Leveraged buyouts



Panel B: Matched public companies

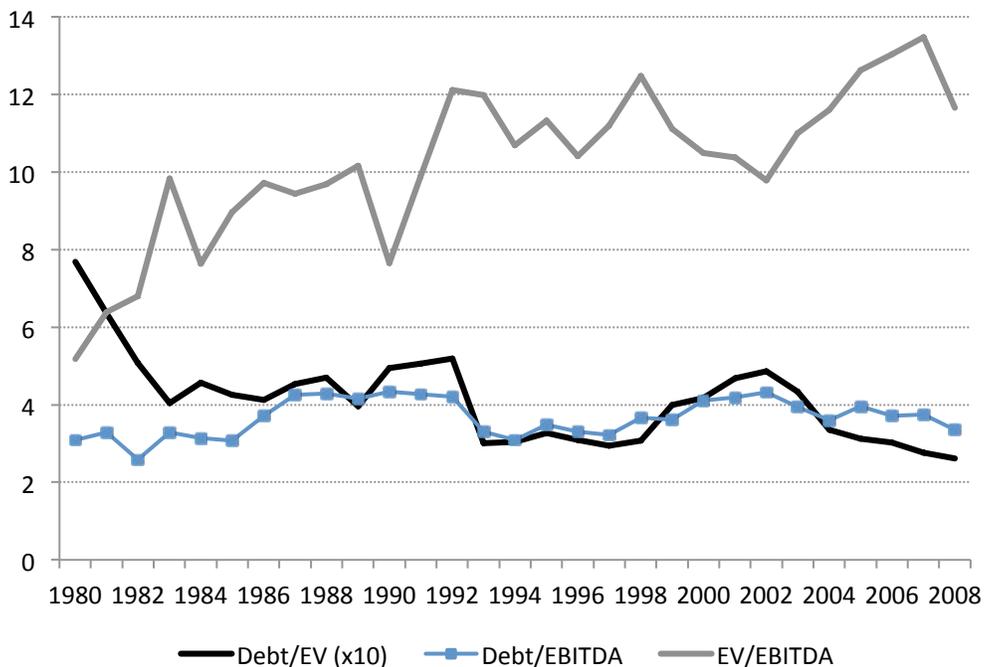
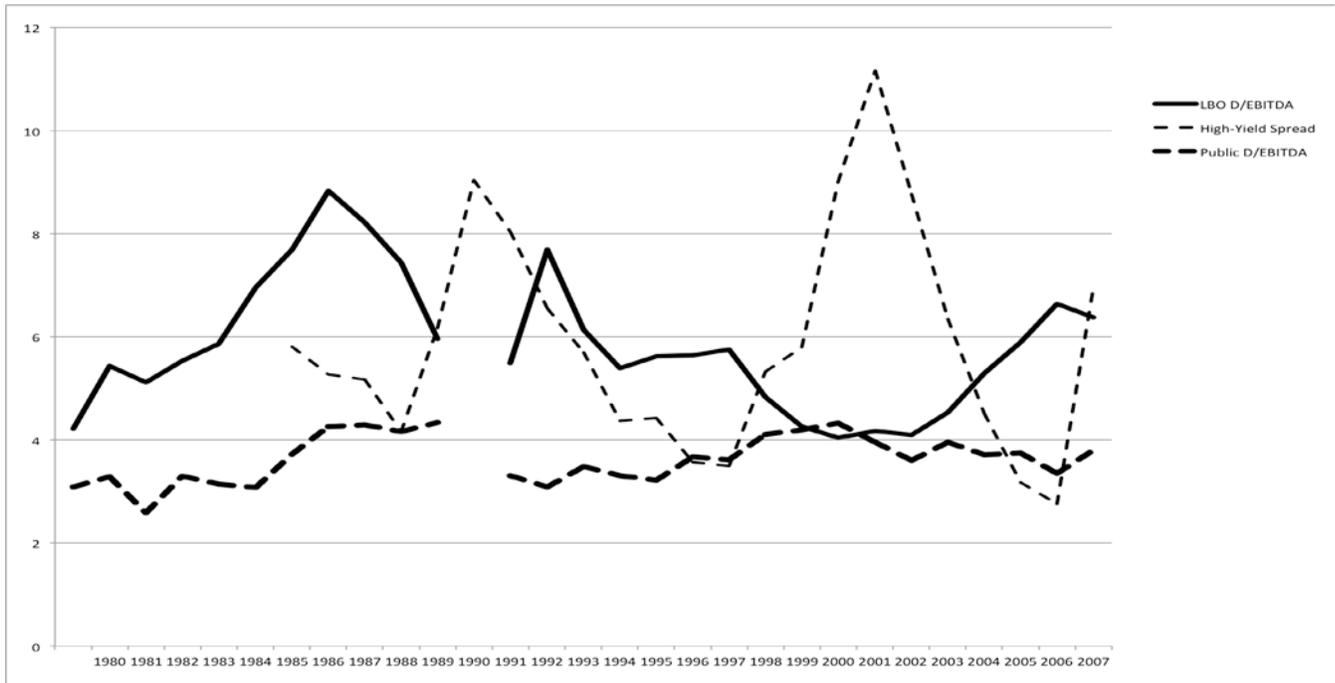


Figure 3: Leverage, credit spreads and debt structure

The figure presents time-series data on average credit spreads (U.S. high-yield rate minus libor), leverage and debt structure. Panel A plots credit spreads against median Net Debt to EBITDA for a sample of 1157 leverage buyout transactions and the corresponding median values for matched public companies. See Table IV for definitions of all variables. 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). Panel B plots leverage (divided by 10 for scaling) against debt maturity (measured as the fraction of total LBO debt due in five years or less) and the Fraction of Term Loan A out of total LBO Debt for the deals in our sample between 1993 and 2008.

Panel A: Leverage and Credit Spreads



Panel B: Leverage and debt structure

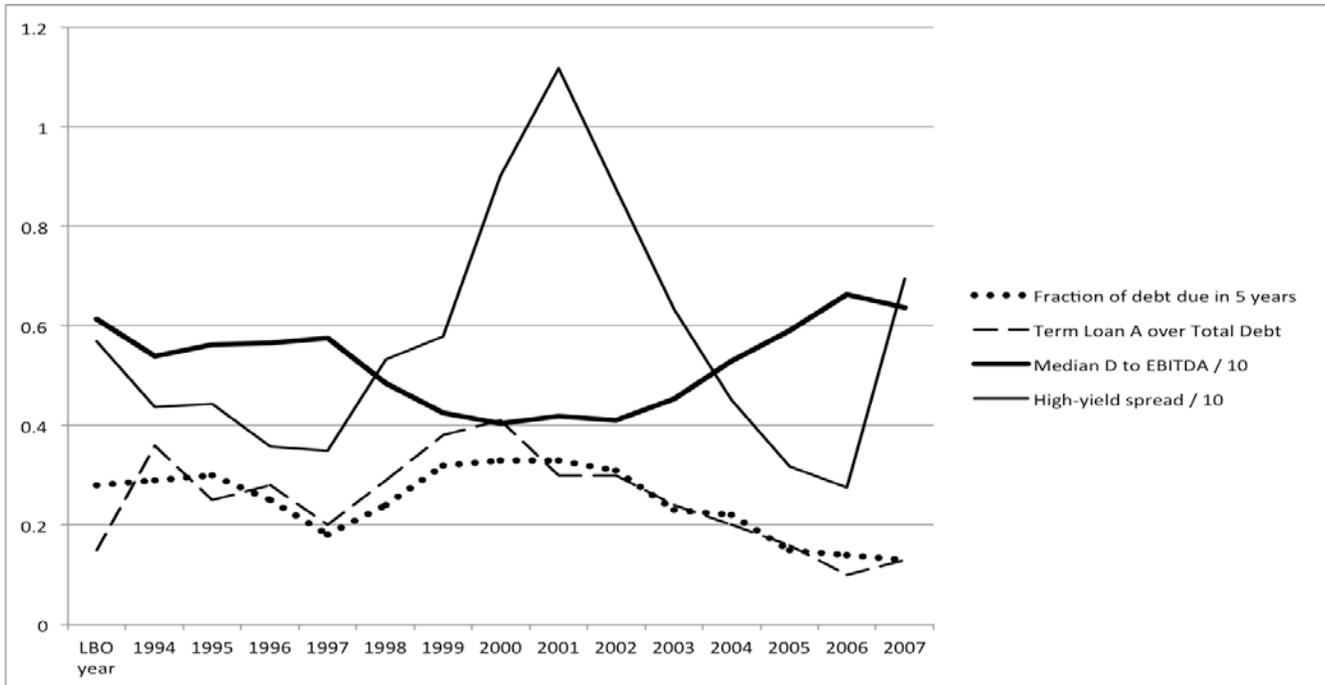


Figure 4: Fund vintage performance and credit spreads

The figure plots the value weighted vintage-year public market equivalent measure for buyout funds in the Preqin universe against median log Net Debt to EBITDA for deals in our sample that can be attributed to a certain fund vintage (982 out of 1157 deals satisfy this criterion). Value weighting is by size of funds raised. The benchmark public portfolio used for calculating the public market equivalent measure is the CRSP NYSE/Amex/NASDAQ Value-Weighted Market Index. Vintage year refers to the year when the acquiring private equity fund was raised. From the Preqin database, only funds classified as “Buyout” and only funds with complete cash in – cash out data are used (648 funds in total).

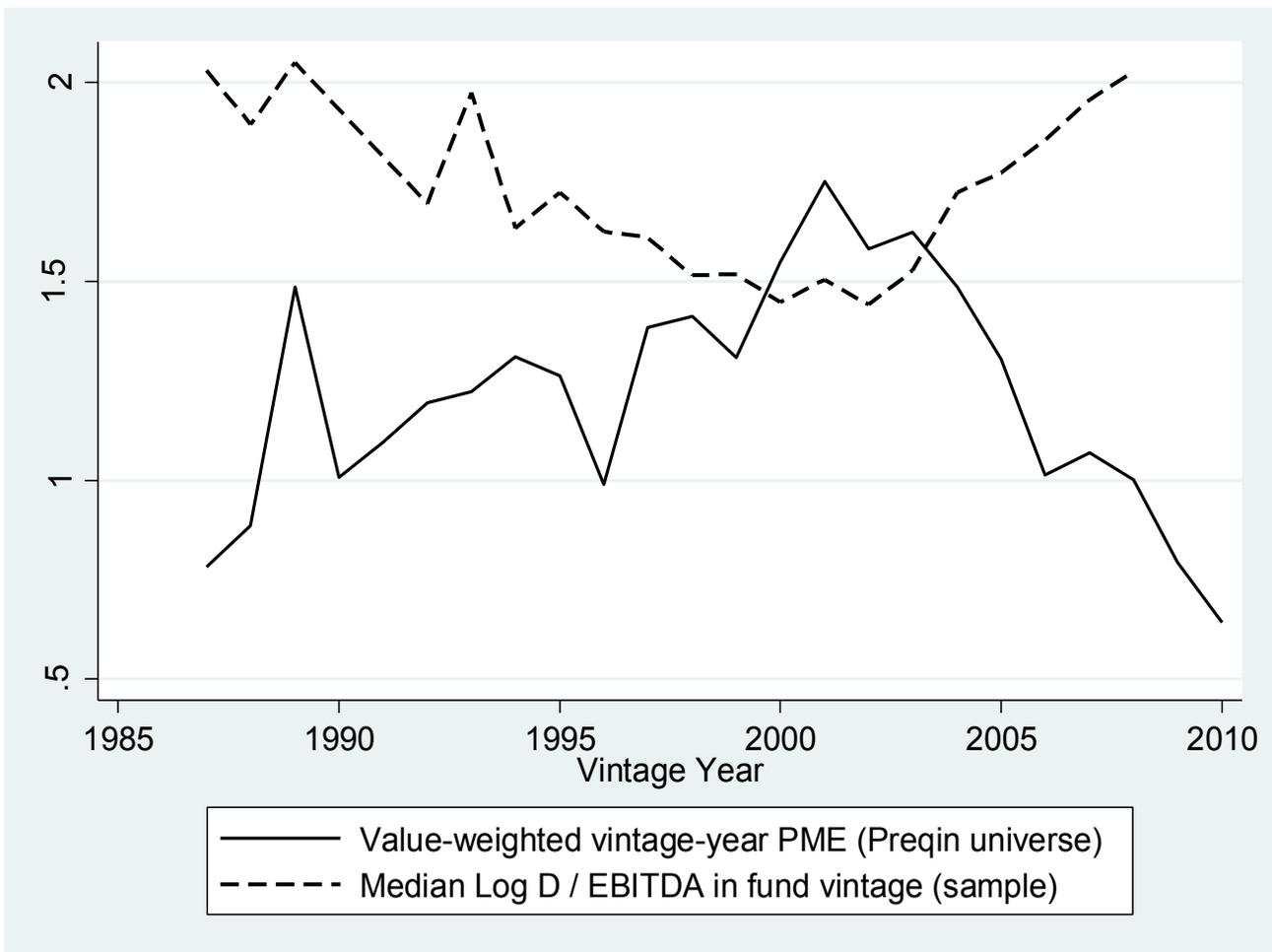


Table I: A typical private equity buyout: the August 2005 purchase of Kwik-Fit

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%	
<i>Total Senior Debt</i>	<i>410.0</i>			<i>4.3 x</i>
2 nd 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 II: 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
<u>Senior bank debt</u>				
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%
<u>Subordinated debt</u>				
2 nd lien	10.6%	2.5%	543	5.3%
Mezzanine	41.0%	9.9%	519	1.3%
<u>Bonds</u>				
Senior	7.1%	2.3%	485	4.7%
Junior	21.9%	9.3%	561	0.5%
<u>Other debt</u>				
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%
<u>Contingent debt</u>				
Revolver	92.1%	14.2%		
Other facilities	25.2%	3.7%		
<u>Preferred equity</u>	2.6%	0.5%	627	-

Table III: Descriptive statistics on LBO leverage and deal pricing

This table shows the transaction value, amount of debt used and the valuation multiple paid in the transaction in the sample of LBOs. Debt includes senior secured bank debt and all forms of subordinated debt (see Table II for details). Measures are (1) enterprise value measured in millions of 2008 USD (EV), (2) enterprise value divided by earnings before interest, taxes, depreciation and amortization (EV/EBITDA) (3) debt divided by EBITDA (D/EBITDA), and (4) debt divided by enterprise value (D/EV).

	EV				EV / EBITDA			
	N	Mean	Median	Std Dev	N	Mean	Median	Std Dev
All LBO transactions	1023	1514	677	3582	1009	8.2	7.6	3.3
Divisional	295	1290	702	1812	290	7.4	6.8	2.8
Private company	117	603	432	503	114	7.8	7.4	2.6
Public-to-private	365	2343	829	5543	362	8.8	8.0	3.8
Secondary	240	974	599	1446	237	8.5	7.9	3.2
Privatization/ Bankruptcy	6	1383	1802	935	6	8.8	8.6	3.5
North America	630	1654	639	4226	625	8.5	7.7	3.3
Western Europe	387	1282	721	2186	378	7.8	7.4	3.2
Rest of World	6	1660	1877	1011	6	8.5	8.9	2.7

	D / EBITDA				D / EV			
	N	Mean	Median	Std Dev	N	Mean	Median	Std Dev
All LBO transactions	1142	5.6	5.2	2.4	1002	0.69	0.70	1.4
Divisional	315	5.0	4.7	1.8	289	0.69	0.70	0.13
Private company	163	4.9	4.7	1.6	115	0.64	0.65	0.14
Public-to-private	366	6.5	5.8	3.0	354	0.73	0.73	0.15
Secondary	289	5.6	5.3	2.1	238	0.66	0.68	0.11
Privatization/ Bankruptcy	9	4.0	3.7	1.4	6	0.51	0.60	0.25
North America	689	5.8	5.3	2.6	619	0.70	0.70	0.15
Western Europe	443	5.3	4.9	2.1	377	0.68	0.68	0.12
Rest of World	10	5.7	5.5	1.7	6	0.70	0.68	0.12

Table IV: 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) and Net Debt to earnings before interest, taxes, depreciation and amortization (D/EBITDA) for the sample of 1157 LBO transactions and matched public companies split into subgroups. In panels (A), (B), and (E), 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” are the median values among the public companies in each industry-year-region group. In panel (B), LBO leverage is predicted five years after the LBO transaction date, estimated using repayment schedules. 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 (“public adjusters”). In panel (D), LBO leverage is sorted over the leverage the firm had during the latest financial statement before the LBO transaction, using a subsample of 160 public-to-private transactions. In panel (E), LBO and public leverage are sorted over the U.S. high-yield spread, defined as the U.S. high-yield rate minus U.S. Libor.

	D/EBITDA		D/EV	
	LBO	Public Match	LBO	Public Match
Whole sample	5.1	3.8	0.70	0.35
<u>A. Sort by public median leverage</u>				
Public leverage quartile 1 (lowest)	5.4	2.7	0.69	0.19
Public leverage quartile 2	5.3	3.5	0.69	0.31
Public leverage quartile 3	5.2	4.2	0.71	0.40
Public leverage quartile 4 (highest)	4.8	5.2	0.70	0.54
Q4 minus Q1	-0.6***	+2.5***	+0.01	+0.35***
<u>B. Sort by predicted 5-year LBO leverage</u>				
Public leverage quartile 1 (lowest)	4.4	2.7	0.58	0.19
Public leverage quartile 2	4.4	3.5	0.54	0.31
Public leverage quartile 3	4.3	4.2	0.55	0.40
Public leverage quartile 4 (highest)	3.7	5.2	0.53	0.54
Q4 minus Q1	-0.7***	+2.5***	-0.05*	+0.35***
<u>C. Sort by public adjusters</u>				
Adjuster leverage quartile 1 (lowest)	5.3	2.6	0.69	0.16
Adjuster leverage quartile 2	5.3	3.7	0.70	0.28
Adjuster leverage quartile 3	5.4	4.6	0.70	0.39
Adjuster leverage quartile 4 (highest)	4.7	6.2	0.70	0.55
Q4 minus Q1	-0.6***	+3.2***	+0.01	+0.39***
<u>D. Sort by pre-LBO leverage (public-to-private transactions only)</u>				
Pre-LBO leverage quartile 1 (lowest)	6.2	0.2	0.66	0.07
Pre-LBO leverage quartile 2	6.2	2.5	0.68	0.29
Pre-LBO leverage quartile 3	5.6	3.8	0.76	0.51
Pre-LBO leverage quartile 4 (highest)	6.9	6.7	0.72	0.87
Q4 minus Q1	+0.4	+6.5***	+0.06*	+0.80***
<u>E. Sort by US high-yield spread</u>				
Spread quartile 1 (lowest)	6.1	3.7	0.70	0.29
Spread quartile 2	5.6	3.8	0.70	0.33
Spread quartile 3	4.8	3.8	0.70	0.37
Spread quartile 4 (highest)	4.2	4.2	0.66	0.44

Q4 minus Q1

-1.9***

+0.5***

-0.04***

+0.15***

Table V: Determinants of LBO versus public company leverage

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 fixed effect for industry, country, and deal year. "Public D/EBITDA" are median values for net debt over EBITDA 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. t-statistics using standard errors clustered at the LBO deal-year level are in parentheses. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

VARIABLES	(1) LBO log D/EBITDA	(2) LBO log D/EBITDA	(3) LBO log D/EBITDA	(4) LBO log D/EBITDA	(5) LBO log D/EBITDA
High-yield bond spread over LIBOR				-0.060*** (-8.39)	-0.059*** (-7.68)
Industry FE	Yes	No	Yes	No	Yes
Country FE	No	No	Yes	No	Yes
Year FE	No	Yes	Yes	No	No
Observations	1136	1136	1136	1097	1097
Adjusted R-squared	0.033	0.254	0.291	0.157	0.193
VARIABLES	(6) Public log D/EBITDA	(7) Public log D/EBITDA	(8) Public log D/EBITDA	(9) Public log D/EBITDA	(10) Public log D/EBITDA
High-yield bond spread over LIBOR				0.019*** (3.95)	0.006* (1.75)
Industry FE	Yes	No	Yes	No	Yes
Country FE	No	No	Yes	No	Yes
Year FE	No	Yes	Yes	No	No
Observations	1136	1136	1136	1097	1097
Adjusted R-squared	0.713	0.019	0.755	0.009	0.752

Table VI: Descriptive statistics for regression variables

This table shows descriptive statistics for the variables used in the regression analyses in Tables VII-XI. “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
<u>LBO characteristics</u>							
LBO D/EV	1002	0.69	0.00	0.61	0.70	0.78	0.99
LBO D/EBITDA	1142	5.6	0.0	4.2	5.2	6.4	29.4
LBO log D/EBITDA	1143	1.66	0.18	1.44	1.65	1.86	3.82
LBO EV/EBITDA	1009	8.2	1.0	6.1	7.6	9.5	37.8
LBO log EV/EBITDA	1009	2.04	-0.01	1.81	2.02	2.25	3.63
<u>Macro variables</u>							
US high-yield spread	1118	5.53	2.23	3.46	5.01	6.74	12.31
Capital Commitments/Stock M.V. (%)	1068	0.53	0.01	0.346	0.435	0.684	1.24
<u>Public ...</u>							
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
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 / PPE	1149	6.73	0.11	3.26	5.76	7.76	42.29
R&D/Sales	1149	0.01	0	0.00	0.00	0.00	0.87
ROIC	1149	0.10	-0.25	0.09	0.11	0.12	0.24
Volatility in ROIC	1149	0.05	0	0.04	0.05	0.06	0.24
<u>Public adjuster ...</u>							
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
<u>Private equity sponsor/fund</u>							
Years since first fund raised	1120	11.93	0	6	11	18	36
Investing through fund	1157	0.95	0	1	1	1	1
Log no. of deals by sponsor last 3 yrs	1154	3.05	0	2.48	3.04	3.74	5.77
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
Bank affiliated sponsor (dummy)	1157	0.15	0	0	0	0	1
Fund PME	706	1.36	0.32	1.09	1.35	1.59	3.67
Log fund sequence number	1079	1.40	0	0.69	1.39	1.95	3.09
First-time fund (dummy)	1079	0.09	0	0	0	0	1
PME in previous fund	659	1.26	0	0.82	1.44	1.79	3.67

Table VII: Determinants of LBO leverage

This table shows the results from OLS regressions of LBO leverage on matched public company median leverage, 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 the same region, Fama-French 49 industry, and month as the corresponding LBO transaction. t-statistics using standard errors clustered at the deal-year level are presented in parentheses. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***)

VARIABLES	(1) LBO log D / EBITDA	(2) LBO D / EV	(3) Pub. log D / EBITDA	(4) LBO log D / EBITDA	(5) LBO log D / EBITDA
High-yield bond spread over LIBOR	-0.059*** (-7.94)	-0.010*** (-3.41)	-0.005 (-1.49)	-0.058*** (-6.72)	-0.050*** (-8.09)
Industry median log net debt /	-0.044 (-1.59)				-0.021 (-1.36)
Industry median net debt / EV		0.072* (1.97)			
Industry median Market / Book			-0.148*** (-5.04)	-0.002 (-0.12)	
Industry median Sales / PPE			0.004** (2.73)	0.001 (0.39)	
Industry median R&D/Sales			-1.732** (-2.22)	0.052 (0.22)	
Industry median ROIC			-4.129*** (-6.89)	0.238 (0.55)	
Industry median earnings volatility			-13.301*** (-11.72)	0.886 (1.58)	
Western Europe			0.084** (2.13)	-0.065** (-2.24)	-0.043 (-1.63)
Rest of world			-0.046 (-0.53)	-0.070 (-0.61)	-0.107 (-0.74)
Independent private					0.004 (0.12)
Privatization / distressed deal					-0.309*** (-4.58)
Public to private					0.126*** (3.97)
Secondary buyout					0.081*** (2.96)
EV quartile 2					0.075* (1.93)
EV quartile 3					0.216*** (8.80)
EV quartile 4					0.290*** (8.22)
Years since first fund raised					0.002 (1.28)
Investing through fund					-0.297* (-2.06)
Log no of deals by sponsor in last 3 yrs					-0.015 (-0.83)
Log Fund size, USD2008					0.023 (1.43)
Bank affiliated					0.046 (0.91)
Observations	1097	944	1091	1078	923
Adjusted R-squared	0.159	0.031	0.608	0.161	0.312

Table VIII: 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. t-statistics using standard errors clustered at the LBO deal-year level are presented in parentheses. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	LBO log EV multiple	Public log EV multiple	LBO log EV multiple	LBO log EV multiple	LBO log EV multiple IV HiYld	LBO log EV multiple IV TermA
High-yield spread	-0.048*** (-6.86)	-0.026*** (-6.07)	-0.045*** (-6.06)	-0.034*** (-5.97)		
Log LBO D/EBITDA					0.656*** (8.68)	0.808* (1.93)
Public EV multiple			0.106** (2.23)	0.104** (2.47)	0.126*** (6.18)	0.130*** (3.06)
Western Europe				-0.074*** (-2.90)	-0.034 (-1.49)	-0.015 (-0.34)
Rest of World				-0.097 (-0.80)	-0.039 (-0.56)	-0.023 (-0.29)
Private company				0.075** (2.24)	0.071** (2.66)	0.070** (2.32)
Privatization/Bankruptcy				0.158 (1.23)	0.354*** (2.85)	0.397** (2.26)
Public-to-private				0.107*** (3.96)	0.025 (0.97)	-0.020 (-0.21)
Secondary				0.116*** (6.05)	0.071*** (6.69)	0.052 (1.07)
EV quartile 2				0.092** (2.33)	0.022 (1.18)	0.002 (0.04)
EV quartile 3				0.200*** (7.85)	0.041* (2.06)	0.000 (0.00)
EV quartile 4				0.276*** (10.41)	0.063** (2.35)	0.012 (0.08)
Constant	2.433*** (27.59)	2.728*** (22.56)	2.028*** (19.50)	1.789*** (18.09)	0.589*** (4.91)	0.363 (0.72)
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 IX: Determinants of leverage and pricing - time-series specifications

This table shows the results from time-series regressions of the quarterly median leverage (log D/EBITDA) and valuation (log EV/EBITDA) of LBOs and matched public companies. Explanatory variables include the U.S. high-yield bond spread over three-month U.S. LIBOR ("US High-Yield - LIBOR"), US 12-month rolling inflation, the net percentage of loan officers surveyed by the Fed in medium and large banks reporting tightening standards for loans ("Fed credit tightening index") 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. t-statistics computed using Newey-West standard errors with 12 quarterly lags are reported in parentheses. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

VARIABLES	(1) LBO Log D/EBITDA	(2) Public Log D/EBITDA	(3) LBO Log D/EBITDA	(4) Public Log D/EBITDA	(5) LBO Log D/EBITDA	(6) LBO Log D/EBITDA	(7) LBO Log D/EBITDA	(8) LBO Log EV/EBITDA
US Libor			-0.005 (-0.18)	-0.041*** (-3.27)	0.016 (0.74)	0.037* (1.74)	-0.003 (-0.14)	-0.032** (-2.50)
US 12-month rolling inflation			0.025 (0.62)	-0.018 (-1.04)	0.044 (1.37)	-0.007 (-0.18)	-0.009 (-0.19)	-0.055** (-2.01)
US High-Yield - LIBOR	-0.055*** (-10.39)	0.028*** (3.02)	-0.059*** (-3.69)	0.031*** (4.39)			-0.037** (-2.31)	
US 10yr - 3mo Treasury			0.016 (0.67)	-0.080*** (-9.22)	-0.045 (-1.46)	-0.011 (-0.48)	-0.013 (-0.54)	-0.079*** (-3.23)
US GDP growth			0.015 (0.88)	-0.012** (-2.48)	0.022 (1.30)	0.019 (0.96)	0.019 (1.03)	-0.002 (-0.47)
Fed credit tightening index					-0.005*** (-3.15)			
S&P Earnings Yield - US High-Yield						0.040*** (4.13)		
S&P Earnings/Price							4.666** (2.24)	
LBO log D/EBITDA								0.755*** (8.72)
Public log EV/EBITDA								0.106* (1.71)
Constant	1.934*** (40.86)	1.138*** (15.97)	1.840*** (7.46)	1.900*** (33.90)	1.438*** (8.55)	1.645*** (9.29)	1.609*** (7.45)	0.931*** (4.36)

Table X: Leverage and fund performance – time-series specifications

This table shows the results from OLS regressions with Newey-West corrected standard errors of the value weighted vintage-year public market equivalent measure for buyout funds in the Preqin universe against various market condition and leverage variables. Vintage year refers to the year when the acquiring private equity fund was raised. Value weighting is by size of funds raised. The benchmark public portfolio used for calculating the public market equivalent measure is the CRSP NYSE/Amex/NASDAQ Value-Weighted Market Index. From the Preqin database, only funds classified as “Buyout” and only funds with complete cash in – cash out data are used (648 funds in total). “Median Deal Log D / EBITDA” is the median leverage (measured as log of Debt to EBITDA) for deals in our sample that can be attributed to a certain fund vintage (982 out of 1157 deals satisfy this criterion). “Median Deal Log EV / EBITDA” is the median pricing (measured as log of enterprise value to EBITDA) for deals in our sample that can be attributed to a certain fund vintage (862 out of 1157 deals satisfy this criterion). “High-yield bond spread over LIBOR” is the median high-yield bond spread over all deals attributable to a certain fund vintage year, measured at the time of the deal. “Capital Commitments / Stock Market Value” is the aggregate amount of funds raised into buyout funds in the US in a certain vintage year as a fraction of total US stock market capitalization, where funds raised are estimated by Private Equity Analyst. “Value-weighted PME in previous funds” is calculated by taking each fund in a vintage year, locating the previous fund raised by the same sponsor, calculating the PME for that fund, and then taking the value-weighted average over all such previous funds for a given vintage year. Regression coefficients and T -statistics displayed in the table, where T-statistics are calculated using Newey-West corrected standard errors. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Value-weighted vintage-year PME					
Median Deal Log D / EBITDA		-0.741*** (-4.67)			-1.106 (-1.65)	-0.551*** (-5.80)
Median Deal Log EV / EBITDA			-0.794*** (-5.01)		0.441 (0.62)	
High-yield bond spread over LIBOR				0.074** (2.71)		0.053** (2.94)
Capital Commitments / Stock Market Value	-0.330** (-2.41)	-0.141 (-1.43)	-0.062 (-0.57)	-0.339*** (-3.20)	-0.203 (-1.31)	-0.154* (-2.13)
Value-weighted PME in previous funds	0.485*** (4.45)	0.399*** (3.22)	0.413** (3.01)	0.545*** (5.18)	0.394*** (3.14)	0.486*** (4.69)
Constant	0.774*** (5.77)	2.078*** (8.57)	2.421*** (8.52)	0.345 (1.48)	1.814*** (5.04)	1.370*** (4.67)
Adjusted R-squared	0.365	0.659	0.617	0.638	0.634	0.749
Number of years	22	16	16	16	16	16

Newey-West corrected standard errors, lag: 2

Table XI: Leverage and fund performance at the fund level

This table shows the results from OLS regressions of the acquiring private equity fund's PME (calculated using cash flow data from Preqin, using the CRSP NYSE/Amex/NASDAQ Value-Weighted Market Index as the benchmark public index) 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 PME						
Deal Log D / EBITDA		-0.237***	-0.333**	-0.166**			-0.123*
		-2.697	-2.460	-2.256			-1.889
Deal Log D / EBITDA, predicted					-0.741***	-0.846***	
					-2.745	-2.984	
Deal Log D / EBITDA, residual					-0.166**	-0.163*	
					-2.256	-1.705	
Deal Log EV/EBITDA			0.058				
			0.614				
High-yield bond spread over LIBOR				0.035**			
				2.170			
Capital Commitments / Stock Market Value	-0.611***	-0.531***	-0.529***	-0.411***	-0.411***	-0.409***	-0.237*
	-9.526	-8.025	-7.248	-3.847	-3.847	-4.074	-1.798
Log fund size, 2008 USD	0.005	0.013	0.026	0.002	0.002	0.007	0.011
	0.102	0.226	0.484	0.039	0.039	0.162	0.195
Log fund sequence number	0.010	0.021	0.016	0.019	0.019	0.019	0.013
	0.124	0.277	0.223	0.275	0.275	0.314	0.194
First-time fund	0.340*	0.337*	0.325*	0.358**	0.358**	0.380*	0.380**
	1.921	1.896	1.765	2.059	2.059	1.904	2.445
PME in previous fund	0.266***	0.268***	0.274***	0.279***	0.279***	0.276***	0.276***
	2.971	3.070	3.253	3.215	3.215	3.308	3.075
Constant	1.262***	1.534***	1.461***	1.236***	2.376***	2.392***	1.366**
	3.768	4.899	4.573	4.152	4.452	4.853	2.201
Industry, region, and LBO type fixed effects	No	No	No	No	No	Yes	No
Deal year fixed effects	No	No	No	No	No	No	Yes
Number of LBO deals	505	502	443	502	502	502	502
Number of funds	156	156	143	156	156	156	156
Number of vintage years	17	17	17	17	17	17	17
Adjusted R-squared	0.203	0.238	0.262	0.263	0.263	0.294	0.293