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

ULF AXELSON, TIM JENKINSON, PER STRÖMBERG, and MICHAEL S. WEISBACH*

ABSTRACT

Private equity funds pay particular attention to capital structure when executing leveraged buyouts, creating an interesting setting for examining capital structure theories. Using a large, international sample of buyouts from 1980 to 2008, we find that buyout leverage is unrelated to the cross-sectional factors, suggested by traditional capital structure theories, that drive public firm leverage. Instead, variation in economy-wide credit conditions is the main determinant of leverage in buyouts. Higher deal leverage is associated with higher transaction prices and lower buyout fund returns, suggesting that acquirers overpay when access to credit is easier.

> "We buy stuff with cheap debt and arbitrage on the difference with equity markets." (Guy Hands, founding partner of the private equity firm Terra Firma, *Financial Times*, November 15, 2007)

PRIVATE EQUITY INVESTORS are expert, repeat, and largely financially motivated players in capital markets. Over a career executing 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. In this paper, we fill this gap by documenting the factors that affect the financial structure of private equity–backed buyout firms in detail, and we 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

*Axelson is with the London School of Economics and SIFR; Jenkinson is with the Said Business School, Oxford University and CEPR; Strömberg is with SIFR, Stockholm School of Economics, CEPR, and NBER; and Weisbach is with Ohio State University, NBER, and SIFR. We are extremely grateful to Steve Kaplan for sharing his data on 1980s LBOs, and to Joakim Bång, Ji-Woong Chung, and Reimo Juks for excellent research assistance. We would also like to thank Viral Acharya, Malcolm Baker, Laura Bottazzi, Phil Canfield, Chris Collins, Marco DaRin, Francois Derrien, Chris James, Steve Kaplan, Steven Ongena, Morten Sorensen, David Sraer, Ayako Yasuda, as well as the Editor (Cam Harvey), the referees, and participants in numerous seminar presentations for valuable comments.

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

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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 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 argues that leverage is an essential part of the private equity governance model. Unlike public firms, private equity funds optimize the capital structure in the 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 industry, tangibility of assets, and volatility of cash flows, should explain capital structure in buyouts.

A second view, reflected in the opening quote from Guy Hands of Terra Firma, is that the most important factor in buyout capital structure is the ability of buyout funds to use "cheap" debt to take levered bets on firms. Private equity funds 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)).[2] In addition, the General Partners (or GPs) running private equity funds have agency problems of their own that are likely to affect their choice of leverage in their portfolio companies. Axelson, Strömberg, and Weisbach (2009) present a model in which GPs tend to overinvest, taking value-decreasing investments in addition to value-increasing ones because of their option-like compensation. If they are capital-constrained, so that they must raise external debt in order to complete deals, the investors (the Limited Partners, or LPs) have some protection against this tendency of GPs 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.[3] Both the market-timing and the agency stories share the common prediction that

[2] In this paper, we do not take a stand on the underlying economic reasons for debt being "cheap," or equivalently, credit spreads being relatively low. Proposed explanations include relative changes in credit risk premia (Collin-Dufresne, Goldstein, and Martin (2001)), supply shocks due to changes in intermediary capital (Leary (2009) and Shin (2011)), or changes in credit market sentiment (Baker, Ruback, and Wurgler (2004)). Either way, there is now substantial evidence that there are changes in credit risk premia and debt pricing that are largely unrelated to equity risk premia and other macroeconomic factors (see Collin-Dufresne, Goldstein, and Martin (2001) and Gilchrist and Zakrajsek (2011)).

[3] 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 and pricing of individual deals vary with credit market conditions. More recently, Gorbenko and Malenko (2012) present evidence that financial buyers bid more aggressively in auctions for firms when credit conditions are stronger.

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 1,157 buyouts, 694 of North American firms and the remaining 463 of firms from 24 countries outside North America, mainly in Western Europe. For each buyout in the sample, we obtain detailed information about the financial structure of the transaction. Unlike most previous work, our sample includes 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 for a much longer temporal analysis than in most previous studies.[4] Our data include deals from a total of 176 distinct private equity sponsors and incorporate practically all the major investors active in the market during our period of study.

We first consider the question 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 no discernible 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, as well as 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 subsample of 160 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 quantity of leverage used by buyouts and that by matched public firms have little to no relation with one another, 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 buyout transactions. As a consequence, leverage in LBO deals is procyclical, with leverage peaking during "hot" credit market conditions, such as in 2006 to 2007, and falling when debt markets

[4] Guo, Hotchkiss, and Song (2011) study a sample of U.S. public-to-private transactions from 1990 through 2006. Some recent studies consider 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.

deteriorate, such as in 2008 to 2009. In contrast to the procyclicality of buyout leverage, we find that a matched set of public firms exhibits *counter*cyclical leverage.

We next 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 both panel and time-series regressions, controlling for a large set of macroeconomic variables and using several alternative measures of debt market conditions.

Since debt market conditions affect buyout leverage and pricing, even when controlling for public firm multiples in our pricing equations, debt market conditions appear to have an independent effect on LBO pricing over and above variation in the economy-wide discount rate. These results are most 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 but in line with the agency story.

Our findings contribute to the literature on private equity fund returns, for example, Kaplan and Schoar (2005), Phalippou and Gottschalg (2009), and Harris, Jenkinson, and Kaplan (2012). In particular, we document how excess leverage could have led to disappointing returns in years when debt was available in abundance. 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 lead in turn to high subsequent default rates. Whether this imposes a major cost on the economy is an open question. Some evidence, for example, Andrade and Kaplan (1998), Bernstein et al. (2010), and Hotchkiss, Smith, and Strömberg (2012), 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, Ofek, and Yermack (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 Section I, 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. Section IV concludes.

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

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

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.

The trade-off theory is often augmented with some version of Myers and Majluf's (1984) pecking order theory, in which the issuance of securities is costly due to information asymmetries, leading firms to temporarily stray from the optimal target leverage suggested by the trade-off theory. In particular, firms that have historically been more profitable, so that they have not needed to issue securities to finance investments, might end up with low leverage, even though more profitable firms have higher debt tax shield and incentive benefits of debt. This "drift" in capital structure is less likely to be observed in our sample of buyouts since we measure leverage in buyouts at the time of the transaction. As a robustness check, we therefore also compare buyout leverage to leverage in public firms that have made an active leverage decision recently.

B. View 2: Leverage Is Driven by Market-Wide Factors That Vary over Time

B.1. Market Timing

Baker and Wurgler (2002), among others, suggest that managers take advantage of mispricing in equity markets when issuing securities, so that, for example, 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.[5] Managers aware of this market imperfection should take advantage of it, and issue more debt when the debt markets are overvalued.[6] 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. 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 (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 that buyout firms should also be willing to pay higher prices when debt financing is "cheap." Although this pattern could also hold for publicly traded firms, private equity sponsors are likely to be better at timing

[5] For example, Collin-Dufresne, Goldstein, and Martin (2001) find that credit spread changes are largely driven by a common factor unrelated to individual firm characteristics. They interpret this as evidence of supply and demand effects driving corporate debt pricing.

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

debt markets than the managers of publicly traded 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 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.

B.2. GP–LP Agency Conflicts

Just as there are agency problems between CEOs and owners that can explain leverage choices for publicly traded firms, there are potential agency problems between private equity fund managers and investors in the fund 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 large levered stakes in portfolio firms.[7] 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. Note that we are not suggesting that mispricing in debt markets cannot occur under the agency story—on the contrary, the existence of "cheap" credit during certain periods can potentially exacerbate the agency problem by making it easier for a GP to overlever at the expense of LPs.

B.3. Effects of Time-Varying Discount Rates and Equity Market Mispricing

Both the market-timing and agency stories imply that leverage and pricing multiples in buyouts should be driven by credit market conditions, where the main measure of credit market conditions we use is the prevailing high-yield spread in the market. However, even in a world without mispricing or agency effects we could see the same time-series pattern if the market-wide discount rate is time-varying. The high-yield spread in such a world is likely

[7] 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; the GPs earn no carried interest if the fund does not exceed the hurdle rate.

to be lower when overall discount rates are lower, while pricing multiples will be higher. Leverage multiples could also become higher when the cost of debt goes down in a standard trade-off theory model—for a given level of cash flow firms should be able to take on more debt and still be able to meet interest payments. Importantly, however, the impact of general discount rate movements should hit public firms and LBOs symmetrically (particularly with respect to pricing multiples), while the market-timing and agency stories apply mostly to LBOs. Hence, controlling for pricing and leverage in public firms—when we test for the effect of credit market conditions on LBO leverage and pricing—should pick up any effect of movements in general discount rates.

Of course, public equity markets could also exhibit mispricing, and it is possible that equity and debt markets become overheated at the same time. The market-timing story in particular is about the relative mispricing of debt versus equity markets, so ideally we would like to control for any common component of overheating in debt and equity markets. This logic emphasizes the importance of controlling for public market prices when measuring the impact of credit conditions on the LBO market.

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, 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, and transaction size, and for a subset there is also financial accounting information (primarily for public-to-private transactions and LBOs involving public bond issues).[8]

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 5,678 loans. From this list we exclude loans that did not

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

back the original LBO transaction (i.e., refinancings and recapitalizations as well as loans financing subsequent add-on acquisitions by the LBO target), ending up with 2,467 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 for the 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, and 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, 1989b) sample of 83 buyouts from the 1980s. These buyouts predated the development of the syndicated loan market, so would clearly not have entered our sample otherwise.[9] Through this process, we end up with a sample of 1,157 buyouts occurring between 1980 and 2008.

An important part of our analysis is to match these private equity buyouts with comparable publicly traded 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

[9] We are grateful to Steve Kaplan for providing us with these data.

the high-yield rate; and a credit tightening measure (obtained from the Federal Reserve).[10] We also obtain inflation and exchange rates from the IMF.[11]

Finally, we calculate various private equity sponsor characteristics, such as the number of funds raised, fund sizes, and fund returns (public market equivalent (PME) measures, described later). 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 nonoverlapping, 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 our source for fund returns. Traditional sources of data on private equity returns rely on self-reporting by GPs and/or LPs and are likely to suffer from sample selection biases. However, 85% of the data gathered by Preqin is collected via Freedom of Information Act requests and consequently should not be subject to such self-reporting biases.

Direct information about which exact fund each deal belongs to is only available in about a third of the cases (through Capital IQ). When this information is not available, we match a deal to the sponsor fund that was actively investing in the time period and region of the deal. We match 1,099 of our 1,157 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

Of our sample of 1,157 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 focus 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.[12] First, our sample selection relies on Dealscan for capital structure information, which mainly covers syndicated bank loans. Deals outside of the United States and Western Europe tend to be smaller and therefore rarely use syndicated

[10] We use the Senior Loan Officer Opinion Survey on Bank Lending Practices, which is conducted quarterly by the U.S. 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.

[11] We also use average spreads on leveraged loans for the U.S. and European markets over LIBOR, obtained from Standard & Poor's. We are only able to obtain these spreads 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. In addition, we reestimate our equations for our U.S. and European deals using local spreads with virtually identical results.

[12] 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.

loans. Second, our 1980s deals are taken from Kaplan (1989a, 1989b), 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 toward 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.

Further information on the sample is contained in the Internet Appendix.[13] In particular, we provide breakdowns of the sample across region, time, and type of LBO, as well as by country and industry. In addition to the United States, the United Kingdom and France are the most common countries represented. The sample is widely distributed across industries, with no one industry representing more than 10%. We also show 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 using 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 (EV) of £773.5 million. The purchase was financed using £191 million of equity (provided by funds advised by PAI) and £582.5 million of debt. The initial debt-to-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

[13] The Internet Appendix may be found in the online version of this article.

Table I

A Typical Private Equity Buyout: The August 2005 Purchase of Kwik-Fit

Kwik-Fit is a leading tire and exhaust-fitting company, operating in the United Kingdom, the 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 debt level 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 £95.9 million is the reference point. Pricing of the debt is expressed relative to 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 ×**
Equity	**191.0 (25%)**			**2.0 ×**
Debt				
Term Loan A	140	7-year amortizing	2.25%	
Term Loan B	135	8-year bullet	2.50%	
Term Loan C	135	9-year bullet	3.00%	
Total Senior Debt	*410.0*			*4.3* ×
Second Lien	75	9.5 years	5.00%	
Mezzanine	97.5	10 years	4.5% + 5% PIK	
Total Debt	**582.5 (75%)**			6.1 ×
Revolving credit facility	40	7 years	2.25%	
Capex facility	50	7 years	2.25%	

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 second lien tranche of £75 million, which was senior to a mezzanine tranche of £97.5 million. Second lien tranches started to appear in buyouts during 2004, and became a very common feature of LBO 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 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 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. Term Loan A is used in 62.2% of deals, whereas 89.3% use Term Loan B. The use of amortizing debt (Term Loan A) declined noticeably in the years leading up to the financial

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, whereas Term Loans B, C, and higher are typically nonamortizing. Subordinated debt can take a variety of forms including mezzanine and second lien debt. Similarly, bonds can be senior or high-yield junior bonds. 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, existing debt is paid off as part of the transaction, 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 put in place at the time of the LBO to fund working capital, capital expenditures, 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 do not include preferred equity or contingent debt in our calculations of leverage in subsequent tables.

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

crisis as lenders were increasingly prepared to lend on a nonamortizing basis. Table II also presents the fraction of debt financing accounted for by each type: Term Loan A averages 23.4% of total debt and Term Loan B 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, together representing 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 noncontingent debt, and contingent debt, such as revolving credit facilities, capital expenditure and acquisition lines of credit, and 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 drawdown of contingent debt would be concurrent with a subsequent investment in the firm, which in turn would involve a change in EV and EBITDA. As indicated in Table II, buyouts use substantial quantities of contingent debt; these additional facilities amount to nearly 18% of the value of total (noncontingent) 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 (i) the interest rate on these loans equals the local LIBOR rate plus the U.S. high-yield spread over U.S. LIBOR, and (ii) the debt is nonamortizing. Although these assumptions are somewhat arbitrary, they have very little impact on our results given the small fraction of total debt that 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 contains some very large deals; the average (median) LBO EV is just over $1.5 billion ($677 million) 2008 U.S. dollars 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 EV, and include the sample's largest deal, KKR's buyout of RJR-Nabisco (EV 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 $600 million in EV.

We use two different measures of leverage: total debt divided by earnings before interest and depreciation (D/EBITDA) and total debt divided by EV (D/EV).[14] Our main measure of deal pricing is EV divided by EBITDA. As expected, LBOs are indeed highly leveraged. The average deal in the sample

[14] 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 rerun our analysis for the subsamples with different sources, and our results are qualitatively the same.

Table III

Descriptive Statistics on LBO Leverage and Deal Pricing

This table shows the transaction value, amount of debt used, and 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	1,023	1514	677	3,582	1,009	8.2	7.6	3.3
Divisional	295	1,290	702	1,812	290	7.4	6.8	2.8
Private company	117	603	432	503	114	7.8	7.4	2.6
Public-to-private	365	2,343	829	5,543	362	8.8	8.0	3.8
Secondary	240	974	599	1,446	237	8.5	7.9	3.2
Privatization/ Bankruptcy	6	1,383	1,802	935	6	8.8	8.6	3.5
North America	630	1,654	639	4,226	625	8.5	7.7	3.3
Western Europe	387	1,282	721	2,186	378	7.8	7.4	3.2
Rest of World	6	1,660	1,877	1,011	6	8.5	8.9	2.7

	D/EBITDA				D/EV			
	N	Mean	Median	Std Dev	*N*	Mean	Median	Std Dev
All LBO transactions	1,142	5.6	5.2	2.4	1,002	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

raises 69% of its capital through debt of various forms and has a debt-to-EBITDA ratio 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 EV in 2008 U.S. dollars) having higher leverage and pricing multiples.

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 from publicly traded companies.

To evaluate the extent to which common theories explain leverage in public companies and LBOs, we compare leverage choices in our buyout 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, region (North America, Western Europe, Eastern Europe, Asia, or Australia), and Fama–French industry (using their 49-industry classification) as the LBO.[15]

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 1 year) minus cash and short-term investments. We estimate EV as the market value of equity plus long-term debt minus cash and short-term investments. We calculate the matched median 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.[16] We exclude public companies with negative EBITDA when calculating the industry-region-date median values of D/EBITDA and EV/EBITDA.

Panel A of Table IV reports results from an experiment in which we sort 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

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

[16] 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.

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 1,157 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 (United States, W. Europe, E. Europe, Asia, or Australia), and "matched public" are the median values among the public companies in each industry-year-region group. In Panel B, LBO leverage is predicted 5 years after the transaction date, estimated using repayment schedules. In Panel C, each LBO is matched to public companies in the same industry, date, and region whose long-term debt divided by debt plus book equity changed by more than 10 percentage points in absolute value in a given year ("public adjusters"). In Panel D, LBO leverage is sorted by the leverage in 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. Differences between the top and bottom quartiles are statistically significant at the 10% (*), 5% (**), and 1% (***) levels using a rank sum test.

	D/EBITDA		D/EV	
	LBO	Public Match	LBO	Public Match
Whole sample	5.1	3.8	0.70	0.35
Panel A: Sort by public median leverage				
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***
Panel B: Sort by predicted 5-year LBO leverage				
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***
Panel C: Sort by public adjusters				
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***
Panel D: Sort by pre-LBO leverage (public-to-private transactions only)				
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***
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***

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^2 of 0.004) and for D/EBITDA the relationship is slightly negative (with an R^2 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 generated by the firm 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 level 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 5 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 firm leverage (although predicted future LBO leverage ratios are 10% to 20% lower on average than at the time of the buyout).

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 structure, 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.[17] To address this possibility, we consider an alternative set of matched public firms: those that have significantly adjusted

[17] See, for example, Fisher, Heinkel, and Zechner (1989) and Strebulaev (2007) for theoretical models of costly adjustment, and Leary and Roberts (2005) for supporting empirical evidence for U.S. public companies.

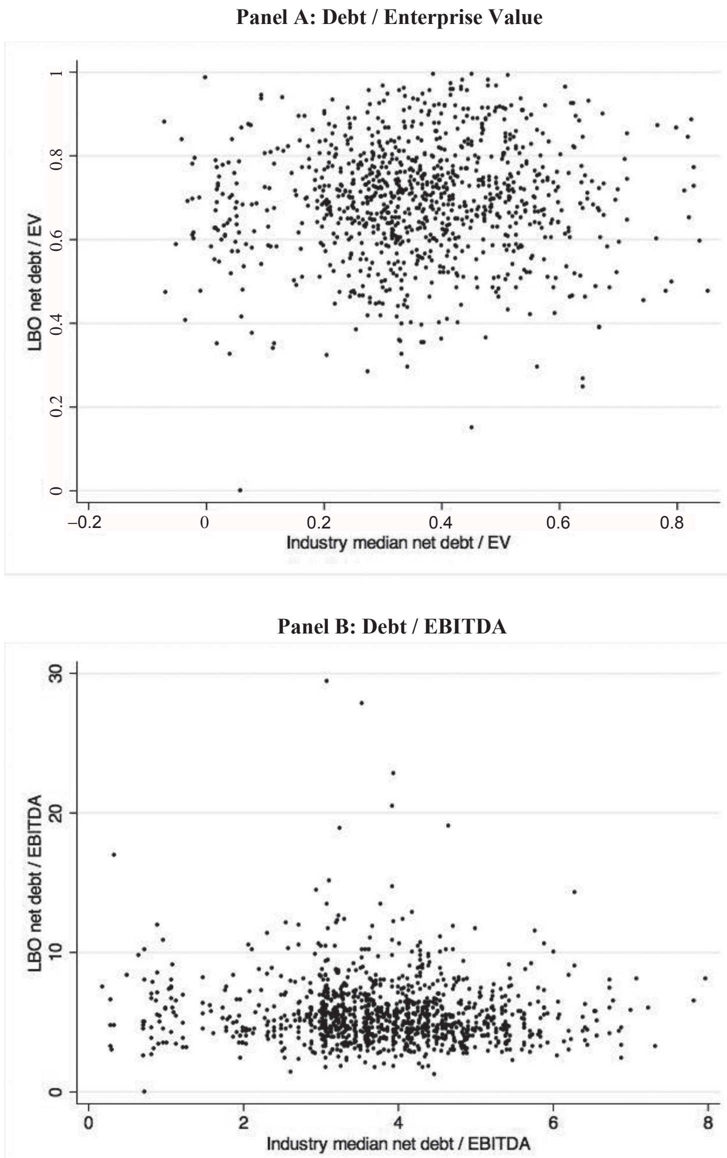

Figure 1. LBO versus public market leverage. This figure shows LBO leverage for the sample plotted against the median public company leverage in the same Fama–French 49 industry, year and month, and region (United States, Western Europe, Eastern Europe, Asia, or Australia) as the LBO. The sample excludes LBOs in the banking and insurance industries (Fama–French industries 45 and 46). In addition, Panel B excludes 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, and net debt (i.e., debt minus cash and short-term investments) to EBITDA in Panel B. For public companies, 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, net debt does not include contingent debt such as lines of credit.

their capital structures in a given year, with a change in debt to book assets of more than 10 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.[18]

Finally, and related to the previous point, there could be important 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.[19] 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 160 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. Panel D of Table IV sorts buyouts according to quartiles of pre-LBO leverage. For D/EBITDA there is no relation between pre-LBO and LBO leverage, whereas for D/EV there is a slightly positive and marginally statistically significant relation. 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, we find no systematic relation between the leverage of LBOs and comparable public companies. This lack of a relation does not appear to be due to measurement or matching issues; rather, LBO leverage appears to be determined by different factors from 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

[18] Another potential reason for the lack of a relation could be that public companies are averse to taking on debt because of agency problems (see Berger, Ofek, and Yermack (1997)). To address this potential explanation, we also match 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 the Internet Appendix, which makes similar comparisons using other variables, such as market-to-book ratios, sales growth, R&D-to-sales, profitability, etc.).

[19] For a sample of U.S. 1980s 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 Yim (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.

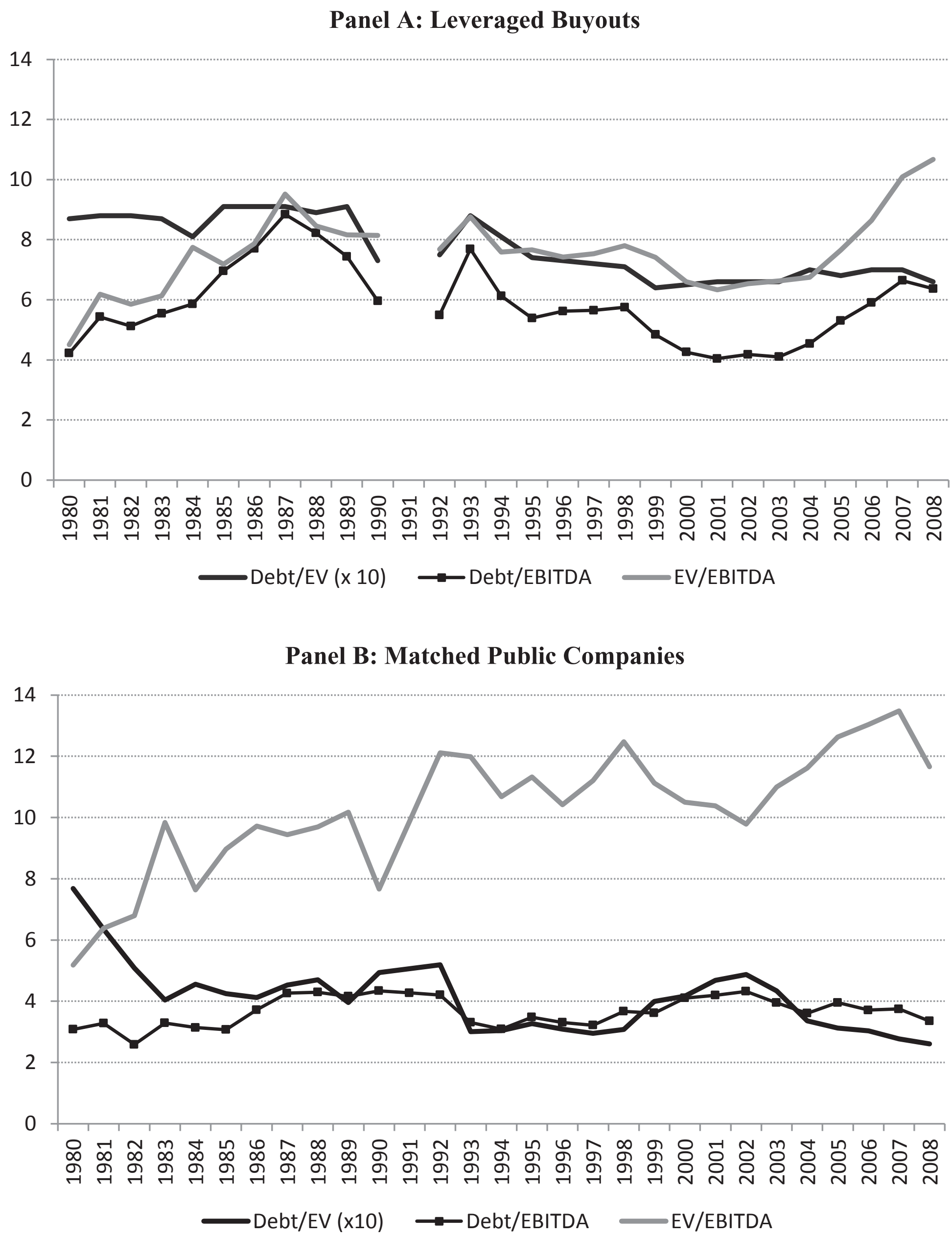

Figure 2. Market trends in leverage and pricing. The figure shows median values of net debt to enterprise value times 10, net debt to EBITDA, and enterprise value to EBITDA for a sample of 1,157 leverage buyout transactions (Panel A) and the corresponding median values for matched public companies (Panel B). Each leveraged buyout is matched to the median value for public firms in the same Fama–French 49 industry, month, and region (United States, Western Europe, Eastern Europe, Asia, or Australia). See Table V for definitions of all variables. There were no buyouts in 1991.

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 collapse of the junk bond market in 1989 to 1990 and the Internet crash in 2000 to 2001, whereas leverage peaks at the top of the business cycles in 1988, 1998, and 2007.[20] This pattern suggests that macroeconomic conditions affect LBO leverage in a highly procyclical 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 EV over our sample period, with an average D/EV of over 80% in each subperiod before 1994 and below 70% following 1995. One partial explanation for this trend is that many of the deals in the 1980s 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 procyclical pattern for buyouts, public company leverage is countercyclical, peaking in the early 1990s recession and again after the Internet crash in 2000 to 2001. The countercyclical leverage of public companies is consistent with other research, such as Korajczyk and Levy (2003) and Halling, Yu, and Zechner (2012). In addition, the strong 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 combined with the distribution of our sample over time (see the Internet Appendix) the impact of credit market conditions on the LBO market is immediately apparent. For instance, when the junk bond market collapsed in the early 1990s, and the high-yield rate peaked, LBOs essentially stopped occurring: our sample includes only seven LBOs over the period 1990 to 1993 inclusive. In the aftermath of the dot-com

[20] We have very few observations, between zero and three per year, for the 1990 to 1993 period. Therefore, the large movements in leverage and pricing over this period are not statistically reliable.

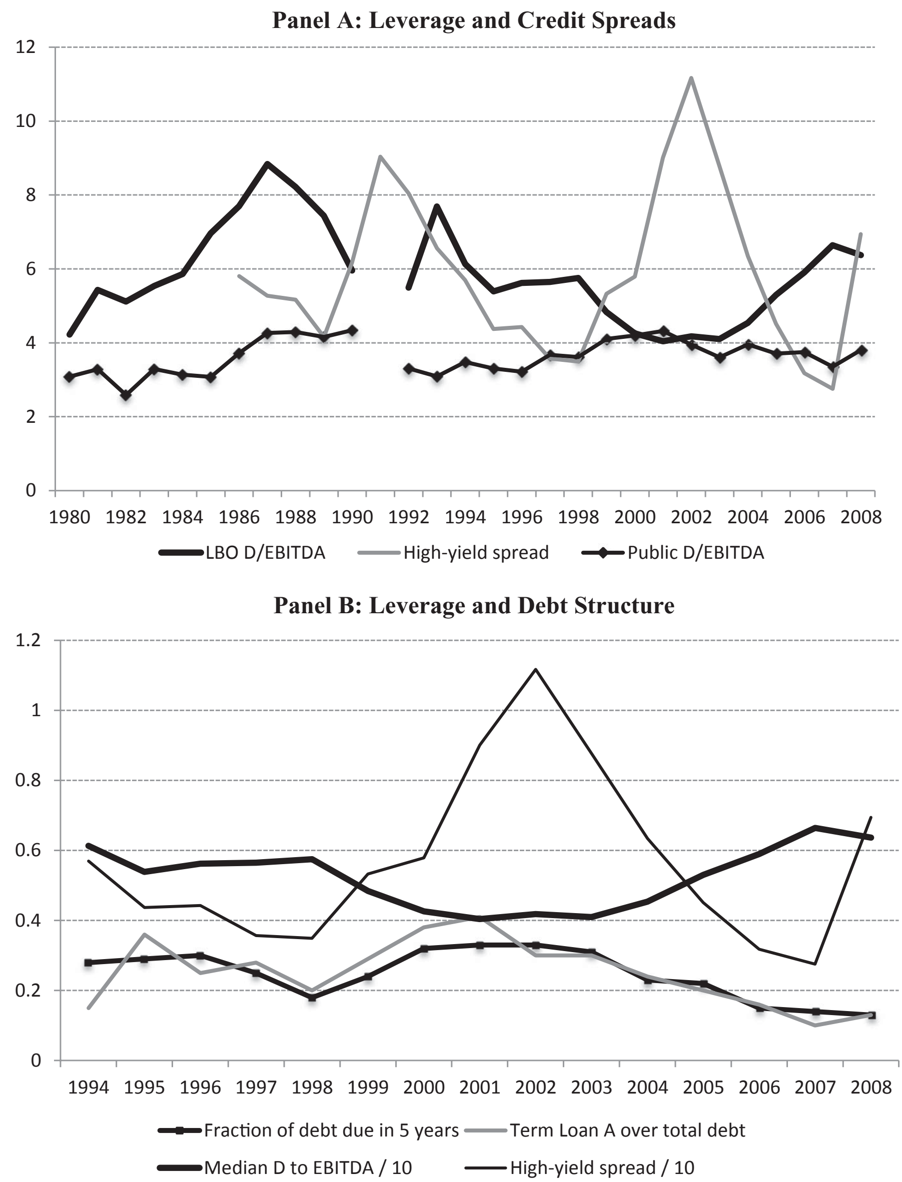

Figure 3. Leverage, credit spreads, and debt structure. This figure presents time-series data on average credit spreads (U.S. high-yield rate minus LIBOR), leverage, and debt structure. Panel A plots credit spreads against median Net Debt to EBITDA for a sample of 1,157 leverage buyout transactions and 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 (United States, 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 5 years or less) and the fraction of Term Loan A out of total LBO debt for the deals in our sample between 1994 and 2008.

bubble high-yield spreads hit 11% (in 2001) and leverage fell markedly, as did deal volume. When debt market conditions improve, as reflected in lower high-yield spreads, leverage tends to increase. This can be seen most dramatically in the credit boom that ended in 2007: spreads fell to around 3%, buyout leverage increased to around 6.5 times EBITDA (on average), and deal volumes and values increased to all-time highs.

In contrast, the relationships between leverage, valuation, and spreads are not apparent for public companies. If anything, leverage appears to decrease when debt becomes cheaper, and there is no obvious relationship between valuation and credit market conditions.

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 of Term Loan A tranches (amortizing debt held by banks) within total debt. We restrict the sample to deals since 1994, as 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, collateralized loan obligations (CLOs), and other nonbank financial institutions.[21] A very similar pattern is found for the fraction of total debt maturing in 5 years, with maturities being shortened when debt market conditions improve.

D. Cross-Sectional versus 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 from 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 examine this idea further 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.

[21] Consistent with this finding, Shivdasani and Wang (2011) find that, during hot credit conditions, CLOs provide a higher fraction of LBO credit, suggesting that the supply of nonbank debt fuelled LBO activity.

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 effects 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.

	(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***	−0.059***
				(−8.39)	(−7.68)
Industry FE	Yes	No	Yes	No	Yes
Country FE	No	No	Yes	No	Yes
Year FE	No	Yes	Yes	No	No
Observations	1,136	1,136	1,136	1,097	1,097
Adjusted R^2	0.033	0.254	0.291	0.157	0.193
	(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***	0.006*
				(3.95)	(1.75)
Industry FE	Yes	No	Yes	No	Yes
Country FE	No	No	Yes	No	Yes
Year FE	No	Yes	Yes	No	No
Observations	1,136	1,136	1,136	1,097	1,097
Adjusted R^2	0.713	0.019	0.755	0.009	0.752

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. This specification yields a very low adjusted R^2 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^2 of 0.25 (Model (2)). Adding the full set of dummy variables (industry, country, and year) only increases R^2 marginally, to 0.29 (Model (3)). Thus, time-series effects have explanatory power almost an order of magnitude larger 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^2 of 0.71), while year dummies explain very little (R^2 of 0.02).

Including the high-yield spread now yields a *positive* and significant coefficient, but a very low R^2 (less than 0.01). Hence, public leverage seems to be driven largely by cross-sectional variation rather than time-series effects.[22] 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 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 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.[23]

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 (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 5 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 (specification (3)), all industry characteristics are statistically 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

[22] We also considered whether the lack of time-series variation in the estimates for public firms is due to inertia by reestimating the equations using only public firms that actively adjust their capital structure. These results are presented in the Internet Appendix. We also perform this analysis on the full set of public company region-year-industry median D/EBITDA, instead of restricting the sample to industry-region-years in which 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 the United States and Western Europe over the full sample period, 1980 to 2008, for a total of 3,822 observations. The results are very similar: regressing public leverage on only year dummies leads to an R^2 of 0.04, while including only industry dummies produces an R^2 of 0.61.

[23] Replacing matched public medians with adjuster medians gives the same result.

Table VI

Descriptive Statistics for Regression Variables

This table shows descriptive statistics for the variables used in the regression analyses in Tables VII to 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. "Bank affiliated" means that the PE sponsor was a subsidiary of a commercial bank, investment bank, or insurance company. Fund return data are from Preqin in June 2009. "Preqin fund benchmark IRR" are average fund returns for funds of the same vintage, region, and market segment.

	N	Mean	Min	25th %tile	Median	75th %tile	Max
LBO characteristics							
LBO D/EV	1,002	0.69	0.00	0.61	0.70	0.78	0.99
LBO D/EBITDA	1,142	5.6	0.0	4.2	5.2	6.4	29.4
LBO log D/EBITDA	1,143	1.66	0.18	1.44	1.65	1.86	3.82
LBO EV/EBITDA	1,009	8.2	1.0	6.1	7.6	9.5	37.8
LBO log EV/EBITDA	1,009	2.04	−0.01	1.81	2.02	2.25	3.63
Macro variables							
U.S. high-yield spread	1,118	5.53	2.23	3.46	5.01	6.74	12.31
Capital Commitments/Stock M.V. (%)	1,068	0.53	0.01	0.346	0.435	0.684	1.24
Public							
D/EV	1,131	0.36	−0.11	0.26	0.35	0.47	0.85
log D/EBITDA	1,149	1.28	−1.67	1.14	1.34	1.52	3.64
log EV/EBITDA	1,130	2.48	1.65	2.29	2.45	2.62	3.90
M/B ratio	1,131	1.57	0.62	1.18	1.44	1.74	6.14
Sales/PPE	1,149	6.73	0.11	3.26	5.76	7.76	42.29
R&D/Sales	1,149	0.01	0	0.00	0.00	0.00	0.87
ROIC	1,149	0.10	−0.25	0.09	0.11	0.12	0.24
Volatility in ROIC	1,149	0.05	0	0.04	0.05	0.06	0.24
Public adjuster							
D/EV	1,033	0.35	−0.09	0.23	0.33	0.46	1.09
log D/EBITDA	1,125	1.40	−0.95	1.17	1.43	1.67	4.71
Private equity sponsor/fund							
Years since first fund raised	1,120	11.93	0	6	11	18	36
Investing through fund	1,157	0.95	0	1	1	1	1
Log no. of deals by sponsor last 3 years	1,154	3.05	0	2.48	3.04	3.74	5.77
Fund size, 2008 USD millions	1,059	3,773	17	1,092	2,395	4,861	23,047
Log fund size	1,059	7.71	2.83	6.99	7.78	8.49	10.05
Bank affiliated sponsor (dummy)	1,157	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	1,079	1.40	0	0.69	1.39	1.95	3.09
First-time fund (dummy)	1,079	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% (***).

	(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***	−0.010***	−0.005	−0.058***	−0.050***
	(−7.94)	(−3.41)	(−1.49)	(−6.72)	(−8.09)
Industry median log net debt/EBITDA	−0.044				−0.021
	(−1.59)				(−1.36)
Industry median net debt/EV		0.072*			
		(1.97)			
Industry median Market/Book			−0.148***	−0.002	
			(−5.04)	(−0.12)	
Industry median Sales/PPE			0.004**	0.001	
			(2.73)	(0.39)	
Industry median R&D/Sales			−1.732**	0.052	
			(−2.22)	(0.22)	
Industry median ROIC			−4.129***	0.238	
			(−6.89)	(0.55)	
Industry median earnings volatility			−13.301***	0.886	
			(−11.72)	(1.58)	
Western Europe			0.084**	−0.065**	−0.043
			(2.13)	(−2.24)	(−1.63)
Rest of World			−0.046	−0.070	−0.107
			(−0.53)	(−0.61)	(−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 years					−0.015
					(−0.83)
Log fund size, USD 2008					0.023
					(1.43)
Bank affiliated					0.046
					(0.91)
Observations	1,097	944	1,091	1,078	923
Adjusted R^2	0.159	0.031	0.608	0.161	0.312

with previous literature, public leverage is decreasing in profitability, which is inconsistent with the trade-off theory and 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 (specification (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 potential concern could be that the firms targeted for LBOs are different from the rest of the industry, and that they may have different characteristics from the median industry firm. To address this issue, we reestimate the equations in Table VII on the subsample of public-to-private deals, except 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 the Internet Appendix. Again, these estimates indicate that firm characteristics do not affect buyout leverage in the way they do for public firms, and the high-yield spread is the only consistent predictor of buyout leverage. The results also 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 private equity 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 (Demiroglu and James (2010) and Ivashina and Kovner (2011)) presents 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 private equity firm and the number of transactions undertaken during the last 3 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 private equity investors do not use fund structures (e.g., such as evergreen funds and publicly traded private equity firms) we also include a dummy for whether the private equity firm invests through a fund. Finally, we include fund size and a variable indicating whether the private equity firm is affiliated with 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 private equity variables are statistically significant, with the exception of the dummy for whether the private equity 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.[24] Deal size, however, is an important determinant of LBO leverage. Larger deals (measured by EV 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 market-timing and agency explanations for buyout leverage is that buyers will pay more for deals when debt market conditions are favorable, which we examine in this subsection.

Our measure of deal pricing is EV 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 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 peaks (as in the late 1980s, in the late 1990s, or in 2006 to 2007), pricing multiples peak as well. Panel B of Figure 2 shows that this positive relation 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 is related to the high-yield spread. The results in these columns indicate that the spread has a negative and statistically significant impact on prices of both buyouts and public firms. Comparing the coefficients, however, the negative magnitude is significantly larger for the LBO multiple than the public

[24] We tried measuring reputation a number of different ways, none of which have much explanatory power. For example, instead of using absolute measures we calculated the relative ranking of the sponsor according to these measures at the time of the deal, normalized between zero and one, 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 also tried using dummy variables for whether the sponsor was relatively highly ranked according to these measures.

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.

	(1) LBO log EV multiple	(2) Public log EV multiple	(3) LBO log EV multiple	(4) LBO log EV multiple	(5) LBO log EV multiple IV HiYld	(6) LBO log EV multiple IV TermA
High-yield spread	−0.048***	−0.026***	−0.045***	−0.034***		
	(−6.86)	(−6.07)	(−6.06)	(−5.97)		
Log LBO D/EBITDA					0.656***	0.808*
					(8.68)	(1.93)
Public EV multiple			0.106**	0.104**	0.126***	0.130***
			(2.23)	(2.47)	(6.18)	(3.06)
Western Europe				−0.074***	−0.034	−0.015
				(−2.90)	(−1.49)	(−0.34)
Rest of World				−0.097	−0.039	−0.023
				(−0.80)	(−0.56)	(−0.29)
Private company				0.075**	0.071**	0.070**
				(2.24)	(2.66)	(2.32)
Privatization/Bankruptcy				0.158	0.354***	0.397**
				(1.23)	(2.85)	(2.26)
Public-to-private				0.107***	0.025	−0.020
				(3.96)	(0.97)	(−0.21)
Secondary				0.116***	0.071***	0.052
				(6.05)	(6.69)	(1.07)
EV quartile 2				0.092**	0.022	0.002
				(2.33)	(1.18)	(0.04)
EV quartile 3				0.200***	0.041*	0.000
				(7.85)	(2.06)	(0.00)
EV quartile 4				0.276***	0.063**	0.012
				(10.41)	(2.35)	(0.08)
Constant	2.433***	2.728***	2.028***	1.789***	0.589***	0.363
	(27.59)	(22.56)	(19.50)	(18.09)	(4.91)	(0.72)
Industry and country fixed effects	Yes	Yes	No	No	No	No
Observations	970	1,091	951	951	949	985
R^2	0.233	0.612	0.123	0.235	0.631	0.631

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. As we discussed earlier, time variation in economy-wide discount rates could explain our findings that both leverage and pricing in buyouts are negatively related to debt market conditions. Therefore, before we can conclude that debt market conditions have an independent effect on LBO pricing, it is important to control econometrically for changes in discount rates. In 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. In contrast to the leverage equations, 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 largely 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 (EV) 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 adequately controls 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, in Model (6) the fraction of debt that is Term Loan A is used 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 do for leverage, we also reestimate the regression analysis of pricing in the Internet Appendix 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 Estimates of Leverage

Our results thus far suggest that time-series variation in debt market conditions affect both leverage and pricing in buyouts. One potential concern with 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 macroeconomic 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 autocorrelated 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 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 the fourth quarter of 1993, leading to 59 quarterly observations. We control for autocorrelation using the Newey–West (1987) correction with 12 quarterly lags. We also include one specification (Model (3)) with annual observations starting in 1986, where we have interpolated the values for 1991 as the average of 1990 and 1992 values, since we had no buyout observations in 1991. In this specification, we use three lags to perform the Newey–West correction when calculating the standard errors.

In the first model, we use a parsimonious specification where we estimate buyout leverage 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, with the magnitude of the coefficient being almost identical to the equations estimated using panel data reported earlier.

In Models (2), (3), and (4), we add a number of additional macroeconomic variables in addition to the high-yield spread, each measured at the quarterly frequency: U.S LIBOR rate, U.S. inflation over the previous 12 months, U.S. term spread (the 10-year Treasury bond rate minus the corresponding 3-month T-bill), and U.S. GDP growth.[25] In the quarterly specification, the only statistically significant variable predicting buyout leverage is the high-yield spread, whereas in the annual specification LIBOR and the term spread have a slightly positive effect on leverage. The main variable affecting buyout leverage in both the annual and the quarterly specifications is still the high-yield spread. These results suggest that it is primarily 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.

[25] We also estimate these equations separately for the United States and Europe, using European macroeconomic variables for the latter, with very similar results.

Table IX

Determinants of Leverage and Pricing: Time-Series Specifications

This table shows the results from time-series regressions of median leverage (log D/EBITDA) and valuation (log EV/EBITDA) of LBOs and matched public companies. All specifications except Model (4) use quarterly data between 4Q 1992 and 2Q 2008. Specification (4) uses yearly data between 1986 and 2008, where 1991 values have been interpolated. Explanatory variables are the U.S. high-yield bond spread over 3-month U.S. LIBOR ("US High-Yield – LIBOR"), U.S. 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 (three yearly) lags are reported in parentheses. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

	(1) LBO Log D/EBITDA	(2) LBO Log D/EBITDA	(3) Public Log D/EBITDA	(4) LBO Log D/EBITDA	(5) LBO Log D/EBITDA	(6) LBO Log D/EBITDA	(7) LBO Log D/EBITDA	(8) LBO Log EV/EBITDA
U.S. LIBOR		−0.005	−0.041***	0.068*	0.016	0.037*	−0.003	−0.032**
		(−0.18)	(−3.27)	(2.04)	(0.74)	(1.74)	(−0.14)	(−2.50)
U.S. 12-month rolling inflation		0.025	−0.018	0.048	0.044	−0.007	−0.009	−0.055**
		(0.62)	(−1.04)	(1.21)	(1.37)	(−0.18)	(−0.19)	(−2.01)
U.S. High-Yield−LIBOR	−0.055***	−0.059***	0.031***	−0.067***			−0.037**	
	(−10.39)	(−3.69)	(4.39)	(−2.92)			(−2.31)	
U.S. 10 years−3 months Treasury		0.016	−0.080***	0.132**	−0.045	−0.011	−0.013	−0.079***
		(0.67)	(−9.22)	2.41	(−1.46)	(−0.48)	(−0.54)	(−3.23)
U.S. GDP growth		0.015	−0.012**	0.005	0.022	0.019	0.019	−0.002
		(0.88)	(−2.48)	(0.11)	(1.30)	(0.96)	(1.03)	(−0.47)
Fed credit tightening index					−0.005***			
					(−3.15)			
S&P earnings yield−U.S. 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***	1.840***	1.900***	1.404***	1.438***	1.645***	1.609***	0.931***
	(40.86)	(7.46)	(33.90)	(7.17)	(8.55)	(9.29)	(7.45)	(4.36)
Adjusted R^2	0.310	0.304	0.329	0.538	0.243	0.320	0.312	0.782
Observations	59	57	57	22	57	57	57	57

Models (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 nonprice 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, with a larger value of this variable indicating that equity is relatively “cheap” compared to high-yield bonds. Consistent with this interpretation, Model (6) shows that fluctuations in this measure are significantly positively related to changes in buyout leverage levels. Model (7) splits this measure into its two parts, the S&P earnings-to-price ratio and the high-yield spread, and in this equation both of these variables are statistically significant predictors of leverage. 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 is that they are better at optimizing leverage in a world in which something like the trade-off theory held, we would expect that at least some proxies for the 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 those that actively manage their capital structure) 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 earlier than with those 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, depends on 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 that 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 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 the risk-adjusted excess return to a buyout fund investment under the assumption that the market beta of the fund is one; this is clearly a simplification but roughly in line with estimates of the beta of private equity investments.[26,27]

Fund cash flow data necessary to calculate PMEs are available from Preqin for 648 private equity funds 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 are not available. Nonetheless, we have a reasonably large sample of fund returns, and detailed information on approximately 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

[26] 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, Lin, and Phalippou (2012), and Korteweg and Sorensen (2010) for a discussion of the issues involved.

[27] The results are similar if we measure returns as IRRs instead of PMEs.

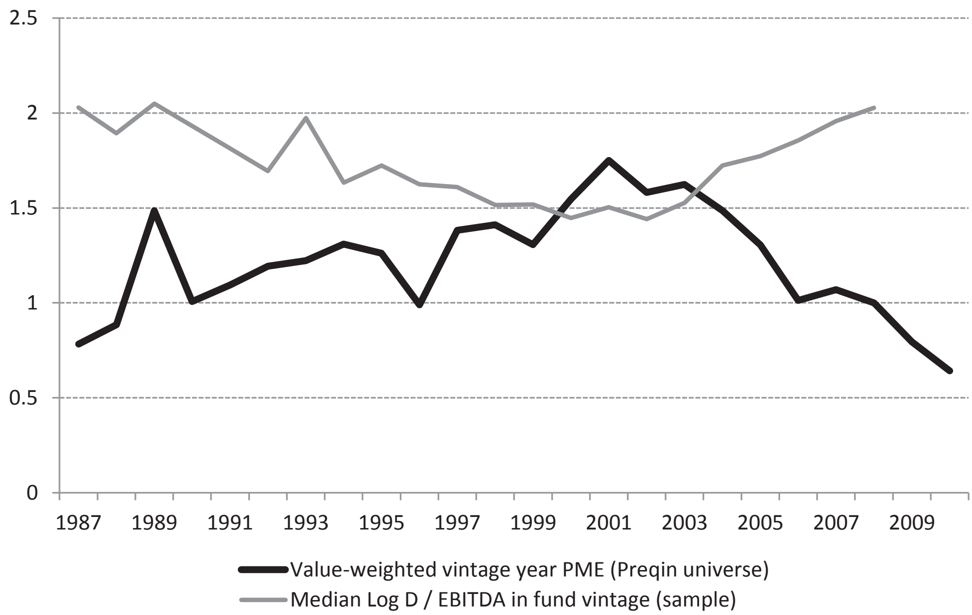

Figure 4. Fund vintage performance and credit spreads. This figure plots the value-weighted vintage year public market equivalent (PME) measure for buyout funds in the Preqin universe against median log net debt to EBITDA for deals in our sample that can be attributed to a certain fund vintage (982 of 1,157 deals satisfy this criterion). Value weighting is by size of funds raised. The benchmark public portfolio used for calculating the PME 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).

year a fund was raised.[28] LBO leverage and subsequent fund returns are found to be negatively correlated; high leverage for funds in a given vintage year 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 that predicts that leverage should have a strong effect on returns. This effect, 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) and Robinson and Sensoy (2012), private equity returns are negatively related to

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

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 of 1,157 deals satisfy this criterion). "Median Deal Log EV/EBITDA" is the median pricing (measured as log of enterpise value to EBITDA) for deals in our sample that can be attributed to a certain fund vintage (862 of 1,157 deals). "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 United States in a certain vintage year as a fraction of total U.S. 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 are displayed in the table (in parentheses) where *t*-statistics are calculated using Newey–West corrected standard errors with two lags. Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

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

the amount of money flowing into the PE industry (as measured by aggregate U.S. fundraising in a given vintage year from Private Equity Analyst divided by U.S. 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 database 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 25^{th} percentile to the 75^{th} percentile (log of debt to EBITDA going from 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 leads them 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, 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 the 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 to 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 the 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.[29] 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

[29] 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.

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 (in parentheses) are 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 (2011) and Petersen (2009) (using Mitchell Petersen's "cluster2"-command in STATA). Coefficients are statistically significant at the 10% (*), 5% (**), and 1% (***) levels.

	Dependent variable: Fund PME						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Deal Log D/EBITDA		−0.237***	−0.333**	−0.166**			−0.123*
		(−2.70)	(−2.46)	(−2.26)			(−1.89)
Deal Log D/EBITDA, predicted					−0.741***	−0.846***	
					(−2.75)	(−2.98)	
Deal Log D/EBITDA, residual					−0.166**	−0.163*	
					(−2.26)	(−1.71)	
Deal Log EV/EBITDA			0.058				
			(0.61)				
High-yield bond spread over LIBOR				0.035**			
				(2.17)			
Capital Commitments/Stock Market Value	−0.611***	−0.531***	−0.529***	−0.411***	−0.411***	−0.409***	−0.237*
	(−9.53)	(−8.03)	(−7.25)	(−3.85)	(−3.85)	(−4.07)	(−1.80)
Log fund size, 2008 USD	0.005	0.013	0.026	0.002	0.002	0.007	0.011
	(0.10)	(0.23)	(0.48)	(0.04)	(0.04)	(0.16)	(0.20)
Log fund sequence number	0.010	0.021	0.016	0.019	0.019	0.019	0.013
	(0.12)	(0.28)	(0.22)	(0.28)	(0.28)	0.314	0.194
First-time fund	0.340*	0.337*	0.325*	0.358**	0.358**	0.380*	0.380**
	(1.92)	(1.90)	(1.77)	(2.06)	(2.06)	(1.90)	(2.45)
PME in previous fund	0.266***	0.268***	0.274***	0.279***	0.279***	0.276***	0.276***
	(2.97)	(3.07)	(3.25)	(3.22)	(3.22)	(3.31)	(3.08)
Constant	1.262***	1.534***	1.461***	1.236***	2.376***	2.392***	1.366**
	(3.77)	(4.90)	(4.57)	(4.15)	(4.45)	(4.85)	(2.20)
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^2	0.203	0.238	0.262	0.263	0.263	0.294	0.293

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. To do so, we split leverage into the component explained by variation in debt markets and residual leverage. Specifically, we first estimate a regression of log D/EBITDA on high-yield spreads and use 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 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 more competitive 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 an alignment of interests 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 nontraded 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, Strömberg, and Weisbach (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 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 indicate that the prices that 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 1,157 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. We find no cross-sectional relation 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 LBO 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 driven almost entirely by time-series variation related to debt market conditions. In contrast, public company leverage is mostly driven by differences in firm characteristics. 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 from that of 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, Strömberg, and Weisbach (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 GPs 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 the capital structures of private equity firms and public firms highlight the fundamental link between the contractual structure of an organization and the way it raises capital. Understanding the way in which an organization's design 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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