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How do sophisticated investors structure debt?

Establishing a link between debt heterogeneity, leverage and equity returns in leveraged buyouts

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ABSTRACT

Responding to calls for research into debt heterogeneity, this thesis explores, in the context of private equity-backed leveraged buyouts, the drivers of debt structure, its impact on leverage, and, in turn, the relationship between leverage and outcome measures such as equity returns. We propose a novel conceptual framework that ties together these aspects, and which unifies diverse debt structure elements, such as seniority, security, covenants, and instrument, on an 'aggressiveness' dimension. Testing the major implications of the proposed framework using multivariate quantitative methods, including OLS and 2SLS, and duly attempting to accommodate endogeneity concerns we find that i) sensitivity of buyout targets to agency problems leads to more defensive debt structures, ii) more aggressive debt structures allow for higher deal leverage, possibly because of so-called clientele effects, iii) higher leverage causes higher buyout pricing as general partners at PE firms are incentivised to use excessive leverage and overpay for deals when credit markets are hot, iv) leverage predicted by credit conditions impact equity returns negatively, while residual leverage is positively related to equity returns, and v) no clear relationship exists between leverage and the probability of financial distress.

Table of Contents

Chapter 1: Introduction 1

1.1 Problem statement and research questions 4

Chapter 2: Background to the thesis 5

2.1 The private equity industry 5
2.2 Debt structure in leveraged buyouts 10

Chapter 3: Case Study - The 2005 leveraged buyout of TDC 17

3.1 Background to the transaction 17
3.2 Deal financing and debt structure 17
3.3 Strategic initiatives and financial performance 20
3.4 Exit and return analysis 21

Chapter 4: Literature review and theoretical framework 25

4.1 Theoretical background 25
4.2 Hypothesis 1&2: What drives debt structure and how PE-funds structure buyout debt to maximize leverage 31
4.3 Hypothesis 3&4: How leverage affects buyout pricing and PE-fund returns 40

Chapter 5: Data collection and representativeness 45

5.1 Data sources and sample selection 45
5.2 Sample characteristics and representativeness 47
5.3 Handling outliers and missing observations 50
5.4 Quantitative methods and assumptions 53
5.5 Philosophy of Science and our approach to deriving knowledge 55

Chapter 6: Results and analysis 57

6.1 Drivers of debt structure 57
6.2 Debt structure's influence on leverage ratios 68
6.3 Leverage's impact on pricing 74
6.4 Leverage's impact on returns 86
6.5 Robustness considerations: Multicollinearity and entity and time controls 95

Chapter 7: Discussion of results 103

7.1 Debt structure and leverage 103
7.2 Leverage and outcomes 107

Chapter 8: Practical implications 113

Chapter 9: Limitations and suggestions for future research 115

9.1 Limitations relating to delimitations of the research subject 115
9.2 Limitations relating to measurement error 115
9.3 Limitations relating to the choice of quantitative methods 116

Chapter 10: Conclusion 119

References 122

Appendix A: Distribution of sample leverage 127

Appendix B: Literature review - Early capital structure theory 128

Appendix C: Literature review - Introduction to the lines of research dealing with different debt structure elements 132

Appendix D: Menu of debt structure alternatives 137

Appendix E: Definition of variables and overview 138

Appendix F: Preview of data set 143

Appendix G: Regression output - Drivers of debt instruments 144

Appendix H: Regression output - Drivers of debt characteristics 145

Appendix I: Regression output - Debt instruments' impact on leverage 146

Appendix J: Regression output – Debt characteristics' impact on leverage 147

Appendix K: Regression output – Leverage's impact on returns 148

Appendix L: Regression output – Likelihood of financial distress 149

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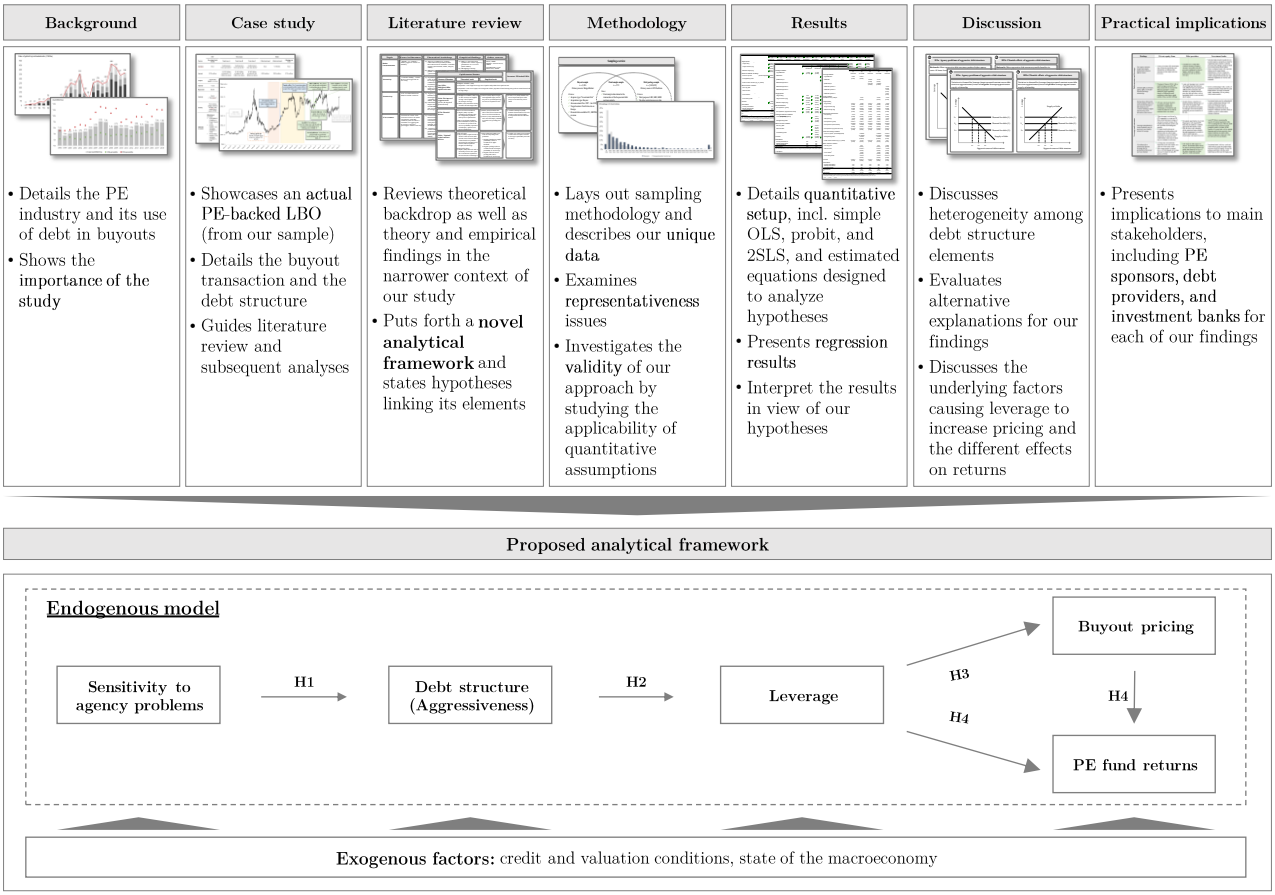
Chapter 1: Introduction

Private equity investors are often considered a class of 'sophisticated investors' which has led several authors to study their behaviour in an attempt to extract teachings about optimal behaviour (e.g. Cronqvist & Fahlenbrach, 2013). The sense of sophistication associated with private equity stems from their ability to consistently (notwithstanding a few booms and busts) generate superior risk-adjusted returns compared to the broader public equity market (Kaplan & Strömberg, 2009). The aspect of private equity (PE) behaviour that this thesis aims to explore is their financial policies with regard to debt structure, its drivers, its impact on deal leverage, and deal leverage's relation to equity returns. In order to do this, we propose a novel conceptual framework and hand-collect a unique data set of 972 leveraged buyouts backed by PE firms and the debt structure of these buyouts which allows us to test the major relations of our proposed framework. In the following paragraphs, we briefly introduce the essence of the theoretical background for our study, the proposed framework, our data, and the way we go about testing the framework. Figure 1.1 outlines the structure of the thesis and the proposed analytical framework.

Figure 1.1: Parts to the thesis and analytical framework



Clearly, a fairly extensive body of literature exists dealing with aggregate capital structure, starting with Modigliani and Miller's (1958) famous propositions of capital structure irrelevance. Researchers

have since introduced various imperfections, including the tax benefits of debt (e.g. Bull, 1989; Knauer, Lahmann, Pflücke, & Schwetzler, 2014; Miller, 1977), financial distress costs (Andrade & Kaplan, 1998; Warner, 1977), and agency benefits and costs of debt (Jensen, 1986; Jensen & Meckling, 1976). These nuances have subsequently been condensed into the trade-off theory whose normative implication is that optimal aggregate capital structure should vary cross-sectionally as variables, such as asset tangibility and growth opportunities, determine the intersection of marginal tax benefits and cost of financial distress (Myers, 2001).

More recently, however, Rauh and Sufi (2010) criticized previous research's focus on aggregate debt and its homogenous treatment of all debt. While this focus has allowed building out tractable theories, traditional capital structure literature has failed to properly account for aspects such as seniority, security, covenants, and investor-base of different debt products, all of which produce differences in cash flow claims, risk, information sensitivity, and incentives for managers and equity-holders. These features have been studied in a separate, scattered body of literature (Appendix C provides a review). Nonetheless, the way that these features are structured in buyout financing seems to be the product of conscious choice with PE firms' general partners deliberately structuring debt to attain as much deal leverage as possible given the prevailing credit conditions (Rizzi, 2016).

The first part of our analysis is devoted to studying, in the context of debt packages raised by PE firms to finance LBOs, 1) what drives debt structure and 2) how debt structure relates to overall leverage. The thesis proposes a novel framework that defines debt structure in terms of its *aggressiveness*. An aggressive debt structure, to be defined in detail in Chapter 4, is one that is multi-tiered with both senior and subordinated and secured (first and second lien) and unsecured debt pieces that provide little covenant protection and which is distributed widely ("public debt"). Alternatively, a defensive structure is all senior secured (first lien only) bank debt with extensive covenant protection. We will argue that a more aggressive debt structure provides minimal protection against agency problems and may itself be associated with agency costs. A normative implication of our framework is that buyout targets less sensitive to agency problems (e.g. those where business risk is lower, and profitability is higher) will have higher optimal debt structure aggressiveness as they have less need for protection via a defensive debt structure and can afford to subject themselves to the agency cost of an aggressive structure. This hypothesis, formulated formally in Section 4.2, is tested in Section 6.1 where we find some evidence that proxies for agency problem sensitivity is a driver of debt structure.

We go on to study how debt may be structured so as to attain higher aggregate leverage. Two opposing arguments are identified in the literature. On the one hand, a defensive debt structure provides protection against agency problems. Given that, as argued by Jensen and Meckling (1976), high leverage is associated with agency problems such as asset substitution, we expect a defensive debt structure to be beneficial in bringing about higher leverage as it may stop agency costs from increasing exponentially. On the other hand, as a corollary to the tax clientele effects of traditional capital structure theories (Elton & Gruber, 1970; Kalay, 1982), different lenders/debt investors may have

different demand characteristics due to e.g. preferences or regulation. As such, it may be beneficial to 'tranche' the debt structure, i.e. decompose it into different instruments with different characteristics leading to different risk-return properties, in order to target multiple investor bases. Based on these two arguments, alternative hypotheses are put forth in Section 4.2 and tested in Section 6.2.

The second part of our analysis looks at the consequences that leverage has on buyout pricing and PE performance. Two very different views have dominated the research agenda on this topic, and it is an objective of this thesis to provide further clarity in this regard. The first view, which builds on the notion that PE firms are sophisticated investors, holds that these acquirors time the market in determining the financing structure of leveraged buyouts (Engel, Braun, & Achleitner, 2012). Intuitively, when credit conditions are favourable, PE firms should optimally have higher deal leverage according to the market-timing hypothesis. The second view, represented by Axelson, Strömberg, & Weisbach (2009), holds that in the principle-agent relationship between general and limited partners (GPs, respectively, LPs) of a PE firm, certain misalignments caused by incentive structures may cause agency problems (denoted here as *intra-PE* agency problems). Specifically, the GPs' compensation will be based on carried interests which are convex and option-like with respect to the returns of the PE fund. The raising of ex-post debt to finance leveraged buyouts subjects the GPs' investment decisions to a standalone evaluation by debt capital markets and restrain GPs ability to engage in overly risky, bad investments. However, when credit conditions are very strong, and lenders are too eager to provide capital at relaxed terms, this ex-post evaluation system may start to fail, and GPs will be incentivized to lever up and potentially over-pay for deals (Axelson, Jenkinson, Strömberg, & Weisbach, 2013).

In terms of the relations studied here, both views have the same implication for the relation between leverage and buyout pricing. Under the market-timing hypothesis, firms will use a greater amount of leverage when credit is easy and, in so doing, obtain lower average costs of funding (Engel et al., 2012). LBO value creation is likely to be appropriated in part by the target via purchasing prices (Knauer et al., 2014). The mechanics under the PE-intra agency problem view is somewhat different but leads to the same conclusion; excessive leverage during periods of easy credit finances overpayment for risky buyout bets (Axelson et al., 2013). While the implications on buyout pricing are theoretically similar, they are normatively different. These differences become apparent in the relation between leverage and PE equity returns. Here, the market-timing hypothesis suggests that PE firms will be able to earn higher returns via higher leverage when credit conditions are favourable (Engel et al., 2012). The appropriation of value by GPs under the intra-PE agency hypothesis, however, implies that higher leverage will be associated with lower returns (Axelson et al., 2013). Section 4.3 elaborates on the existing literature on the relations between leverage, on the one hand, and buyout pricing and returns on the other hand and proposes testable hypotheses. Section 6.3 and 6.4 present results of such tests.

To analyse the relations stated above, we collect a cross-sectional data set at the deal-level (leveraged buyout) containing information about the target, the acquiring PE firm and fund, and valuation/pricing of the buyout. To this data, we add information, at the facility level, on the debt

structure of the buyout. As such, our final data set includes information about all the debt instruments (where information is public) used to finance a buyout and their contractual and structural characteristics, incl. seniority, security, covenants, and pricing (cost of debt). Lastly, information about fund-level returns is sampled to relate debt structure and leverage to subsequent performance.

Our analysis will rely on a variety of simple and more complicated quantitative methods to estimate the equations measuring the relations presented above. In addition to simple OLS regressions, probit regressions are used in Section 6.1 to estimate the effect on the probability of the presence of various debt structuring elements of our explanatory variables. Section 6.3 also utilize 2SLS instrumental variable regressions to deal with problems of simultaneity. Moreover, the way that the story was told above, and in the literature, the variation in leverage and relevant outcome measures, incl. buyout pricing and fund returns, come about as a consequence of variation in credit conditions in the first instance. To nuance our analysis, we will separate the variation in leverage into the part explained by credit conditions and an unexplained part, and then estimate each components' effect on PE equity returns. In so doing, we find some evidence for the intra-PE agency view, but at the same time, our results suggest that other effects of leverage on returns are present. Chapter 7 discusses our findings while Chapter 8 and Chapter 9 puts forth, respectively, practical implications and limitations.

1.1 Problem statement and research questions

Above, we briefly introduced the basic problems, i.e. the importance of debt heterogeneity and its impact on overall capital structure as well as capital structure's relation to outcome measures and laid out how the thesis attempts to analyse these. Here, we formally outline the heart of the problem in the following problem statement:

> Little existing literature acknowledges debt heterogeneity and no encompassing framework exists for the understanding of debt heterogeneity and its relation to outcome measures, such as performance. Clearly, leverage plays a central role in such a relation and, on this topic, previous literature has failed to come to an agreement on leverage's impact on fund returns with some arguing for a positive while others arguing for a negative relationship. Accordingly, there is a need for a theoretically motivated framework that recognizes heterogeneity in debt structure and suggests links between debt structure, leverage, and equity-level outcome measures as well as an empirical settlement of the disputing hypotheses.

As a further tool to guide the forthcoming literature review, adopted methodology, and empirical analysis, the following research questions are provided,

> *Q1: What drives private equity firms' choice of debt structure in LBOs and how does debt structure affect the amount of leverage obtainable?*
>
> *Q2: How does leverage relate to LBO outcomes, including valuation at buyout and subsequent equity performance?*

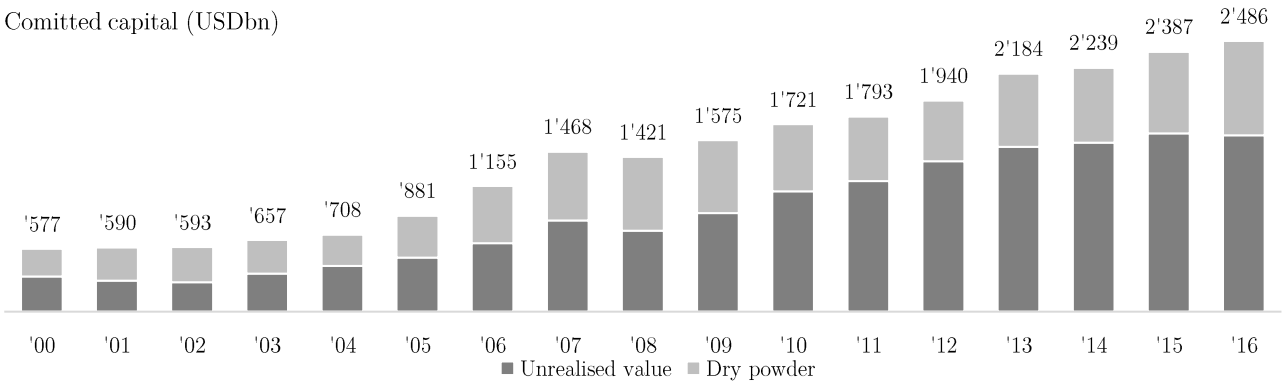
Chapter 2: Background to the thesis

The following section provides a brief introduction to the PE industry and the different debt instruments and their characteristics typically used in a leveraged buyout. Section 2.1 will cover the structure of PE firms and funds, a typical leveraged buyout and the value drivers behind as well as historical returns. Section 2.2 introduces the different debt instruments used in a leveraged buyout and their characteristics and presents output from the sample of the use of such instruments in a historical perspective. Finally, a case study of the 2005 TDC public-to-private transaction is presented in Chapter 3 which aims to give a practical introduction to the different parts of a leveraged buyout.

2.1 The private equity industry

The term 'private equity' refers to investment funds specialized in investing in private assets, and covers funds with different investment strategies such as buyout funds, venture capital, turnaround funds, real estate, infrastructure, natural resources etc. Here, we will refer to funds specialised in leveraged buyouts when we refer to the PE industry. Buyout funds is the largest segment within the PE industry, with almost USD 2.5tn in committed capital in 2016 (Preqin, 2017), and has received more attention from academics than other areas of private equity (see, for example, Axelson et al., 2009; Ivashina & Kovner, 2011; Jensen, 1989; Kaplan & Strömberg, 2009). A leveraged buyout (LBO) refers to a transaction in which a company is acquired using a relatively small amount of equity and a large proportion of debt financing. One obvious reason for using a large portion of debt in financing the acquisition is that leverage exaggerates returns, albeit in both directions. As will be discussed in Section 4.1, other theories on the benefits of debt financing have been put forth such as minimising agency costs and increasing the tax shield from interest rate payments.

Figure 2.1: Committed capital for global buyout funds split between unrealised value and dry powder



Source: Preqin (2017)

LBOs were first introduced in the 1960s but gained widespread propagation in the 1980s with the introduction of the 'junk' bond market, which allowed PE firms to raise debt from a broader investor base, making financing LBOs much easier and cheaper for PE firms. LBOs and the PE industry also received widespread public attention in the 1980s following large hostile takeovers where public

companies were taken private using considerable amounts of leverage. One of the largest and most scrutinized LBOs was the public-to-private buyout of RJR Nabisco in 1988 by Kohlberg Kravis Roberts & Co. At USD 25bn, the buyout was the largest at the time and became a preeminent example of corporate greed and created some scepticism toward the PE industry among the general public.

After the junk bond market crashed at the end of the 1980s and a number of high-profile LBOs resulted in default and bankruptcy, the market for LBOs had almost disappeared by the early 1990s. However, LBOs re-emerged at the end of the 1990s and by the mid-2000s, a record amount of capital had been committed to PE, both in nominal terms and as a fraction of the stock market. The second wave of leveraged deals topped the activity of the first wave in the late 1980s but came to a drastic halt with the dry-up in debt markets during the financial crisis of 2008. It seems that we are now in the midst of a third wave of LBOs, with committed capital to the PE industry exceeding previous peaks and with the number and size of transactions rivalling the previous waves.

With this short introduction to the PE industry, we move on to describe the industry in a more detailed manner. We start by discussing the role of PE firms and funds and move on to describe a typical PE transaction and the value drivers most often used by PE firms. Finally, we look at PE returns in a historical perspective.

2.1.1 Private equity firms

PE firms (also referred to as 'financial sponsors') are typically organized as partnerships or limited corporations employing investment professionals to identify and execute on investment opportunities. The owners of PE firms are typically referred to as general partners. PE firms are relatively small organizations compared to the firms they own. The Blackstone Group, one of the largest and most prominent PE firms today, with more than USD 457bn under management, reported 136 managing directors and 2,225 other employees in their 2017 10-K (Blackstone, 2018), a relatively small number compared to the more than 500,000 people employed by its portfolio companies. Other large and prominent PE firms include the Carlyle Group and Kohlberg Kravis Roberts & Co. (KKR). All three of these are U.S. firms and the industry has historically been dominated by North American firms although European PE firms today also make up a large proportion of the world's buyout firms.

2.1.2 Private equity funds and compensation schemes

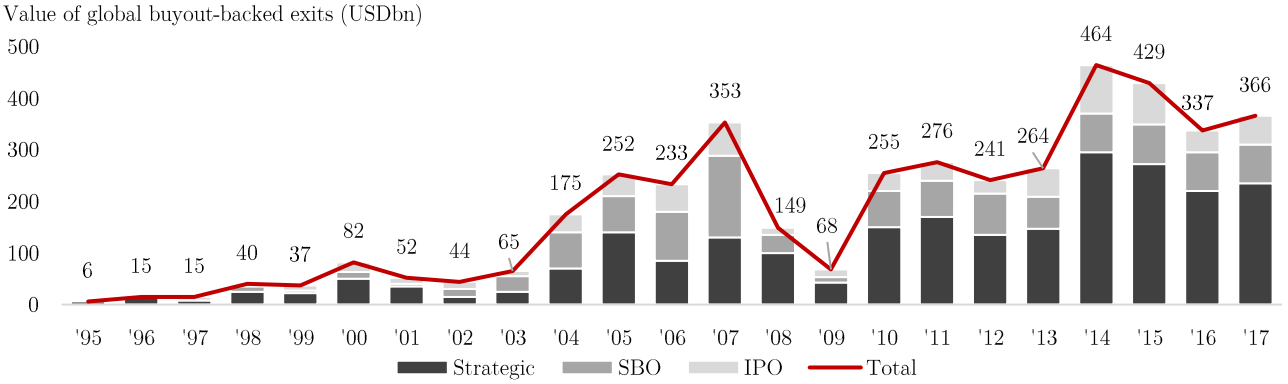
While the PE firm is the entity employing investment managers, the firm raises equity capital through PE funds. Legally, PE funds are set up as limited partnerships managed by the GPs, whose co-investment customarily amount to at least 1% of the total equity capital, while most of the capital comes from LPs ("investors"). The funds are "closed-end" funds LPs commit to provide a certain amount of capital used to pay the 'equity cheque' of investments in portfolio companies and management fees to the PE firm. The LPs usually consist of pension funds, sovereign wealth funds, university endowment funds, and high-net-worth individuals.

PE firms are compensated in two ways: 1) from management fees and 2) from a carried interest. The management fee is a percentage of invested capital paid yearly throughout the life of the fund and has historically been around 2% per year. The management fee is used to pay for daily expenses of running the firms. The carry fee is calculated as a percentage of the return generated to LPs and is almost always 20%. This fee structure is typically referred to as a 2/20 fee structure. Some funds employ hurdle rates for its carry fee, meaning that carried interest will only be paid to GPs once LPs have received a certain hurdle return (typically 7-8%). After the hurdle rate has been achieved, the fund enters a so-called "catch-up phase", where 80-100% of subsequent returns accrue to the GPs until the GPs carried interest equal 20% of the entire return so far. The carried interest is in place to align interests between LPs and GPs by incentivising GPs to stay away from low-risk projects.

2.1.3 Private equity transactions

In a typical buyout transaction, a considerable portion of the acquisition price is financed with debt, hence the term leveraged buyout, and typically ranges from 60% to 90%. The remaining stake is financed with equity from the fund, but the post-buyout management team typically also contributes a small proportion of equity financing to align incentives with the fund. The debt financing may consist of senior, secured loans often underwritten by a number of banks to spread the risk and subsequently syndicated to a broader investor universe. The debt also often includes junior, unsecured loans or bonds that are subordinate to the senior loans and carry significantly higher risk and return. Section 2.2 provides a more detailed introduction to the debt structures used in a typical LBO.

Figure 2.2: Value of global buyout exits from 1995 to 2017 by exit type



Note: Bankruptcies excluded. IPO value represents offer amount and not market value of company. Strategic denotes sale to a strategic buyer, SBO denotes sale to a financial sponsor, IPO denotes initial public offering.
Source: Bain Global Private Equity Report 2018

The transaction size and the nature of a deal varies significantly from deal to deal. Target companies can be acquired from private individuals, another financial sponsor ("secondary buyout"), or it can be a public company that is taken private (a public-to-private transaction). A target can also be a specific division in a corporation that is sold off for strategic reasons (a carve-out). Likewise, PE funds have different exit alternatives when it comes to divesting its portfolio companies. The three most often-used exit routes are 1) sale to a strategic buyer, 2) sale to another financial sponsor, or 3) an initial

public offering. Figure 2.2 shows that exits to strategic buyers have been the most common exit route in recent years, but the importance of secondary buyouts as an exit route has grown significantly over time, especially during the mid-2000s. The proportion of initial public offerings as an exit route has been rather stable in recent years but seem to vary with the health of public stock markets. For example, the market for IPOs dried up in the early-2000s and in 2008-09 following the financial crisis.

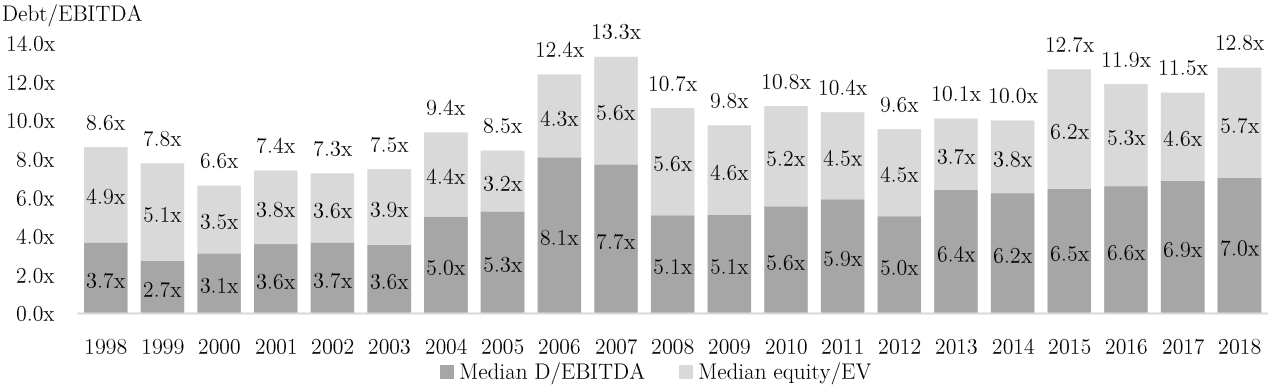
2.1.3.1 Transaction multiples

In private equity, acquisition prices are often evaluated based on a multiple of the enterprise value (EV) over some earning measure. The most widely used multiple is EV/EBITDA.[1] EV is calculated as

$$Enterprise\ Value = Equity + Net\ Debt + Minority\ Interests \tag{2.1}$$

and reflects the acquisition price of the whole company. EBITDA is often used as the earnings measure since it disregards the firm's capital structure, capex needs and differences in effective tax rates, making comparisons across industries and countries easier. The average transaction multiple for LBOs has varied historically and is likely to be affected by economy, or industry wide factors such as valuations in public stock markets, access to and cost of debt, competition for deals among PE firms among other things. Figure 2.3 shows the average EV/EBITDA multiple for LBOs in our sample and the split between debt and equity financing and shows a clear upward trend in recent years. The peak set during the buyout wave of the mid-2000s have almost been topped in recent years. The recent uptrend in transaction multiples may be explained by such factors as lax credit markets which have pushed up valuations for all asset classes and increased competition for deals due to ever more capital being committed to the PE industry.

Figure 2.3: Median EV/EBITDA multiples from 1998 to 2018 split between debt and equity contributions



Note: Total debt excludes contingent debt
Source: Mergermarket, DealScan

[1] EV: Enterprise value, EBITDA: Earnings before interest, depreciation and amortization

2.1.3.2 Value drivers of private equity investments

PE firms generally proclaim that they rely on three sources of value creation: 1) operational improvements, 2) financial engineering, and 3) improvements in corporate governance. Operational improvements are implemented to ultimately increase the free cash flow of the portfolio company and is typically done by increasing revenue growth, reducing costs or accelerating the cash conversion cycle. The increase in free cash flow will allow the portfolio company to pay down its debt more quickly and will justify a higher price at exit, both of which increases returns for the fund.

Financial engineering refers to PE firms' ability create value for investors through non-operational initiatives and includes 1) PE firms' ability to employ a significant amount of leverage that boosts returns, and 2) multiple arbitrage where a portfolio company is eventually exited at a higher transaction multiple than it was initially acquired for.

Finally, many PE firms improve corporate governance in their portfolio companies by reducing agency costs between the management team and the PE firm. This is typically done by making the management team invest a relatively small equity stake in the portfolio company at the time of the acquisition to ensure that a significant amount of their wealth is tied to the performance of the company (Jensen, 1986). Moreover, the large amount of debt employed in LBOs disciplines managers and reduces the free cash flow available to be squandered by the management team (see Section 4.1.2 for a more detailed discussion of leverage as an agency-reducing mechanism).

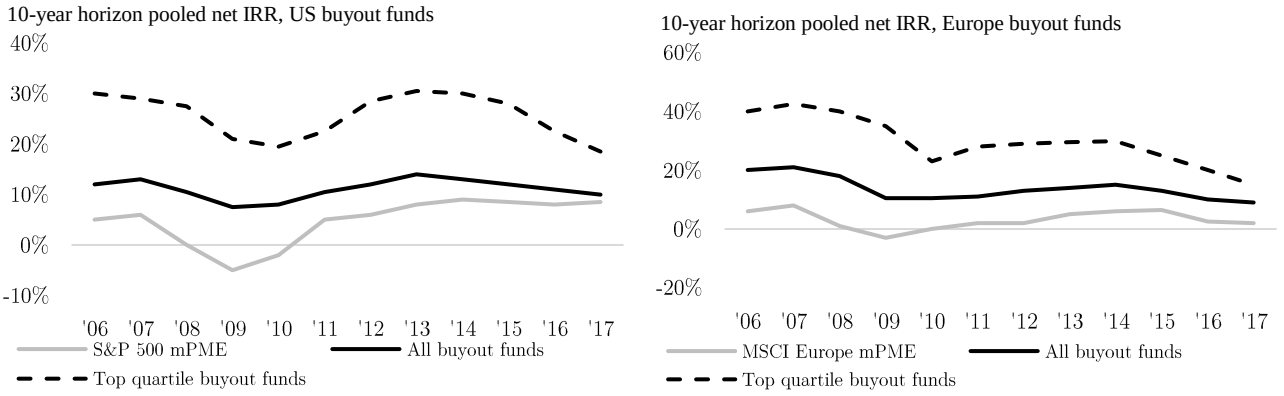
2.1.4 Historical returns

PE firms generally use two measures of return when an investment or a fund is evaluated: 1) the money multiple, and 2) the internal rate of return (IRR). The money multiple is simply a multiple of gross returns over the initial investment and does not adjust for the timing of cash flows. The measure is appealing to practitioners due to its simple interpretation but is often seen as a flawed measure due to its failure to correct for the timing of cash flows. For an investment, the IRR is the discount rate that makes the net present value of all cash flows from an investment equal to zero. As opposed to the money multiple, the IRR correctly adjust for the timing of cash flows such that the IRR for a specific investment will decrease in the holding period, all else equal.

The returns generated by buyout funds have historically been superior to public stock markets. PE firms typically aim at achieving an IRR of 20-25% on their portfolio investments. When comparing PE returns to public markets returns, the modified public market equivalent (mPME) is often used. The mPME replicates the timing and size of private equity cash flows (both purchases and sales) as if they had been invested in public equities and thereby allows for an "apple-to-apples" comparison between private and public equity returns. Figure 2.4 shows the historical development in returns for U.S. and European buyout funds as well as the mPME for relevant benchmark stock indices. Evidently, buyout funds have consistently outperformed public market equities historically, although the gap has

narrowed considerably in recent years suggesting that private equity has become a mature and competitive asset class.

Figure 2.4: Net internal rate of return of all buyout funds and top quartile buyout funds in US and Western Europe respectively from 2006 to 2017



Note: The returns are benchmarked against modified public market equivalents (mPME) for the S&P 500 index and the MSCI Europe index for US and European buyouts respectively. Data in dollars for US funds and euros for European funds
Source: Bain Global Private Equity Report 2018

2.2 Debt structure in leveraged buyouts

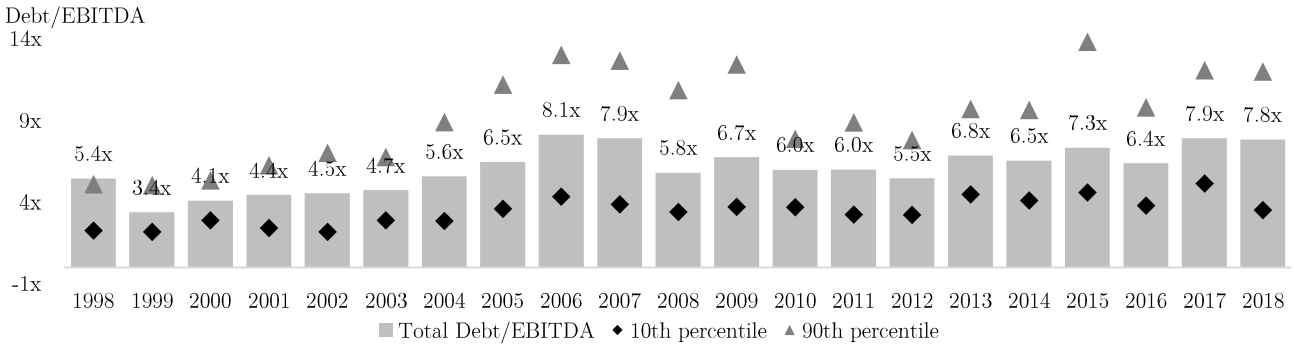
Chapter 3 will showcase a concrete example of a buyout and detail the extent to which various debt instruments were used to finance the transaction, as well as outline some of the particulars of these debt instruments incl. coupon type, yield/spread, years to maturity, covenants, as well as distribution form. First, however, the present section will present evidence on the various aspects related to LBO debt financing on an aggregated basis to provide readers with the background necessary to understand the forthcoming analyses. In turn, we look at aggregate volumes, the split between loans, bonds, and other debt instruments, as well as characteristics of these instruments, incl. seniority, security, covenants, and means of distribution. We examine how these elements have evolved over the period 1998-2018. Unless otherwise stated, we will be relying on data from our sample (whose construction and representativeness will be described in detail in Section 5.2).

2.2.1 Total leverage

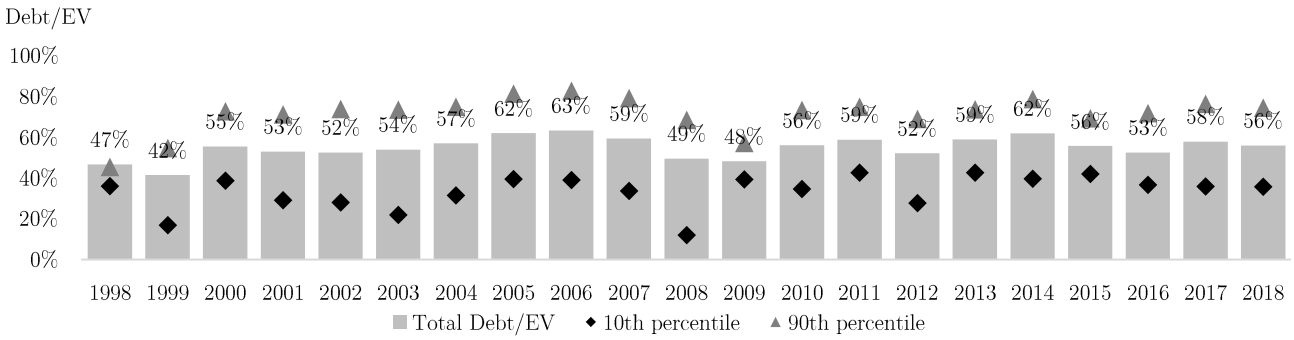
Figure 2.5 shows the development over the 1998-2018 period in average leverage for the two mostly used leverage measures namely debt-to-EBITDA (D/EBITDA) and debt-to-enterprise value (D/EV). Similarly, the figure shows the top 10% percentile as well as bottom 10% percentile for both leverage measures to indicate the within-year variation in leverage (see Appendix A for histograms of both measures for the entire sample). Clearly, leverage is large relative to both EBITDA and EV and shows sign of pro-cyclicality.

Figure 2.5: Average leverage and top- and bottom-10 percentiles from 1998 to 2018

Panel A:



Panel B:



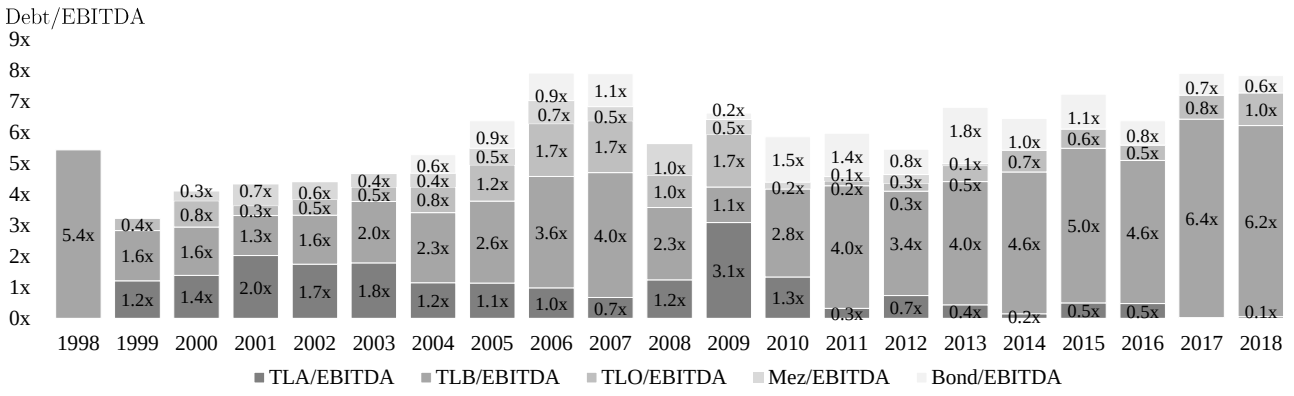
Note: Panel A shows average D/EBITDA from 1998 to 2018. Panel B shows D/EV from 1998 to 2018. Total debt excludes contingent debt
Source: Mergermarket, DealScan, LCD

Note that we are using gross debt, not taking into account any cash holdings of the target, and LTM EBITDA not making pro forma adjustments, why our leverage measures are somewhat higher than e.g. LCD's (2019) 2018 D/EBITDA estimate of ~6x. In line with previous research, revolvers and other facilities (such as Capex facilities) designed to finance additional investment in working capital or capital expenditures and which can be drawn and repaid flexibly are labelled 'contingent debt' and excluded from our definition of total debt (see e.g. Axelson et al., 2013). The reason for excluding contingent debt from total debt is that the majority of such financing is likely not going toward financing the buyout but rather incremental investment. As such, the additional debt may lead to higher future cash flows in case it is drawn and, as a consequence, higher EV. To have a measure of total debt corresponding to the implied EV at the time of the buyout, we thus need to exclude contingent debt.

2.2.2 Debt instruments

Many LBOs will be financed by more than one debt facility (or "tranche"). An overall distinction can be made between loan, bond, and mezzanine facilities. Figure 2.6 shows that the majority of leverage in any given year has come from loans.

Figure 2.6: Average debt/EBITDA from 1998 to 2018 split between loan type



Note: Total debt excludes contingent debt
Source: Mergermarket, DealScan, LCD

In the family of loans, the most common type used in LBO financing is so called term loans. In many deals, several 'tranches' of term loans will be offered to cater to different investor/lender types. Term loans often carry a letter, e.g. term loan A (TLA), term loan B (TLB), term loan C (TLC), and so on. In our sample, we observe the use of even term loan Es. Usually, TLAs are amortizing while TLBs and higher are bullets. In many cases, TLAs remain on the investment banks' balance sheet or are syndicated primarily to other banks, while TLBs, TLCs, and so on are syndicated to a wider institutional investor base. From Figure 2.6 the proportion of buyout financing that is amortizing and which is more likely to stay with banks seems to be decreasing over time and less common during times of more favourable credit conditions.

Term loans will in almost all cases be senior secured instruments. Some term loans, here labelled as "other term loans" (TLO), which also includes TLCs and higher, may however be subordinated in terms of its secured ranking via a second-ranking or lower pledge to the assets as opposed to a first ranking-pledge. Term loans are usually floating rate instruments and they may be available in a range of currencies although most major facilities are dollar or euro denominated.

Within the family of bond products, conventional notes make up the majority while so-called payment-in-kind notes (PIK), on which coupon payments consist of additional notes (or may alternate between cash and 'in-kind' payments at the issuers discretion, so called PIK Toggle Notes), are less common. PIKs will usually be structurally subordinated sitting at the HoldCo level while traditional bonds may be found at all levels of the financial structure and may be contractually senior or subordinated as well as secured or unsecured. Virtually all bonds issued in connection with LBOs are bullets, i.e. non-amortizing, they may carry floating or fixed coupons and will often carry non-call periods of minimum 2-3 years. A range of currencies are available in the bond market but large volumes at affordable yields are available mainly in US dollar and euro.

Mezzanine capital will usually be structured as an unsecured or subordinated note but may also take the form of preferred stock. As such, what distinguishes mezzanine capital from simple subordinated

and unsecured loans or bonds is that they may carry certain hybrid features, e.g. embedded warrants or conversion features. Partly as a consequence, mezzanine debt is normally privately placed with specialized mezzanine funds. Mezz debt may carry either cash or PIK interest and be available primarily in the major currencies. Figure 2.6 shows that mezzanine capital has almost evaporated in recent years which may partly be a consequence of the increasing use of second lien term loans as a replacement.

2.2.3 Debt characteristics

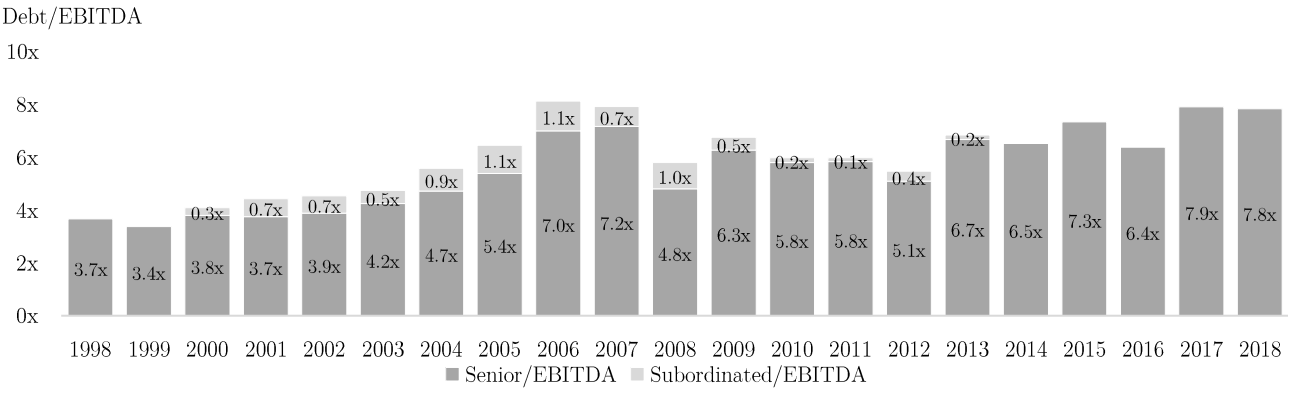
2.2.3.1 Seniority (contractual)

Seniority refers to the order of payment in the event of distress and is highly important for capital providers' rate of recovery and, as a consequence, risk. A second order effect of seniority is, obviously, that more senior debt will be "cheaper", i.e. carry lower interest rates.

Contractually, we largely distinguish between senior and junior (or subordinated) debt. When all debt ranks parri passu we continue to say that the debt is senior. In case the debt structure contains term loans or RCFs, they will almost always be senior. Bonds may be senior (and thus pari passu with term loans if such are present) or subordinated. In European LBO debt structures, however, it is common for bonds to be structurally subordinated by way of their placement at the HoldCo level (but still be labelled senior relative to their ranking at the HoldCo level). In the US, bankruptcy regulation is fairly accommodative of contractual subordination why it is less common to structurally subordinate bonds.

Figure 2.7 shows the yearly average amount of senior and *contractually* subordinated debt relative to EBITDA from 1998 to 2018. Clearly, the use of contractually subordinated debt was increasing up until the financial crisis but has since almost disappeared which is also evident in LCD (2019) data.

Figure 2.7: Average debt/EBITDA from 1998 to 2018 split between seniority



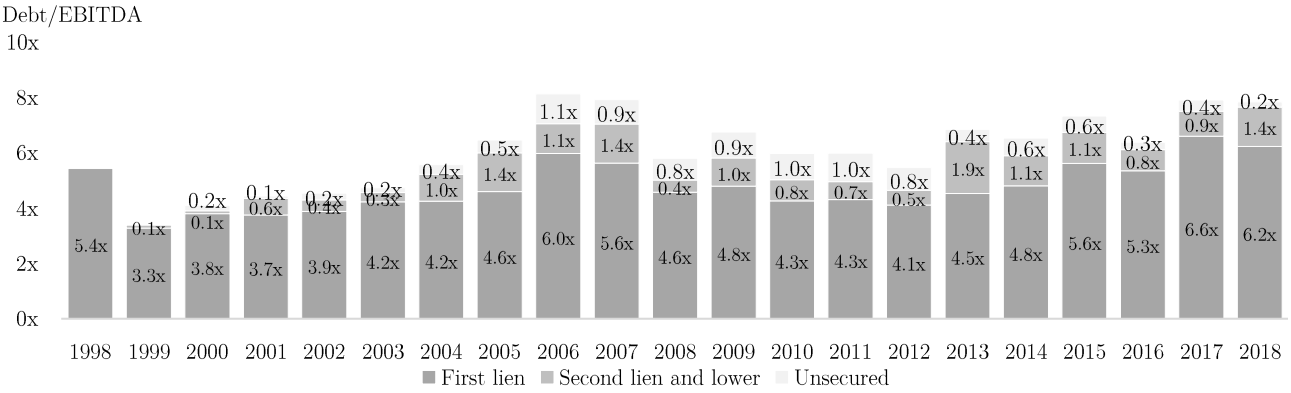
Source: Mergermarket, DealScan, LCD

Security is a pledge over the borrower's property which, when serving as security in a debt agreement, will be referred to as collateral. In LBO financing packages, collateral will usually be made up of share pledges at various levels of the financial structure, potentially complemented by pledges over operational assets or real estate. When security is granted to a class of debt providers, they will, even

if pari passu with other senior debt, rank first in right of payment when it comes to the proceeds of the secured assets. Secured and unsecured creditors will, however, be treated equally when it comes to proceeds from unencumbered assets subject to their seniority.

2.2.3.2 Security

Figure 2.8: Average first, second and lower lien, and unsecured debt relative to EBITDA

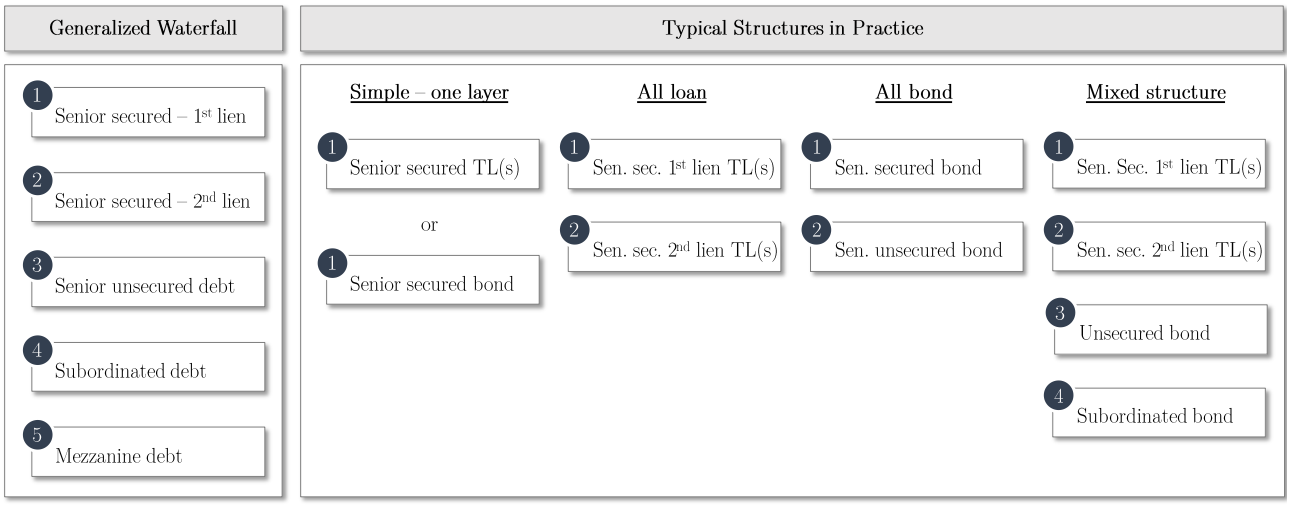


Source: Mergermarket, DealScan, LCD

In addition to the distinction between secured and unsecured creditors, it is also common in LBO financing structures to see differentiation within the group of secured creditors. As such, debt may be secured either first lien or second lien (or lower) terms. First lien lenders will be first-ranking when it comes to the proceeds of collateral while second lien lenders will only be paid when the first lien lenders are repaid in full (in principle). Figure 2.8 shows average first-lien debt to EBITDA, second-lien (and lower) debt to EBITDA, and unsecured debt to EBITDA on a yearly basis from 1998-2019.

2.2.3.3 Effective priority of claims (waterfall)

Figure 2.9: Illustrative payment waterfall



The interplay of contractual (and structural) seniority and security pledges creates a richer effective order of the priority of claims. To avoid ambiguity, such order of priorities ("payment waterfall") will

often be spelled out in an inter-creditor agreement. In general, the waterfall will look something like Figure 2.9. In practice, all the elements on the left-hand side of Figure 2.9 are unlikely to be represented in any given LBO financing structure. Some common examples from practice are shown on the right.

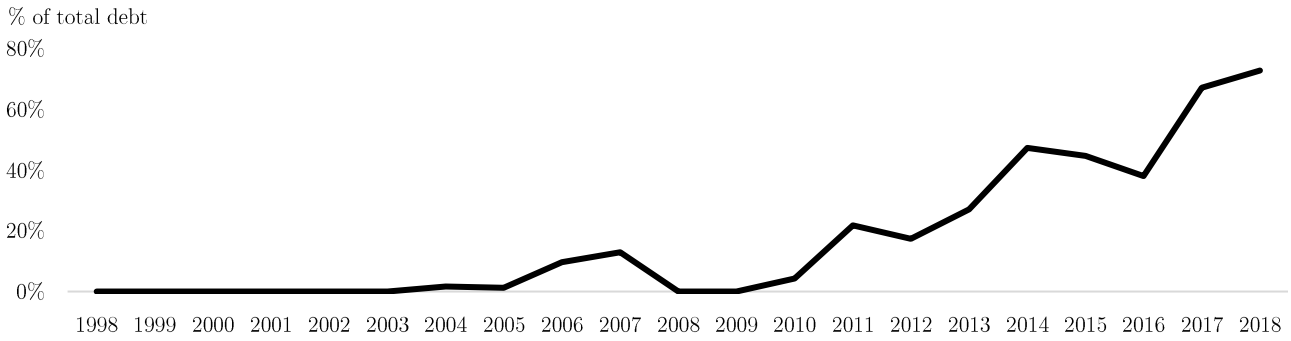
2.2.3.4 Covenants

In general, practitioners (e.g. S&P Global Market Intelligence, 2019) and researchers (Berk & DeMarzo, 2017) group covenants into affirmative covenants, negative covenants, and financial covenants. Affirmative covenants describe mandatory actions on the part of the borrower, such as the obligation to maintain insurance and pay taxes, while negative covenants limit the actions that the borrower can take, e.g. the ability to make acquisitions or issue further debt.

Focus here will be on financial covenants which consist of minimum restrictions on a borrower's performance as per financial reporting or pro forma measures. Financial ratios often covenanted include the leverage ratio, the current ratio, and various interest coverage ratios. Regardless of the financial ratio, financial covenants generally take one of two forms; maintenance and incurrence (S&P Global Market Intelligence, 2019). Maintenance covenants are strict in the sense that they require that agreed-upon minimum or maximum ratios are maintained periodically whether or not the borrower has taken an action. Incurrence covenants, on the other hand, only require that the agreed-upon ratios are met when the borrower takes an action, such as paying dividends or engaging in M&A.

Financial covenants in bond docs are fairly limited in number and almost always incurrence tested. Term loans, on the other hand, have historically featured a comprehensive list of maintenance covenants. In the last 15 years, originating in the US and more broadly introduced in Europe following the financial crisis, the covenant-lite (CovLite) market, whose defining feature, according to Slaughter and May (2016, p. 5), "is that the comprehensive suite of negative covenant restrictions seen in a traditional bank loan is replaced with a set of incurrence-style covenants" more akin to those found in bond docs, has gained prominence. CovLite loans favour borrowers relative to traditional bank loans by providing more flexibility while also conveniently provide greater consistency with bond covenants.

Figure 2.10: Average share of total debt that is covenant lite from 1998 to 2018



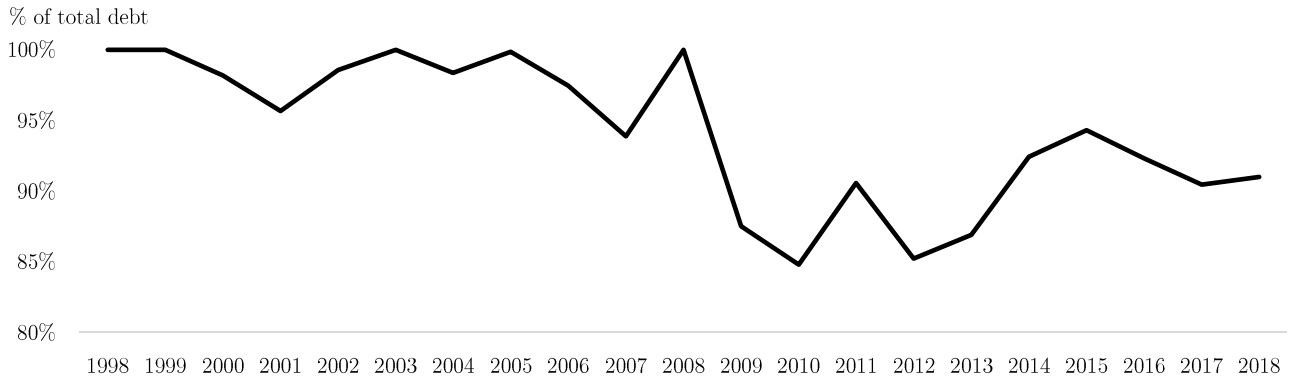
Note: Total debt excludes contingent debt
Source: Mergermarket, DealScan, LCD

Rather than conducting a detailed study of loan documentation and covenants, the focus will instead be on whether or not a given loan is classified as CovLite by market observers. Figure 2.10 above, shows the average yearly fraction of term loans that are CovLite is shown from 1998-2018. In addition to showing the growing use of CovLite structures, Figure 2.10 also provide some evidence that its use likely varies with wider credit conditions as a noticeable drop occurred during the financial crisis.

2.2.3.5 Mean of distribution

Even though loans and bonds originate at banks, they will in most cases be sold (distributed) to a wider lender/investor base. In small leveraged buyouts or for smaller facilities, this may not necessarily be the case. Facilities that stay with the originating entity are called bilateral (debt) deals. When facilities are intended to be passed on, in whole or in part, it usually happens either 1) by banks coming together in club deals (for loans) to share the risk and balance sheet capacity, or 2) through a syndication process. Whereas club deals entail fairly private processes, syndication involves a more extensive public marketing campaign ("roadshow"), the production and publication of public investor material, and a subsequent book-building phase where participating investors may range anywhere from 10-250 investors with varying degrees of institutionalization. Figure 2.11 shows that the far majority of LBO financing is syndicated albeit the share of syndicated debt has been declining somewhat. Notably, the share of debt that is syndicated declined sharply during the financial crisis.

Figure 2.11: Average share of total debt that is syndicated from 1998 to 2018



Note: Total debt excludes contingent debt
Source: Mergermarket, DealScan, LCD

This concludes the introduction to the PE industry and the debt structure typically used in an LBO. The following section will showcase a concrete example of an LBO from our sample, namely the public-to-private buyout of TDC.

Chapter 3: Case Study - The 2005 leveraged buyout of TDC

3.1 Background to the transaction

3.1.1 History and previous ownership

TDC Group is a Danish telecommunications company dating back to 1882 when the first telephone exchange opened in Copenhagen. As telecom markets in many European countries became liberalised in the 1980s, the Danish parliament decided to merge four regional telecom companies to form a single entity, Tele Danmark, to take on competition from international players. Initially, the newly formed entity was 100% owned by the Danish State but was partially privatised through an initial public offering in 1994 in which the Danish State decreased its ownership stake to 41%. In 1997, the Danish State sold its remaining shares to the American telecom company, AT&T which in turn offloaded its shares in 2004, after which the company was widely held by Danish and international retail and institutional investors.

3.1.2 Transaction in brief

On November 30, 2005, a private equity consortium consisting of Apax, Blackstone, KKR Permira and Providence set forth a recommended public tender offer to acquire the entire share capital of TDC for DKK 382 in cash per share through a newly-formed entity, Nordic Telephone Company from its existing shareholders. The offer valued the equity value at EUR 10,161m and the EV at EUR 12,984m, making it Europe's largest leveraged buyout at the time. With a FY2004 EBITDA of EUR 1,672m, the offer implied an EV/EBITDA (FY'04) multiple of 7.8x.

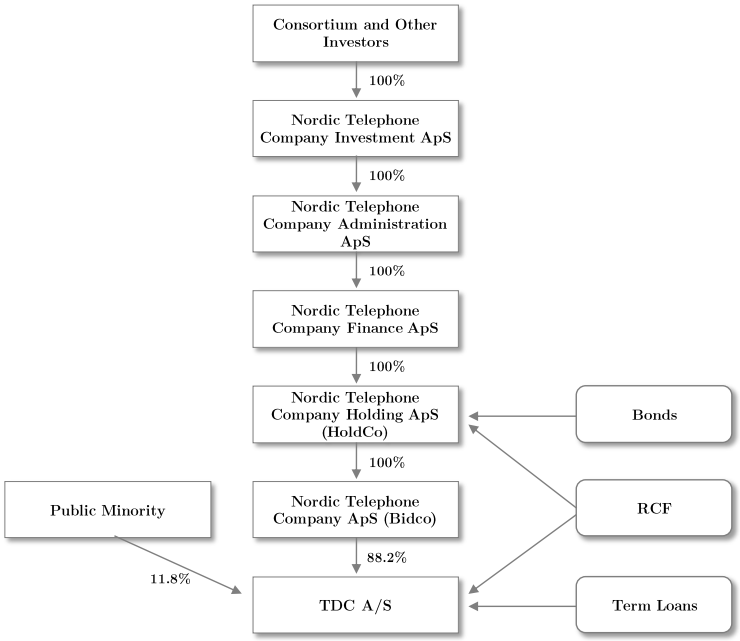
Initially, the tender offer was conditional on a 90% acceptance rate from existing shareholders, but the offer met resistance from certain minority shareholders and the consortium was unable to achieve the 90% acceptance rate that permits the bidder to initiate compulsory acquisition. Consequently, TDC continued to be listed on Copenhagen Stock Exchange but with a minimal free float.

3.2 Deal financing and debt structure

The ultimate financing structure of the 2005 LBO of TDC, as provided in debt offering documentation at the time, is set out in Figure 3.1. In connection with the tender offer, a HoldCo ("Nordic Telephone Company Holding ApS") was formed which received a cash equity contribution of DKK 16.4 billion (EUR 2.197 billion) from the consortium via a number of administrative holding companies. In addition, the HoldCo entered into senior credit facilities and a bridge facility. The senior credit facilities included a TLA drawn in an amount of €1.576 billion, a TLB drawn in an amount of €2.465 billion and a Term Loan C drawn in an amount of €2.465 billion as well as a revolving credit facility (RCF) of up to EUR 700 million. The bridge, a typical bridge-to-bond structure on which EUR 2.031 billion was drawn, was repaid and cancelled following a 3-part bond offering. Before the bond offering, and subsequent to the successful acquisition of ~88.2% of the shares in TDC, a so-called debt pushdown was conducted whereby TDC became a borrower and guarantor of the senior credit facilities. The RCF,

however, remained available to the HoldCo for the purpose of financing cash interest payments on the bonds.

Figure 3.1: TDC's financing and holding structure after bond issuance



Source: Bond prospectus

Table 3.1 shows an overview of the facilities and their characteristics of the 'final' financing package backing the buyout of TDC, although several facilities were amended, repriced and/or repaid early over the few years following the buyout (as is often the case when an investment is performing). When it comes to the terms of the facilities, the term loans were clearly cheaper in terms of coupon payments with margins of 2.125-2.875% and spot 3-month Euribor at 2.50%-3.00% in early 2006, compared to the fixed and floating rate bonds yielding in excess of 8% at issue. Part of the reason is the longer time-to-maturity combined with upward sloping rates and credit curves.

But equally important, the loan documentation provided stronger protection compared to the bond docs. First of all, while all debt is contractually senior at the entity in which it is sitting, the bonds are structurally subordinated to the term loans given that the term loans sit closer to the cash flows and are due to be serviced ahead of the bonds sitting at the HoldCo level. In terms of security, certain fixed assets as well as a first-ranking pledge of the shares in the HoldCo secured the term loans and the RCF, while the bonds are only secured by a second-ranking pledge of the HoldCo shares. Lastly, the term loans featured what was at the time a typical suite of financial maintenance covenants with limits to debt relative to EBITDA as well as various debt service coverage ratios, some of which were tightening over time according to predefined schedules.

Table 3.1 Overview of facilities financing TDC leveraged buyout

	RCF	Term Loans			Bonds		
Feature	Revolving Credit Facility	Term Loan A	Term Loan B	Term Loan C	€ fixed-rate bond	4 fixed-rate bond	€ floating-rate bond
Currency	Euro	"multicurrency term loan facility"	"multicurrency term loan facility"	"multicurrency term loan facility"	Euro	US Dollar	Euro
Amount	€700 million	~€1.825 billion of which €1.570 billion was drawn	€2.465 billion of which €2.465 billion was drawn	€2.465 billion of which €2.465 billion was drawn	€800 million	$600 million	€750 million
Coupon	"Applicable" IBOR + 2.125%	"Applicable" IBOR + 2.125%	"Applicable" IBOR + 2.375%	"Applicable" IBOR + 2.875%	8.250%	8.750%	3 month Euribor + 5.500%
Maturity	7 years	7 years	8 years	9 years	10 years	10 years	10 years
Repayment	Bullet	Amortizing	Bullet	Bullet	Bullet	Bullet	Bullet
Seniority	Senior ("Pari passu")	Senior ("Pari passu")	Senior ("Pari passu")	Senior ("Pari passu")	Senior (but structurally subordinated to other senior debt)	Senior (but structurally subordinated to other senior debt)	Senior (but structurally subordinated to other senior debt)
Security	First ranking pledge of shares in BidCo and certain fixed assets of TDC	First ranking pledge of shares in BidCo and certain fixed assets of TDC	First ranking pledge of shares in BidCo and certain fixed assets of TDC	First ranking pledge of shares in BidCo and certain fixed assets of TDC	Second-ranking pledge of shares in BidCo	Second-ranking pledge of shares in BidCo	Second-ranking pledge of shares in BidCo
Financial covenants	Maintenance covenants: Consolidated Cashflow to Fixed Charges; 1.00x FCCR; initially 2:0x, springing gradually to 3.00x Net leverage; initially 6.95x springing gradually to 3.40	Maintenance covenants: Consolidated Cashflow to Fixed Charges; 1.00x FCCR; initially 2:0x, springing gradually to 3.00x Net leverage; initially 6.95x springing gradually to 3.40	Maintenance covenants: Consolidated Cashflow to Fixed Charges; 1.00x FCCR; initially 2:0x, springing gradually to 3.00x Net leverage; initially 6.95x springing gradually to 3.40	Maintenance covenants: Consolidated Cashflow to Fixed Charges; 1.00x FCCR; initially 2:0x, springing gradually to 3.00x Net leverage; initially 6.95x springing gradually to 3.40	Incurrence covenants: Net leverage; 6.0x	Incurrence covenants: Net leverage; 6.0x	Incurrence covenants: Net leverage; 6.0x

Source: LCD

In contrast, the bonds only featured a single financial incurrence covenant (on Net Leverage), although with less headroom than that initially under the terms of the term loans.

In terms of amounts, term loans made up the majority of drawn debt at a combined EUR 6.5bn of the total approx. EUR 8.5bn drawn with bonds making up the remaining ~23%. Relative to last 12-month reported EBITDA at the time of the buyout, this amounts to D/EBITDA ratio of 5.1x, a headroom of 27% relative to the Net Leverage maintenance covenant of 6.95x in the loan covenants.

Table 3.2: Debt instruments used to finance acquisition

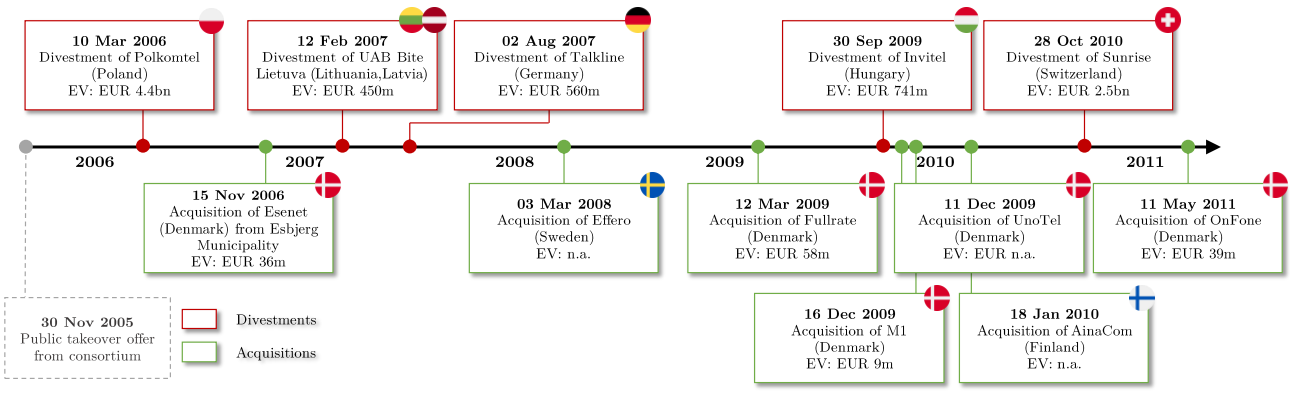
Gross debt (excl. cash)	Amt (EURm)	xEBITDA	% of total
RCF	700	-	-
Term Loan A	1'570	0.9x	18.6%
Term Loan B	2'465	1.5x	29.2%
Term Loan C	2'465	1.5x	29.2%
Senior Secured Debt	**6'500**	**3.9x**	**76.9%**
€ fixed-rate bond	800	0.5x	9.5%
$ fixed-rate bond	404	0.2x	4.8%
€ floating-rate bond	750	0.4x	8.9%
HoldCo Debt	**1'954**	**1.2x**	**23.1%**
Total Leverage	**8'454**	**5.1x**	**100.0%**

Note: Debt relative to EBITDA using FY2004 EBITDA of EUR 1,672m and USD/EUR 1.4839
Source: LCD

3.3 Strategic initiatives and financial performance

Following the acquisition, TDC divested several of its European subsidiaries over the subsequent five years, including Polkomtel in Poland, UAB Bite in Lithuania, and Talkline in Germany, and instead increased its focus on the Nordic markets by acquiring Effero in Sweden, Fullrate, UnoTel and M1 in Denmark, and AinaCom in Finland among others (see Figure 3.2). The Swiss subsidiary, Sunrise, was also eventually divested in September 2010 for an EV of EUR 2,533m.

Figure 3.2: Timeline with TDC's divestments and acquisitions during the holding period



Source: Mergermarket

The divestment of the various European subsidiaries is reflected in the development in revenue for TDC during the ownership of the consortium. Revenue decreased from DKK 46,6bn in 2005 to DKK 26,2bn in 2010 while EBITDA margins increased substantially from 28% in 2005 to 41% in 2010 as evident from the financials presented in Table 3.3. Note that the financials are from TDC's annual reports and that the leverage figures therefore do not include HoldCo debt.

Regarding leverage, net interest-bearing debt (NIBD) increased dramatically from DKK 16.5bn in 2005 to DKK 55.2bn 2006, reflecting the high amount of debt used in the acquisition, and were subsequently paid down in the following years using generated free cash flows which typically characterises a

leveraged buyout. The NIBD/EBITDA ratio increased from 1.3x in 2005 to 4.0x in 2006 and the D/E ratio increased from 0.4x in 2005 to 16.8x in 2006.

As discussed in section 2.1, PE funds mainly achieve returns through operational improvements and financial engineering. From Table 3.3, we see that return on capital employed (ROCE) increased during the ownership of the consortium which implies actual value creation through operational improvements for all investors. Further, we see that return-on-equity increased dramatically during the ownership period. This amplification of equity returns is caused by the high degree of gearing and only reflects returns to equity holders. Further, the debt pushdown described above is evident from the abnormally high dividend payment in 2006 whereby senior credit facilities were guaranteed and drawn by TDC to finance the dividend payment which, in turn, was used to pay down drawn debt at the HoldCo level.

Table 3.3: TDC financials from 2005 to 2013

		Private equity controlled							
DKKm	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Revenue	46'588	47'429	39'321	38'819	35'939	26'167	26'304	26'116	24'605
Growth		*1.8%*	*-17.1%*	*-1.3%*	*-7.4%*	*-27.2%*	*0.5%*	*-0.7%*	*-5.8%*
EBITDA	13'003	13'655	12'498	13'175	13'046	10'772	10'940	10'331	10'149
Margin	*27.9%*	*28.8%*	*31.8%*	*33.9%*	*36.3%*	*41.2%*	*41.6%*	*39.6%*	*41.2%*
EBIT	6'213	6'785	6'271	7'356	5'540	5'416	5'713	5'349	5'111
Margin	*13.3%*	*14.3%*	*15.9%*	*18.9%*	*15.4%*	*20.7%*	*21.7%*	*20.5%*	*20.8%*
Capex	5'637	5'300	5'200	5'100	5'000	3'534	3'421	3'492	3'696
Margin	*12.10%*	*11.2%*	*13.2%*	*13.1%*	*13.9%*	*13.5%*	*13.0%*	*13.4%*	*15.0%*
Total assets	93'500	80'800	79'500	74'900	86'400	64'800	65'165	63'516	60'410
Equity	43'520	3'289	10'309	11'660	27'078	20'855	22'244	21'513	20'384
NIBD	16'500	55'200	41'400	35'100	33'500	22'600	21'013	21'918	21'654
Dividend per share	0	223.9	3.5	3.6	39.9	0	2.18	4.6	3.7
Shares outstanding (n	195.2	197.8	198.1	198.1	198.1	981.8	825	825	812
Total dividend	0	44'287	693	713	7'904	0	1'799	3'795	3'004
Leverage and return measures:									
NIBD/EBITDA	1.3x	4.0x	3.3x	2.7x	2.6x	2.1x	1.9x	2.1x	2.1x
NIBD/Equity	0.4x	16.8x	4.0x	3.0x	1.2x	1.1x	0.9x	1.0x	1.1x
ROCE	10.4%	11.6%	12.1%	15.7%	9.1%	12.5%	13.2%	12.3%	12.2%
ROE	14.3%	206.3%	60.8%	63.1%	20.5%	26.0%	25.7%	24.9%	25.1%

Note: The highlighted columns indicate the years of PE ownership
Source: Annual reports

3.4 Exit and return analysis

3.4.1 Exit process

On December 9, 2010 the consortium behind Nordic Telecom Company began their exit by starting to sell down shares. Practically, the exit paralleled a re-IPO of TDC wherein an offering prospectus was prepared for potential investors and Joint Global Coordinators and Bookrunners were appointed to coordinate the share offering. The first share offering consisted of 210m shares at a price of DKK 51 each, valuing TDC's equity at DKK 41.5bn (EUR 5.6bn). With net interest-bearing debt amounting to DKK 22.6bn (EUR 3.0bn) at the end of 2010, the EV at the time of exit was DKK 64.1bn (EUR

8.6bn). TDC's 2010 EBITDA was DKK 10.7bn (EUR 1.4bn), implying an EV/EBITDA exit multiple of 6.0x.

The offering raised DKK 10.7bn for the consortium and reduced its stake from 88.2% to 59.1%. Further, TDC initiated a buy-back program of shares at DKK 51 per share, which raised an additional DKK 8.7bn for the consortium. On February 14, 2012 an additional 128.7m shares was sold to institutional investors through an accelerated book building, reducing Nordic Telephone Company's ownership stake to 43.3%. The remaining shares was sold down in a number of accelerated book buildings and NTC's exit was completed on April 3, 2013 where the final shares were sold (see Figure 3.3 for an overview of the TDC share price development and main events).

Figure 3.3: TDC share price development from IPO in 1994 to delisting in 2018

Note: Share price adjusted for splits why the share price at the time of acquisition does not equal DKK 382
Source: FactSet, company filings, news reports

3.4.2 Return estimation

Table 3.4 shows a rough return estimation for the consortium from the public takeover of TDC in 2005 and the following exit. The table estimates cash outflows and inflows throughout the holding period and calculates returns based on this. First, the cash outflow consists of the initial equity contribution by the consortium, amounting to DKK 16.4bn. The cash inflows are made up of dividend payments, share buybacks and finally sell downs. The total estimated cash inflow is DKK ~50bn throughout the holding period. This gives a money multiple of 3.0x. The IRR is calculated based on the timing of cash flows and results in an IRR of 20.4%, which is within the typical targeted return range for PE funds.

Table 3.4: Analysis of equity returns to private equity consortium

Outflows	**EURm**	**DKKm**
Total debt financing	8'454	63'057
Equity contribution	2'197	**16'387**
Total amount paid	10'651	79'444
Stake acquired	88.2%	88.2%
Implied enterprise value at entry	12'076	90'072

Money Multiple	**DKKm**
Total equity investment	16'387
Total proceeds to equity holders	49'948
Money multiple	**3.0x**
IRR	**20.4%**

Cash flows to consortium during holding period (i.e. excl. minority owners)

DKKm	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Outflows:										
Investment	(16'387)	-	-	-	-	-	-	-	-	(16'387)
Inflows:										-
Dividends	-	-	612	629	6'971	-	1'063	1'450	-	10'725
Share buybacks	-	-	-	-	-	7'938	-	246	-	8'184
Sell downs	-	-	-	-	-	-	10'710	5'586	14'744	31'039
Total inflow	-	-	612	629	6'971	7'938	11'773	7'281	14'744	49'948
Total cash flow	**(16'387)**	**-**	**612**	**629**	**6'971**	**7'938**	**11'773**	**7'281**	**14'744**	**33'561**

Note: Return calculated as inflows less outflows during the holding period adjusted for ownership stake (88.2%)
Source: Mergermarket, company filings, news reports

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Chapter 4: Literature review and theoretical framework

In this section, we provide the theoretical and empirical backdrop of our research and state the hypotheses motivated by the extant literature. In so doing, we propose a comprehensive framework with leverage at its centre that contains, on the one hand the drivers of debt structure and leverage and, on the other hand, leverage's impact on equity performance. In formulating this framework, we propose several original relationships, one of which concerns agency sensitivity of a buyout target and debt structure, guided by our reading of existing academic work as well as practical experience. Our hypotheses make the major links in our framework explicit; they concern 1) the drivers of buyout debt structure, 2) how PE-firms structure debt to attain desired amounts of leverage, 3) the impact of leverage on buyout pricing, and 4) the impact of leverage on fund returns. The theoretical concepts that we rely upon are set forth in Section 4.1 and predominantly consist of agency theory and its basis in information asymmetry and incentive structures, but we also draw on traditional capital structure theory as well as so called clientele effects. Throughout the formulation of our hypotheses (Section 4.2 and 4.3), we also draw on the narrower fields of research dealing with the particular problems at hand, for instance the relationship between covenant strength and leverage.

4.1 Theoretical background

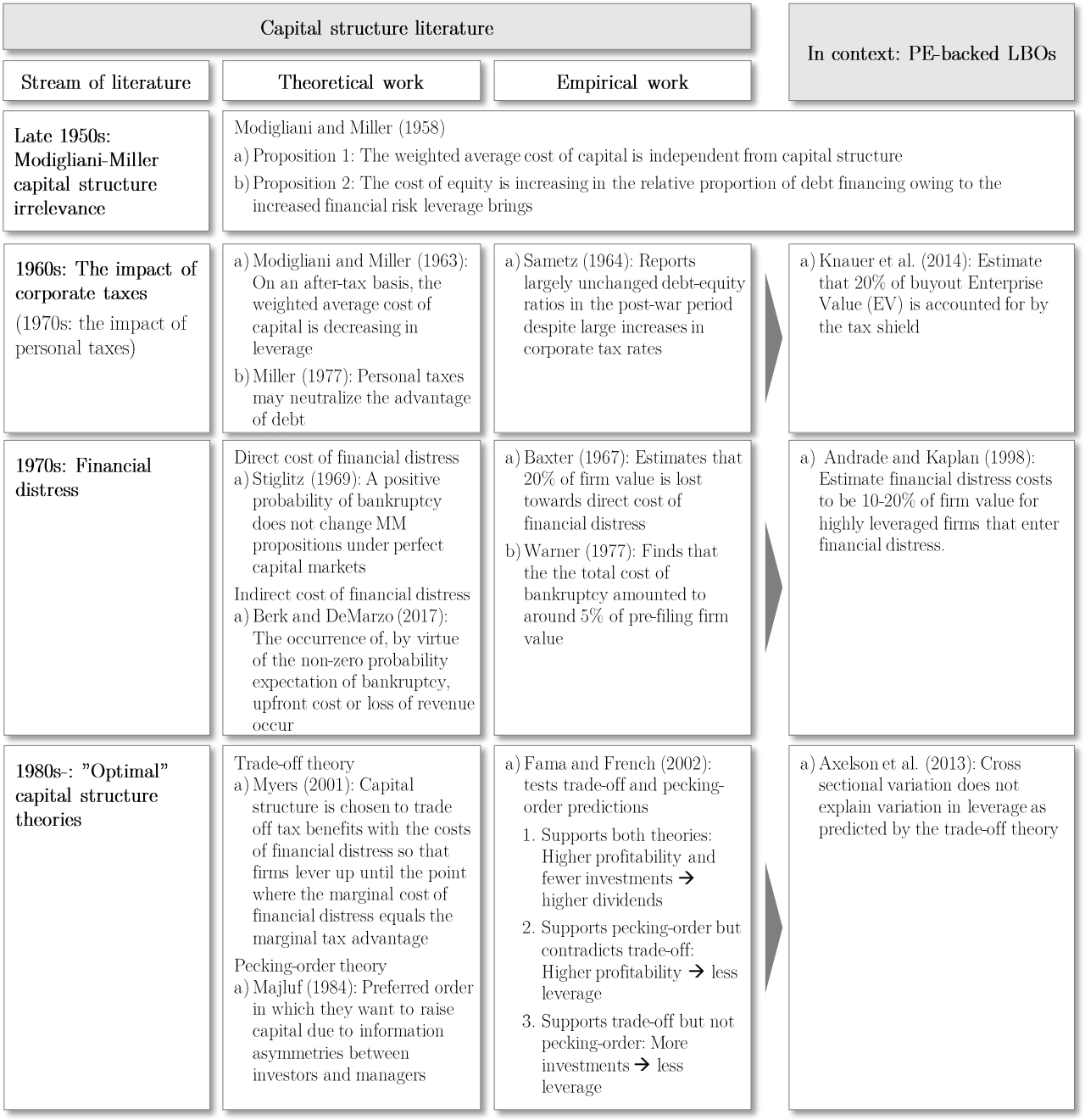
4.1.1 Traditional capital structure theory

Given our focus on debt heterogeneity and the use of leverage in a PE context, it is beyond the scope of this text to provide a comprehensive review of traditional capital structure theories which were largely developed in a corporate context, and, as pointed out by Axelson et al. (2013), have little explanatory power on the capital structure of PE owned firms. A brief review is provided in Appendix B and summarized in Figure 4.1. Modigliani and Miller's (1958) perfect markets' capital structure irrelevance hypothesis has received much attention but for our research, the main takeaway is the second Modigliani-Miller Proposition which states that equity returns will be increasing in leverage as financial risk increases. Clearly, this is an important finding that imply, all else equal, a positive relation between leverage and equity returns prompting researchers to use 'risk-adjusted' equity returns in empirical work (Engel et al., 2012). Subsequent research has pointed out that that leverage may bring other effects than an increase in required return on equity, such as tax benefits of debt (e.g. Bull, 1989; Knauer et al., 2014; Modigliani & Miller, 1958, 1963) and financial distress costs (Andrade & Kaplan, 1998; Warner, 1977).

Because debt has both benefits and costs in imperfect markets, a trade-off theory was put forward postulating that capital structure is chosen to trade off tax benefits with the costs of financial distress so that firms lever up until the point where the marginal cost of financial distress equals the marginal tax advantage (Myers, 2001). A key contribution of the trade-off theory is that the optimal capital structure of firms should vary with firm-specific characteristics such that firms with a high debt capacity and which are positioned to utilize tax benefits should have more debt in their capital

structure. These firms are characterized as firms with tangible assets and stable profits. On the other hand, firms with many investment opportunities and more intangible assets, characterized as growth companies, should have less debt in their capital structure. Fama and French (2002) indeed found that firms with more investment opportunities tend to have lower leverage but, in contrast to the prediction of the trade-off theory, also provided evidence for a negative relationship between profitability and leverage.

Figure 4.1: Review of traditional capital structure theory



Note: See also Appendix B for a more thorough review

The trade-off theory is often complemented with the pecking-order theory which suggests that public companies have a preferred order in which they want to raise capital due to information asymmetries between investors and managers (Myers & Majluf, 1984). Specifically, a public company that have a valuable real investment opportunity and needs to raise cash to finance this investment opportunity will be reluctant to raise capital in the public market, if managers act on behalf of existing shareholders, as this will signal that the company's shares are overvalued. The same principle applies to debt issuance although the signalling value of debt issuance is lower than for equity issuance. Companies will therefore prefer internal funds as a mean of financing. An implication of this theory is that profitable companies with large free cash flows may refrain from reaching the "optimal" amount of debt due to the information asymmetries associated with debt as opposed to internal funds. In terms of our research setting, the main takeaway of the literature on corporate capital structure as reviewed here is the necessity of including industry controls in our data analysis.

4.1.2 Agency Theory and Information Asymmetry

The potential for agents not maximizing profits presents another plausible deviation from the perfect capital market assumptions of Modigliani and Miller (1958). Jensen and Meckling's (1976) seminal piece brought the then novel agency theory into the literature on capital structure. Economists had recently been formulating models that incorporated a separation of control rights (see e.g. Berhold, 1971; Ross, 1973). Ross (1973, p. 134) defines an agency relationship as

> "an agency relationship has arisen between two (or more) parties when one, designated as the agent, acts for, on behalf of, or as representative for the other, designated the principal, in a particular domain of decision problem."

The relationship between managers (agents) and owners (principals) or equity holders (agents) and debtholders (principals) are examples of relationships often viewed in this way. We will deal with both of these agency relations below.

As alluded to in the quote above, the critical aspect of an agency relationship is the delegation of control rights from someone who has an interest in the outcome of any decisions to someone whose personal interests may or may not be perfectly aligned with the principal's preferred outcome of those decisions. A consequence that sometimes arises thereof, dubbed the principal-agent problem, is that the agent, if maximizing its own utility, may act/take decisions that are not in the best interest of the principal. In addition to separation of ownership and control, conflicts of interests, and rationality, the conditions under which principal-agent problems may occur include the existence of information asymmetries and uncertainty (risk) such that principals cannot perfectly observe a one-to-one relationship between agents' efforts and decisions on the one hand and outcomes on the other hand (Thomsen & Conyon, 2012). The following subsections provide an overview of a few of the agency relations and the problems therein relevant to our empirical setting.

4.1.2.1 Manager-owner relation

In large part, the field of corporate governance came about as a response to the need for better alignment between managers' interests and those of the shareholders and, if such interests are incongruent, systems that force managers to take actions in the best interest of shareholders. If the corporate governance system is not effective, agency problems are thought to result in e.g. excessive perks, empire building, and management entrenchment (Berk & DeMarzo, 2017).

Capital structure was linked to these agency problems by Jensen (1986), who argued that leverage serves to reduce the free cash flow problem, a precedent for wasteful investments. Large amounts of debt, by requiring significant amounts of cash flow to be devoted towards interest and repayment of principal, eliminates any residual cash flow available for value destroying investments as well as forces managers to make efficiency improvement. The presence of debtholders also adds another layer of management oversight that, when a firm is highly levered, will be closely monitoring managers' actions. What is more, by lowering the equity cheque, leverage allows ownership to be more concentrated, which in turn increases the incentive for owners to engage in management monitoring (Jensen & Meckling, 1976). In sum, agency predicts that the effect of leverage lessens agency problems in the manager-owner relationship which decreases the cost of debt and, in turn, increases firm value.

Particularly relevant to our setting is also Jensen's (1989) claim that leveraged buyouts create value through 1) high leverage as mentioned above, and 2) powerful incentives. The organizational form imposed by PE firms, with its closely held ownership structure combined with small board sizes and incentivized managers, creates a superior governance structure to public corporations. Jensen's view was later backed by other authors who provided evidence that leveraged buyouts create value by significantly improving the operating performance of acquired companies and by reducing free cash flow problems via high debt service requirements. Kaplan (1989) used a sample of 76 large management buyouts of public companies completed between 1980 and 1986 and found that, in the three years after the buyout, these companies experienced increases in operating income and net cash flow, and an average increase in market value of 96% from two months before the buyout announcement to the post-buyout sale. Furthermore, he found that the operating changes was due to improved incentives rather than layoffs or managerial exploitation of shareholders through inside information.

4.1.2.2 Owner-lender relation

Notwithstanding adverse selection problems in loan origination, in the owner-lender relation, "a conflict of interest exists if investment decisions have different consequences for the value of equity and the value of debt" (Berk & DeMarzo, 2017, p. 597). Equity (the agent) has control rights (if the firm is not in bankruptcy) and management is hired by owners. Particularly in high leverage situations, it may be a rational response of equity holders to exploit creditors.

Two distinct generic problems have been pointed out in the literature. The first, asset substitution, was pointed out by Jensen and Meckling (1976). It refers to situations where, because high leverage

means that the equity stake is small in absolute terms or maybe even under water, equity holders can benefit by taking risky, negative-NPV decisions, such as replacing safer projects with riskier ones. Equity's incentive to engage in asset substitution rests on the fact that most of the risk will be borne by creditors while most of the upside is captured by equity. Leland's (1998) model of asset substitution problems in a Modigliani-Miller framework shows, however, that the impact on optimal leverage of owner-lender conflicts is negative but likely to be relatively small in magnitude. The second problem concerns under-investment (Berk & DeMarzo, 2017). Specifically, if equity is under water, owners will hesitate to finance low-risk positive NPV projects because part of the positive NPV will be captured by debt holders and, as such, the project may be negative NPV from a purely equity perspective.

4.1.2.3 General-Limited PE Partner relation

PE funds generally share a common organizational structure; they raise equity when they are formed, and raise capital, in the form of debt, when investments are made. Equity is raised from the fund's LPs, typically pension funds, sovereign wealth funds, insurance companies and high-net-worth individuals. Meanwhile, the GPs identify investment opportunities and have, more or less, full discretion over which investments to pursue. A typical fee structure for a PE sponsor consist of a fixed yearly management fee (typically 2% of committed capital) and a carry fee calculated as a percentage of the nominal return created for the LPs (typically 20%). Because GPs have no real down-side risk, this fee structure is convex, and option-like, which creates adverse incentives for GPs' investment behaviour. Specifically, GPs have an incentive to over-invest and invest in bad deals because they only participate in positive returns. Axelson et al. (2009) argue that ex-ante equity financing of PE funds somewhat alleviates this problem. By basing the GPs' compensation on the collective performance of a fund, GPs are reluctant to pursue risky deals with a negative NPV since these will potentially contaminate the returns from goods deals. However, pure ex-ante equity financing still leaves considerable freedom for the GPs to invest and this creates an agency problem. For example, if the GPs have failed to identify any good investment opportunities so that there are no fund returns to contaminate, and the fund is approaching the end of its investment period, the GPs have an incentive to pursue risky investments with negative NPV to gain exposure to any upside potential. Axelson et al. (ibid.) show that a mix of ex-ante and ex-post financing alleviates this agency problem. By introducing ex-post financing (debt), the general partner will have to raise debt on a deal-by-deal basis and each individual deal will be evaluated on its own by the capital markets. Only deals with a positive NPV will be financed and the general partner is therefore prevented from investing in bad deals. However, the model also predicts that when access to debt is "easy", PE funds will nonetheless have an incentive to lever up as much as possible and to overpay for deals.

This view is somewhat supported by Ljungqvist, Richardson, & Wolfenzon (2007) who analyse the determinants of buyout funds' investment decision in a model where the supply of capital is "sticky" in the short-run. They find that established funds accelerate their investment flows when investment opportunities improve, and credit market conditions loosen. Moreover, they find that younger funds

invest in riskier buyouts in an effort to establish a track record, which is in accordance with the view that GPs tend to overinvest due to their option-like payoff.

4.1.3 Clientele effects

An interesting finding in the capital structure literature is the existence of so-called tax clienteles (Berk & DeMarzo, 2017). In essence, the tax clientele argument concerns the relative favourability of dividends versus capital gains. Certain investors will have relatively higher dividend tax rates while other investors will have relatively higher capital gains tax rates. The former will prefer that firms' earnings are retained or paid out by means of share repurchases to get their return in the form of capital gains while the latter prefers dividends. An implication of this view is that dividend policy should be a function of investor base. Elton and Gruber (1970) were among the first to provide evidence for such a relationship between firms' dividend policy and differences in tax brackets. Another implication is that investors in different tax brackets can benefit from trading around the ex-dividend date to position themselves most favourably given their tax structures. Kalay (1982) finds evidence for such trading behaviour, dubbed dividend-capture.

Clearly, the literature on clientele effects has been preoccupied with payout policy and tax brackets but its implication for other aspects of financial policy may be equally important. Lewellen, Stanley, Lease, and Sclarbaum (1978, p. 1397), in contrasting equity to other asset classes, summarize the view in terms of "specialization" by proposing that "[i]t is conceivable that some specialization along tax or other lines might prevail for bonds, preferred stocks, options, and other instruments". Broadly speaking, we adopt here a somewhat more general definition of clientele effects that capture differences in demand characteristics for different assets. For the purposes of Hypothesis 2, which will be discussed in Section 4.2.2 below, the different assets under considerations are different debt products (different instruments and different structures in terms of security, seniority, and covenants).

Differences in demand characteristics may be the consequence of 1) regulation (incl. taxation) of different investor types, and 2) differences in preferences. When it comes to regulation, certain institutional debt investors such as debt-focused hedge funds are only very lightly regulated when it comes to what they can invest in whereas banks and e.g. pension and insurance institutions are often under much heavier regulation. Pension funds often face diversification requirements while banks face capital and liquidity requirements in the form of Basel III, and the Federal Reserve's leveraged lending guidelines have included a leverage limit of 6x EBITDA for major US investment banks since 2013 (Federal Reserve, 2013).

The second source of differences in demand characteristics, namely variations in preferences among debt investors, is a straightforward implication of the asset pricing literature, or Capital Asset Pricing Model to be precise (Lintner, 1965; Sharpe, 1964; Treynor, 1961). While all portfolios on the capital market line will be efficient, the optimality of any given portfolio for individual investors will depend on their risk averseness (Munk, 2017). Specifically, the optimal portfolio will be found at the

intersection of investors' utility function with the capital market line. In the terminology adopted in this section, then, we say that different clienteles may favour different risk/return characteristics of debt and capital structures as a consequence of differences in the risk adversity of their utility functions.

4.2 Hypothesis 1&2: What drives debt structure and how PE-funds structure buyout debt to maximize leverage

Figure 4.2: Overview of theory and empirical findings on main debt structuring elements

Topic	Focus in literature	Theoretical backdrop	Empirical findings	Other sources
Debt instruments	"Bank" vs "public" debt (approx. loans vs bonds)	a) Agency/collective action: concentrated (banks) better incentivized to monitor and take action (Diamond, 1991; Rajan, 1992) b) Market imperfections: access to public markets moderate "preferability" considerations	a) More concentrated syndicates when agency problems are severe (Sufi 2007) b) Hedging activity increasing in bank financing (Lookman 2009)	Bolton and Freixas, 2000 Faulklander and Petersen, 2006 Park, 2000
Security	'Collaterability' rather than actual grants of security	a) Equilibrium modeling: marginal cost of debt as a function of leverage shifts down as collateral increases (Binsbergen, Graham, and Yang 2010) b) Agency theory: collateral reduce agency costs (Rajan and Zingales 1995)	a) Unsecured creditors' claims more likely be violated in bankruptcy proceedings (Weiss 1990) b) Collateral increases availability of bank debt (Augostino & Trivieri 2017)	Boot et al., 1991 Cerqueiro et al., 2016 Coco, 2000
Seniority	Use of subordinated debt in bank context	a) Agency/moral hazards: sub-debt holders incentivized to monitor managers/owners, fostering "market discipline (Chen et al 2004; Stanton 1998) b) Clientele effects/market imperfections: limits to the availability of senior debt drives use of sub-debt to increase leverage	a) Subordinated debt associated with lower risk of financial distress (Ashcraft 2008) b) Hedging activity increases in proportion of sub-debt (Belkhir 2013) c) More risky firms more likely to use sub-debt (Rauh and Sufi 2010)	Evanoff et al., 2011 Zhang et al., 2014
Covenants	Covenant count and restrictiveness in both corporate and PE-context (but no direct relation to aggregate leverage, buyout pricing or fund returns)	a) Contracting literature & information asymmetries: covenants lessen the need for extensive information gathering and processing pre-contracting (Smith and Warner 1979; Achleitner 2011) b) 'Agency Thery of Covenants': covenants rein in agency problems between debt and equityholders at high levels of debt (Bradley and Roberts 2015)	a) Ex ante uncertainty associated with stronger covenants (Demerjian 2017) b) Covenants reduce overinvestment problems (Chava and Roberts 2008) c) Covenant strength is increasing in leverage (Billett et al. 2007	Gilje, 2016 Rauh and Sufi, 2010

As pointed out by Rauh and Sufi (2010, p. 4243), capital structure research has traditionally adopted a homogenous treatment of all corporate debt and focused on the aggregate, often relative to the

amount of equity, "presumably in the interest of building more tractable theory models or due to a previous lack of data". But as the authors point out, distinct heterogeneity exists in the debt structure of corporates. The properties of different debt instruments differ significantly when it comes to their cash flow claims, risk, sensitivity to information, and incentive effects for managers and equity holders.

We focus on four main debt structuring elements, namely 1) debt instrument, 2) security/collateral, 3) contractual seniority, and 4) covenants. The literature on these individual structuring elements is somewhat sparse, with different theoretical concepts being applied, sometimes in different ways, for each structuring element. Moreover, little work has been done on how the individual structuring elements relate to aggregate leverage, and even less on how they may impact buyout pricing and PE fund returns, i.e. the objects of interests in this thesis. To maintain a degree of focus here, a survey of the main strands of research pertaining to each structuring element has been moved to Appendix C while a summary is provided in Figure 4.2 above. In the following section, we draw on these scattered strands of research as well as our main theoretical concepts reviewed above to provide 1) a hypothesis of the drivers of the use of different debt structures, and 2) two alternative hypothesis relating structuring elements to the amount of leverage used to finance buyouts.

From the literature review on each structuring elements in Appendix C, a few generalisations start to emerge. Firstly, certain structures, when it comes to debt instrument usage, seniority, security, and covenants, are, all else equal, associated with larger agency problems. We refer to such riskier and agency-prone structures that are characterized by incorporating claims that are e.g. subordinated to other claims, unsecured or second in line to collateral, and with less protection from covenants as being aggressive. Aggressive structures contrast defensive structures that are characterized by all-senior, secured bank debt with restrictive covenants. Debt structures obviously come in different shapes and will in most cases be characterized by varying degrees of aggressiveness across different structuring elements. Nonetheless, it is fruitful to think in general terms, and Figure 4.3 below illustrates the two extremes that provide the framework for the first p[2]art of our analysis which investigates the drivers of debt structure as well as debt structure's impact on leverage.

The link between structure (aggressiveness) and properties (riskiness and agency-problems) is a corollary to the link between aggregate debt and agency problems, and here we provide some of the arguments found in the literature for such a link.

When it comes to debt instruments, the literature has tended to focus on the investor/lender identity rather than idiosyncratic characteristics of different debt instruments (Diamond, 1991; Rajan, 1992). Bank financing (primarily TLAs in the leveraged space), with a fairly concentrated lending base as opposed to public debt (TLBs and bonds in the leveraged space), is seen associated with lower agency problems as having concentrated lenders provide sufficient incentives to monitor and limit moral hazards and thereby overcome collective action problems (Park, 2000). Higher hedging activity for

2

firms with more bank financing supports this view (Lookman, 2009). When aggressiveness is defined as greater reliance on 'public' debt, as in Figure 4.3, then the above papers provide support for the proposition that agency problems increase in aggressiveness. In contrast, Rajan (1992) suggests that the flipside of concentrated bank financing is the creation of an information monopoly that could lead to rent extraction. As such, one would expect that, at least for low levels of aggressiveness, increasing aggressiveness in the form of a more dispersed lender/investor base generates agency benefits.

Figure 4.3: Drivers of debt structure and impact on leverage

		Types of debt structure (Aggressiveness)	
		Defensive structure	Aggressive structure
	Structure	Structuring elements • Instruments: "Bank" debt, amortizing • Security: Secured only • Liens: First lien • Seniority: Senior only • Covenants: Many and restrictive, maintenance tested	Structuring elements: • Instruments: "public" debt, bullet structure • Security: Secured and unsecured • Liens: 2nd lien (and more) • Seniority: Senior and subordinated • Covenants: Few and loose, incurrence tested
	Properties	Riskiness (debt-holders): Low Agency-problems: Low	Riskiness (debt-holders): High Agency-problems: High
Hypothesis 1	Drivers	Business/environment prone to agency problems: • Less profitable firms • Smaller firms • Riskier firms	Business/environment not prone to agency problems • More profitable firms • Larger firms • Less risky firms
Hypothesis 2	Impact on leverage	**Hypothesis 2a:** Defensive structures allow PE-firms to raise more leverage for buyout financing **Rationale:** Defensive structures provide lenders/investors **more protection against agency problems**, allowing more capital to be raised thereby increasing leverage	**Hypothesis 2b:** Aggressive structures allow PE-firms to raise more leverage for buyout financing **Rationale:** Clientele effects of multi-tiered, public debt, structures (senior/subordinated, secured/unsecured) allow raising capital from more investors thereby increasing leverage.

On security, Rajan and Zingales (1995, p. 1455) suggest "that tangible assets are easy to collateralize and thus they reduce the agency costs of debt". In a detailed survey of the then existing literature and evidence, Coco (2000) found that agency costs are reduced through collateral's ex ante role as a signalling device of credit worthiness. Boot, Thakor and Udell (1991) instead focus on the ex post disciplinary role that collateral has in preventing asset substitution. Partially as a function of collateral's effect on agency cost, Binsbergen, Graham, and Yang's (2010) model of the marginal cost of debt shifts down in a parallel fashion with respect to the collateralizability of assets. Separately, in the literature on distressed debt Weiss (1990) finds that unsecured creditors' claims may be violated in bankruptcy proceedings which we would expect to lead to higher ex ante cost of unsecured debt. Cerqueiro, Ongena, and Roszbach (2016) tell a somewhat different story in suggesting that reduced collateral leads to tighter credit limits which, in turn, reduces the need for monitoring. However, the reduced need for monitoring, obviously, is not the consequence of lower agency problems caused by lower collateral. Rather, reduced collateral, according to the authors, leads creditors to tighten (or structure more defensively) other aspects of the debt structure.

In terms of contractual seniority, several authors have argued that the presence of subordinated debt adds a highly incentivized monitoring layer to the corporate governance structure. Stanton (1998) proposes a model where sub-debt is associated with a reduction in the overinvestment problem but more extensive underinvestment problems. The empirical literature on contractual seniority has predominantly used financial institutions as the object of analysis given the contractually richer nature of the liability side of banks' balance sheets. In this setting, Evanoff, Jagtiani, and Nakata (2011) and Zhang, Song, Sun, and Shi (2014) emphasize preconditions, incl. liquidity of the sub-debt market for yields to serve as an effective signalling mechanics, necessary for effective monitoring by subordinated debt holders. Nonetheless, Ascraft (Ashcraft, 2008, p. 554) suggests that sub-debt looks to be "effective in limiting moral hazard" after finding a lower probability of financial distress or bankruptcy for firms with subordinated debt. Clearly, these authors seem to suggest that aggressiveness in terms of seniority reduces agency problems as opposed to increases agency problems. We note that the empirical findings of previous research focusing on banks may be distorted relative to our setting by the presence of depositors as the most senior lenders on banks' balance sheet. Depositors are generally weaker monitors, given that they are highly dispersed, and their deposits are very loosely covenanted relative to other loans on banks' balance sheet. As such, the distinction between senior and subordinated debt capital in a bank setting is materially different from that of leveraged buyouts where senior lenders will be large, sophisticated, more or less concentrated institutions.

Lastly, on covenants Bradley and Roberts' (2015) Agency Theory of Covenants (ATC) posits that the main purpose of covenants is to put in place controls over agency problems. Achleitner et al. (2012) similarly suggest that covenants are used to reduce the risk of agency problems. Empirical support is provided by Chava and Roberts' (2008) who find that covenant breaches result in capex reductions and Begley and Feltham's (1999) result that covenant restrictiveness reduces agency problems via managerial compensation policies. In conclusion, the covenant literature indicates that increasing aggressiveness in terms of fewer and less restrictive covenants produce increasing agency problems.

4.2.1 Hypothesis 1: Drivers of debt structure

Above, we provided support for the proposition that a more aggressive debt structure is related to greater agency problems. Here, we make the argument that certain firm or environmental characteristic fosters greater sensitivity to agency problems, and that such sensitivity governs the optimal aggressiveness. We review relevant literature on each of our four structuring elements (i.e. debt instrument, security, seniority, and covenants) and find that the literature generally supports the proposition that sensitivity to agency problems drive debt structure aggressiveness (or, defensiveness), except for the seniority structure.

On debt instrument usage, Faulkender and Petersen (2006, p. 46) argue that "[f]irms that are opaque (and thus difficult to investigate ex ante), or that have more discretion in their investment opportunities (and thus are difficult for lenders to constrain contractually), are more likely to borrow from active lenders". The authors operationalize this statement by claiming that larger firms and less

risky firms, i.e. factors negatively correlated with sensitivity to agency problems, are more likely to raise capital from institutional investors. Bradley and Roberts (2015), similarly, suggest that issuers of private debt are more likely to be smaller, riskier, and have fewer tangible assets but more growth opportunities. Khang and King (2015, p. 377) support this view, pointing out that "issuing public debt (versus not issuing) may indicate a lower potential for debt-related agency problems, because public debt could not have been issued if the associated agency problems were too severe". Lastly, Sufi (2007) finds that, in syndicated loan transactions, lead banks will retain a larger share of the loan and form more concentrated syndicates when agency problems are severe. Clearly, these authors suggest that the incentive to put in place more aggressive debt structures, in terms of using instruments that are distributed more broadly, is decreasing in sensitivity to agency problems.

In terms of security, when sensitivity to agency problems are low, the need for collateral to align incentives and protect lenders is lower. As stated by Boot et al. (1991, p. 460), "[t]he good borrower gets an unsecured loan since it is not efficient to motivate it to work harder", whereas borrowers who otherwise face moral hazard problems have to post collateral to disincentivize e.g. asset substitution. Agostino and Trivieri (2017) claim that informational opaqueness in the context of SMEs causes asymmetries that collateralizable assets are important in reducing. Relatedly, Weiss' (1990) finding that violations of the priority of claims are rare for secured debt providers but are common between unsecured creditors and equity holders in bankruptcy suggests that an all-secured debt structure is optimal in cases where sensitivity to agency problems are high.

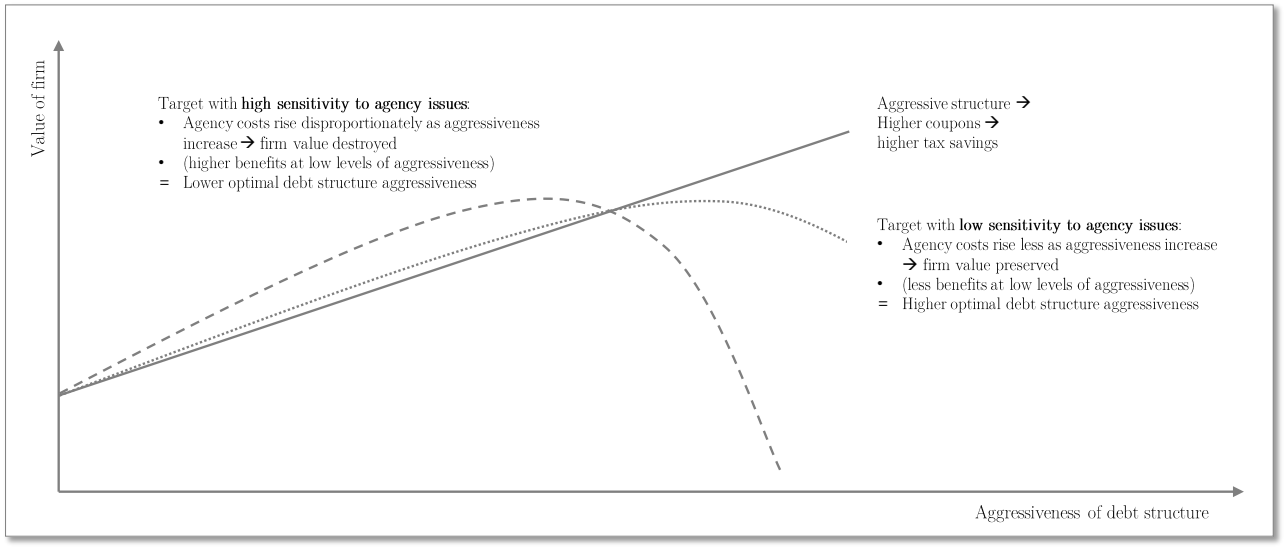
Since previous literature has found that subordinated debt is associated with a reduction in agency problems, one could hypothesize that higher sensitivity to agency problems causes firms to optimally make use of a greater proportion of subordinated debt in their debt structure. For instance, Belkhir (2013) provides evidence that subordinated debt is associated with greater hedging activity. In addition, firms of lower credit quality are more likely to use subordinated debt, and Rauh and Sufi (2010) suggest that this finding stems from sub-debt's ability to reduce incentive conflicts via monitoring. We suggest that supply effects may be distorting this result, however, in that senior lenders hesitate to provide the required amount of debt to firms' highly sensitive to agency problems and that the relation with lower credit quality is confounded by higher leverage, which may be associated with higher use of subordinated debt (which we examine in the next section).

In the covenant literature, sensitivity to agency problems have been examined in terms of information asymmetries. Here, Achleitner et al. (2012) suggest that if information asymmetries are otherwise extensive, maintenance covenant tests providing early warnings if risks are escalating, afford a way of reducing agency problems without needing costly monitoring. Under the cloak of contracting theory, Smith and Warner (1979) make a related point. Specifically, where circumstances can be described as highly complicated and opaque, stronger covenants reduce contracting costs as lenders need to spend less time on information gathering and processing as well as negotiation. Empirically, Demerjian (2017) finds that ex ante uncertainty is associated with stronger covenants. Other authors have put forth

circumstantial evidence in favour of a relationship between agency problem sensitivity and covenant aggressiveness. Malitz (1986) finds that the presence of covenants correlates negatively with firm size indicating that sensitivity to agency problems and access to public debt markets are key drivers. Bradley and Roberts (2015) find that firm size is negatively related to the presence of covenants (the authors argue that larger, more mature firms, less likely to have large growth opportunities and more free cash flow subject to agency issues), but profitability, measured as EBITDA-to-assets, is found to be unrelated to the use of covenants. Achleitner et al. (2012) argue that PE-firms, whose frequent interactions with lenders and investors produce reputational capital as well as reductions in information asymmetry, both of which lower sensitivity to agency problems which, in turn, allows them to increase the aggressiveness of portfolio company debt structure.

In textbook presentations of the agency benefits and costs of aggregate debt it is customary to take as starting point a linear relationship between firm value (Y-axis) and aggregate debt (X-axis) with a positive slope representing the tax benefits of debt (Berk & DeMarzo, 2017, p. 608). Such representations then overlay this chart with a concave function that initially exceed the linear function due to agency benefits of debt outweighing agency costs at low leverage levels, while this function eventually breaks below the linear function and heads toward zero at high leverage levels as agency costs magnify. The argument here is similar in nature to that of the relation between firm value and aggregate debt, why we have opted to visualize it in a similar fashion in Figure 4.4.

Figure 4.4: Relationship between aggressiveness of debt structure and firm value



Rather than having aggregate debt on the X-axis, as in Berk and DeMarzo (2017), Figure 4.4 has 'aggressiveness of debt structure'. The starting point is an upward sloping line (upward sloping because more aggressive debt structures are likely to carry higher coupons, e.g. as compensation for less covenant protection, which carry tax benefits; but this is not the essence of our argument, and for all practical purposes, the line could be flat) with two concave functions overlaid. Both of these capture the idea that as aggressiveness of debt structure increases, there may initially be benefits in terms of

firm value as more aggressive structures may provide agency benefits, such as the market disciplining effect of subordinated debt (Chen, Robinson, & Siems, 2004). As aggressiveness increase, agency problems become more severe, for instance, as shown by Billett et al. (2007), when covenants become less restrictive (increasing aggressiveness) overinvestment problems become more pronounced, which is to the detriment of firm value.

The difference between the two concave functions gauge the drivers of debt structure. As argued earlier, certain firm characteristics, such as low current profitability, are associated with higher sensitivity to agency problems as aggressiveness of debt structure increases. For such firms, represented by the dashed line, the optimal aggressiveness is lower than otherwise in order for the debt structure to accommodate agency problems. For instance, Rauh and Sufi's (2010) finding that lower credit quality firms are more likely to have larger covenant suites in order to reduce incentive conflicts confirm this line of argument. In contrast, firms with lower sensitivity to agency problems (represented by the dotted line) have higher optimal aggressiveness because the positive aspects of aggressiveness (one of which may be higher leverage, to be discussed further in the next section) outweigh the agency costs of aggressiveness for a greater spectrum of aggressiveness. Notice also that the dashed line initially lies above the dotted line; the argument here is that firms with high sensitivity to agency issues also benefit, to a greater extent, of the agency problem reducing effects of e.g. the increased monitoring incentives provided by unsecured and subordinated debt and a reduction in monopoly rents for banks as debt provision becomes more dispersed, which may dominate the agency problems created by an aggressive structure at low levels of aggressiveness. These arguments are captured in the following hypothesis:

H1: Targets with lower sensitivity to agency problems will have more aggressive debt structures

4.2.2 Hypothesis 2: Debt structure's impact on leverage

Rizzi (2016) holds that it is a well-established belief among practitioners that more aggressive structures serve the purpose of increasing the amount of leverage available for financing buyouts. But from a theoretical standpoint, it is not immediately clear that more aggressive structures serve to increase leverage. In fact, implicit in our review of the literature, we see two main competing arguments emerging. Firstly, agency problems are increasing in leverage (Berk & DeMarzo, 2017) so one could think that structures less prone to agency problems (defensive) would be instrumental in increasing leverage as safety provided by concentrated lenders/investors, seniority, security, and covenants would limit the degree to which agency costs spin out of proportion compared to aggressive structures. On the other hand, an aggressive structure also featuring riskier debt offerings may attract specialized investors who seek different risk/return combinations, thereby adding another layer on top of senior/secured debt providers. In essence, the second contribution of our thesis is to establish which of

the above arguments, i.e. agency-based versus clientele effects both of which we will elaborate upon below, dominate empirically.

The agency-based explanation is closely connected with the discussion of the link between sensitivity to agency problems and debt structure presented in Section 4.2.1 in the sense that leverage increases sensitivity to agency problems. We expect particularly the debt instrument usage, security, and covenant dimensions of debt structure to be connected to leverage via their interrelations to agency costs while the relationship between subordinated debt's agency features and leverage is less straightforward given the discussions above. When it comes to debt instrument usage, on the one hand, we expect that because agency problems of debt are larger at high debt levels, PE-firms optimally engage bank lenders that are better positioned to accommodate such problems (e.g. Diamond, 1991; Rajan, 1992). On the other hand, higher leverage, all else equal, means that investors receive higher allocations in absolute terms in a public debt deal which increases their incentive to monitor. This increases the relative favourability of bond and institutional term loan financing, holding agency problems fixed. Overall, we think that the first argument tends to dominate the second, i.e. monitoring advantages of banks mean that bank lending is positively related to leverage.

On security, Rajan and Zingales (1995, p. 1451) argue that fixed assets are easily collateralized and that "the greater the proportion of tangible assets on the balance sheet (fixed assets divided by total assets), the more willing should lenders be to supply loans, and leverage should be higher." Similarly, Agostino and Trivieri (2017) claim that collateral alleviates credit rationing and, as a consequence, foster better financing conditions. In more formal terms, the downward shift to the upward sloping marginal cost of the debt curve in Binsbergen et al.'s (2010) model leads to higher equilibrium leverage given that the marginal benefit function is downward sloping. Note, however, that both papers deal with the capacity of a firm's assets to serve as collateral rather than de facto grants of security over such assets in debt documentation. The question at hand is whether taking out security on a first-ranking basis is associated with higher willingness on the part of lenders and debt investors to provide capital. Still, the naïve agency-story as highlighted above suggests that even at the margin more debt is available at secured terms relative to a more aggressive structure featuring both secured (with tiered pledge rankings) and unsecured debt.

Echoing the discussion in Section 4.2.1, an aggressive structure on the seniority dimension have been argued to provide a better defence against agency problems than a defensive one, in contrast to the other debt structure dimensions (Stanton, 1998). Given that an aggressive structure with subordinated debt providing investors with high-powered incentives to monitor and take steps to avoid appropriation by equity holders, one would expect an aggressive seniority structure to allow for higher leverage. Again, we hesitate that previous empirical literature (e.g. Ashcraft, 2008; Evanoff et al., 2011; Zhang et al., 2014) has largely been confined to the financial services industry and may not easily extrapolate to other sectors. We hypothesize that senior lenders in a leveraged buyout setting will be sufficiently incentivized (relative to senior lenders in e.g. banks) for them to carry out extensive monitoring. As

such, it seems unlikely that subordinated debt would have enough of a monitoring incentive to provide leverage in excess of what could be provided on a senior basis. Rather, we are inclined to think that the risk of getting appropriated by equity holders, or senior creditors for that matter (for instance, as argued by Asquith, Gertner, and Scharfstein (1994), senior lenders may push a company into bankruptcy when they have certainty with respect to their own claims instead of letting the company restructure and pursue risky but positive NPV projects where subordinated debt investors would receive some of the value creation), means that subordinated debt, i.e. an aggressive structure, has less relevance in a high leverage case from a purely agency perspective.

Viewing covenants from the perspective of financial risk, Achleitner et al. (2012) posit that financial risk associated with higher leverage is a main driver of the covenant setting. Intuitively, when risk is greater, lenders prefer more and stronger contractual safeguards in the form of covenants. Similarly, as argued in Section 4.1, agency problems are increasing in leverage (at high levels of leverage) and the Agency Theory of Covenants holds that covenants are a function of the need to rein in such agency problems (Bradley & Roberts, 2015). Empirically, Malitz (1986) finds that more covenant protection (more defensive debt structure) is required when leverage is higher. Billett et al. (2007), who measure covenant strength in terms of restrictiveness, find that covenant strength is increasing in leverage. Circumstantial evidence in the form of Rauh and Sufi's (2010) finding that lower credit quality firms are more likely to have larger covenant suites supports a positive relationship between leverage and covenant strength. These authors also emphasize covenants as a tool to reduce incentive conflicts at high leverage.

In sum, the literature on agency theory in the context of debt structure holds that relying on public debt with unsecured and subordinated elements as well as weak covenants reduces the leverage available for leveraged buyout financing

H2a: Targets with more aggressive debt structures have lower leverage

The alternative argument, which we broadly characterize as based on clientele effects, has received relatively little explicit attention in the context of the relationship between debt structure and leverage, but is clearly considered important in practice. The authors of this thesis, through their employment in corporate finance and leveraged finance at one of the largest investment banks in the Nordics, have been intimately involved in a number of transactions in which considerations on the amount of leverage obtainable took centre stage. Appendix D shows a hypothetical menu of three different debt structure alternatives resembling something the authors have been involved with pitching to a private equity firm contemplating a leveraged buyout in practice. The example clearly shows that the more aggressive debt structures, here alternative 2 featuring a senior CovLite TLB and a second lien piece and alternative 3 featuring secured and unsecured bonds, are intended to bring about higher leverage.

In the literature, Rizzi (2016) is adopting a practitioner-oriented perspective and is worth citing at length given its relevance

> "In practice, however, buyout debt capacity is effectively determined by the risk appetite of creditors, by the amounts and kinds of debt they are willing to provide a given borrower (and/or its PE sponsor)." (p. 62)

> "The result is a more complex capital structure reflecting multiple financing layers, each directed at investors with different risk appetites for which the type of debt matters as much as the level of debt. This matching of specific instruments with new non-bank investor clienteles willing to pay "up" for them, as we just noted, has enabled issuers to increase their debt capacity." (p. 64)

Clearly, explicit in this view is that different risk/return clienteles can be engaged in combination to bring about higher leverage. From Section 4.1.3, we hypothesize that in addition to variation in the risk averseness of various investors, regulation impacting different investors differently might also contribute to creating different clienteles for different debt structures. In any case, in Section 4.2 we defined an aggressive structure as a multi-tiered structure featuring both senior secured (present in almost all cases) as well as unsecured or subordinated layers on top distributed to a wider range of debt investors. Clientele theory, here, suggests that such an aggressive structure would correlate positively with leverage, as set forth in H2b,

H2b: Targets with more aggressive debt structures have higher leverage

We do not expect all dimensions of debt structure to necessarily be uniformly positively related to leverage as per Hypothesis 2b. For instance, it seems unlikely that clientele effects govern the relationship between covenant strength and leverage as no clientele supposedly prefers weaker covenants without some form of compensation. In the discussion in Section 7.1, we comment on the inadequacy of treating all dimensions of debt structure alike.

4.3 Hypothesis 3&4: How leverage affects buyout pricing and PE-fund returns

The next contribution of the thesis is to revisit the relationship between the use of debt and performance measures. The preeminent authors in this regard are Axelson et al. (2013) whose proposition that PE firms, by virtue of internal agency problems, tend to over-leverage, particularly when credit conditions are favourable, in order to afford higher acquisition prices which, in turn, lowers fund returns has become an accepted maxim. The following hypotheses will be based on this maxim, but below we also present an alternative view put forth in the literature based on the market-timing hypothesis. Both views, their theoretical basis, their underlying rational, and their implications on buyout pricing and fund returns are sketched in Figure 4.5 below.

Each view takes as given that the use of leverage interacts with credit market conditions. On credit conditions, it has been shown repeatedly that credit conditions can vary significantly over time (Kaplan & Stein, 1993), possibly due to variation in credit risk premia distinct from macroeconomic and stock

market sentiment (Collin-Dufresne, Goldstein, & Martin, 2001). Kaplan and Stein's (1993) argument that the boom in the HY bond market in the 1980s caused an overheating of the private equity industry continues to stand out as evidence clearly indicating the importance of credit conditions. The way in which the two views differ concerns the dynamics that translate variation in credit conditions into an effect on buyout pricing and fund returns via leverage.

4.3.1 Hypothesis 3: Leverage on buyout pricing

The agency-view on the effect of leverage pioneered by Axelson et al. (2009) suggest, as alluded to earlier, that GPs at a PE firm have an incentive to use excessive leverage when debt is cheap because their payoff is option-like in nature and thus benefits more from the upside. Ex-post deal financing in the form of debt, which is intended to limit the extent to which GPs can engage in bad buyout deals because external capital serves as a gatekeeper, simply does not serve its purpose when lenders and investors have too much liquidity and are way too eager to provide debt at cheap terms. In other words, the agency reducing constraint of external debt is not binding when debt is too cheap. The resulting story is one in which easy credit conditions drive leverage higher which in turn causes overpayment for deals (Axelson et al., 2013).

Figure 4.5: Views on leverage's impact on buyout pricing and fund returns

	View	Conventional	Alternative
	Theory	Agency (GP-LP problems)	Market timing
	Assumption/ prerequisites	Use of leverage is driven by variations in credit conditions.	
	Modus operandi	When credit markets are hot, general partners have an incentive to over-leverage with cheap debt and engage in risky buyouts.	Leverage will be higher when credit markets are hot because GPs arbitrage cheap debt against equity.
Hypothesis 3	Impact on buyout pricing	**Hypothesis 3:** Cheap debt is used to finance higher buyout prices.	Arbitraging cheap debt implies lower cost of capital which increase firm value and allows acquirers to pay higher purchase prices.
Hypothesis 4	Impact on fund returns	**Hypothesis 4:** Overpayment caused by higher leverage leads to lower fund returns.	Fund returns are positively related to the use of leverage, as arbitrage during times of easy credit leads to higher leverage with rents befalling to equity holders.

The alternative view is based on the market-timing hypothesis which holds that market participants exploit arbitrage opportunities brought about by mispricing in equity and debt markets by adjusting the extent to which equity and debt are used as financing sources (Baker & Wurgler, 2002). Collin-Dufresne et al. (2001) suggest that a consequence of mispricing in debt markets may be that investors/lenders are not properly compensated for risks during times of overheated credit conditions. PE firms are regarded as a class of highly sophisticated investors and, in combination with Ivashina

and Kovner's (2011) finding that reputational capital is built between lenders/debt investors and PE firms as a consequence of repeated interactions, PE firms should be in a unique position to take advantage of any mispricing. The market-timing view also postulates a positive relationship between leverage and buyout pricing. Specifically, arbitraging on cheaper debt lowers the cost of capital which increases firm value and thereby allows PE firms to pay higher acquisition multiples.

Both theoretical views, therefore, posit a positive relationship between leverage and buyout pricing. In terms of empirical evidence, Axelson et al. (2013) provide statistical results on equations measuring this relationship using the US high yield credit spread as an instrument. The authors find a statistically significant positive association between leverage and buyout pricing but notably at no point measure directly the relation between uninstrumented leverage and buyout pricing. This highlights precisely the limitations of the existing views on leverage's impact on buyout pricing; that it is merely a mediator of the effect of credit conditions. As such, Axelson et al.'s (ibid) empirical approach has clearly, either deliberately or because of troubling results when measuring direct effects, been designed to focus on the positive relationship between credit conditions and pricing although the centre of their analysis is the relationship between leverage and pricing. Our quantitative efforts will attempt to measure the relationship directly and control for credit conditions, but given the predominance of the above views and evidence suggesting a positive relationship between leverage and buyout pricing, we form the following hypothesis:

H3: Portfolio company leverage at buyout is positively related to buyout pricing

4.3.2 Hypothesis 4: Fund returns

While buyout pricing is an interesting object, fund returns may be more telling in terms of normative implications. Specifically, whereas a high buyout price is not good or bad per se, higher PE fund returns are clearly preferable to lower returns. The agency and market-timing views had similar implications for the relationship between leverage and buyout pricing but their implications for the relationship between leverage and fund returns differ significantly as outlined below.

An implication of Axelson et al.'s (2009) agency framework is that PE investments become highly sensitive to aggregate credit conditions. In times where debt is abundant, some bad investments may be financed while some good deals may not be able to obtain financing during times of scarce debt. Consequently, investments undertaken in scarce credit markets should outperform investments in abundant credit markets. Said differently, in times where PE-funds tend to use more leverage, they might also tend to acquire worse firms. As Axelson et al. (2013, p. 2258) put it, "[t]he agency story, in contrast, predicts that PE sponsors will overinvest more and overpay for deals when debt is more accessible, leading to a negative relation between fund performance and leverage."

Market-timing, however, holds that leverage choices are a function of profit maximizing agents exploiting arbitrage opportunities (Baker & Wurgler, 2002). Clearly, the distinction lies in whether

agents, here GPs at PE funds, are choosing leverage optimally given prevailing credit conditions, as held by the market-timing hypothesis, or whether agents choose leverage sub-optimally (i.e. over-leveraging when credit conditions are loose and vice versa) because they maximize their own utility at the expense of principals, here LPs of PE funds, as held by Axelson et al. (2009). Whereas suboptimal choices, as argued above, would lead to a negative relationship, it is less clear how optimal, market-timing choices would impact the leverage-fund return relationship. We tend to think that, all else equal, no measurable relationship may be observed empirically if leverage, in fact, is optimally chosen given relevant antecedents and that such antecedents are properly controlled for in the regression set-up. However, all else is obviously not equal, for instance in terms of credit conditions whose fluctuations Kaplan and Stein (1993) highlighted as attenuators of booms and busts in the buyout market. Axelson et al. (2013, p. 2229) suggest that "to the extent that the competition for deals between PE 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 PE sponsors are able to use higher leverage to finance individual deals." Extant literature has been inconclusive on the value sharing between targets and acquiring PE firms with, for instance, Bull (1989) arguing that tax benefits of debt are likely to be appropriated in full by target shareholders while value creation form other operational and financial policies introduced by the new owners may stay with the PE firm.

A number of factors outside our conceptual framework, based on intra-PE firm agency problems and market-timing as laid out in Figure 4.5, may influence the relationship between leverage and fund returns. Firstly, early capital structure theory, which we reviewed in Figure 4.1 (and Appendix B) held that higher leverage leads to higher required (and expected) return because investors need to be compensated for the additional financial risk (Modigliani & Miller, 1958). As such, leverage in a very elementary sense increases expected return of equity. Secondly, tax benefits of debt contribute significantly to buyout valuations, although some of that value is captured by the target (Knauer et al., 2014). Nonetheless, some of the tax shield may be captured by the PE-firm, leading to a positive relationship between leverage and fund returns. Lastly, debt may help reduce agency problems primarily between managers and sponsors by reducing slack and free cash flow problems, although these issues are less likely to be pronounced in PE-owned firms given the strong monitoring and control incentives and capabilities of such owners (Jensen, 1989).

The two latter arguments suggest that leverage may bring about improvements in profitability (bottom line and operational, respectively). Empirically, circumstantial evidence has instead supported a negative relationship between leverage and profitability. In a comprehensive review of early theoretical and empirical work, Harris and Raviv (1991) find that this consensus in empirical work is best explained by the pecking order theory which holds that firms with lower profitability are pushed to engage external sources of finance due to insufficient generation of cash flow internally. Moreover, in the presence of information asymmetry, such firms tend to opt for debt financing rather than the more information sensitive equity issues (Rajan & Zingales, 1995). Intuitively, debt signals that managers believe in the prospects of future investments whereas issuing equity signals that managers believe the

stock is overvalued. However, as Fama and French (2002, p. 18), who compares the pecking order theory and the trade-off theory, makes clear, these traditional capital structure theories "attempt to explain the behaviour of leverage". Notably, the implicit line of causality goes from profitability to leverage and may provide little insight into the causal effect of leverage on profitability. In sum, we believe that traditional capital structure theory could explain a positive relationship between leverage and fund returns while a negative relationship would be best explained by the intra-PE firm agency story provided by Axelson et al. (2009). Lastly, the absence of a significant relationship could be interpreted as evidence in favour of the market-timing hypothesis with leverage chosen optimally given other antecedents and therefore unrelated to fund returns when those antecedents are properly controlled for.

In terms of existing empirical evidence, the two most relevant studies have found opposing results. Axelson et al. (2013) find a negative relationship between leverage and fund-level returns and argues that this finding is mostly consistent with a story in which PE firms use excessive leverage when debt is cheap, overpay for the targets, with returns suffering as a consequence. Engel et al. (2012), on the other hand, find a positive relationship between leverage and risk-adjusted deal-level equity returns, at least up to leverage ratios exceeding 0.90 where default risk crowds out the positive effects of leverage. The authors, in fact, conclude that their results provide support for the market-timing hypothesis.

Given the parallels of this thesis to the work of Axelson et al. (2013), we adopt their "overpayment" explanation as a starting point for our working hypothesis:

H4: Portfolio company leverage at buyout is negatively related to PE fund returns

Chapter 5: Data collection and representativeness

5.1 Data sources and sample selection

This section describes the construction of the data set and the different data sources from which we have sourced information. In short, the foundation of the sample consists of two separate data sets; a sample of sponsor-backed buyout transactions and a sample of leveraged loans. These were manually merged and complemented by information on bond and other financing transactions, as well as financial reporting of buyout targets and PE-fund level data. The sample selection primarily relies on two commercial databases: Mergermarket and LPC/DealScan and is complemented and enhanced by data from S&P's Leveraged Commentary & Data (debt data) and Preqin (PE-fund level data). The following sections describe the sampling procedure as well as difficulties and objections and provide some evidence on the comprehensiveness and representativeness of the final sample.

5.1.1 Buyout transaction data

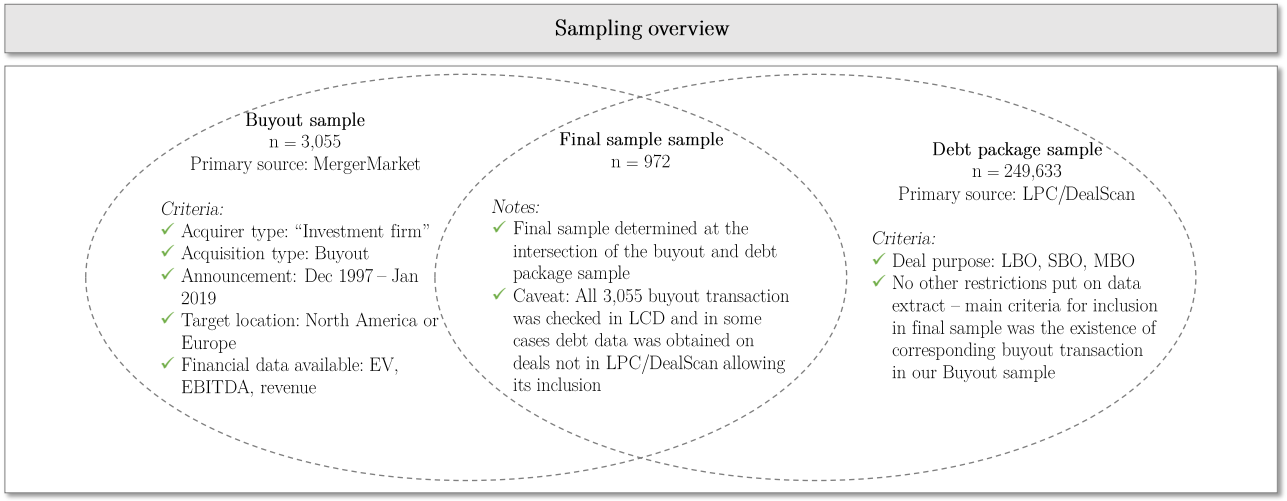
We begin the construction of the sample by extracting a base sample of buyouts from Mergermarket. The base sample contains all transactions in Mergermarket in which the acquirer includes at least one investment firm and the acquisition is classified as a "buyout transaction" (leveraged buyout, management buyout, secondary buyout or public-to-private transaction) announced between December 1997 and January 2019 with the target company located in North America or Western Europe. This results in 9,442 transactions which approximate the overall population of buyouts in the specified time period. Of the 9,442 transactions, Mergermarket contains data on transaction multiples, revenue and EBITDA for the last fiscal year before the transaction for 3,055 of the transactions. We discard transactions on which Mergermarket lacks data on the EV/EBITDA multiple and, accordingly, proceed with the sample of 3,055 buyouts on which data is available.

5.1.2 Debt data

The second single main source of data used is LPC/DealScan from which we gather information on leveraged loans. LPC/DealScan is the preferred database on loans by researchers in debt-related PE research (Axelson et al., 2013). LPC/DealScan maintains two individual databases of interest, one on loan packages and one on loan facilities, both of which we access via Wharton Research Data Services. As outlined in Section 2.2, leveraged buyouts are often financed by multiple debt instruments, or facilities. The facility data contains line-by-line data on every loan across and within packages. The data available on each loan includes deal purpose (e.g. LBO), type of loan (e.g. revolving facility, term loan), amount (in USD), maturity, seniority, secured/unsecured, currency, and method of distribution (e.g. syndication, club deal, bilateral). The package data contains a package ID (also available in the facility data set) and overall information about a certain debt deal. In downloading these data sets, the only criteria applied was that the package was dated within our sample period, i.e. 1997-2019 and that the deal purpose was either LBO, SBO, or MBO. Our original extract from LPC/DealScan resulted in 249,633 debt packages and 364,526 facilities.

Unfortunately, the Mergermarket and DealScan databases do not contain similar identifiers. Accordingly, for each of the 3,055 LBOs in our Mergermarket data set, we manually look for a loan deal package in the DealScan data issued in connection with the buyout transaction and match Package ID to the buyout. Matching is done by, conditional on the buyout and the deal package both being completed within 6 months from each other, looking up the buyout targets' name, as well as any HoldCo, TopCo, or BidCo names, or other identifying information in the Mergermarket deal description. Matching the Package ID to the buyout transaction then allowed us to easily retrieve information on all debt facilities under this package and match all information on all facilities to the relevant buyout transaction.

Figure 5.1: Overview of sampling methodology



To complement the data obtained from LPC/DealScan as well as filling out any missing data, we manually run every buyout transaction through the search-engine database of S&P's Leveraged Commentary & Data (LDC), the premier debt database used in practice. From this source, we also obtain data on whether a given facility is covenant lite. In addition, LCD contains information on a greater number of bond deals than LPC/DealScan which predominantly samples leveraged loans.

As we are not able to identify debt packages in LPC/DealScan or LCD for all 3,055 LBOs, this procedure reduces our sample to 972 buyouts for which a matching debt deal package was identified. This sample constitute our final sample and forms the basis for statistical analyses related to the determinants of leverage and LBO pricing.

5.1.3 Private equity and deal-specific data

Our analyses also require information on private equity returns since we want to investigate how deal leverage and deal pricing affects transaction returns. We use Preqin's database to obtain information on different variables related to the financial sponsor involved in each transaction. As we are not able to obtain information on deal returns for the majority of transactions, we use PE fund-returns of the specific fund to which the target company belonged as a proxy for transaction-returns. In section 6.4

we provide evidence for why fund-level returns are a valid proxy and discuss its appropriateness. Here, we simply note that fund-returns likely proxy deal-level returns since the return from a specific transaction will affect the return of the overall fund, and since we suspect that deal-financing characteristics of a specific transaction will represent the general deal-financing approach of the overall fund.

In addition to return measures, we collect information on the financial sponsor involved in each transaction because some of these may cause spurious correlations if excluded in our regression set-up. They include variables such as fund size, experience (years since inception), number of funds raised, and entry deal type. Since many of the recent transactions in our sample may not have been exited yet, the majority of observations on which return data is available will be in the period before 2013. We are unable to obtain information on 305 buyouts, which leaves us with 667 buyouts for the statistical analyses of Section 6.4 (while the analyses in Section 6.1-0 do not include return measures why the sample size in those sections remains 972).

5.1.4 Debt market variables and other macroeconomic variables

We also require information about credit conditions and other macroeconomic variables. Our credit condition variables include the U.S. and Euro asset swap spreads, the U.S. Treasury 10-year yield, the U.S. 3-month Libor and the Fed tightening index for the corresponding month. We also introduce other macroeconomic control variables such as U.S. and Eurozone GDP growth, inflation rates, and the EV/EBITDA ratio for the S&P 500 index to control for variations in the market-wide discount rate. We obtain all macroeconomic variables from Bloomberg Terminal (see Appendix E for an overview of macro variables and Bloomberg tickers used).

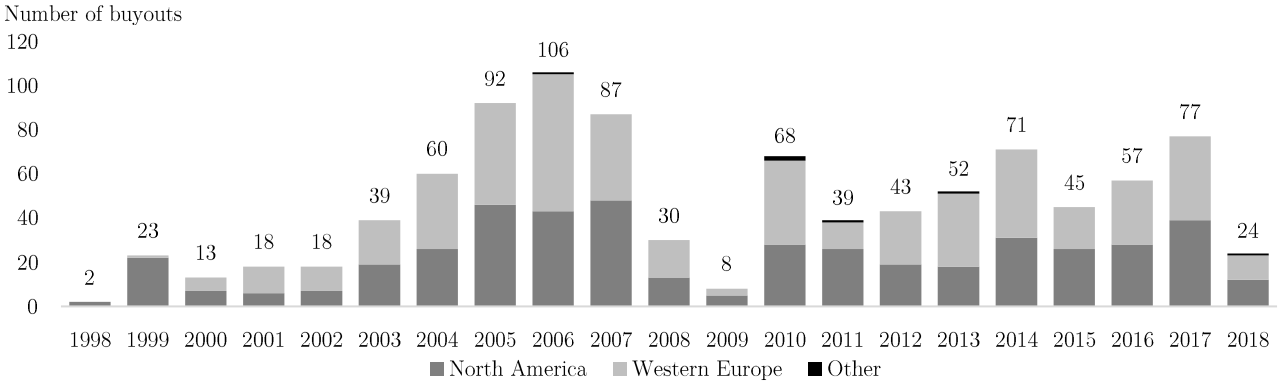
Appendix E provides a thorough introduction to the variables used in the analysis section and the reasoning behind including the various variables while Appendix F shows a preview of our data set.

5.2 Sample characteristics and representativeness

5.2.1 Target geography and industry distribution

Of our sample of 972 buyouts, 471 (48.5%) are of North American firms, 495 (50.9%) are of Western European firms, and 6 (0.6%) are from other regions, primarily the Middle East and China. Contrary to previous papers, our sample does not focus entirely on, or overweighs U.S. buyouts relative to Western Europe buyouts. As evident from Figure 5.2, the early years of our sample period is, however, dominated by U.S. deals, but this quickly evaporates in the early 2000s. We suspect that this is due to the more widespread use of syndicated loans to finance buyouts in the U.S. compared to Europe in the early years of the sampling period. In addition to the United States, the United Kingdom, France and Germany are the most common countries represented (see Table 5.1, panel A).

Figure 5.2: Sampled buyouts split between North American and Western European buyouts



Source: Mergermarket

The sample is widely distributed across industries. With 208 buyouts (21%), the Consumer sector is the best represented sector among target companies in our sample followed by Medical (10%), Computer Software (8%), Industrial Products and Services (7%), and Leisure (7%) (see Table 5.1, panel B for top 10 target industries represented in the sample).

Table 5.1: Top 10 target countries and industries sampled

Panel A: Top 10 countries

Geography	**# buyouts**	**% of sample**
USA	448	46.1%
United Kingdom	176	18.1%
France	73	7.5%
Germany	63	6.5%
Italy	36	3.7%
Netherlands	34	3.5%
Sweden	24	2.5%
Spain	22	2.3%
Canada	22	2.3%
Belgium	15	1.5%

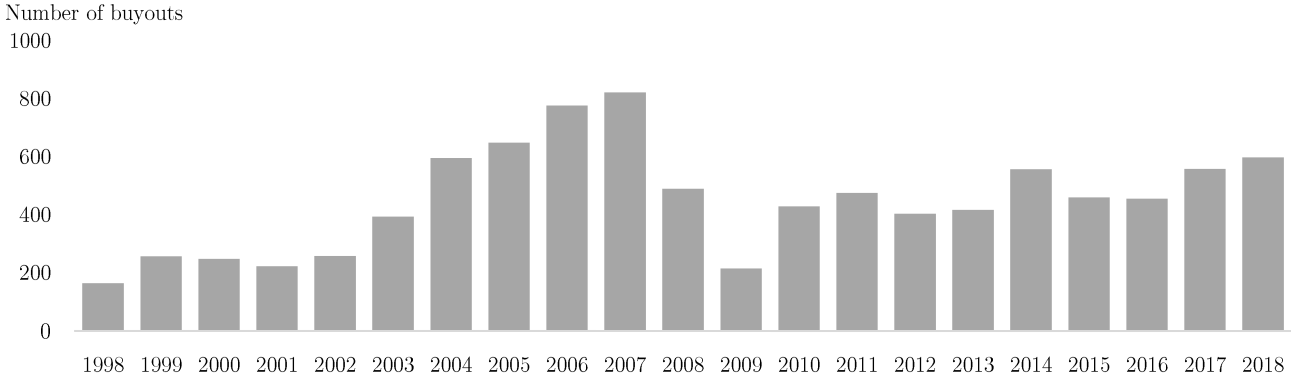
Panel B: Top 10 industries

Industry	**# buyouts**	**% of sample**
Consumer	208	21.4%
Medical	93	9.6%
Computer software	73	7.5%
Industrial products and services	68	7.0%
Leisure	65	6.7%
Services	59	6.1%
Computer services	57	5.9%
Construction	51	5.2%
Chemicals and materials	46	4.7%
Automotive	35	3.6%

Another important thing to note from Figure 5.2 is the variability in number of buyouts over the observed period. The market for leveraged buyouts is cyclical and has historically moved with general economic activity and stock market performance. Our sample captures this cyclicality well with the number of buyouts peaking in 2006 and bottoming in 2009 before resurging in 2010. Comparing the variability in buyouts from our sample with the Mergermarket population (in Figure 5.3), it seems that the years 2000 to 2002 and 2009 are somewhat under-sampled. The under-sampling in the early years may be a consequence of the syndicated bank loan market becoming increasingly important in later years and more information becoming publicly available.

The number of buyouts in 2018 is also considerably lower (proportionally) compared to the Mergermarket population. This can be attributed to the fact that loan data for recent buyouts have not become public yet.

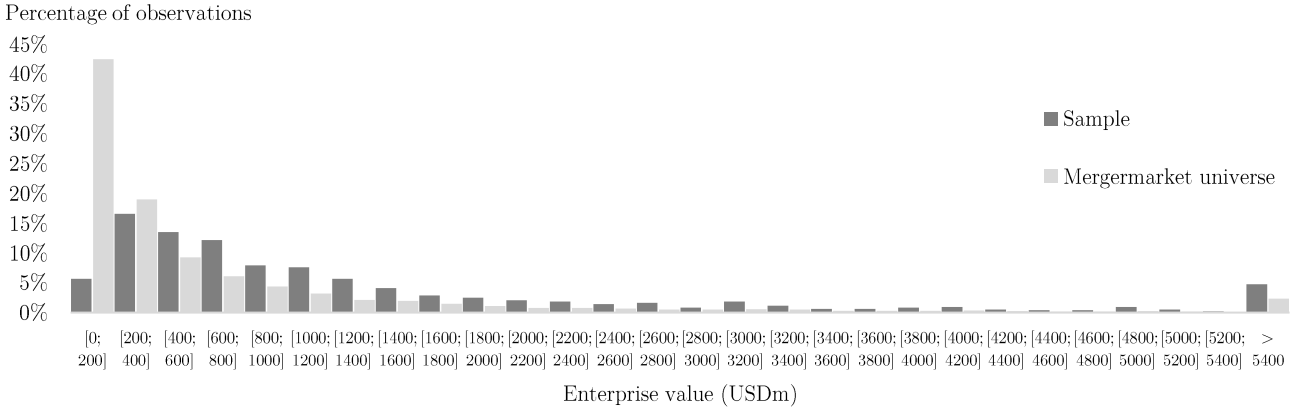
Figure 5.3: Mergermarket buyout universe from 1998 to 2018 (N = 9,442)



Note: Mergermarket buyout universe from 1998 to 2018 for targets located in North America or Western Europe. 9,442 observations.
Source: Mergermarket

5.2.2 Target size distribution

Figure 5.4: Distribution of buyouts on EV from sample vs from Mergermarket universe



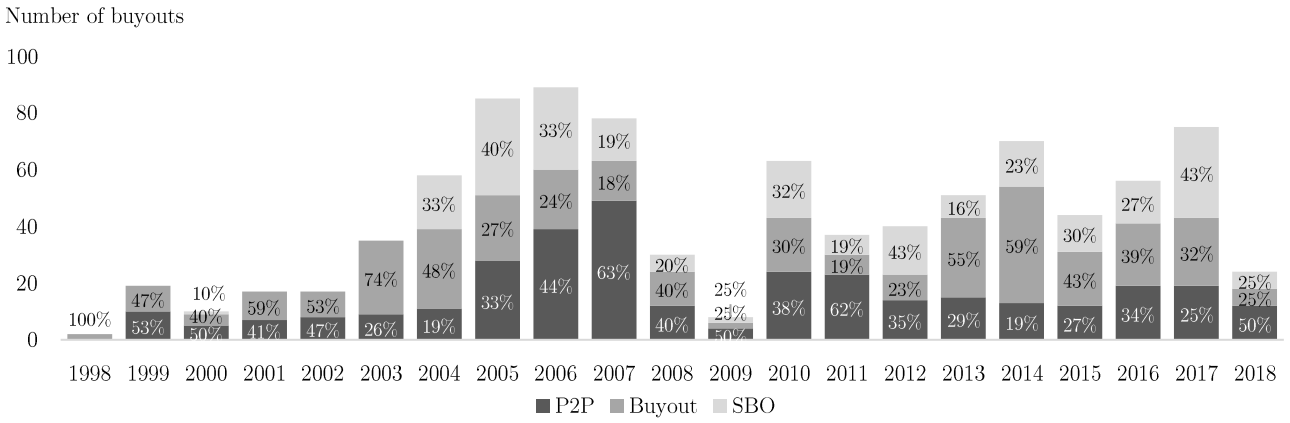
Source: Mergermarket

A concern that is often voiced in private equity research is that larger firms may be oversampled if information on larger transactions are more often available, leading to sampling bias. We find that the sampled distribution of EVs represents the Mergermarket population fairly well, except for very small EVs (see Figure 5.4). Specifically, target companies with EVs under USD 200m make up only 5.8% of our sample compared to 42.5% of the Mergermarket population.

This underrepresentation is due to loan data being scarcer for smaller deals, causing these to be excluded from the data set. However, this problem only pertains to the smallest group of targets. As we move to the next bucket containing targets with EVs between USD 200-400m, our sample distribution matches the Mergermarket population fairly well with 161 buyouts (16.6%) compared to 1,569 (19.0%), respectively.

Figure 5.5 shows the distribution of buyout types for our sample. We have used Preqin's buyout classification to classify each buyout as either 1) a public-to-private (P2P) transaction in which a public company is taken private by a financial sponsor, 2) a regular buyout (Buyout) in which a private company or a division of a company is acquired by a financial sponsor, and 3) a secondary buyout (SBO) in which a company is acquired from another financial sponsor. As is evident from Figure 5.5, P2P and regular buyout transactions seem to dominate in most years except for 2005 and 2006. P2P transactions may be overrepresented in our sample since information on such transactions is more often available.

Figure 5.5: Distribution of sampled buyouts by buyout entry type



Note: P2P denotes public-to-private transactions, Buyout denotes acquisition of a private company, SBO denotes acquisition from a financial sponsor
Source: Mergermarket, Preqin

5.2.3 Sample bias

Since we are constrained by the availability of information when sampling, our sample will overweigh larger, more recent deals where more information is available. Public-to-private deals may also be overrepresented since more information about these deals are often disclosed.

Controlling for country and sector, deal size, deal type and other variables that may carry explanatory power in and of itself or because of sampling bias contributes to unbiasing the coefficients of interest in our formal hypotheses tests. Nonetheless, we hesitate to extrapolate our results to e.g. small deals or other geographies as the dynamics may differ under different circumstances.

5.3 Handling outliers and missing observations

5.3.1 Winsorization

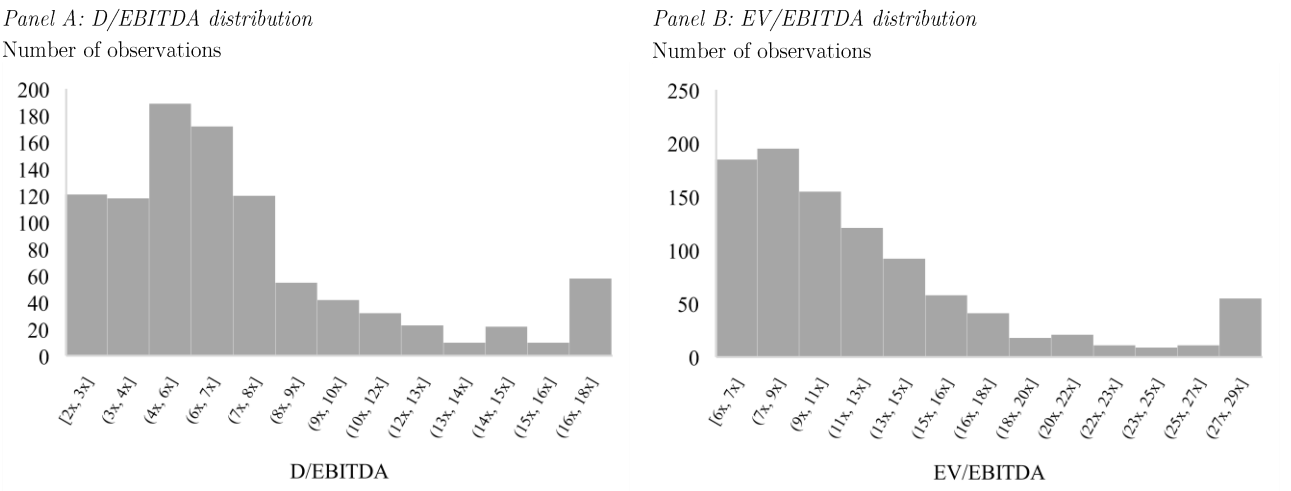
For two of our dependent variables, D/EBITDA and EV/EBITDA, our data set contains a few extreme and non-meaningful observations. Specifically, we find 38 cases (3.9%) with a D/EBITDA above 20. Likewise, we find 43 cases (4.4%) with an EV/EBITDA multiple above 30. Debt and EV multiples above these values are non-normal and seems unrealistic from a practical standpoint. They may be

caused by an unusually low EBITDA value for the given year, causing the multiple to increase dramatically.

To deal with such values, we resort to winsorization as a method to reduce the effect on distributions from spurious outliers. Specifically, we use a 90% winsorization, where all data below the 5th percentile is set to the 5th percentile and all data above the 95th percentile is set to the 95th percentile. Winsorized estimators are usually more robust to outliers than their standard form and contrary to trimming, winsorization does not reduce the number of observations.

The distribution of the two variables after winsorization can be seen in Figure 5.6. As expected, most transactions are levered at 5-6x EBITDA with a few transactions levering above 10x EBITDA. Similarly, most transactions are acquired at an EV/EBITDA multiple around 10x. For both variables, we still observe extremely high values that seems infeasible. Nonetheless, winsorization has limited the distorting effect from such outliers.

Figure 5.6: Distribution of sampled D/EBITDA and EV/EBITDA



Note: Winzorized data
Source: Mergermarket

5.3.2 Data imputation

Our final data set contains 972 cases with 35 variables. Naturally, a substantial number of cases have one or several missing values on certain variables. When one or more values are missing for a sample observation, most statistical packages default to discarding the entire observation. Such an exclusion of all cases with missing values on one or more variables would decrease our data set and could potentially inflict bias into the sample.

To mitigate loss of observations and the bias that this may inflict on the sample, we turn to data imputation. Imputation preserves all cases by replacing missing data with an estimated value based on other available information. Several methods of imputation exist including random drawing, last observation carried forward, and mean substitution. We use regression imputation as we believe that

this method predicts missing values most accurately for our data set. A regression model is estimated for each variable to predict observed values of that variable based on other variables, and that model is then used to impute values in cases where the value of that variable is missing. In other words, available information for complete and incomplete cases is used to predict the value of a specific variable. Fitted values from the regression model are then used to impute the missing values.

One problem with single regression imputation is that the imputed data do not have an error term included in their estimation. This causes relationships to be over identified. To alleviate the problem of over identification introduced by the single regression imputation method, we use multiple imputation by chained equations (MICE). MICE is based on a Fully Conditional Specification and is often used to impute values in multivariate data sets (Azur, Stuart, Frangakis, & Leaf, 2011). MICE specifies the multivariate imputation model on a variable-by-variable basis by a set of conditional densities, one for each incomplete variable. Starting from an initial imputation, MICE draws imputations by iterating over the conditional densities. A low number of iterations (say 5) is often sufficient why we use 5 iterations (Buuren & Groothuis-Oudshoorn, 2011). By imputing multiple times, we are able to account for the uncertainty and range of values that the true value could have taken.

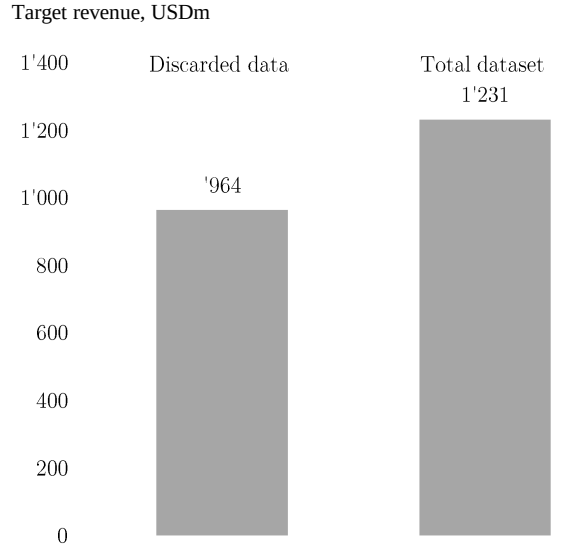
We impute missing values on 11 variables using 27 variables that we deem as relevant predictors.

Figure 5.7: Imputed variables and potential sample bias

Panel A: Variables with missing data points

Variable	Missing value	Imputed
TLa	9	No
TLb	9	No
TLo	9	No
Mezzanine	9	No
Bond	9	No
Unsecured	9	No
Lower liens	9	No
Subordinated	9	No
Covlite	9	No
Syndicated	9	No
Target rating	469	Yes
Target revenue	76	Yes
EBITDA margin	76	Yes
PE experience (years)	77	Yes
PE experience (fund number)	150	Yes
PE experience (fund size)	112	Yes

Panel B: Target bias from discarding cases with missing data



Note: Panel A shows missing data points for the most important variables. Indicated are also whether data imputation was used for the relevant variable. Panel B shows average target revenue for data that would have been discarded without data imputation and the total data set

Figure 5.7 panel A shows the imputed variables and the number of imputed values per variable. Besides target rating, the number of missing observations for the other variables are limited. Further, panel B shows that cases that would have been discarded without data imputation tend to be smaller than the rest of the sample, meaning that discarding these would introduce size bias into the sample.

5.4 Quantitative methods and assumptions

The primary econometric tool adopted in this thesis is the ordinary least squares (OLS) multiple linear regression. OLS set-ups are the convention in the broader managerial and financial literature (see e.g. Fama and French, 2002) and in PE-specific research (e.g. Axelson et al. 2013). According to Axelson et al. (2013, p. 2247), they "allow for direct measurement of the *effect* of cross-sectional and time-series factors on leverage ratios", among other things. We caution to interpret OLS coefficients as causal effects since OLS estimators, in general, only have the ability to capture correlations. To deal with causal identification, as well as other methodological difficulties of simple OLS regressions, we will be complementing our analysis with other econometric approaches such as instrumental variable regressions (2SLS), the treatment of which will be presented in the context in which they are used.

Indeed, despite being the most widely adopted regression technique, the use of OLS regression approaches may present several methodological issues if the four assumptions underpinning OLS are grossly violated, including omitted variable biases and simultaneity. Here, we briefly survey these assumptions as well as the extent to which our data and regression specifications comply with these (see e.g. Stock & Watson, 2015 for a more thorough treatment of the OLS assumptions). The first assumption state that the conditional distribution of the error term (conditional on values of the independent variables) has to have a mean of zero. A necessary condition for the assumption to be true is that the error term is uncorrelated with the independent variables. Said differently, correlation would imply a non-zero conditional mean. The implication does not follow the opposite direction, however, since correlation is a linear measure and errors could conceivably vary non-linearly across values of the independent variables. According to Stock and Watson (2015, p. 127), this "assumption is the most important to consider in practice", because it is precisely violations of this assumption that can systematically bias coefficient estimates. In particular, an omitted variable will skew coefficient estimates if it correlates with at least one of the independent variables as well as the dependent variable, which, mathematically, will correspond to correlation between a regressor and the error term, i.e. a violation of the first assumption. Obvious confounding variables in the context of our research include the overall credit conditions as these are likely to influence both the availability of riskier debt instruments as well as pushing up leverage and buyout pricing (Axelson et al. 2013). Broadly speaking, we circumvent omitted variable biases by including potentially confounding variables as regressors in our model specification. In more practical terms, how omitted variable biases may confound our results and how precisely we deal with them is presented throughout the analyses as they occur.

The second assumption concerns the randomness of our observations. In particular, the second assumption holds that the observations of both our dependent and independent variables are independently and identically distributed (i.i.d.). This will be the case if a sample is drawn randomly from the population. The assumption ensures that the sample retains the same distributional characteristics as the population of buyouts. In addition, the i.i.d. assumption is a requirement for the sampling distribution of e.g. means, standard deviations, and OLS regression

coefficients to be asymptotically (i.e. well approximated in large samples) normally distributed. As a side note, asymptotical normal distributions of sample measures follow from the central limit theorem which, remarkably, holds even if the population distribution is far from normally distributed (Stock & Watson, 2015). As we saw in Section 5.2, several of our variables exhibit sample distributions that are highly skewed, but the central limit theorem allows us to apply fairly simple, conventional econometric methods derived from near-normal distributions (t distribution) for statistical inference.

But is our sample drawn according to a random scheme? Since our sampling methodology is entirely a function of data availability this would arguably only be the case in so far as our main data sources contain i.i.d. data. This is obviously highly unlikely to be exactly the case. Nonetheless it might be a good approximation, as we indicated in the above investigation into the representativeness of our final sample relative to the original broader sample of the buyout universe. Alternatively, one could interpret the population about which our data tells a story as one of slightly larger PE-backed buyouts with slightly higher leverage (given that debt data availability also features into our final sample) and, as a consequence, be cautious about making inferences about the entire universe of PE-backed buyouts. In either case, in defence of our approach we suggest that it corresponds to, by far, the most widespread sampling methodology adopted in research relying on cross-sectional data. In the empirical literature cited in this thesis, sampling of data proceeded along the same line as ours in the sense that data availability, rather than random draws, governed the composition of samples. Needless to say, many of the same statistical methods applied in this thesis have been used under circumstances where similar violations to the second OLS assumption are present (e.g. Axelson et al., 2013). In sum, we conclude that despite violating the second assumption in theory, our sampling approach sufficiently approximates i.i.d. sampling to make statistical inference possible and entirely consistent with previous literature.

The third assumption of OLS regressions is that the likelihood of large outliers is low (Stock & Watson, 2015). Mathematically, this assumption is akin to assuming that all dependent and independent variables have finite kurtosis. It also acts as a requirement for the large sample approximations made possible via the central limit theorem mentioned above. We discovered several outliers in our data that may be due to 1) typographical errors or incorrect use of differing units on the part of our data providers or ourselves and 2) naturally occurring extreme values e.g. in EV to EBITDA ratios brought about by e.g. near-zero denominator values. As discussed in Section 5.3.1, we winsorize and take the log of some of the most important variables in our data which should ensure compliance with the third assumption.

The fourth assumption, which is particular to multiple regressions, is that there must be no perfect multicollinearity. Perfect multicollinearity arises when one of the independent variables is a perfect linear function of one or more of the other independent variables. Violations usually only occur because of technical misspecification of the regression model, such as by including a dummy for each of the categories of a categorical variable. In the model specifications where we, for instance, include

industry, country, and year dummies, we make sure to exclude one of the binary indicators for each categorical variable to avoid perfect multicollinearity. Imperfect multicollinearity, while not a violation of the OLS assumptions and therefore not a producer of biases, makes it hard to disentangle the partial effect of at least one of the independent variables. Coefficient estimates may become imprecise in the sense that the sample variance increases as a result of multicollinearity. To accommodate this problem, we hesitate to unnecessarily clutter our regression specifications with too many independent variables albeit still ensuring that confounding factors are included such that the first assumption is not grossly violated. What is more, for each problem surveyed in the analysis below, we will be presenting multiple regression specifications, where each specification adds an additional group of variables in order to shed light on the robustness of various specifications. Lastly, Section 6.5.1 specifically examines the extent to which multicollinearity exists in our regression set-ups.

5.5 Philosophy of Science and our approach to deriving knowledge

From the above discussion on data and quantitative methods, it is self-evident that this thesis's approach to deriving knowledge relies on empirical analysis. To a certain extent we will be following the inductivist approach whereby scientific knowledge results from theories based on observed 'facts' (Chalmers, 2013). For instance, we proposed a new framework for the understanding of the drivers of debt structure, leverage, buyout pricing, and fund returns in Chapter 4. At the same time, we acknowledge Hume's problem of induction, namely that observations, no matter how many, of covariation does not imply cause and effect, why we repeatedly hesitate to infer causality, except where statistical methods precisely designed to capture causality is used, such as 2SLS (Stock & Watson, 2015).

Moreover, as argued by first Popper (1992) and subsequently Kuhn (2012), scientific maxims and knowledge cannot be proven true, regardless of how much evidence is accumulated in the defence of an inductive statement as a single contrarian observation, a black swan in Taleb's (2007) terminology, negates the hypothesis. Inspired hereby, in Section 6.2 and 6.4, we pit alternative hypotheses against each other and aim to falsify at least part of either hypothesis.

Lastly, problems of preconceived knowledge will, as argued by social constructivism, affect both the way we think about the questions at hand, the questions we ask, and the methods we apply to answer these questions. As such, our philosophical approach, as well as application of quantitative methods in practice, to deducting scientific findings are aligned with the fields of research dealing with capital structure and private equity which are situated in the broader epistemic communities of economics and finance. On the one hand, this raises questions about objective validity, as alluded to above. On the other hand, the alignment of our research approach to the academic background provides comfort around the epistemological assumptions underlying our research being in accordance with established conventions.

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Chapter 6: Results and analysis

6.1 Drivers of debt structure

Whereas previous literature has focused either on aggregate leverage or on individual debt structuring elements in isolation, this thesis responds to Rauh and Sufi's (2010) call for more research into debt heterogeneity in the context of overall debt and capital structure. As such, the first component of our analysis consists of an in-depth look at the debt structure of PE funds' buyout financing. Specifically, this section will survey what drives debt structure aggressiveness in terms of which debt instruments are used as well as debt characteristics such as seniority, security, and covenants. Section 6.2 look at how these structuring elements relate to the aggregate amount of leverage used in buyout financing.

6.1.1 Regression set-up

The objective of the present analysis is to investigate whether sensitivity to agency problems drive aggressiveness of LBO debt structure. As such, the present section takes as dependent variables what will become the independent variables in subsequent sections. Specifically, we will be regressing variables that measure the use of 1) different debt instruments and 2) various debt characteristics distinct from their instrumental type, and we will do so on a number of plausible determining variables that proxy sensitivity to agency problems. Analytically, these debt instrument and characteristic variables (debt structure elements, collectively) can take two forms; 1) binary variables that indicate whether a certain debt structure element is present in the financing package, and 2) the proportion of debt coming from these individual debt structuring elements. As shown in Figure 6.1, for the binary measures, we apply two distinct econometric methods. Firstly, simple multiple linear OLS regression is applied, which in the case of binary dependent variables becomes a linear probability model. Secondly, owing to methodological difficulties associated with the linear probability model (as discussed below), the probit model is applied as means to test the robustness of the naïve OLS regression. The 'proportion', or fractional, measures are treated as continuous and, as a consequence, the appropriate design is an OLS-regression set-up.

Figure 6.1: Econometric method applied

	Econometric method	
Measurement of dependent variable	**OLS**	**Probit**
Binary *Debt structure element (instrument/characteristic) present in financing package*	✓	✓
Fractional *Proportion of financing package financed by instrument/carrying characteristic*	✓	✗

6.1.1.1 Binary dependent variables and choice of quantitative method

When regressing on binary variables that indicate whether a certain debt instrument or debt feature, e.g. CovLite or subordinated debt, is present in the financing package, conceptual difficulties prompt us to apply two distinct regression methodologies. The first and seemingly most straightforward is multiple linear OLS regression, which we described in some detail in Section 5.4, applied to the binary indicator. When we use binary variables indicating whether a certain debt instrument or feature is present in the financing package as dependent variable, the way to interpret the regression is as modelling the conditional probability, given the value of the regressors, of the debt instrument or feature being present (Stock & Watson, 2015). The interpretation of the OLS coefficients is equally straightforward in that they estimate the change in the probability that a debt instrument or feature is present in the debt factor for a unit change in our independent variables.

While linear OLS regressions in a binary setting allow for easy interpretation, the linearity of the model is conceptually inadequate. In reality, a debt instrument or feature is either present or not, i.e. the binary indicator is either one or zero, and the associated conditional probability will always be bound by these limits. Because of these boundaries, a consistent model of our dependent variable ought to be nonlinear. For example, the effect on, say, the probability that a buyout is partially bond financed, from a change in an independent variable, such as firm size/revenue, will be lower if the probability of the presence of bonds is already very high rather than if it is in a more neutral part of its probability distribution. And, in any case, firm size going towards infinity could not push the probability of bond financing above 1 or below zero. The linear probability model, nonsensically, allows for the probability to travel above 1 and below zero as coefficients stay linear across values of the regressors. Nonetheless, the linear probability model may provide good approximations within reasonable values of the independent variables and the ease of interpretation also speaks to its advantage. While caution should be taken in extrapolating the results, then, the results may be similar in a qualitative sense to results of proper nonlinear models. According to Stock and Watson (2015, p. 394) "[t]he only way to know this, however, is to estimate both a linear and nonlinear model and to compare their predicted probabilities."

The above advice is taken to heart and the choice of nonlinear model comes down to a choice between a logit or a probit specification. As the only difference between the two models is that the probit makes use of the cumulative standard normal distribution whereas logit models rely on the cumulative standard logistic distribution function, which produce very similar results. Stock and Watson (2015) provide little normative insights into the appropriateness of either model. Logit regressions were historically favoured because they were easier to calculate but with the advent of modern computers, probit models have increasingly been adopted and we similarly opt for the probit model.

The probit model essentially stipulates assumptions like the ones discussed in Section 5.4 for OLS regressions. In terms of modelling, we will be providing the same specification of independent variables as used under OLS regressions for the probit model, which basically places the usual regression function

inside a cumulative standard normal distribution function. Because of mediation via the cumulative standard normal distribution function, the effect of the coefficients on the probability of the presence of certain debt instruments or features become nonlinear, precisely what we intended to accomplish, but also harder to interpret.

When it comes to estimating the coefficients in the probit model, we make use of maximum likelihood estimation (MLE), which produces minimum variance estimators that are consistent and normally distributed in large samples (Stock and Watson, 2015). This, in turn, means that we can apply the usual t-statistics to test significance. For measures of fit, the usual r-squared does not apply so we instead adopt so called pseudo r-square measures. Two often used pseudo r-square measures applied to categorical dependent variables are McFadden's r-square and Nagelkerke/Cragg-Uhler r-square (Long & Freese, 2001). McFadden's measure intuitively resembles the usual r-square in the sense that it takes the ratio between predicted log likelihood and log likelihood of a naïve model. The Nagelkerke measure normalizes (such that values fall between zero and 1) the Cox & Snell generalized measure, which can be seen as the geometric mean square improvement of the full model compared to an intercept-only model.

6.1.1.2 Proportions as dependent variables and choice of quantitative method

When we use proportions, more precisely the proportion of the total debt package that is financed via a certain instrument or with a certain feature, as dependent variables, we face a problem akin to that of the binary variable setting discussed above. The proportion is bound upwards by one and downwards by zero but can be anywhere in between (contrary to the binary dependent variable that takes on either zero or one). Clearly, multiple linear OLS regression faces the same theoretical difficulties as in the binary case in the sense that extreme values of the independent variables will cause the predicted proportion to travel beyond its real boundaries.

Several attempts at developing a more suitable model have been put forth in the literature. Broadly speaking, they fall into two categories. The first category of models adopts a one-step approach where both the limit observations and the interim observations are included in the regression to estimate a single equation. The other category of models utilises a two-step approach. Here, the first step would estimate an equation predicting whether, say, a debt instrument or feature is present or not and the second step would estimate an equation prediction the fraction of the debt package financed via a certain debt element, but only using the observations where the proportion is non-zero (see Greene, 2000 for a more in-depth disposition of two-step approaches). The problem with two-step approaches in settings such as ours is that the decision of whether to use a certain debt instrument or feature and the extent to which such an instrument or feature is used is jointly determined. This make two-step approaches, whereby the characteristics and circumstances under which the proportion is zero are ignored, inappropriate.

In terms of one-step approaches, a naïve strategy has been to log-transform the dependent variable after adding very small increments to the zero observations. A famous and more sophisticated method

is the Tobit model, which is a censored regression model that deals with nonlinear dependent variables. However, it was designed for cases of unobserved variables due to censoring rather than cases of theoretically bound dependent variables (Maddala, 1991). Yet more sophisticated attempts at modelling fractional dependent variables are found in the literature that models the dependent variables as drawn from beta distributions (Kieschnick & Mccullough, 2003). A drawback of at least the early beta distribution applications was that they were not able to handle observations of zero, which in our sample occurs very frequently (Wagner, 2001). Lastly, a quasi-likelihood estimation method was put forth by Papke and Wooldrige (1996) and was applied by Wagner (2001) to the estimation of export-to-sales proportions.

What is common for the approaches to handling fractional dependent variables discussed above is that they have gained fairly limited traction in empirical research. Despite the theoretical inconsistencies in applying simple OLS regressions in such settings, it remains widely used. For instance, Axelson et al. (2013) applied simple linear regression when estimating the predictors of D/EV in LBOs. We stick to this tradition and note that the results obtained from regressing with fractional measures of debt instrument and feature usage as dependent variables will be contrasted to the results obtained from using binary measures as dependent variables as discussed earlier. The application of multiple methods at analysing essentially the same question, will hopefully provide some robustness to our results.

6.1.1.3 Explanatory variables

Having detailed the statistical methods used across different dependent variables and their measurement above, attention now turns to the specification of our explanatory model. Since the list of dependent variables is fairly long and since in some cases multiple measures and multiple methods are applied to these dependent variables, the specification of independent variables is kept fairly concise. Specifically, we propose two models; a short and longer model consisting of a suite of control variables. The first model only consists of target specific variables, incl. target rating, the natural logarithm of target revenue, and the natural log of target EBITDA margin (see Appendix E for an extensive description of the variables) as well as the local HY yield spread. Essentially, since the present section is largely explorative with little extant literature to guide us as to what drives the use of various debt instruments and structuring elements, we hypothesized that certain firm-specific variables proxying sensitivity to agency problems may be decisive in line with traditional capital structure theory (Myers, 2001). For instance, Burkart, Miglietta, and Ostergaard (2017) argued that larger firms (here proxied by log of revenue) are more likely to have boards (with independent directors) and we hypothesize that boards could, to some extent, substitute for the agency problem-reducing effect of a defensive debt structure. Berk and DeMarzo (2017) hold that less profitable firms (proxied by the log of EBITDA-margin) and firms closer to financial distress (proxied by target rating) are more prone to debt-equity conflicts. Lastly, overall credit conditions have been found to be a significant driver of various variables in the LBO literature and is often included at least as a control (e.g. Engel et al., 2012) and the local HY spread is included to proxy this.

The second model is augmented to include further measures of the overall credit and valuation environment, here proxied by the Fed tightening index and public equity market (S&P 500) EV/EBITDA valuation multiples, respectively. Both variables are frequently seen as controls and/or explanatory variables in the academic literature (Axelson et al. 2013). The same goes for the four macroeconomic variables included as controls. Here, we use a mix of local and US data given the prominence of US targets in our sample and in line with academic tradition. Specifically, the 10-year yield on US Treasuries and the 3-month US Libor are included to proxy for variation in market-wide discount rates, while local measures of inflation and GDP are utilized to proxy for variation in the business environment. Lastly, the long specification also controls for country, industry, and year. Country is controlled for because, as highlighted in Section 2.2, significant variation exists between particularly US and European LBO structures when it comes to, for instance, structural subordination and the use of term loans (particularly CovLite) versus bonds. Industry dummies are included because traditional capital structure posits the importance of factors such as cash flow volatility and tangibility of fixed assets, characteristics (Berk and DeMarzo 2017). Although we are already controlling for credit and valuation conditions, we include year dummies owing to Axelson et al.'s (2013) emphasis on the importance of time series variation as a predictor of LBO leverage. The importance of these controls is examined in detail in the robustness and validity checks presented in Section 6.5.

6.1.2 Results – drivers of debt structure

6.1.2.1 Summary statistics

Table 6.1: Presence and prevalence of debt instruments and characteristics

	Exists (% of LBOs)	% of Total debt[1] Simple average	% of Total debt[1] Standard error	% of Total debt[1] Weighted average
Debt instruments				
Term loan A	37.9%	14.0%	21.9%	8.1%
Term loan B	88.6%	55.5%	32.4%	57.0%
Other term loans	41.7%	12.4%	18.4%	9.3%
Mezzanine	19.4%	4.5%	10.3%	3.1%
Bond	23.7%	12.4%	26.3%	21.1%
Contigent debt				
Revolver	95.0%	19.0%	33.1%	13.1%
Other facilities[2]	20.9%	3.3%	8.1%	1.6%
Debt Characteristics				
Unsecured	25.8%	8.2%	17.0%	15.7%
Lower liens[3]	61.4%	23.1%	26.6%	28.6%
Subordinated	26.9%	6.5%	13.2%	6.0%
Covlite	25.4%	20.7%	37.4%	29.5%
Syndicated	95.4%	93.8%	22.0%	93.9%

Note: (1) Total debt excludes contingent debt (2) Other facilities include: Acquisition facilities, Capex facilities, letter of credit facilities, restructuring facilities and earn-out facilities, (3) Lower liens defined as second and lower lien loans
Source: DealScan, LCD

Before turning our attention to the regression result, we briefly examine summary statistics on debt structure. Table 6.1 above shows the percentage of LBOs where a certain debt instrument or feature is present as well as the average and weighted average proportion of the financing packages that comes

from a certain debt instrument type of feature. A fairly comprehensive description of the use of various debt instruments and characteristics over time, using our data set, was provided in Section 2.2. The aim of the present section is to cast light on the relative importance of heterogeneous debt factors using simple statistical measures.

The table highlights the importance of term loans to PE-sponsors wishing to finance acquisitions. TLB is, by some margin, the most heavily used debt instrument in leveraged buyout financings, seen in almost 90% of the transactions in our sample. While the rate of occurrence is high, the proportion of total financing is equally high with TLBs making up ~55% of total non-contingent debt, and if we add TLCs, Ds, and so on, that proportion increases to roughly 66%.

The relatively high use of TLBs, TLCs, and so on is balanced by a lower occurrence rate as well as proportion of total debt coming from particularly TLAs as well as mezzanine debt and, to some degree, bonds. An interesting observation in this context is the smaller, respectively larger, proportion of total debt coming from TLAs and bonds between the simple and weighted averages. This indicate that smaller firms tend to be bought out with a greater reliance on bank-driven TLAs while larger targets are bought out using bonds to a larger degree. This finding is investigated in more detail in the regressions below.

TLAs used to be the preferred means of buyout financing when bank financing was the predominant source, but since the financial crisis, which brought a multiplicity of regulatory capital and liquidity requirements on banks, institutional lenders and investors have gained increasing importance as debt capital providers. Year dummies and the Fed tightening index should control for structural shifts affecting the use of TLAs. When it comes to mezzanine debt, it has also been highlighted by industry observers that the amount of mezzanine debt used to finance LBOs have dropped dramatically after the financial crisis. For instance, LCD analyst Wade (2017) asks "[w]here is the mezz?" and shows the near disappearance of mezzanine debt in recent years, partly as a consequence of the low recovery rates seen after the crisis causing several large dedicated mezzanine funds to close down. In terms of bond issuance, the slightly lower occurrence rate in our sample relative to e.g. Axelson et al.'s (2013) is not so much due to a change in recent years but to the extraordinarily hot HY bond market during the first LBO wave of the 1980s (Kaplan and Stein 1993). Again, controlling for year as well as various measures of general credit conditions should eliminate any omitted variable bias created by structural changes.

When studying occurrence rate of debt characteristics, we need to keep in mind the proper counterfactual. For instance, the occurrence rate for unsecured debt is 25.8%, which tells us only that 25.8% of buyouts were financed, in part or in whole, by unsecured debt instruments, and that 74.2% of buyouts did not include an unsecured element. The statistic does not tell us that 74.2% of deals were financed with secured debt, since many deals will be financed by both secured and unsecured debt. In fact, the percentage of deals financed by an element of secured and senior debt will be close

to 100%, why we choose to focus on what varies, namely the occurrence of various kinds of lower ranking debt.

As mentioned, unsecured debt occurs in 25.8% of LBO debt packages and makes up a weighted average 15.7% of total debt compared to 8.2% on a simple average basis, indicating that larger targets tend to be relying more heavily on unsecured debt. This finding likely go hand in hand with the use of bonds that in many cases will take an unsecured position in combination with secured term loans. On secured debt, a large proportion, 61.4%, of buyouts feature a second or lower ranking pledge on specific collateral, and the amount of debt coming from such pieces make up a weighted average 28.6% of total debt. Contractual subordination occurs in about a quarter of buyout deals with approximately 6% of financing packages, on average, being made up of subordinated debt.

CovLite tranches are similarly seen in a quarter of deals while the share of total debt being CovLite is closer to 30% on a weighted average basis. Lastly, LBOs rely heavily on syndication as a means of distributing debt with more than 95% of deals featuring at least one syndicated tranche and ~94% of total debt being syndicated, on average.

6.1.2.2 What drives the use of different debt instruments?

Turning to our regression results, Table 6.2 presents the results of the regressions on binary variables indicating whether the different debt instruments are present in an LBO financing package. Panel A presents the results of an OLS regression set-up whereas Panel B presents the results of probit regressions. Firstly a few observations on the robustness of the results. The sign on coefficients are the same under OLS and probit for all significant variables. What is more, there is a very large degree of overlap in terms of significant coefficients between the two regression methodologies. In addition, significant coefficients in the short specification maintain the same sign in the long specification in all cases except for the effect of HY spread on TLO (model 5 and 6). The coefficient goes from being negative and significant at the 1% level under both OLS and probit to being positive at the 5% level when adding the full suite of controls. The coefficient on the HY spread likewise changes from negative, although not statistically significant, to being positive at the 5% level for TLBs (model 3 and 4). In conclusion, except on HY spread, the addition of controls does not reveal qualitatively important omitted variable biases.

In terms of individual coefficients, the associations between target rating and all loan types incl. mezzanine debt are highly negatively significant in models (3) through (8) under both OLS and probit (at least at the 5% level). Reverse causality is likely to drive particularly the coefficients in model 7 and 8 where the dependent variable is mezzanine as the use of such debt is likely associated with higher leverage ratios and, as a consequence, higher financial risk. We examine the relationship between different debt instruments and leverage ratios in Section 6.2. The coefficients on target rating where the dependent variables are term loans are less likely to be heavily influenced by reverse causality. As such, our results indicate that less risky targets, as proxied by higher ratings, are less likely to be financed using term loans. In terms of economic magnitude, the OLS regression coefficients suggest

Table 6.2: Regression output – Drivers of debt instruments

Panel A: OLS specification

	Dependent variable: Debt instrument dummy - OLS specification									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	TLA	TLA	TLB	TLB	TLO	TLO	Mezzanine	Mezzanine	Bond	Bond
Target specific										
Target rating[1]	0.074***	0.015	-0.042***	-0.041**	-0.050***	-0.052***	-0.111***	-0.148***	-0.023	-0.02
	(0.02)	(0.015)	(0.016)	(0.016)	(0.019)	(0.02)	(0.015)	(0.019)	(0.016)	(0.017)
Target revenue (log)	-0.102***	-0.047***	0.01	-0.001	-0.041***	-0.042***	-0.009	0.024**	0.170***	0.162***
	(0.014)	(0.012)	(0.011)	(0.011)	(0.015)	(0.015)	(0.012)	(0.01)	(0.012)	(0.012)
EBITDA margin (log)	-0.052**	-0.025	0.035*	0.033*	-0.033	-0.03	0.002	0.033**	0.129***	0.127***
	(0.025)	(0.019)	(0.019)	(0.018)	(0.025)	(0.025)	(0.02)	(0.016)	(0.021)	(0.02)
Credit and valuation conditions										
Local HY spread[2] (assetswapspread)	0.0005***	0.001***	-0.0001	0.0005**	-0.001***	0.001**	0.0001	0.001***	-0.0001	-0.0003
	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0003)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
Fed tightening index		-0.004**		0.001		-0.001		-0.0004		-0.002
		(0.002)		(0.002)		(0.003)		(0.002)		(0.002)
Public market valuation (sp_ev_ebitda)		0.080*		0.085**		0.057		0.071**		-0.07
		(0.041)		(0.036)		(0.052)		(0.032)		(0.042)
Macro economic variables										
UST 10y yield		-0.062		0.001		0.048		0.085**		-0.019
		(0.043)		(0.04)		(0.052)		(0.035)		(0.047)
USD 3m Libor		0.082**		0.065**		-0.027		0.039		0.028
		(0.041)		(0.028)		(0.054)		(0.035)		(0.04)
Local inflation[2]		-0.001		-0.026		-0.070**		-0.034*		0.023
		(0.023)		(0.022)		(0.03)		(0.018)		(0.026)
Local GDP growth[2]		-0.033**		0.003		0.011		0.016		-0.006
		(0.014)		(0.014)		(0.021)		(0.014)		(0.016)
Constant	0.108	-0.735	1.268***	-0.51	1.261***	-0.262	1.126***	-0.359	-0.353**	0.177
	(0.163)	(0.82)	(0.123)	(0.648)	(0.163)	(0.854)	(0.131)	(0.551)	(0.137)	(0.658)
Country controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Industry controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	972	972	972	972	972	972	972	972	972	972
R^2	0.077	0.554	0.017	0.143	0.052	0.25	0.061	0.501	0.178	0.299
Adjusted R^2	0.073	0.515	0.013	0.068	0.049	0.184	0.058	0.458	0.175	0.238

Panel B: Probit specification

	Dependent variable: Debt instrument dummy - Probit specification									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	TLA	TLA	TLB	TLB	TLO	TLO	Mezzanine	Mezzanine	Bond	Bond
Target specific										
Target rating[1]	0.202***	0.143*	-0.189***	-0.200**	-0.139**	-0.182**	-0.576***	-1.525***	-0.114*	-0.116
	(0.056)	(0.086)	(0.071)	(0.091)	(0.058)	(0.074)	(0.068)	(0.171)	(0.062)	(0.08)
Target revenue (log)	-0.285***	-0.279***	0.044	-0.021	-0.108***	-0.143***	-0.051	0.095	0.668***	0.776***
	(0.045)	(0.086)	(0.055)	(0.067)	(0.039)	(0.049)	(0.049)	(0.094)	(0.058)	(0.077)
EBITDA margin (log)	-0.147**	-0.126	0.156	0.176*	-0.087	-0.099	-0.00002	0.295**	0.519***	0.600***
	(0.07)	(0.125)	(0.098)	(0.098)	(0.067)	(0.08)	(0.079)	(0.139)	(0.086)	(0.115)
Credit and valuation conditions										
Local HY spread[2] (assetswapspread)	0.001***	0.006***	-0.0004	0.003**	-0.002***	0.002**	0.001	0.005**	-0.001	-0.005***
	(0.0003)	(0.002)	(0.0003)	(0.001)	(0.0004)	(0.001)	(0.0004)	(0.002)	(0.0003)	(0.002)
Fed tightening index		-0.017*		0.003		-0.001		0.018		-0.001
		(0.01)		(0.012)		(0.009)		(0.016)		(0.012)
Public market valuation (sp_ev_ebitda)		0.476**		0.553**		0.179		0.717*		-0.127
		(0.227)		(0.227)		(0.17)		(0.427)		(0.237)
Macro economic variables										
UST 10y yield		-0.496**		-0.086		0.273		0.752**		-0.259
		(0.204)		(0.222)		(0.199)		(0.363)		(0.219)
USD 3m Libor		0.389*		0.523**		-0.103		0.088		0.314
		(0.203)		(0.207)		(0.171)		(0.317)		(0.255)
Local inflation[2]		0.041		-0.157		-0.217**		-0.167		0.085
		(0.119)		(0.134)		(0.101)		(0.191)		(0.133)
Local GDP growth[2]		-0.111		-0.005		0.024		-0.005		-0.038
		(0.082)		(0.085)		(0.069)		(0.154)		(0.084)
Constant	-1.016**	-6.812	2.972***	0.324	2.071***	-6.276**	3.950***	-4.65	-2.933***	-13.800***
	(0.452)	(4.244)	(0.552)	(3.406)	(0.505)	(2.811)	(0.565)	(6.006)	(0.516)	(3.934)
Country controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Industry controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	972	972	972	972	972	972	972	972	972	972
McFadden's R^2	0.059	0.560	0.021	0.184	0.039	0.212	0.080	0.678	0.179	0.349
Nagelkerke R^2	0.103	0.714	0.029	0.241	0.070	0.337	0.121	0.778	0.268	0.477

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions

*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

that the probability that the different kinds of term loans are used (except TLAs), decreases by between

4.1% and 5.2% for each upward notch in credit rating. The probability of the presence of mezzanine debt in an LBO package decreases at a more rapid pace in excess of 11% as credit ratings increase.

Size, as proxied by target revenue, is statistically significantly negatively related to the use of TLAs and TLOs, while it is positively related to bond issuance at the 1% level. Intuitively, smaller companies may be more prone to agency problems or less likely to undertake e.g. the disclosure requirements associated with raising public debt and rather opt for bank financing in the form of TLAs. Moreover, targets with higher EBITDA margins are more likely to use bond financing suggesting that the availability of public financing increases in target profitability. A marginally significant effect of EBITDA margin is also found on the use of term loan Bs.

HY yield spreads, which is broadly acknowledged as a proxy for the market wide cost of debt for HY issuers, is perhaps surprisingly positively related to the use of all term loan types as well as mezzanine debt at least at the 5% significance level in OLS regressions featuring all independent variables. Broadly the same picture is seen in probit regressions, where we also find a negative relationship between the HY spread and the use of bond financing which is significant at the 1% level in model (10). The reason for the positive coefficients on loan instruments is probably that the HY spread is effectively a measure pertaining to bonds although the yields and yield spreads on loans will be highly correlated to bond yield spreads. For banks and institutional lenders, other factors than those prevailing in the bond market may influence their cost of funds which, in turn, translates into different loan yield spreads. As a consequence, we interpret the positive coefficients on HY spread in regressions with loans as dependent variables as arising because loans become relatively more attractive compared to bonds when bond yield spreads increase.

When it comes to our other control variables, there is little evidence to indicate that our alternative measure of credit conditions, the Fed tightening index, is having an impact on the choice of debt instrument. Public market equity valuation seems to have a positive effect on the use of TLAs and TLBs. Little systematic and theoretically backed pattern is seen in the coefficients on our macroeconomic variables.

In terms of model fit, adjusted r-squares indicate that the target specific variables have relatively little explanatory power in the OLS regressions. On average, adjusted r-squares increase by 5.1x going from the short to the long specification of independent variables. We note, however, that OLS r-square measures are inappropriate measures of fit in linear probability models (Stock & Watson, 2015). For the probit model, the "pseudo" r-squared measures paint the same picture as the naïve reading of the adjusted r-square measures of the OLS regressions in that they are, on average, 5.7x and 6.8x higher for the long specification compared to the short specification for McFadden's, respectively, Nagelkerke's r-square. This leads us to the conclusion that market wide factors, such as the state of the economy and financial market conditions are strong drivers of the use of different debt instruments relative to firm- or industry-specific variables. Section 6.5.2 presents further evidence on the importance of particularly the country, industry, and year dummies.

The results of the regressions with fractional dependent measures of instrument usage are presented in Appendix G. Broadly speaking, the results are consistent with the regressions using binary dependent variables although goodness-of-fit as measured by r-squared is worse and less statistically significant coefficients are seen in the regression output. Specifically target rating have less explanatory power in the models with fractional dependent measures, except in model (7) and (8) on mezzanine usage where results confirm the negative relation found above. The fractional dependent variable analysis, however, paints the same picture of the effect of target size and profitability as well as the HY spread that was seen in the linear probability and probit models. The conclusion we can make here is that not only are the buyouts of larger targets financed by TLAs and TLOs less often and bonds more often, but TLAs and TLOs also compose a smaller share of financing packages while bonds compose a larger share, on average, for larger targets.

Bank financing (TLA), as argued earlier, is a trait of a defensive debt structure while bonds are components of a more aggressive debt structure because of their distribution to a more dispersed investor base. The above results, notwithstanding the fairly low measures of fit for the short models, indicate that larger and more profitable firms are more likely to make use of such 'public' debt and, thus, provide some support for Hypothesis 1 that targets less prone to agency problems are more likely to be financed by a more aggressive debt structure.

6.1.2.3 What drives the use of different debt characteristics?

Turning to an investigation of what determines various contractual and structuring choices of PE firms in connection with transaction financing. Table 6.3 below presents probit estimates of the effects of the two specifications of independent variables described earlier for binary dependent variables indicating whether the following elements occur in the buyout financing package: 1) unsecured debt, 2) secured but 2nd lien or lower ranking debt in terms of asset pledges, 3) contractually subordinated debt, 4) CovLite debt, and 5) whether one or more debt tranche is syndicated. The results of OLS regressions on measures of both binary dependent indicators of the presence of the above debt features as well as fractional measures of the proportions of debt packages that carry these features are presented in Appendix H, panel A and B respectively. These alternative statistical methods and measures provide, broadly speaking, the same results why focus here will be on the probit regressions in Table 6.3.

Coefficients on target rating are significant at the 1% level across models (1) through (7) as well as (9) and (10), while in the long specifications of independent variables, the coefficient on rating is not significant for regressions on the presence of CovLite. Moreover, we hesitate that simultaneity is likely distorting results for the same reason that the coefficients on rating in the regressions with mezzanine capital may be misleading. Specifically, our dependent variables in models (1) through (6) may covary positively with leverage as higher leverage may be driven by the use of these debt features and, at the same time, leverage may be negatively associated with rating. The object of the next section is precisely to study the direct relationship between debt heterogeneity and leverage, and further discussion in this regard can be found there. Here, we merely conclude that the coefficient on rating has the sign we

would expect from the simple hypothesis that more risky firms are likely using more risky debt (i.e. subordinated and with worse or no security as well as covenants) because lenders hesitate to provide the required amount of leverage at senior secured terms.

Table 6.3: Regression output – Drivers of debt characteristics

	Dependent variable: Debt characteristic dummy - Probit specification									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Unsecured	Unsecured	Lower liens[2]	Lower liens[2]	Subordinated	Subordinated	Covlite	Covlite	Syndicated	Syndicated
Target specific										
Target rating[1]	-0.331***	-0.414***	-0.449***	-0.473***	-0.195***	-0.405***	-0.340***	-0.092	-0.194***	-0.922***
	(0.06)	(0.076)	(0.071)	(0.09)	(0.067)	(0.091)	(0.077)	(0.08)	(0.075)	(0.159)
Target revenue (log)	0.488***	0.546***	0.329***	0.351***	0.052	0.199***	0.382***	0.434***	0.314***	0.722***
	(0.055)	(0.061)	(0.046)	(0.061)	(0.044)	(0.061)	(0.047)	(0.075)	(0.079)	(0.212)
EBITDA margin (log)	0.553***	0.629***	0.254***	0.326***	0.091	0.384***	0.293***	0.305***	0.205*	0.575**
	(0.084)	(0.097)	(0.069)	(0.081)	(0.073)	(0.105)	(0.089)	(0.116)	(0.11)	(0.265)
Credit and valuation conditions										
Local HY spread[2] (assetswapspread)	0.001**	0.002*	-0.001***	0.003***	-0.0005	0.001	-0.001**	-0.002	-0.001	0.002
	(0.0003)	(0.001)	(0.0003)	(0.001)	(0.0004)	(0.001)	(0.0003)	(0.002)	(0.0005)	(0.003)
Fed tightening index		-0.017*		-0.019**		0.01		-0.037**		-0.092***
		(0.01)		(0.008)		(0.01)		(0.015)		(0.023)
Public market valuation (sp_ev_ebitda)		-0.21		0.017		0.054		-0.156		0.36
		(0.188)		(0.173)		(0.251)		(0.267)		(0.402)
Macro economic variables										
UST 10y yield		0.344*		0.340*		0.367		-0.225		-0.385
		(0.186)		(0.182)		(0.231)		(0.263)		(0.413)
USD 3m Libor		0.125		0.123		0.268		0.367		-1.465*
		(0.194)		(0.171)		(0.191)		(0.315)		(0.847)
Local inflation[2]		0.012		-0.058		0.066		-0.318**		0.426
		(0.103)		(0.097)		(0.119)		(0.141)		(0.305)
Local GDP growth[2]		-0.021		0.155**		-0.122		-0.054		0.892***
		(0.069)		(0.063)		(0.076)		(0.104)		(0.314)
Constant	-0.28	-13.261***	2.827***	-6.445**	1.028*	-5.643	0.531	-12.375***	2.054***	23.214
	(0.508)	(2.849)	(0.602)	(2.867)	(0.568)	(4.024)	(0.637)	(4.357)	(0.614)	(0)
Country controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Industry controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	972	972	972	972	972	972	972	972	972	972
McFadden's R^2	0.112	0.224	0.088	0.223	0.015	0.445	0.08	0.512	0.062	0.531
Nagelkerke R^2	0.177	0.331	0.151	0.349	0.025	0.588	0.128	0.649	0.073	0.577

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
Significance levels: *p<0.1; **p<0.05; ***p<0.01

The estimated coefficients on target financials are less likely to be confounded as their values are not set contemporaneously with leverage or the dependent variables. Oppositely, PE-firms could arguably be seen to choose the optimal contractual features and structures of debt given target financials and financial market conditions. Our results clearly indicate that larger and more profitable firms (i.e. those with lower sensitivity to agency problems) are more likely to obtain part of their financing at subordinated and unsecured terms. Indeed, the coefficients on both EBITDA margin and revenue are significant at the 1% level for models featuring all controls with unsecured, lower liens, subordinated, and CovLite as dependent variables in the probit model. The same results are seen in the linear probability models, at equally strong significance levels, and in the regressions using fractional dependent variables. Lastly, profitability and revenue are also positively related at high levels of statistical significance with the use of syndication as a means of distributing the debt.

We suggest that larger and more profitable firms are farther away from equity-debt agency problems, and, accordingly, are better positioned to take out more risky debt without having to pay excessive premiums for the potential agency problems. Moreover, such firms are easier to finance via public debt

markets because of e.g. better name recognition and lower information asymmetries. The findings provide strong support for Hypothesis 1 in that more aggressive structures are more common when size and profitability of targets are higher.

6.2 Debt structure's influence on leverage ratios

Above, we found results indicating that sensitivity of the buyout target to agency problems drive debt structure aggressiveness. Specifically, assuming that PE acquirors structure debt optimally, less agency sensitive firms were found to have higher optimal debt structure aggressiveness. Now, we ask the question whether an aggressive or defensive debt structure better promotes higher leverage. On the one hand, we hypothesized that a more defensive structure protects against agency problems brought about by higher leverage and therefore, in an accommodative sense, should allow higher leverage. On the other hand, from a clientele perspective, we expect that a more aggressive structure with multiple debt tiers allows raising debt capital from alternative investor bases and thereby attains higher leverage.

6.2.1 Regression set-up

What we are aiming to explain in this part of the analysis is relative leverage levels. To do so, we adopt the two mostly used measures of debt, namely the D/EBITDA ratio (logged) and the D/EV. Both ratios are heavily used by practitioners in financial modelling with the former also an often-covenanted financial ratio (Chava & Roberts, 2008). Moreover, both measures were adopted in Axelson et al.'s (2013) analysis of LBO leverage. We calculate these measures ourselves based on reported EBITDA (last 12 months at buyout) and EV (from takeover valuation), and the sum of each (non-contingent) debt instruments' nominal value. Clearly, the D/EV measure is proportional and bounded downwards by zero and upwards by one. As such, the methodological difficulties associated with fractional measures as dependent variables, which we discussed extensively in Section 6.1.1.2 apply here as well.

In this part of the analysis, the dependent variables of the previous analysis become explanatory variables. As such, our debt structuring variables, i.e. the debt instrument variables (e.g. TLAs, TLBs, bonds and so on) and debt characteristic variables (e.g. seniority, security, CovLite, and so on) are included as our main explanatory variables of interest. To keep regression specifications succinct and to avoid strong imperfect multicollinearity (for instance, between subordinated and mezzanine measures), we run separate regressions for debt instrument explanatory variables and debt characteristic explanatory variables. In addition, we run alternative regressions, first, with dummy measures of debt structure and, secondly, with fractional measures of debt structure. Since the fractional debt instrument variables sum to one, we exclude an instrument for this specification to avoid perfect multicollinearity. Perfect multicollinearity is not a problem in the case of instrument dummies, since multiple instruments can be present in the same buyout financing package. The same applies to debt characteristics where, furthermore, the sum of the fractional measures does not, per

construction, sum to any predetermined value since, in principle, all debt characteristics surveyed here could characterize the entire debt package as they are not mutually exclusive.

For each combination of dependent leverage variable (D/EBITDA vs D/EV), debt structure element (instrument vs characteristic), and measure of debt structure element (dummies vs proportions), we specify 5 combinations of independent and control variables (yielding a total of 40 different regression equations to be estimated). Model (1) assumes orthogonality and contains only debt structure elements, i.e. debt instrument or debt characteristic, without any controls. Model (2) adds year, industry, and country dummies. Model (3), in addition to our explanatory debt structure values and excluding year, industry and country dummies, adds target specific variables including revenue (logged), EBITDA margin (logged), and target rating. Model (4) expands (3) by including the same credit and valuation condition variables and macroeconomic variables as we used in Section 6.1 above where the justification for their inclusion was also outlined. Furthermore, Model (4) adds buyout deal type as well as a suite of PE-firm and fund variables that have previously been shown to influence leverage and which may have a confounding influence on our results if omitted. In particular, buyout deal type has been seen to vary with portfolio company profitability and investment policy (Jenkinson & Sousa, 2015) and, since operational improvements will often be exhausted after a first round of PE-ownership, value creation following secondary buyouts will be a function of financial engineering (Bonini, 2015). As such, there is reason to believe that the buyout deal type influences leverage while at the same time being related to debt structure, why we include public-to-private and secondary buyout (SBO) as dummies in our regression (with primary LBO the category left omitted). PE fund characteristic variables are included because lender experience and reputation has been shown to facilitate access to debt markets (Ivashina & Kovner, 2011). Accordingly, we include PE fund size and number of the acquiring fund as well as PE firm age at the time of buyout as controls. Finally, model (5) complements the full suite of controls with year, country, and industry dummies.

The above models will be estimated in a multiple linear regression set-up using OLS (refer to Section 5.4 and 6.1.1 for an explication of the advantages and difficulties of this method in our context). There will be a degree of endogeneity in our regression set-up as leverage and debt structure are plausibly set simultaneously. The problem in this context, however, is largely a matter of caution in interpretation. We will hesitate to conclude that e.g. certain debt instruments cause higher leverage, since one could imagine that the need for higher leverage causes the use of certain debt instruments. Clearly, our hypotheses postulate relations that are not necessarily causal in the sense that they merely argue for a certain co-occurrence of high leverage and defensive debt structure (H2a) or aggressive debt structure (H2b). We do not believe that these relations are unidirectional, but we cling to traditional quantitative methods for the purpose of being able to control for a number of confounding variables, such as credit conditions, time series trends and variations across countries. In essence, what we will be able to tell from our regression output is whether, in equilibrium, higher leverage is associated with defensive or aggressive debt structures. Further discussion of this point is provided in Section 7.1.

6.2.2 Results – How does different debt structures influence the amount of debt obtainable

Summary statistics on our leverage measures are provided in Section 6.3.2.1. In Table 6.4 below, we present regression results with debt instrument dummies where specifications (6)-(10) are akin to (1)-(5) but with D/EV instead of D/EBITDA. The same regressions using fractional measures of debt instrument usage have been moved to Appendix I. Table 6.5 presents the results of regressions with debt characteristic dummies as explanatory variables and also here, the fractional equivalent regressions have been moved to Appendix J.

Table 6.4 provides support for Hypothesis 2b which stated that an aggressive debt structure is associated with higher leverage. Specifically, we characterized an aggressive debt structure as one that incorporates distributed debt (such as TLBs, TLCs, and so on, as well as bonds) as opposed to bank debt (largely TLAs). In all models (1) through (5), dummies for TLB, TLO, and bonds are positively associated with both leverage measures at the 1% significance level. The results are somewhat weaker for the fractional measures in Appendix I where only the coefficient on bonds remain significant at the 5% level for regressions on D/EV after adding the full set of controls.

Furthermore, with all controls added, no significant coefficients on our main explanatory variables (debt instruments here) are found in the fractional regressions on D/EBITDA. The fact that no strong results are found for our fractional measures of debt instrument structure indicates that the relative share of distributed/public instruments in the financing package carries little impact on the aggregate leverage attainable, but that the mere presence of the instruments is associated with higher leverage, as suggested by the significant coefficients on the TLB, TLO, and bond dummies in Table 6.4. In addition to being statistically significant, the results are significant in a qualitative sense; the inclusion of TLBs in the financing package increases leverage by 0.375-0.434 turns[3] while bonds contribute some 0.379-0.559 across models (1)-(5) in Table 6.4. Given median D/EBITDA of 5.9x as seen in Table 6.6, the coefficients suggest that leverage is some 6-9% higher compared to the median for buyouts financed partly with either TLBs or bonds. In terms of the D/EV ratio, the effect is even larger with TLBs/TLOs seen to be associated with a 10-12%-points increase in the leverage ratio while the presence of bonds is associated with a 20%-points increase. We add to these finding that the dummy on mezzanine is also highly significant across all models in Table 6.4. Given mezzanine's subordinated and higher yielding nature, this finding also provides support for Hypothesis 2b that a more aggressive structure is associated with higher leverage.

Somewhat surprisingly, no coefficient on any debt instrument is negative at any of the usual significance levels given that Hypothesis 2a would have predicted that the coefficients on TLB, TLO, mezzanine and bonds would be negative while Hypothesis 2b would have it that the coefficient on TLA would be negative. To us, this result indicates that tiering, i.e. the use of multiple instruments, regardless of

[3] turn refers to the ratio between debt and EBITDA

which, is contributing to higher leverage over and above any benefits brought about by individual debt instruments. Clearly, this interpretation is mostly consistent with the clientele effects underpinning Hypothesis 2b.

Table 6.4: Regression output – Instruments' impact on leverage

	Dependent variable: Leverage ratios									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	D/EBITDA (log)	D/EBITDA (log)	D/EBITDA (log)	D/EBITDA (log)	D/EBITDA (log)	D/EV	D/EV	D/EV	D/EV	D/EV
Debt instrument (dummies)										
TLA	-0.064	0.116**	-0.038	0.018	0.092*	-0.995	1.107	-0.267	0.292	0.95
	(0.045)	(0.05)	(0.042)	(0.042)	(0.049)	(1.313)	(1.693)	(1.328)	(1.454)	(1.752)
TLB	0.429***	0.375***	0.481***	0.457***	0.434***	11.705***	9.918***	12.283***	12.400***	11.718***
	(0.061)	(0.056)	(0.056)	(0.059)	(0.057)	(2.052)	(2.056)	(2.062)	(2.157)	(2.147)
TLO	0.278***	0.259***	0.292***	0.279***	0.264***	10.115***	9.668***	10.293***	10.657***	10.166***
	(0.038)	(0.036)	(0.035)	(0.034)	(0.034)	(1.179)	(1.214)	(1.163)	(1.222)	(1.237)
Mezzanine	0.165***	0.147***	0.106**	0.200***	0.185***	8.138***	9.126***	7.019***	8.738***	9.132***
	(0.05)	(0.051)	(0.047)	(0.049)	(0.053)	(1.641)	(1.752)	(1.658)	(1.727)	(1.89)
Bond	0.379***	0.384***	0.559***	0.545***	0.556***	19.614***	19.217***	21.374***	20.890***	20.945***
	(0.042)	(0.039)	(0.045)	(0.046)	(0.043)	(1.321)	(1.354)	(1.514)	(1.535)	(1.545)
Target specific										
Target rating[1]			-0.104***	-0.008	0.012			-1.858***	-0.579	-0.293
			(0.023)	(0.023)	(0.022)			(0.624)	(0.693)	(0.697)
Target revenue (log)			-0.148***	-0.225***	-0.221***			-1.234**	-1.566***	-1.399**
			(0.018)	(0.02)	(0.02)			(0.593)	(0.604)	(0.609)
EBITDA margin (log)			-0.185***	-0.270***	-0.279***			-0.228	-0.883	-0.377
			(0.029)	(0.028)	(0.028)			(0.905)	(0.927)	(0.901)
Deal and PE-characteristics										
P2P (dummy)				0.089**	0.053				-0.732	-0.675
				(0.036)	(0.036)				(1.201)	(1.267)
SBO (dummy)				0.038	0.018				-2.438*	-2.726**
				(0.037)	(0.037)				(1.292)	(1.333)
PE experience (years)				-0.001	-0.002				-0.031	-0.062
				(0.002)	(0.002)				(0.05)	(0.05)
PE experience (fund number)				0.003	0.003				0.011	-0.071
				(0.003)	(0.003)				(0.117)	(0.122)
PE experience (log fund size USD)				0.130***	0.114***				0.106	0.171
				(0.017)	(0.017)				(0.563)	(0.583)
Credit and valuation conditions										
Local HY spread[2] (assetswapspread)				-0.001***	-0.0003				-0.009	-0.004
				(0.0002)	(0.0003)				(0.006)	(0.011)
Fed tightening index				0.001	0.001				-0.079*	-0.119
				(0.001)	(0.003)				(0.043)	(0.094)
Public market valuation (sp_ev_ebitda)				-0.007	-0.048				-0.538	-2.005
				(0.012)	(0.053)				(0.433)	(1.834)
Macro economic variables										
UST 10y yield				-0.133***	0.024				-1.695*	-0.092
				(0.026)	(0.05)				(0.879)	(1.84)
USD 3m Libor				0.042**	0.042				0.613	-0.723
				(0.017)	(0.05)				(0.59)	(1.723)
Local inflation[2]				-0.024	0.001				-0.352	0.029
				(0.018)	(0.028)				(0.602)	(0.94)
Local GDP growth[2]				-0.028*	0.003				-0.161	-0.628
				(0.015)	(0.019)				(0.496)	(0.716)
Constant	1.184***	1.029***	2.542***	1.847***	0.846	35.515***	23.064***	57.297***	62.207***	72.887**
	(0.063)	(0.299)	(0.211)	(0.308)	(0.834)	(2.24)	(7.724)	(5.596)	(10.002)	(30.106)
Country controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Industry controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Year controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Observations	972	972	972	908	908	931	931	931	871	871
R^2	0.162	0.38	0.293	0.421	0.514	0.248	0.342	0.265	0.299	0.368
Adjusted R^2	0.158	0.33	0.287	0.408	0.461	0.244	0.285	0.259	0.282	0.296

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

Turning to the importance of debt characteristics, Table 6.5 reports the results of models with dummies indicating whether the buyout financing package include unsecured, lower liens, subordinated,

covenant-lite, and syndicated debt. The results for fractional measures of these variables are presented in Appendix J.

The variable most pertinent to the discussion above on debt instrument is the syndicated dummy given it proxies for whether a debt tranche is widely distributed or not. The syndicated variable becomes highly significant after adding the full set of controls and with a positive sign consistent with Hypothesis 2b. A similar result is seen in Appendix J. Combined with our findings on debt instruments' relation to leverage, there is strong evidence that widely distributed debt (property of an aggressive debt structure) is more conducive to increasing leverage suggesting that collective action problems and the agency benefits of concentrated lending are dominated by the ability to raise capital from a wider investor base.

In terms of the other structuring elements, only the liens priority variable is consistently statistically significant across the models in Table 6.5. Specifically, buyouts financed by debt where part of the secured debt has a second ranking pledge have significantly higher leverage, with estimates ranging between 0.33-0.42 turns and 14-15%-points in terms of the D/EV ratio, than buyouts whose financing package has no security subordination. The evidence for a relationship between the use of unsecured debt and leverage is somewhat weaker. Only in regressions on D/EV is the coefficient significant albeit at the 5% level even after adding the full suite of controls.

In contrast, we find no evidence that the inclusion of contractually subordinated debt is related to leverage. We speculate that contractually subordinated debt, and possibly to some degree unsecured debt, is associated with too large agency problems at high levels of debt but that the security of 2nd lien loans, albeit with a second ranking claim, provide material protection that is superior in a risk-return perspective taking into account agency problems. In particular, it may be harder for equity-holders (agents) to appropriate or destroy the value of secured assets than the value associated with being a going concern to which unsecured and contractually subordinated debt's claim predominantly lie. At high leverage levels, then, the relative advantages of secured, albeit at lower liens, debt increases.

The results on covenant strength's relation to leverage is mixed. In Appendix J, the coefficients on the proportion of the debt package being covenant-lite are positive and statistically significant at least at the 5%-significance level across all models. The coefficients on the covenant-lite dummy in Table 6.5, however, are not significant in models featuring country, industry, and year controls. Clearly, the use of covenant-lite debt is highly pro-cyclical and so is the amount of leverage used to finance buyouts. Accordingly, the positive coefficients in the naïve models, e.g. (1) and (3) as well as (6) and (8), are probably confounded by credit conditions as well as a positive increasing time trend. As such, although there is weak evidence that the use of less restrictive and fewer covenants are associated with higher leverage, we hesitate to emphasize this result.

When it comes to the robustness of the regression coefficients on our main explanatory variables toward omitted variable bias, we note that only marginal changes are seen across the models in Table 6.4 and

Table 6.5 when adding controls, i.e. in model (3)-(5) and (8)-(10), except for the covenant-lite dummy. This suggests that the effects of debt structure on leverage are largely orthogonal and unbiased.

Table 6.5: Regression output – Debt characteristics' impact on leverage

	Dependent variable: Leverage ratios									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	D/EBITDA (log)	D/EBITDA (log)	D/EBITDA (log)	D/EBITDA (log)	D/EBITDA (log)	D/EV	D/EV	D/EV	D/EV	D/EV
Debt characteristic (dummies)										
Unsecured	-0.078**	-0.051	0.016	0.029	0.051	2.177*	2.640**	2.530*	2.944**	3.293**
	(0.038)	(0.039)	(0.04)	(0.04)	(0.041)	(1.238)	(1.274)	(1.313)	(1.335)	(1.388)
Lower liens[2]	0.422***	0.334***	0.415***	0.381***	0.358***	15.117***	13.858***	15.196***	14.856***	14.343***
	(0.045)	(0.043)	(0.041)	(0.042)	(0.041)	(1.303)	(1.349)	(1.286)	(1.339)	(1.357)
Subordinated	0.029	0.025	-0.002	0.053	-0.002	2.118	2.104	1.881	2.728*	1.992
	(0.043)	(0.05)	(0.042)	(0.046)	(0.049)	(1.374)	(1.664)	(1.383)	(1.525)	(1.693)
Covlite	0.174***	0.007	0.219***	0.131***	0.082*	3.232**	1.341	3.559***	3.365**	2.038
	(0.042)	(0.045)	(0.041)	(0.043)	(0.046)	(1.281)	(1.562)	(1.332)	(1.434)	(1.581)
Syndicated	-0.08	0.123	0.002	0.109	0.209***	3.233	5.257**	3.699	3.599	5.529**
	(0.093)	(0.096)	(0.081)	(0.074)	(0.081)	(2.391)	(2.597)	(2.406)	(2.505)	(2.708)
Target specific										
Target rating			-0.084***	-0.019	-0.005			-0.308	0.496	0.432
			(0.021)	(0.022)	(0.023)			(0.603)	(0.677)	(0.685)
Target revenue (log)			-0.134***	-0.202***	-0.196***			-0.797	-1.038*	-0.69
			(0.018)	(0.019)	(0.019)			(0.572)	(0.607)	(0.62)
EBITDA margin (log)			-0.141***	-0.222***	-0.239***			0.332	-0.203	0.13
			(0.03)	(0.03)	(0.029)			(0.918)	(0.925)	(0.925)
Deal and PE-characteristics										
P2P (dummy)				0.083**	0.062				-1.035	-0.346
				(0.037)	(0.039)				(1.219)	(1.29)
SBO (dummy)				0.005	-0.012				-3.713***	-3.950***
				(0.037)	(0.039)				(1.302)	(1.368)
PE experience (years)				0.0004	-0.001				0.009	-0.021
				(0.002)	(0.002)				(0.051)	(0.052)
PE experience (fund number)				0.003	0.002				-0.058	-0.17
				(0.003)	(0.003)				(0.106)	(0.111)
PE experience (log fund size USD)				0.118***	0.102***				-0.251	-0.218
				(0.018)	(0.018)				(0.599)	(0.598)
Credit and valuation conditions										
Local HY spread[3] (assetswapspread)				-0.001***	-0.0001				-0.007	-0.005
				(0.0002)	(0.0003)				(0.006)	(0.011)
Fed tightening index				-0.001	0.002				-0.124***	-0.073
				(0.001)	(0.003)				(0.046)	(0.095)
Public market valuation (sp_ev_ebitda)				-0.012	-0.002				-0.425	-1.105
				(0.013)	(0.052)				(0.438)	(1.813)
Macro economic variables										
UST 10y yield				-0.089***	-0.003				-0.741	-1.24
				(0.027)	(0.051)				(0.931)	(1.898)
USD 3m Libor				0.049***	0.071				0.778	-0.304
				(0.018)	(0.049)				(0.595)	(1.735)
Local inflation[3]				-0.029	-0.007				-0.297	-0.246
				(0.018)	(0.029)				(0.585)	(0.958)
Local GDP growth[3]				-0.028*	-0.005				-0.233	-0.952
				(0.014)	(0.02)				(0.508)	(0.737)
Constant	1.565***	1.136***	2.735***	2.103***	0.53	41.687***	23.753***	49.285***	55.841***	64.246**
	(0.092)	(0.4)	(0.201)	(0.289)	(0.862)	(2.314)	(9.152)	(5.737)	(9.992)	(31.662)
Country controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Industry controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Year controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Observations	972	972	972	908	908	931	931	931	871	871
R^2	0.17	0.338	0.26	0.37	0.458	0.242	0.33	0.246	0.284	0.347
Adjusted R^2	0.165	0.283	0.253	0.355	0.399	0.238	0.272	0.239	0.267	0.273

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) Lower liens means second and lower lien loans (3) Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

In terms of the direct effect of the controls on leverage, there are only few statistically significant results. Somewhat surprisingly, target revenue and EBITDA-margin are negatively related to leverage for both measures across most models. In light of the argument presented in the previous section that larger and more profitable firms are less sensitive to agency problems, we would have expected a positive impact on leverage ratios. The coefficient on EBITDA-margin, however, may be a largely

mechanical result of EBITDA featuring in both the denominator of the dependent variable and as numerator in the regressor. Indeed, the models utilizing D/EV exhibit no statistically significant coefficients on the EBITDA-margin.

On deal and PE-characteristics, there is only weak evidence that leverage varies across different buyout types. Surprisingly, the D/EV ratio is, on average, lower for SBOs than first-time buyouts in contrast to the expectation given rise to, by the argument that operational optimization is exhausted after having already been PE-owned (Bonini, 2015). The only proxy for PE-experience exhibiting a significant relationship to leverage in our data is fund size, which is positively related to D/EBITDA at the 1% significance level. Notably, however, fund size is not related to D/EV which suggests that the relation with the D/EBITDA ratio is confounded by a relation between fund size and valuation of targets.

There seems to be little evidence that valuation and credit conditions as well as the macroeconomic environment have an impact on leverage in stark contrast to the findings of e.g. Axelson et al. (2013). Even the effect of the HY spread seizes to be significant in models with country, industry and year controls. Keeping in mind, however, the finding in Section 6.1.2 that debt structure relates to credit conditions and the above results that debt structure affects leverage, we propose the following narrative; credit, valuation, and macroeconomic conditions have an exogenous impact on the aggressiveness of debt structure and that debt structure mediates the effects of broader market conditions on leverage but that there are no independent, direct effects of the broader market conditions on leverage. If this story is true, it clearly enriches the conventional thinking of capital structure in highlighting the role of debt structure as a determinant of overall capital structure.

6.3 Leverage's impact on pricing

The results from the previous section established that the use of an aggressive debt structure is associated with higher aggregate deal leverage. We continue the analysis by looking at how aggregate deal leverage affects LBO pricing.

6.3.1 Regression set-up

This section aims to explore the relationship between leverage and LBO pricing and as such takes LBO pricing as the dependent variable and leverage as the independent variable. We adopt EV/EBITDA as the dependent variable. This is a standardized measure that takes the EV relative to EBITDA and therefore compares well across firm size. Despite being a standardised measure, we observe a non-normal distribution of EV/EBITDA multiples in our sample caused by a relatively few observations with extremely high multiples that we are unable to explain. In line with Axelson et al. (2013), we use the natural log of EV/EBITDA to alleviate the effect from such extreme observations.

As the independent variable, we use leverage. Similar to previous sections, we adopt D/EBITDA and D/EV as measures of leverage. Again, D/EBITDA multiples are logged to alleviate the effect from

extreme observations. Since the D/EV is a standardised measure that is bound by a lower and upper limit of 0 and 1, respectively, we do not worry about extreme observations for this variable.

6.3.1.1 The effect from credit and valuation conditions on pricing

We start by specifying a preliminary model excluding deal leverage where LBO pricing is regressed on the local high yield spread, the Fed tightening index, and the public valuation level measured as the aggregate EV/EBITDA multiple for the S&P 500 index. Further, various controls are included pertaining to target-specific and sponsor-specific characteristics as well as macro variables. With this specification, we aim to explore to what extent pricing multiples are driven by market-wide credit and valuation conditions and, in addition, avoid the problems of endogeneity associated with regressing pricing on leverage, as discussed below.

6.3.1.2 The effect from leverage on pricing – OLS set-up

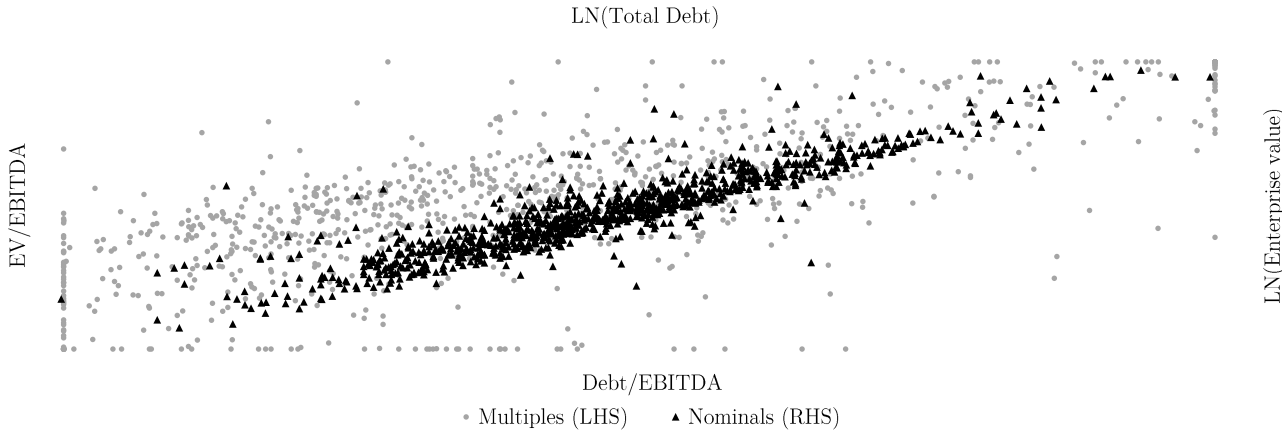
Next, we turn our focus to the relationship between deal leverage and LBO pricing. Here, we specify a set of OLS regressions with LBO pricing (EV/EBITDA) as the dependent variable and leverage (D/EBITDA and D/EV) as the independent variable. Controls are added incrementally for each specification.

We suspect that an endogeneity issue exists between our dependent and independent variables. The first concern relates to reverse causality. Specifically, there is a possibility that causality may run backwards from buyout pricing to deal leverage instead of forward from deal leverage to buyout pricing since variations in LBO pricing and deal leverage are both likely to be functions of common unobserved factors. Firstly, PE sponsors may be required to finance a larger part of the buyout using debt if buyout pricing is pushed up by some unobservable factor. Secondly, in a situation where buyout pricing is high due to unobservable factors, PE sponsors may deliberately want to finance a larger chunk of the deal using debt in order to meet their minimum required rate of equity return.

The second concern relates to one variable being partly a function of the other simply due to their measurement rather than causal dynamics. Consider the dependent and independent variables, namely EV/EBITDA and D/EBITDA. The numerator in the dependent variable, EV, largely consists of equity and debt and, in LBOs, debt will make up a significant proportion of EV. EV is therefore a linear function of debt and it is natural that a strong, positive relationship exists between EV/EBITDA and D/EBITDA, but this relationship is caused by the independent variable being endogenously determined by the dependent variable.

Figure 6.2 depicts the relationships between logged D/EBITDA and logged EV/EBITDA multiples, and between logged nominal debt and logged EV. The chart shows winsorized data which explains the upper and lower "cap" for debt and EV multiples. As we would expect, there is a strong positive relationship between debt and EV, both relative to EBITDA and in nominal terms.

Figure 6.2: Scatterplot of logged D/EBITDA and EV/EBITDA and nominal debt and EV



Note: Depicts winsorized data which explains the "upper" and "lower" bounds on the multiples

In a more formal manner, we can present the problem as follows. Our equation of interest is

$$p_i = \beta_0 + \beta_1 lev_i + \beta_2 W_{1i} + \cdots + \beta_{k+2} W_{ri} + u_i \tag{6.1}$$

where p_i is LBO pricing (i.e. EV/EBITDA), lev_i is deal leverage (i.e. D/EBITDA or D/EV) and is the endogenous problematic variable, and W_{ri} is the exogenous control variables. That is, we try to estimate the causal effect from *lev* to *p*, but if *lev* is an endogenous variable that is correlated with the error term, u_i, the estimated coefficient on *lev* will be inconsistent. To control for such reverse causality and endogeneity, we turn to Instrumental Variables (IV) regression.

6.3.1.3 The effect from leverage on pricing – TSLS set-up

Broadly speaking, IV regression is a method to obtain consistent estimators of the unobserved coefficients of the population regression function when there is correlation between the regressor and the error term (Stock & Watson, 2015). The general idea behind IV regression is to use a two stage least square (TSLS) set-up to decompose variation in the endogenous variable into two parts; a problematic component that correlates with the regression error and another problem-free component that varies independently of the error term.

The first-stage regression estimates a component of the independent variable that is exogenous from the dependent variable using a valid instrument. In general terms, the first-stage regression would look something like the following:

$$lev_i = \pi_0 + \pi_1 Z_{i,1} + \cdots + \pi_k Z_{i,k} + \pi_{k+1} W_{i,1} + \cdots + \pi_{k+j} W_{i,j} + v_i \tag{6.2}$$

where $Z_{i,1\ldots k}$ are valid instruments, $W_{i,1\ldots j}$ are the exogenous variables, π_0 is the intercept, $\pi_1 \ldots \pi_{k+j}$ is the slope coefficients and the equation is estimated using OLS. As will be discussed further in Section

6.3.3, we employ several instruments. One of them is a dummy variable indicating the presence of a TLB in the debt package. With leverage as the endogenous variable and TLB as the instruments, the first-stage regression becomes:

$$lev_i = \pi_0 + \pi_1 TLB_i + \pi_2 W_{i,target\ spec.} + \pi_3 W_{i,deal\ spec.} + \pi_4 W_{i,valuation\ cond.} + \pi_5 W_{i,macro.} + v_i \quad (6.3)$$

where W_j represents control variables grouped by category. This regression decomposes the leverage variable into a component that can be predicted by the presence of a TLB in the debt package, $\pi_0 + \pi_1 TLB_i$. If the presence of a TLB is not related to the dependent variable in the equation of interest, namely pricing, it is exogenous and therefore uncorrelated with the error term, u_i (we test this in section 6.3.3.1). The other component of the leverage variable is v_i, which is the problematic component of lev_i that is correlated with u_i. In TSLS, we use the problem-free component of *leverage*, namely $\pi_0 + \pi_1 TLB_i$, and disregards the problematic component v_i. The first-stage regression uses the predicted values from OLS regression, $\widehat{lev_i} = \pi_0 + \pi_1 TLB_i$ where π_0 and π_1 are OLS estimates and $\widehat{lev_i}$ is predicted leverage from the model. In the second stage, we regress Y_i on X_i using OLS. In our case, the second-stage regression becomes:

$$p_i = \beta_0 + \beta_1 \widehat{lev_i} + \beta_2 W_{i,target\ spec.} + \beta_3 W_{i,deal\ spec.} + \beta_4 W_{i,valuation\ cond.} + \pi_5 W_{i,macro.} + u_i \quad (6.4)$$

The resulting coefficient estimates are the TSLS estimates and will be unbiased if a valid instrument is used. For an instrument to be valid, two conditions must be satisfied, namely the instrument relevance condition and the instrument exogeneity condition:

1. Instrument relevance: $corr\ Z_i, X_i \neq 0$
2. Instrument exogeneity: $corr\ Z_i, u_i = 0$

First, the instrument must be relevant meaning that variations in the instrument is related to variations in the endogenous variable X_i. Second, the instrument must be exogenous, meaning that the instrument must not be correlated with the error term. Because valid instruments are vital for IV regression to produce unbiased estimators, we formally test the validity of the employed instruments in Section 6.3.3.1. Further, we use two different sets of instruments to check robustness of the results to the choice of instruments.

6.3.2 Results – Drivers of LBO pricing (OLS regression)

This section presents the results from OLS regressions pertaining to credit conditions' and leverage's effect on pricing. The subsequent section will present results from IV regression on the effect from leverage on pricing.

6.3.2.1 Summary statistics

Table 6.6 presents summary statistics on the size as well as the leverage and pricing of the buyout deals in our sample. The average (median) buyout is USD 1,743m (USD 851m) measured by EV.

Public-to-private transactions are the largest type with an average (median) EV of USD 2,726m (USD 1,159m). This is not surprising since some of the largest buyout transactions in history have been of public companies. Moreover, public companies may, on average, be larger than private companies considering the direct and indirect costs of being a listed entity, e.g. the additional disclosure and compliance requirements (see Hartman, 2007).

Table 6.6: Summary statistics on LBO Enterprise value, leverage and pricing

	EV (USDm)				EV/EBITDA			
	N	*Mean*	*Median*	*Std Dev*	*N*	*Mean*	*Median*	*Std Dev*
All LBO transactions	972	1'743	851	3'144	972	12.1x	10.4x	5.9x
Buyout of private company	335	1'259	715	2'034	335	11.2x	9.8x	5.5x
Public-to-private	333	2'726	1'159	4'643	333	12.5x	10.5x	6.3x
Secondary buyout	240	1'166	874	958	240	13.0x	11.3x	6.0x
North America	471	2'126	983	3'938	471	11.6x	10.2x	5.8x
Western Europe	495	1'383	788	2'097	495	12.4x	10.7x	6.1x
Other regions[1]	6	1'313	629	1'203	6	13.0x	14.3x	4.3x

	D/EBITDA				D/EV			
	N	*Mean*	*Median*	*Std Dev*	*N*	*Mean*	*Median*	*Std Dev*
All LBO transactions	972	6.9x	5.9x	4.0x	972	0.56	0.57	0.18
Buyout of private company	335	6.2x	5.5x	3.5x	325	0.55	0.54	0.17
Public-to-private	333	7.3x	6.2x	4.4x	317	0.57	0.58	0.18
Secondary buyout	240	7.4x	6.2x	3.9x	229	0.56	0.58	0.16
North America	471	6.6x	5.8x	4.0x	451	0.55	0.58	0.19
Western Europe	495	7.2x	5.9x	4.0x	474	0.57	0.57	0.16
Other regions[1]	6	6.9x	6.6x	1.5x	6	0.57	0.57	0.17

Note: Winzorized data (1) Countries included in "Other regions" include: China, Israel, UAE and Australia

North American buyouts are larger than their European counterparts, on average. Firstly, North American firms may be larger than European firms in general, causing buyouts to be equally larger when drawing randomly from the population. Second, the more advanced nature of the American buyout market and the market for leveraged loans may allow financial sponsors to conduct larger buyouts of American targets.

Turning to LBO pricing, the average (median) EV/EBITDA multiple is 12.1x (10.4x) for the whole sample while secondary buyouts show the highest average multiples (13.0x) and buyouts of private companies show the lowest average multiples (11.2x). A plausible explanation for this may be that the sellers involved in a secondary buyout are financial sponsors themselves, leveraging their expertise and negotiating skills to achieve a higher exit multiple. The higher than average EV/EBITDA multiple reported for public-to-private transactions may be due to the fact that acquirers often pay a substantial control premium to existing shareholders when taking a public firm private. Interestingly, LBO pricing is higher for European firms than for North American firms.

As regards leverage, the average (median) D/EBITDA multiple is 6.9x (5.9x) and is highest for secondary buyouts (7.4x). We suggest two possible explanations for this. Firstly, because secondary buyouts have previously proven to be able operate with high leverage ratios, financial sponsors are better able to max out leverage ratios for these targets. Secondly, the fact that secondary buyouts are

acquired at higher multiples, as shown above, suggest that financial sponsors need to deploy more leverage to achieve their minimum required rate of return.

The following sections presents regression results. We start by briefly presenting results on how credit and valuation conditions affect LBO pricing before turning to the relationship between deal leverage and LBO pricing.

6.3.2.2 How does credit and valuation conditions affect LBO pricing?

Table 6.7 presents the results from the OLS regression. Focusing on specification (1) and (2) which estimates equations predicting EV/EBITDA multiples as a function of credit and valuation conditions, we note that these specifications do not include deal leverage as an independent variable as solely want to explore the effect from credit and valuation conditions. These specifications should, therefore, not be concerned with endogeneity issues and OLS should provide consistent and unbiased coefficient estimates.

Specification (1) controls for target and macroeconomic conditions. The results indicate that the local HY spread has a negative and statistically significant impact on buyout pricing. Axelson et al. (2013) found a similar relationship in their study and suggested that the HY spread not only proxies for debt market conditions, but also picks up changes in the economy-wide discount rate or risk premium. However, as we already include public market valuations, which should proxy well for the economy-wide discount rate and risk-premium, and credit conditions through the Fed tightening index, we theorise that the HY spread picks up changes in investor risk appetite not explained by the other variables. Further, it may be that a low HY spread proxies well for lax credit markets which causes higher LBO pricing.

Turning to the target-specific control variables, we find that target revenue is significantly negatively related to pricing across all specifications, indicating that larger firms trade at lower EV multiples. We speculate that omitted variable bias may play a role here: Smaller firms may have a tendency to exhibit higher revenue growth rates on average, justifying a higher price multiple. Unfortunately, we are unable to obtain target revenue growth rates. Similarly, LBO pricing is significantly negatively related to profitability (proxied by EBITDA margin) across all specifications, suggesting that mature, profitable targets trade at lower multiples than growth targets.

Regarding macroeconomic variables, LBO pricing is negatively related to the 10-year US Treasury yield. We suspect this effect is confounded by leverage. That is, since we do not include deal leverage in specification (1) and (2), it is possible that the negative coefficient on the US Treasury yield is due to less leverage being deployed when the Treasury yield is high and vice versa. Indeed, the coefficient becomes insignificant in specification (4) and (6) when the leverage variable is included.

Specification (2) expands to include deal and sponsor characteristics. The type of the buyout has a significant effect on the price of the target. Public-to-private transactions and secondary buyout exhibit higher pricing multiples than regular buyouts of private companies. As discussed under summary

Table 6.7: OLS output – The effect from credit conditions and leverage on LBO pricing

	Dependent variable: Deal pricing (OLS specification)					
	(1)	(2)	(3)	(4)	(5)	(6)
	EV/EBITDA (log)	EV/EBITDA (log)	EV/EBITDA (log)	EV/EBITDA (log)	EV/EBITDA (log)	EV/EBITDA (log)
Leverage ratio						
Debt/EBITDA (log)			0.520***	0.487***		
			(0.023)	(0.023)		
Debt/EV					-0.003***	-0.003***
					(0.001)	(0.001)
Target specific						
Target rating[1]	-0.024	-0.006	0.026*	0.049***	-0.043*	0.024
	(0.019)	(0.02)	(0.014)	(0.013)	(0.023)	(0.022)
Target revenue (log)	-0.094***	-0.153***	-0.082***	-0.093***	-0.152***	-0.159***
	(0.013)	(0.014)	(0.01)	(0.01)	(0.015)	(0.015)
EBITDA margin (log)	-0.160***	-0.214***	-0.122***	-0.145***	-0.215***	-0.238***
	(0.024)	(0.025)	(0.019)	(0.017)	(0.026)	(0.023)
Deal and PE-characteristics						
P2P (dummy)[2]		0.110***	0.045**	0.027	0.117***	0.081***
		(0.031)	(0.022)	(0.023)	(0.031)	(0.03)
SBO (dummy)[2]		0.096***	0.064***	0.065***	0.104***	0.077**
		(0.032)	(0.023)	(0.024)	(0.031)	(0.032)
PE experience (years)		0.001	0.001	0.001	0.001	0.0004
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
PE experience (fund number)		0.003	0.002	0.003	0.003	0.004
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
PE experience (log fund size USD)		0.116***	0.057***	0.049***	0.131***	0.105***
		(0.016)	(0.011)	(0.011)	(0.016)	(0.015)
Credit and valuation conditions						
Local HY spread[2] (assetswapspread)	-0.001***	-0.001***	-0.0001	0.00004	-0.001***	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
Fed tightening index	0.003**	0.002*	0.002***	0.001	0.002***	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Public market valuation (sp_ev_ebitda)	-0.030***	-0.012	0.001	-0.009	-0.011	-0.018
	(0.011)	(0.011)	(0.008)	(0.034)	(0.01)	(0.044)
Macro economic variables						
UST 10y yield	-0.128***	-0.091***		0.022		0.017
	(0.02)	(0.021)		(0.034)		(0.042)
USD 3m Libor	0.054***	0.047***		0.066**		0.105**
	(0.013)	(0.014)		(0.033)		(0.041)
Local inflation[3]	-0.022	-0.024		-0.021		-0.038
	(0.016)	(0.016)		(0.017)		(0.023)
Local GDP growth[3]	-0.011	-0.011		0.009		0.017
	(0.013)	(0.012)		(0.012)		(0.016)
Constant	3.899***	2.590***	1.031***	0.639	2.700***	1.13
	(0.201)	(0.252)	(0.188)	(0.589)	(0.282)	(0.718)
Country controls	No	No	No	Yes	No	Yes
Industry controls	No	No	No	Yes	No	Yes
Year controls	No	No	No	Yes	No	Yes
Observations	972	908	908	908	871	871
R^2	0.178	0.267	0.589	0.652	0.268	0.435
Adjusted R^2	0.169	0.254	0.584	0.616	0.257	0.375

Note: heteroskedasticity robust standard errors (1) A higher rating means higher credit quality (2) Coefficient shows comparison to buyout of private company (3) We use Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

statistics, we suggest that the control premium paid for public companies and the fact that SBOs involve financially sophisticated sellers explains the higher average price paid in these types of transactions. Further, LBO pricing is found to be (significantly) positively related to fund size across all specifications, indicating that larger PE funds tend to overpay more than their smaller counterparts.

6.3.2.3 How does deal leverage affect LBO pricing?

Specification (3) through (6) focus on the effect from deal leverage and LBO pricing. As discussed in Section 6.3.1.2, we suspect leverage to be endogenous to pricing and we therefore hesitate to put too much emphasis on the results obtained from the OLS regressions. Rather, we present the results here to show that exactly such a problematic relationship exists between the dependent and the independent variable, further justifying IV regression as the appropriate econometric tool.

In Table 6.7, specification (3) and (4) measure leverage using D/EBITDA while specification (5) and (6) use D/EV. While specification (3) and (5) only includes control variables pertaining to target characteristics, deal and sponsor characteristics, and credit and valuation conditions, specification (4) and (6) expands to also include macroeconomic conditions as well as industry, country and year controls. Investigating the coefficients on the leverage measure in specification (3) to (6) reveals the problematic relationship between leverage and pricing: When leverage is measured using D/EBITDA as in specification (3) and (4), the estimated coefficients are positive (and significant), indicating that leverage has a positive effect on LBO pricing. However, when leverage is measured using D/EV as in specification (5) and (6), the estimated coefficients are negative (and significant), indicating that leverage has a negative effect on LBO pricing. These contradicting findings reveals the inadequacy of OLS in this regard why we turn to IV regressions in the following sections.

6.3.3 Results – Leverage's impact on LBO pricing (IV regression)

We start by introducing the instruments used in the first-stage regressions. As previously discussed, the usefulness of instrumental variables regression hinges on the validity of the instruments. Consequently, we run IV regressions using two separate groups of instruments to check robustness of the results to the choice of instruments. The first group of instruments uses credit conditions to predict leverage. Specifically, the first stage includes the high yield spread and the Fed tightening index as instruments. This group of instruments addresses concerns about EV partly being a function of debt but may not control for simultaneous causality since credit conditions are likely related to LBO pricing, although it is possible that they are only related through leverage. The degree of exogeneity for this group of instruments is therefore uncertain and will be tested in the next section.

The second group of instruments uses debt characteristics to predict leverage. It includes dummies for the presence of TLBs and lower lien loans in the debt package as these were found to be significantly related to leverage in Section 6.2, while they should be unrelated to deal pricing, except through the leverage channel. This group of instruments should therefore address concerns related to endogeneity.

6.3.3.1 Testing instrument validity

Table 6.8 shows the first-stage OLS regressions in the TSLS regressions. Specification (1) and (2), and specification (5) and (6) uses credit conditions as instruments for D/EBITDA and D/EV, respectively. Specification (3) and (4), and specification (7) and (8) uses debt characteristics as instruments for D/EBITDA and D/EV, respectively. According to Stock and Watson (2015, p. 490), the instrument

relevance condition is tested by "computing the F-statistic testing the hypothesis that the coefficients on the instruments are all zero in the first-stage regression of TSLS. The first-stage F-statistic provides a measure of the information content contained in the instruments: The more information content, the larger is the expected value of the F-statistic".

Table 6.8: First-stage regressions in TSLS, testing instrument relevance

	Dependent variable: Leverage							
	(1) D/EBITDA	(2) D/EBITDA	(3) D/EBITDA	(4) D/EBITDA	(5) D/EV	(6) D/EV	(7) D/EV	(8) D/EV
Instruments								
Local HY spread[1] (assetswapspread)	-0.001***	0.0002			-0.003	0.013		
	(0.0002)	(0.0003)			(0.006)	(0.012)		
Fed tightening index	0.0001	0.0002			-0.151***	-0.146		
	(0.001)	(0.003)			(0.05)	(0.103)		
Tlb (dummy)			0.415***	0.347***			9.341***	7.895***
			(0.053)	(0.055)			(2.044)	(1.986)
Lower liens[2] (dummy)			0.451***	0.401***			17.490***	16.792***
			(0.034)	(0.033)			(1.102)	(1.146)
Constant	4.165***	0.622	2.420***	0.648	84.148***	58.655*	46.635***	60.121**
	(0.271)	(0.932)	(0.23)	(0.645)	(9.321)	(35.481)	(7.784)	(23.471)
Control variables								
Target specific controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal and PE controls	No	Yes	No	Yes	No	Yes	No	Yes
Public valuation controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	No	Yes	No	Yes	No	Yes	No	Yes
Industry controls	No	Yes	No	Yes	No	Yes	No	Yes
Year controls	No	Yes	No	Yes	No	Yes	No	Yes
F statistic (instrument relevance)	22.886***	0.259	124.123***	92.718***	12.014***	1.039	130.695***	101.837***
Observations	972	908	972	908	931	871	931	871
R^2	0.188	0.369	0.324	0.484	0.076	0.187	0.262	0.352
Adjusted R^2	0.179	0.305	0.317	0.433	0.066	0.101	0.254	0.284

Note: (1) We use Eurozone HY spread for targets based in Western Europe and US HY spread for targets based in North America or other regions (2) Lower liens means second and lower lien loans
Significance levels: *p<0.1; **p<0.05; ***p<0.01

We use a Wald test to test instrument relevance. The Wald test can be used to test a single hypothesis on multiple parameters. Specifically, the Wald test compares a restricted model to an unrestricted model. In our case, the restricted model employs only the instruments as independent variables:

$$X_i = \pi_0 + \pi_1 Z_i + \cdots + \pi_m Z_{mi} + v_i \tag{6.5}$$

While the unrestricted model employs instruments and control variables:

$$X_i = \pi_0 + \pi_1 Z_i + \cdots + \pi_m Z_{mi} + \pi_{m+1} W_{1i} + \cdots + \pi_{m+r} W_{ri} + v_i \tag{6.6}$$

The null hypothesis is that the coefficients on the instruments are all zero:

$$H_0 \colon \pi_1 = \cdots = \pi_m = 0 \tag{6.7}$$

The F-statistics is presented in Table 6.8. A simple rule of thumb is that the instrument relevance conditions is satisfied if the F-statistic exceeds 10 (Stock & Watson, 2015). For TSLS regressions where we use credit conditions as instruments, this is only the case when we do not include year dummies. That is, when we control for variations over time, credit conditions fail to be a relevant instrument for

leverage. Instead, we focus the specifications where leverage is instrumented by debt characteristics. For these specifications, the F-statistic is way above 10, indicating that this set of instruments are highly relevant.

The exogeneity condition is tested by implicitly comparing the TSLS estimator using different instruments and test if these are close to each other. Because exogeneity of the instruments means that they must be uncorrelated with u_i, we also need that the instruments are approximately uncorrelated with u_{TSLS}, where

$$u_{TSLS} = Y_i - (\beta_0^{TSLS} + \beta_1^{TSLS} X_{1i} + \cdots + \beta_{r+k}^{TSLS} W_{ri}) \tag{6.8}$$

is the residuals from the estimated TSLS regression. If the instruments are exogenous, the coefficients on the instruments in an OLS regression of $\hat{u}^{TSLS}$ on the instruments and controls should all be zero:

$$u_{TSLS} = \delta_0 + \delta_1 Z_{1i} + \cdots + \delta_m Z_{mi} + \delta_{m+1} W_{1i} + \cdots + \delta_{m+r} W_{ri} + e_i \tag{6.9}$$

estimated using OLS, where the null hypothesis is:

$$H_0\text{: } \delta_1 = \cdots = \delta_m = 0 \tag{6.10}$$

The test uses the J statistic which is computed as mF where F is the homoskedasticity-only F-statistic of the above null hypothesis. Under the null hypothesis specifying that all instruments are exogenous, the J statistic follows a χ^2_{m-k} distribution where $m - k$ is the measures the degree of overidentification, i.e. the difference between the number of instruments and the number of endogenous regressors. Table 6.9 presents the estimated coefficients, the Chi-square test-statistics and the corresponding p-values. The p-values test the null hypothesis that all coefficients on the instruments are 0. As evident from the p-values reported, not all specifications are exogenous. Specifically, where we instrument leverage using credit conditions, the instruments do not fulfil the exogeneity condition.

Based on the two instrument validity tests, we conclude the following: Using credit conditions as instruments for leverage is only relevant when year controls *are not* included in the regression, but only exogenous when year controls *are* included in the regression. On the other hand, debt characteristics are both relevant and somewhat exogenous instruments, why we will focus on the results obtained from the TSLS regression where these as used in the following section.

Table 6.9: Testing instrument exogeneity

	Dependent variable: Residuals from IV regression							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	D/EBITDA IV residuals	D/EBITDA IV residuals	D/EBITDA IV residuals	D/EBITDA IV residuals	D/EV IV residuals	D/EV IV residuals	D/EV IV residuals	D/EV IV residuals
	Credit cond.	Credit cond.	Debt charac.	Debt charac.	Credit cond.	Credit cond.	Debt charac.	Debt charac.
Instruments								
Local HY spread[1] (assetswapspread)	-0.0003***	-0.0001			-0.001***	0.0001		
	(0.0001)	(0.0002)			(0.0001)	(0.0002)		
Fed tightening index	0.003***	0.001			0.004***	0.001		
	(0.001)	(0.002)			(0.001)	(0.002)		
TLb (dummy)			0.043	0.05			0.103**	0.104**
			(0.035)	(0.035)			(0.049)	(0.046)
Lower liens[2] (dummy)			-0.018	-0.019			-0.019	-0.014
			(0.024)	(0.023)			(0.032)	(0.03)
Constant	0.229	0.022	-0.009	-0.004	0.460**	-0.238	-0.055	-0.016
	(0.15)	(0.654)	(0.156)	(0.479)	(0.223)	(0.71)	(0.212)	(0.599)
Control variables								
Target specific controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal and PE controls	No	Yes	No	Yes	No	Yes	No	Yes
Public valuation controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	No	Yes	No	Yes	No	Yes	No	Yes
Industry controls	No	Yes	No	Yes	No	Yes	No	Yes
Year controls	No	No	No	No	No	No	No	No
Chi-sq	14.375***	0.4457	2.5392	3.0563*	20.188***	0.4084	5.6796**	6.0477**
df	1	1	2	2	1	1	2	2
p-value	0.000	0.504	0.111	0.080	0.000	0.523	0.017	0.014

Note: (1) We use Eurozone HY spread for targets based in Western Europe and US HY spread for targets based in North America or other regions (2) Lower liens means second and lower lien loans
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

6.3.3.2 Instrumental variables regression – Results

We now move on to present the results from the IV regressions presented in Table 6.10. The regressions that use debt characteristics as instruments are highlighted and we will focus on these as these were deemed to be the most valid set of instruments in the previous section. Focusing on specification (3) and (4) where leverage is measured by D/EBITDA, we find a positive and significant relationship (at the 1% level) between leverage and EV/EBITDA, indicating that higher deal leverage causes higher LBO pricing. The logged dependent and independent variable allow us to interpret the coefficients on leverage as the elasticity of EV/EBITDA with respect to D/EBITDA. The estimated coefficients are quite similar in magnitude and range from 0.215 to 0.250, indicating that a 10% increase in the D/EBITDA causes an increase in the EV/EBITDA multiple of 2.15% to 2.50%. Similar to the naïve OLS regression, we find a negative relationship between target revenue and EV/EBITDA, and EBITDA margins and EV/EBITDA, indicating that large, mature and profitable firms trade at lower multiples. We also find that public-to-private and secondary buyouts, on average, trade higher than buyouts of private companies, and that more experienced funds, proxied by fund number and fund size, pay higher price multiples. On macroeconomic variables, we find that the 3m UDS Libor is related to lower EV/EBITDA multiples. Note that the estimated coefficients for control variables from TSLS is very much in line with the ones obtained from the naïve OLS regression.

Measuring leverage by D/EV in specification (7) and (8), we also find a positive and significant relationship (at the 1% level) between leverage and EV/EBITDA. The relationship between the

dependent and independent variable is that of a log-level model, allowing us to interpret the coefficients as a percentage change in the dependent variable for a nominal change in the independent variable. The estimated coefficients are, again, quite similar in magnitude and range from 0.005 to 0.006, indicating that a 10%-point increase in D/EV causes an increase in the EV/EBITDA multiple of 0.5% to 0.6%.

Table 6.10: TSLS regression output – The impact from leverage on LBO pricing

	Dependent variable: Relative deal pricing - TSLS specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	EV/EBITDA IV Credit cond.	EV/EBITDA IV Credit cond.	EV/EBITDA IV Debt Charac.	EV/EBITDA IV Debt Charac.	EV/EBITDA IV Credit cond.	EV/EBITDA IV Credit cond.	EV/EBITDA IV Debt Charac.	EV/EBITDA IV Debt Charac.
Leverage ratio								
Debt/EBITDA	0.480***	0.77	0.250***	0.215***				
	(0.085)	(0.901)	(0.045)	(0.052)				
Debt/EV					0.006	-0.007	0.006***	0.005***
					(0.005)	(0.015)	(0.002)	(0.002)
Target specific								
Target rating[1]	0.016	0.037	-0.014	-0.005	-0.02	-0.039	-0.019	-0.003
	(0.016)	(0.069)	(0.014)	(0.014)	(0.027)	(0.046)	(0.018)	(0.017)
Target revenue (log)	-0.055***	-0.045	-0.071***	-0.122***	-0.102***	-0.142***	-0.102***	-0.164***
	(0.011)	(0.126)	(0.011)	(0.014)	(0.017)	(0.029)	(0.014)	(0.015)
EBITDA margin (log)	-0.092***	-0.075	-0.115***	-0.178***	-0.159***	-0.204***	-0.159***	-0.234***
	(0.017)	(0.168)	(0.017)	(0.02)	(0.027)	(0.042)	(0.023)	(0.023)
Deal and PE-characteristics								
P2P (dummy)		0.001		0.050*		0.080**		0.076**
		(0.085)		(0.027)		(0.032)		(0.034)
SBO (dummy)		0.046		0.055**		0.041		0.068*
		(0.032)		(0.028)		(0.047)		(0.035)
PE experience (years)		0.0004		-0.0004		-0.001		-0.00005
		(0.002)		(0.001)		(0.002)		(0.001)
PE experience (fund number)		0.004*		0.005**		0.004		0.005*
		(0.002)		(0.002)		(0.003)		(0.003)
PE experience (log fund size USD)		0.019		0.085***		0.115***		0.113***
		(0.108)		(0.014)		(0.015)		(0.016)
Credit and valuation conditions								
Public market valuation (sp_ev_ebitda)	-0.008	-0.005	-0.013	-0.023	-0.01	-0.04	-0.01	-0.022
	(0.008)	(0.046)	(0.008)	(0.035)	(0.012)	(0.047)	(0.011)	(0.045)
Macro economic variables								
UST 10y yield	-0.069***	0.005	-0.109***	0.01	-0.158***	0.003	-0.158***	0.004
	(0.021)	(0.039)	(0.018)	(0.038)	(0.022)	(0.045)	(0.022)	(0.048)
USD 3m Libor	0.039***	0.041	0.063***	0.091**	0.089***	0.111***	0.089***	0.110**
	(0.012)	(0.088)	(0.01)	(0.036)	(0.013)	(0.042)	(0.013)	(0.045)
Local inflation[2]	-0.014	-0.011	-0.019	-0.022	-0.028*	-0.033	-0.028*	-0.026
	(0.011)	(0.028)	(0.012)	(0.021)	(0.017)	(0.026)	(0.017)	(0.026)
Local GDP growth[2]	-0.001	0.007	-0.001	0.011	-0.004	0.016	-0.004	0.019
	(0.009)	(0.016)	(0.01)	(0.014)	(0.014)	(0.017)	(0.013)	(0.018)
Constant	1.849***	0.859	2.712***	1.418**	3.069***	2.109*	3.054***	1.26
	(0.343)	(1.111)	(0.218)	(0.639)	(0.492)	(1.266)	(0.245)	(0.807)
Country controls	No	Yes	No	Yes	No	Yes	No	Yes
Industry controls	No	Yes	No	Yes	No	Yes	No	Yes
Year controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	972	908	972	908	931	871	931	871
R^2	0.556	0.562	0.448	0.57	0.04	0.42	0.035	0.345
Adjusted R^2	0.552	0.519	0.443	0.527	0.031	0.359	0.026	0.277

*Note: Credit condition instruments include HY spread and Fed tightening index, debt characteristics instruments include TLB and lower lien dummy variables (1) A higher rating means higher credit quality (2) We use Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions. Significance levels: *p<0.1; **p<0.05; ***p<0.01*

For the control variables, the direction and significance level for the estimated coefficients are similar in nature and magnitude to the estimated coefficients from specification (3) and (4) where leverage was measured by D/EBITDA. Using relevant and exogenous instruments, the IV regressions therefore estimate a strong, positive and causal relationship between deal leverage and LBO pricing.

The results of the current section can be summarised as follows: First, we found evidence suggesting that the HY spread has a negative impact on buyout pricing when not controlling for leverage. Similar to Axelson et al (2013), we hypothesize that the high yield spread picks up changes in the economy-wide discount rate which explains the relationship found here. Alternatively, the negative relationship goes through the leverage channel meaning that in times when spreads are low, more leveraging are being deployed in LBOs which in turn pushes up prices. The results from the IV regressions confirm this. We find strong support for a positive causal relationship between leverage and pricing when controlling for target and sponsor characteristics, valuation and macroeconomic conditions and well as time-varying effects.

While higher or lower pricing in terms of EV/EBITDA is not per se good or bad, the subsequent section will explore how higher pricing brought about by higher leverage impacts equity returns to PE funds. This should provide results that will form the basis for a discussion of normative implications.

6.4 Leverage's impact on returns

Having established that higher leverage causes higher LBO pricing, we now move on to investigate how leverage and pricing affect equity returns. The literature review led us to propose two possible effects from the part of leverage that is driven by variations in credit conditions: 1) Fund returns are decreasing in leverage as intra-PE firm agency problems causes GPs to overpay for deals in times of lax credit conditions to the detriment of returns, and 2) Leverage, explained by variations in credit conditions, affects returns positively as sponsors arbitrage debt and equity with rents befalling to equity holders. The current section will explore empirical results related to these hypotheses. Similar to previous sections, we start by shortly presenting the regression set-up that will be used to investigate the proposed hypotheses before diving into the actual results.

6.4.1 Regression set-up

6.4.1.1 Dependent and independent variables

The current section takes the internal rate of return (IRR) of the fund that owned the portfolio company as the dependent variable and deal leverage as the independent variable. As discussed in section 5.1, fund-level returns are used as a proxy since we are unable to obtain deal-level returns.

As in section 6.2 and 6.3, leverage is measured using D/EV and D/EBITDA at investment entry. A note on the difference between the two measures in relation to equity return is warranted here. First, D/EV more accurately measures the amplifying effect from leverage on returns as this directly measures debt financing relative to total financing of the firm. D/EBITDA, on the other hand is most often used as the appropriate leverage measure in leveraged buyouts as it captures the debt redemption capacity

of a buyout target (Engel et al., 2012). A higher D/EBITDA ratio implies that the target company will have a harder time meeting its obligations, increasing the risk of financial distress. We will revert to these when discussing the results of the analysis.

We suggest that fund returns are a good proxy for deal-level returns to the extent that 1) deal-level returns will affect the overall return of the fund and 2) the sponsor's approach to deal leverage and debt structure in a specific deal is representative for the overall fund. To see that deal-level returns, in fact, affect the overall return of the fund, we run a simple OLS regression with fund IRR as the dependent variable and an independent dummy indicating whether the portfolio company was exited as a distressed case. The idea is that distressed exits should be associated with very poor performance. If a single buyout significantly affects the return of the overall fund, we should find a negative relationship between fund IRR and distressed exits. The results are reported in Table 6.11. A distressed exit of a portfolio company has a significantly negative effect on fund returns, decreasing fund IRR by 3.7%. Hence, we conclude that fund returns are a somewhat valid proxy for deal-level returns.

Table 6.11: The effect of a distressed exit on fund returns - OLS

Tabel 1: Deal returns and fund returns		
	Dependent variable: Fund returns	
	(1)	(2)
	Fund IRR	Fund IRR
Distressed exit (dummy)	-0.037***	-0.038***
	(0.011)	(0.011)
EV/EBITDA (log)		-0.015*
		(0.009)
P2P (entry type)		-0.012
		(0.009)
SBO (entry type)		-0.013
		(0.009)
Constant	0.153***	0.194***
	(0.004)	(0.022)
Observations	667	667
R^2	0.012	0.022
Adjusted R^2	0.011	0.016

*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

6.4.1.2 The effect of leverage on returns

We start by investigating the effect from leverage and pricing on returns in a simple OLS set-up. Following Engel et al.'s (2012) finding that returns are increasing in leverage up to a point where after default risk begins to outweigh the positive effects from leverage, we investigate linear as well as non-linear relationships between fund returns and leverage. To do so, we include log and squared terms of leverage as well as a variable indicating the leverage quartile of the observation compared to the sample. This allows us to see if the effect from leverage changes as leverage levels become excessive. Further, a pricing variable is included to explore whether the effect on returns from leverage works through the pricing variable rather than directly through the leverage variable.

6.4.1.3 The effect from sponsor arbitrage on returns

We investigate whether financial sponsors generate returns by arbitraging debt and equity markets. We do this by splitting our leverage measures into a component explained by debt market conditions and a residual component. This method follows the approach proposed by Axelson et al. (2013). We estimate a regression of the logged D/EV value (and D/EBITDA) on the high-yield spread and use the fitted values from this regression to calculate predicted leverage. This regression estimates the amount of leverage (predicted leverage) that is determined by debt market conditions, i.e. the high-yield spread. The residual leverage is then the difference between actual and predicted leverage and concerns leverage obtained due to other factors than debt market conditions. Predicted as well as residual leverage from the first regression are then used as explanatory variables in a second regression where fund return is the dependent variable. If PE sponsors successfully arbitrage debt markets against equity markets when debt is relatively cheap, the predicted component of leverage should have a positive impact on returns.

6.4.1.4 The effect from leverage on the likelihood of financial distress

The previous regression set-ups will evaluate the success of a buyout based on the IRR of the fund holding the portfolio company. In this regression set-up we instead investigate what factors cause a buyout to fail. Specifically, we focus on the effect from leverage on the likelihood that the portfolio company is exited in a distressed exit where sponsors, most likely, have lost all invested equity. We set up a probit regression model where the dependent variable is a dummy indicating whether the portfolio company was exited under financial distress. We investigate whether there exists a nonlinear relationship between leverage and the probability of distress by including specifications with nonlinear measures of leverage such as logged and squared values of D/EV (and D/EBITDA). We also include a variable indicating the leverage quartile of the buyout. This allows us to explore the effect at different levels of leverage.

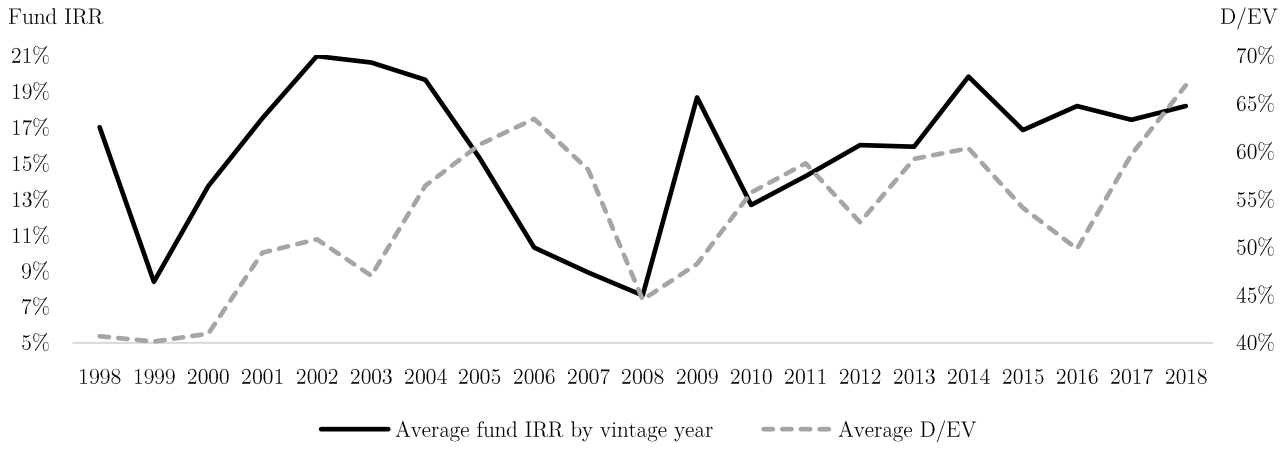
6.4.2 Results – Drivers of fund returns

6.4.2.1 Fund vintage performance and buyout leverage over time

Before presenting results from the regressions, we briefly show the development in fund returns and D/EV over the sampling period in Figure 6.3. The solid line shows the simple average fund return by vintage year and the dotted line shows the simple average D/EV. Not surprisingly, fund returns show great cyclicality with funds established in 2009 having much higher returns than those established in 2008. Although there seems to be an upward trend throughout the sample period, the same pattern of cyclicality is evident for leverage with D/EV decreasing sharply in 2008 and 2009 and picking up again in the years after. However, the cyclicality of leverage seems to be lacking that of fund returns such that funds established when credit conditions are lax, and leverage is high underperform relative to funds established when credit conditions are strict, and leverage is low. This conforms with Axelson et al.'s (2009) proposition that investments undertaken in scarce credit markets should outperform

investments in abundant credit markets because debt providers' role as a gatekeeper does work optimally when lenders have too much liquidity. We explore exactly this relationship between leverage come about by lax credit conditions and fund returns further in Section 6.4.2.3.

Figure 6.3: Average fund performance by vintage year and D/EV



6.4.2.2 How does leverage affect returns?

We now turn to the results. We start by investigating the results from the OLS regression reported in Table 6.12 where leverage is measured by D/EV. Specification (1) uses logged values of D/EV to capture a potential non-linear relationship between leverage and returns. We find a significant positive relationship between log D/EV and fund's IRR, indicating that leverage affects returns positively, but that the positive effect from leverage levels off as leverage increases. This is in line with Engel et al. (2012) who found returns to increase in leverage but only up to a certain point. Our result is, however, only significant at the 10% level, but continues to hold as we add more controls in specification (2).

Specification (1) also shows a significant and negative relationship between target rating and fund performance (10% level), indicating that targets with higher ratings provides inferior returns. At first, this seems surprising, but it may be that higher rated firms are overpaid for so that the negative effect on fund returns actually works through the pricing variable. Indeed, the relationship becomes insignificant as the pricing variable is added in specification (2).

However, what is surprising here is that the estimated coefficient on EV/EBITDA is positive and non-significant, indicating that the negative effect from leverage on fund returns is direct rather than through the pricing variable. Target revenue is significantly positively related to fund performance (10% level), indicating that larger, more mature targets outperform smaller targets. This result continues to hold as we add additional controls in specification (2).

Turning to sponsor characteristics, we find more experienced PE firms to provide significantly higher returns for their investors (1% level), while larger funds perform significantly poorer than smaller funds (1% level). Intuitively, the former result makes sense in that more experienced PE firms are likely to have better access to deal sourcing, better bank relationships and may in general be better

Table 6.12: OLS regression output – Leverage's impact on fund returns

	Dependent variable: Fund returns - OLS specification				
	(1) Fund IRR	(2) Fund IRR	(3) Fund IRR	(4) Fund IRR	(5) Fund IRR
Leverage variables					
Log D/EV	0.017*	0.018*			
	(0.009)	(0.009)			
D/EV			-0.0001	-0.0004	
			(0.001)	(0.001)	
(D/E)^2			0.00001	0.00001	
			(0.00001)	(0.00001)	
D/E Quartile 1					-0.031***
					(0.01)
D/E Quartile 2					-0.022**
					(0.009)
D/E Quartile 3					-0.005
					(0.01)
Pricing variables					
EV/EBITDA entry multiple (log)		0.005		0.006	0.007
		(0.01)		(0.01)	(0.01)
Target specific					
Target rating[1]	-0.010**	-0.007	-0.010**	-0.006	-0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Target revenue (log)	0.009**	0.009**	0.008**	0.008**	0.008*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
EBITDA margin (log)	0.001	0.0003	-0.0003	-0.001	-0.001
	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)
Deal and PE-characteristics					
P2P (dummy)	-0.006	-0.004	-0.007	-0.004	-0.005
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
SBO (dummy)	-0.002	0.002	-0.002	0.003	0.002
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
PE experience (years)	0.001**	0.001*	0.001**	0.001*	0.001*
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
PE experience (fund number)	-0.001	-0.0003	-0.001	-0.0004	-0.0003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
PE experience (log fund size USD)	-0.012**	-0.015***	-0.012**	-0.015***	-0.015***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Credit and valuation conditions					
Local HY spread[2] (assetswapspread)	0.0002***	0.0001**	0.0002***	0.0001***	0.0001***
	(0.00003)	(0.00004)	(0.00003)	(0.00004)	(0.00004)
Fed tightening index	-0.001***	-0.001**	-0.001***	-0.001**	-0.001**
	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0003)
Public market valuation (sp_ev_ebitd	0.015***	0.019***	0.015***	0.019***	0.019***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Macro economic variables					
UST 10y yield		0.006		0.006	0.006
		(0.007)		(0.007)	(0.007)
USD 3m Libor		-0.013***		-0.013***	-0.013***
		(0.004)		(0.004)	(0.004)
Local inflation[2]		0.004		0.004	0.004
		(0.004)		(0.004)	(0.004)
Local GDP growth[2]		-0.012***		-0.013***	-0.013***
		(0.004)		(0.004)	(0.004)
Constant	-0.036	-0.005	0.009	0.047	0.072
	(0.099)	(0.102)	(0.093)	(0.096)	(0.096)
Country controls	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes
Year controls	No	No	No	No	No
Observations	638	638	638	638	638
R^2	0.219	0.255	0.222	0.26	0.264
Adjusted R^2	0.145	0.178	0.147	0.181	0.185

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

able to source and execute on investment opportunities. The second result is more surprising but may be explained by larger funds, to a greater extent, are being forced to pursue mediocre deals because they have abundant amounts of capital that they need to deploy. Furthermore, these results remain significant across all specifications (1) to (5).

Finally, we find a significantly positive relationship between fund returns and public EV/EBITDA multiples, indicating that funds/deals perform better in times when public markets trade at high price multiples. Considering that the public, market-wide EV/EBITDA multiple is inversely related to the economy-wide discount rate, the result also indicates that a negative relationship exists between the economy-wide discount rate and PE returns. Intuitively, this makes sense as a high economy-wide discount rate will force PE funds that are trying to divest portfolio companies, to do so at a lower price multiple, negatively affecting their IRR.

Specification (3) and (4) uses a linear measure and a squared measure of D/EV. The control variables are identical to specification (1) and (2) and shows no significant relationship between leverage and returns. Specification (5) uses D/EV quartiles as independent variables. The quartile variables are dummies indicating which leverage quartile the deal is in compared to the sample. Quartile 4 is omitted meaning that the coefficients on quartile 1-3 compares the effect relative to quartile 4 leverage. The coefficients on quartile 1 and 2 leverage is negative and significant at the 5% level, indicating that buyouts with low leverage performs worse on average compared to buyouts with high leverage (quartile 4 leverage). The estimated coefficients are 2.5% and 2% respectively. However, for quartile 3 the estimated coefficient is close to zero and non-significant indicating that the positive effect from leverage levels off as leverage increases. This further supports the proposition that there exist a non-linear, concave relationship between leverage and returns.

Appendix K presents results similar to Table 6.12, but with leverage measured by D/EBITDA. In general, we find a weaker relationship between D/EBITDA and fund returns compared to D/EV. Reverting back to the discussion in section 6.4.1.1 on the appropriate measure of leverage in relation to returns, we find it natural that a stronger relationship is detected between D/EV than D/EBITDA as the former directly measures the gearing between debt and equity that amplify equity returns. The reason that D/EBITDA is often used by industry practitioners is that is captures the targets repayment capacity, thereby providing some guidance on an upper threshold leverage level. We therefore hesitate to put too much emphasis on the weak relationship detected between fund returns and D/EBITDA.

6.4.2.3 Is debt-equity arbitrage a driver of fund returns?

We now turn to evidence on whether PE sponsors time capital markets to arbitrage cheap debt versus equity. We apply the approach proposed by Axelson et al. (2013) where the leverage measure is split between a component explained by debt market conditions and a residual component. We do this by regressing D/EV and D/EBITDA on the high yield spread (asset swap spread). The results are reported in Table 6.13. Leverage is highly negatively related to the high yield spread for both D/EV and D/EBITDA, indicating that PE sponsors employ more leverage when debt markets are accommodative.

Next, we use the predicted values of leverage from the regression in Table 3.1 as an independent variable in a regression where fund returns are regressed on predicted leverage and residual leverage in an OLS regression. If PE sponsors successfully can time debt and equity markets to drive returns, we should expect a positive relationship between leverage predicted by debt market conditions and fund

returns. We also include various control variables and control for variations between countries and industries.

Table 6.13: Debt-equity arbitrage - Leverage predicted by credit conditions

	Dependent variable: Leverage	
	(1)	(2)
	Log D/EV	Log D/EBITDA
Local HY spread^2 (assetswapspread)	-0.0004***	-0.001***
	(0.0001)	(0.0001)
Constant	4.109***	2.114***
	(0.04)	(0.059)
Observations	638	667
R^2	0.018	0.047
Adjusted R^2	0.017	0.045

*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

The results of these regressions are presented in Table 6.14 below. We find a significant and negative relationship between the component of leverage predicted by debt market conditions and fund returns and a positive, but not statistically significant relationship between residual leverage and fund returns. The results are consistent across all specifications and both for leverage measured by D/EV and D/EBITDA.

The negative relationship between leverage predicted by debt market conditions and fund return is inconsistent with the market-timing hypothesis but supports the intra-PE agency hypothesis proposed by Axelson et al. (2013). According to the intra-PE agency hypothesis, loose credit markets allow PE sponsors to obtain deal financing for bad deals and overpay for deals in general, leading to a negative relation between fund performance and leverage.

The positive relationship between the residual component of leverage indicates that leverage can still be a value driver for PE sponsors, but the value derives from other effects from leverage (e.g. tax shield, disciplinary effect on management etc.) rather than through GPs successfully timing capital markets as argued by Engel et al. (2012).

To summarise the findings related to drivers of fund returns, the positive, non-linear relationship between leverage and fund returns suggests that leverage, in general, drive returns for PE sponsors but only up to a certain point where after the effect from leverage levels off. Further, PE sponsors do not earn returns for their investors by successfully arbitraging debt and equity markets. Rather, the evidence suggests that PE sponsors act in their own interest when they exploit easy access to debt financing to impose highly levered capital structures on their portfolio companies. These results do not necessarily imply that a highly levered capital structure imposes extra costs on the portfolio company itself, as is often argued by critics of LBOs. Rather, our results so far indicate that the negative relationship between deal leverage and fund-level returns is caused by PE sponsors overpaying for portfolio companies when debt markets are loose. This negative relationship should not have any effect on the operating performance of the portfolio company itself since it is a purely financial relationship.

Table 6.14: Debt-equity arbitrage – Predicted leverage's effect on fund returns

	Dependent variable: Fund returns			
	(1) Fund IRR	(2) Fund IRR	(3) Fund IRR	(4) Fund IRR
Log D/E predicted	-0.318**	-0.324*		
	(0.138)	(0.181)		
Log D/E residual	0.016	0.014		
	(0.01)	(0.01)		
Log EBITDA predicted			-0.163***	-0.171**
			(0.061)	(0.08)
Log EBITDA residual			0.007	0.007
			(0.007)	(0.007)
Target specific				
Target rating[1]	-0.0002	-0.0001	-0.004	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)
Target revenue (log)	0.003	0.003	0.004	0.004
	(0.004)	(0.004)	(0.004)	(0.004)
EBITDA margin (log)	-0.002	-0.003	-0.00001	-0.001
	(0.007)	(0.006)	(0.006)	(0.006)
Deal and PE-characteristics				
P2P (dummy)	0.005	0.002	0.004	0.002
	(0.009)	(0.009)	(0.009)	(0.009)
SBO (dummy)	0.001	0.002	-0.002	-0.002
	(0.01)	(0.01)	(0.01)	(0.01)
PE experience (years)	0.001**	0.001**	0.001**	0.001**
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
PE experience (fund number)	-0.001	-0.001	-0.001*	-0.001*
	(0.001)	(0.001)	(0.001)	(0.001)
PE experience (log fund size USD)	-0.012**	-0.012**	-0.011**	-0.010**
	(0.005)	(0.005)	(0.005)	(0.005)
Credit and valuation conditions				
Fed tightening index		-0.0004		-0.001
		(0.001)		(0.001)
Public market valuation (sp_ev_ebitda)		0.037		0.036
		(0.039)		(0.038)
Macro economic variables				
UST 10y yield		0.01		0.008
		(0.012)		(0.012)
USD 3m Libor		-0.008		-0.008
		(0.012)		(0.012)
Local inflation[2]		0.001		0.002
		(0.007)		(0.006)
Local GDP growth[2]		-0.014***		-0.013***
		(0.004)		(0.004)
Constant	1.497***	1.553**	0.552***	0.607***
	(0.562)	(0.721)	(0.138)	(0.177)
Country controls	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes
Year controls	No	No	No	No
Observations	638	638	667	667
R^2	0.276	0.288	0.265	0.276
Adjusted R^2	0.182	0.187	0.174	0.179

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) We use Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

Alternatively, a negative relationship between leverage and fund-level returns could be attributed to deteriorating operating performance of the portfolio company due to increased costs associated with a highly levered capital structure. We explore this relationship further in the following section where we

investigate the relationship between the likelihood of a distressed exit path and a levered capital structure.

6.4.2.4 Does leverage increase the likelihood of financial distress?

Table 6.15 reports the results of a probit model with a distressed exit as the dependent variable and D/EBITDA as the independent variable. A similar set-up with leverage measured using D/EV is moved to Appendix L. Consistent across all forms and measures of leverage, we find no relationship between the likelihood of a distressed exit and leverage for LBOs in our sample.

Table 6.15: Probit regression output – Leverage's impact on the likelihood of distressed exit

	Dependent variable: Distressed exit				
	(1) Distressed	(2) Distressed	(3) Distressed	(4) Distressed	(5) Distressed
Leverage variables					
Log D/EBITDA	-0.104	-0.118			
	(0.115)	(0.126)			
D/EBITDA			0.043	0.062	
			(0.065)	(0.07)	
(D/EBITDA)^2			-0.003	-0.005	
			(0.003)	(0.004)	
D/EBITDA Quartile 2					0.049
					(0.18)
D/EBITDA Quartile 3					0.051
					(0.185)
D/EBITDA Quartile 4					-0.15
					(0.196)
Target specific					
Target rating[1]	0.02	-0.047	0.037	-0.029	-0.037
	(0.071)	(0.079)	(0.072)	(0.08)	(0.08)
Target revenue (log)	-0.022	-0.031	-0.036	-0.052	-0.029
	(0.064)	(0.068)	(0.065)	(0.069)	(0.067)
EBITDA margin (log)	0.057	0.057	0.027	0.018	0.053
	(0.102)	(0.111)	(0.106)	(0.115)	(0.111)
PE-characteristics					
PE experience (years)	-0.008	-0.002	-0.008	-0.002	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
PE experience (log fund size USD)	0.062	0.156**	0.061	0.159**	0.153**
	(0.07)	(0.075)	(0.07)	(0.075)	(0.074)
Credit and valuation conditions					
Local HY spread[2] (assetswapspread)		0.001		0.0005	0.0005
		(0.001)		(0.001)	(0.001)
Fed tightening index		-0.004		-0.003	-0.004
		(0.005)		(0.005)	(0.005)
Macro economic variables					
UST 10y yield		0.271**		0.279**	0.286***
		(0.11)		(0.11)	(0.11)
USD 3m Libor		0.061		0.057	0.057
		(0.071)		(0.072)	(0.071)
Local GDP growth[2]		0.091		0.099	0.097
		(0.065)		(0.065)	(0.065)
Constant	-1.466*	-3.320***	-1.829**	-3.774***	-3.633***
	(0.802)	(0.972)	(0.827)	(1.001)	(0.953)
Country controls	No	No	No	No	No
Industry controls	No	No	No	No	No
Year controls	No	No	No	No	No
Observations	931	931	931	931	931

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) Eurozone HY spread/GDP growth rates for targets based in Western Europe and US HY spread/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

These results further underline that any negative effect from leverage on fund-level returns pertains to a question of deal selection and valuation rather than the operational performance of the underlying portfolio company. Put simply, lax credit markets lead PE sponsors to overpay and pursue bad deals which hurt performance, but the higher levered capital structures that comes with lax credit markets does not hurt the performance of the portfolio company itself, indicating that sponsors are constrained from or conscious about not levering up to a point where the likelihood of financial distress begins to increase significantly. The various effects from leverage on returns and the relationship between financial distress and leverage is discussed further in Section 7.2.

6.5 Robustness considerations: Multicollinearity and entity and time controls

The following section discusses the robustness of the results obtained in Section 6.1-6.4. Specifically, we investigate multicollinearity in our data set and the effect that this may have on the obtained results. We also look into the reasoning behind including country, industry and year controls in the regression set-ups and test whether the preferred model includes these effects or not. Finally, we discuss clustered standard errors.

6.5.1 Multicollinearity

Section 5.4 discussed the four assumptions underpinning the OLS regression where the fourth assumption was no perfect multicollinearity between the independent variables. While the regression models are set up to avoid perfect multicollinearity, for example by excluding one category of a categorical variable, some degree of imperfect multicollinearity likely exists between some independent variables. Imperfect multicollinearity is when two or more of the regressors are highly correlated (Stock & Watson, 2015). While imperfect multicollinearity does not violate the fourth assumption underpinning the OLS and therefore does not bias estimated coefficients, its presence will make coefficients imprecisely estimated in the sense that the variance increases. We check for such imperfect multicollinearity by investigating the correlations between the independent variables.

6.5.1.1 Debt structure and leverage

Table 6.16 shows correlation matrices and corresponding significance levels across debt instruments, characteristics and controls. Panel A shows correlations for debt instruments while Panel B shows correlations for debt characteristics. Significant correlations are widespread across all dependent variables and controls.

Table 6.16: Correlation matrices – Debt instruments and characteristics

Panel A: Debt instruments

Variable	TLa (proportion)	TLb (proportion)	TLo (proportion)	Mezzanine (proportion)	Bond (proportion)
TLa (proportion)	1				
TLb (proportion)	-0.49***	1			
TLo (proportion)	-0.07**	-0.32***	1		
Mezzanine (proportion)	0.23***	-0.38***	0.11***	1	
Bond (proportion)	-0.28***	-0.4***	-0.27***	-0.19***	1
Target rating	0.04	0.01	-0.02	-0.25***	0.06*
Target revenue (log)	-0.24***	0.03	-0.11***	-0.11***	0.26***
EBITDA margin (log)	0.02	0.01	-0.03	0.05	-0.02
Local HY spread	0.25***	-0.08**	-0.14***	0.07**	-0.05
Public market valuation	0	0.09***	0.11***	-0.05	-0.16***
USD Libor	0.11***	-0.22***	0.27***	0.18***	-0.09***
GDP growth	-0.12***	0.07**	0.11***	-0.08**	-0.02

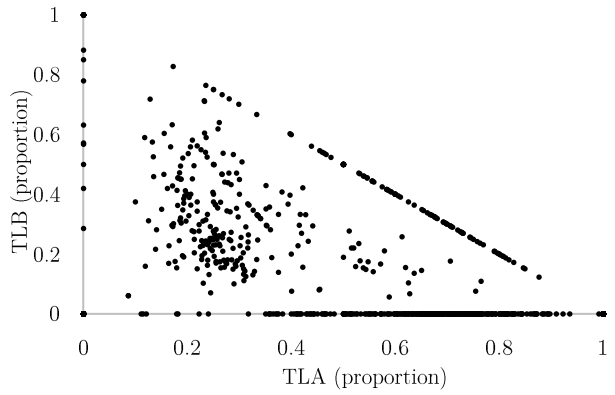
Panel B: Debt characteristics

Variable	Unsecured (proportion)	Lower liens (proportion)	Subordinated (proportion)	Covlite (proportion)	Syndicated (proportion)
Unsecured (proportion)	1				
Lower liens (proportion)	0.41***	1			
Subordinated (proportio	0.24***	0.26***	1		
Covlite (proportion)	-0.01	-0.09***	-0.23***	1	
Syndicated (proportion)	-0.02	0	-0.04	0.02	1
Target rating	-0.11***	-0.09***	-0.17***	-0.11***	0.08**
Target revenue (log)	0.17***	0.18***	-0.04	0.19***	0.09***
EBITDA margin (log)	0.11***	-0.01	0.09***	-0.03	0.01
Local HY spread	0.02	-0.07**	-0.05	-0.1***	-0.06*
Public market valuation	-0.22***	-0.18***	-0.03	0.16***	0.13***
USD Libor	-0.02	-0.01	0.26***	-0.26***	0.13***
GDP growth	-0.04	-0.02	-0.04	-0.01	0.18***

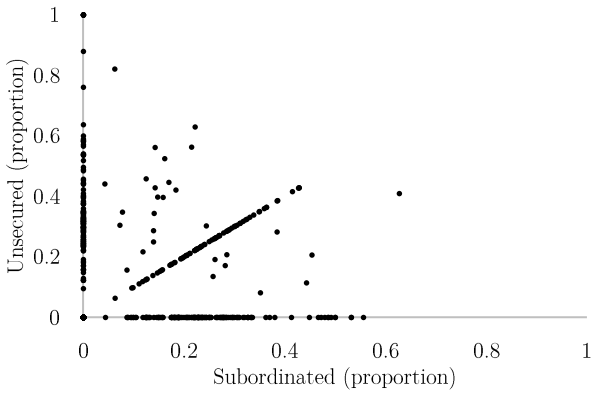
With regards to correlations between debt instruments in panel A, they are generally negatively and highly significantly correlated with each other. Naturally, this is due to one instrument being a substitute for the other instruments. Or put differently, increasing the proportion of one instrument will naturally lead to a decrease in the proportion of the other instruments.

Figure 6.4: Scatterplots – Debt instruments and characteristics

Panel A: Proportion of TLBs plotted against proportion of TLAs



Panel B: Proportion of unsecured debt plotted against proportion of subordinated debt



Note: Winsorized data

Further investigating this relationship, Figure 6.4 panel A plots the proportion of TLAs against TLBs. The proportions of the two are highly, negatively related and the dots on the diagonal represents debt packages that only consist of TLAs and TLBs, meaning that for these cases, TLAs are a direct function of TLBs and vice versa. To mitigate such near-perfect multicollinearity between the proportions of debt instruments, we excluded one of the debt instruments (TLAs) in Section 6.2. Further, it should be noted that the strong collinearity between proportion does not extend to dummies, since it is possible that a debt package includes all instruments.

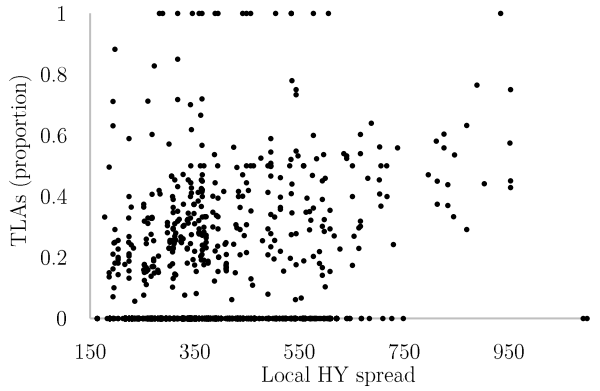
Turning to correlations between debt characteristics in Table 6.16 panel B, aggressive debt characteristics seem to be positively correlated with each other. That is, unsecured debt occurs more

often together with lower lien debt, and lower lien debt occurs more often together with subordinated debt, potentially because a given instrument is both. Figure 6.4 panel B shows this by plotting the proportion of subordinated debt against the proportion of unsecured debt. The dots on the diagonal represents observations where all unsecured instruments in the debt package are also subordinated. The significant amount of observations that lies on the diagonal creates a strong positive relationship between unsecured and subordinated characteristics. However, contrary to debt instruments, the increasing presence of one debt characteristic does not rule out other debt characteristics which is why we do not observe perfect multicollinearity across debt characteristics. Still, we ought to be aware of the rather strong relationships among debt characteristics which can cause coefficients to be estimated incorrectly.

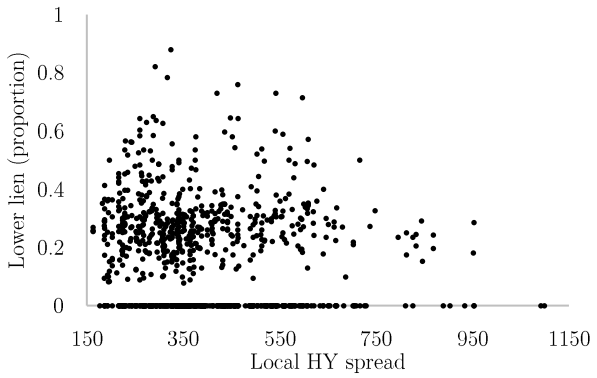
Strong correlations are also observed between features of the debt structure and credit conditions. Figure 6.5 panel A plots TLAs against the local high yield spread while panel B plots lower lien loans against the HY spread. For both plots, the relationship seems to be qualitatively minimal, albeit

Figure 6.5: Scatterplots – Debt structure and credit conditions

Panel A: Proportion of TLAs plotted against the local HY spread



Panel B: Proportion of lower lien loans plotted against the local HY spread



Note: Winsorized data

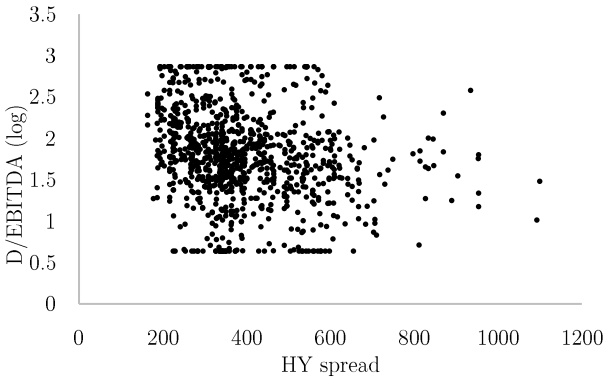
statistically significant in Table 6.16.

6.5.1.2 Leverage and outcome measures

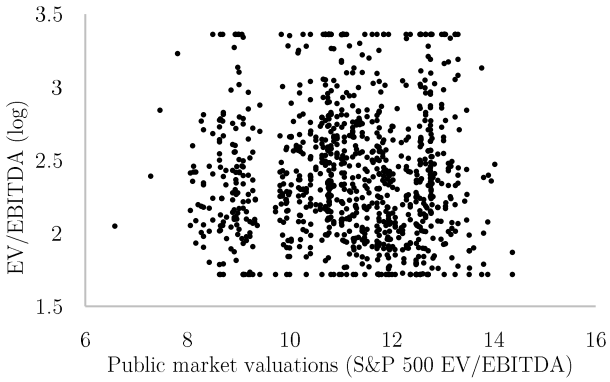
Here, we briefly examine issues of multi collinearity for the independent variables of interest in section 6.3 and 6.4 Figure 6.6 plots logged buyout D/EBITDA multiples for the sample against the local high yields spread in panel A, and EV/EBITDA buyout multiples against public market valuations in panel B. For both figures, the plots are widely scattered and collinearity between the two variables in each plot seems to be qualitatively minimal.

Figure 6.6: Scatterplots – Leverage and pricing multiples

Panel A: D/EBITDA multiples plotted against the local HY spread



Panel B: EV/EBITDA multiples plotted against public valuations



Note: Winsorized data

6.5.2 Entity and time controls

We include dummies for country, industry and year to control for confounding factors that may vary across countries, industries and time. Previous authors in the same field have tended to control for such factors as well, why we are induced to do the same thing (Axelson et al., 2013; Engel et al., 2012). Nonetheless, this section briefly outlines the reasoning behind including country, industry and year controls and tests the relevance of including such controls in our regressions.

6.5.2.1 Country and industry controls

Country and industry controls are included to control for variations in our data caused by inter-country and inter-industry differences. For example, consider a regression with the dependent variable, LBO leverage, and the independent variable, CovLite loans as proportion of total debt:

$$lev_i = \beta_0 + \beta_1 CovLite_i + \beta_2 Z_i + u_i \tag{6.11}$$

where Z_i is an unobserved variable that varies across countries but does not change over time (for example, Z_i represents differences in leverage preferences across countries rooted in cultural differences). We want to estimate β_1, the effect from X on Y holding constant the unobserved country characteristic. We do this by including binary variables in our regression indicating the country of the target company. If we let $C_{i,j}$ be a binary variable that equals 1 when a target's country equals j and 0 otherwise, $C_{i,j+1}$ be equal to 1 when a target's country equals j+1 and 0 otherwise, and so on, the equation of estimation becomes:

$$lev_i = \beta_0 + \beta_1 CovLite_i + \gamma_1 C_{i,1} + \gamma_2 C_{i,2} + \cdots + \gamma_{n-1} C_{i,n-1} + u_i \tag{6.12}$$

where $C_{i,n}$ is omitted to avoid perfect multicollinearity and $\beta_0, \beta_1, \gamma_1, \ldots, \gamma_{n-1}$ are unknown coefficients.

Including country dummies in the leverage regression above lets us avoid omitted variable bias arising from unobservable omitted factors that correlate with *CovLite*, such as cultural attitudes towards

leverage and risk or regulation that vary across countries but are constant over time. For example, it may be that U.S. PE funds prefer using more leverage than their European counterparts while covenant lite loans are also more widely used in the U.S. LBO market. Under such circumstances, leaving out country controls would falsely show a positive relationship between LBO leverage and the use of covenant lite loans. The idea is the same for industry controls and we therefore include these as well.

6.5.2.2 Year controls

Alternatively, it may be that access to debt and risk appetite stay constant across countries due to financial markets being globally integrated but instead varies over time given that supply and demand for credit changes over time. This will lead to more leverage being deployed in times of easy access to debt. If time-varying effects correlate with X, then failing to include time controls will lead to omitted variable bias. For example, if the increased prevalence of covenant lite loans coincides with easing debt markets, the simple regression may falsely show a positive relationship between LBO leverage and CovLite loans when the actual effect stems from easing credit conditions over time. Although including the HY spread would properly capture this effect, other structural aspects of the economy may change over time that are not easily controlled for by including a specific variable. We therefore include year controls to capture such unobservable, time-varying factors.

To control for variations over time, we simply include $n-1$ binary indicators for each time period (year)*:*

$$lev_i = \beta_0 + \beta_1 Covlite_i + \delta_1 Y_{i,1} + \delta_2 Y_{i,2} + \cdots + \delta_{T-1} Y_{T-1} + u_i \tag{6.13}$$

where $\delta_1, \ldots, \delta_{T-1}$ are unknown coefficients and $Y_1 \ldots Y_{T-1}$ are dummy variables for each year.

6.5.2.3 Testing the relevance of country, industry and year controls

To test the relevance of including country, industry and year controls in our regression models, we run a Wald test that compares a fitted model with an alternative model. The fitted model includes country, industry and year controls and the alternative model excludes one of the control groups (e.g. excludes country controls but keeps industry and year controls). We then test whether the coefficients on the excluded regressors are jointly significant in the fitted model by comparing the two models. That is, we test whether the specific control group carry significant explanatory power. If this is the case, the controls should be included in the model. Alternatively, if the controls are left out and these correlate with other explanatory variables included, the alternative model may be subject to omitted variable bias.

The output of the test is an F test statistic. We run Wald tests on two regression specifications where all control variables are employed for each of our four regression sections, resulting in 8 Wald tests. Table 6.17 presents the results of the Wald tests. As evident from the table, country controls do not seem to be a significant predictor of the outcome variable, meaning that inter-country variability should

not be a concern for omitted variable bias. Industry and year controls, on the other hand, seem to be a significant predictor of the dependent variable for most regressions why including these are justified.

An interesting insight from the Wald tests is the high explanatory power that target industry plays in determining obtainable leverage, pricing and, to some extent, returns. The fact that industry is a significant predictor of obtainable leverage is not surprising but merely in line with traditional capital structure theory that asset tangibility, stability of cash flows etc. plays a role in determining the optimal leverage level.

Table 6.17: Wald test on relevance of including country, industry and year controls

	Country controls		**Industry controls**		**Year controls**	
Regression model	F statistic	Preferred model	F statistic	Preferred model	F statistic	Preferred model
Hypothesis 1: Drivers of debt structure:						
Drivers of debt instruments	0.9997	Exclude	1.4655 *	Include	2.8324 ***	Include
Drivers of debt characteristics	1.6386 **	Include	1.0198	Exclude	2.7198 ***	Include
Hypothesis 2: Driver of leverage:						
Debt instruments effect on leverage	0.5049	Exclude	3.1948 ***	Include	3.0032 ***	Include
Debt characteristics effect on leverage	0.8442	Exclude	2.6520 ***	Include	2.3464 ***	Include
Hypothesis 3: Leverage's impact on buyout pricing:						
D/EBITDA as independent variable	1.1282	Exclude	2.8527 ***	Include	1.1614	Exclude
D/EV as independent variable	0.8359	Exclude	3.7482 ***	Include	2.9908 ***	Include
Hypothesis 4: Leverage's impact on fund returns						
D/EBITDA as independent variable	0.8961	Exclude	1.6130 **	Include	1.3253	Exclude
D/EV as independent variable	0.8526	Exclude	1.5615 **	Include	1.3176	Exclude

*Note: F statistics obtained from Wald tests. The Wald test compares a fitted model to an alternative model leaving out one or multiple regressors in the alternative model. The test statistic signifies whether the coefficients on the left out regressors are jointly significant and should therefore be included in the model. In this case, the fitted models include country, industry and year controls and the alternative models excludes only one of the control groups. We run the Wald test on two regression specifications in each section of the analysis. Significance levels: 0.01 '***' 0.05 '**' 0.1 '*'*

Overall, including controls for industry and year effects seems to be justified, while controlling for target country is less relevant. Indeed, several specifications were set up in section 6.1 to 6.4 that both included and excluded country, industry and year controls.

6.5.3 Clustered standard errors

Abadie, Athey, Imbens, and Wooldridge (2017) argue that the reason for including clustered standard errors essentially boils down to a design problem, either a sampling design or an experimental design issue. The sampling design issue arises when sampling follows a two-stage process where in the first stage, a subset of clusters was sampled randomly from a population of clusters, and in the second stage, units were sampled randomly from the sampled clusters. In such a case, including clustered standard errors is justified because there are clusters in the population that are not observable in the sample. This sampling design mimics our sampling approach in that we first chose to focus our sample on two geographical regions, namely North America and Western Europe within a specific time frame, and

then sampled units (buyouts) randomly from the two geographical "clusters". However, even in this case Abadie et al. (2017) note that both the usual heteroskedasticity robust Eicker-Huber-White (EHW) standard errors (which we use), and the clustered standard errors can be correct depending on what you are trying to estimate. If we only want to say something about the particular sample of individuals we have sampled without generalizing to the broader population, the EHW standard errors are sufficient.

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Chapter 7: Discussion of results

7.1 Debt structure and leverage

7.1.1 Uniform vs diverging drivers and effects of different debt structure elements

The framework established in Section 4.2 suggested that an aggressive debt structure is driven by low sensitivity to agency problems and that an aggressive debt structure on the one hand exacerbates agency problems causing lower debt capacity but, on the other hand, has clientele effects whereby the richness of an aggressive structure engages a broader range of debt providers and increases leverage as a consequence. It is possible, however, that aggressiveness along different debt structure dimensions are driven differently by sensitivity to agency problems and may impact leverage differently. For instance, as pointed out earlier, it initially seemed unlikely that loose covenants would appeal to any clientele and thereby allow for higher leverage. Similarly, our literature review revealed that previous authors have suggested contradicting effects for subordinated debt in particular to what our framework proposes.

The results presented in Section 6.1 and 6.2, however, indicated a largely uniform, as predicted by Hypothesis 1 and Hypothesis 2b, relationship between different debt structure elements and their drivers and impact on leverage, respectively. More precisely, the signs on coefficients coincide across the different debt structure parameters across the different regression models albeit not all coefficients are statistically significant. Interestingly, the dummy on CovLite is positive and statistically significant at the 5% level or stronger in all models without country, industry and year controls in Table 6.5 providing some support for even aggressiveness along the covenant dimension increases debt capacity.

While we did not obtain results directly contradicting Hypothesis 1 and Hypothesis 2b, we failed to find statistical significance for the hypothesized relationships across all debt structuring elements. For instance, there were little indication that the use of TLBs were driven by our proxies for sensitivity to agency problems. One could think that TLBs, given their widespread use (as detailed in Section 2.2), are placed more neutrally on the aggressiveness dimension. However, when it came to debt structure's relation to leverage, the use of TLBs were highly positively correlated with leverage. Here, rather, the evidence for a relationship between certain debt structure characteristics, incl. unsecured and subordinated, were somewhat weak.

Indeed, there were also quantitative disparities between the effect sizes on and of different debt structuring elements even where statistical significance was found. For instance, the use of bonds followed by TLBs and TLOs are the instruments with the largest positive impact on leverage. When it comes to debt characteristics, particularly the use of second lien secured debt has a large positive relation to leverage. To sum up, from an academic point of view it is necessary to conceptually distinguish different debt structure elements. From a practical point of view, PE firms need to consider

what debt structure elements are influenced the most by sensitivity to agency problems and which debt structure parameters have the largest impact on debt capacity.

7.1.2 Other possible explanations

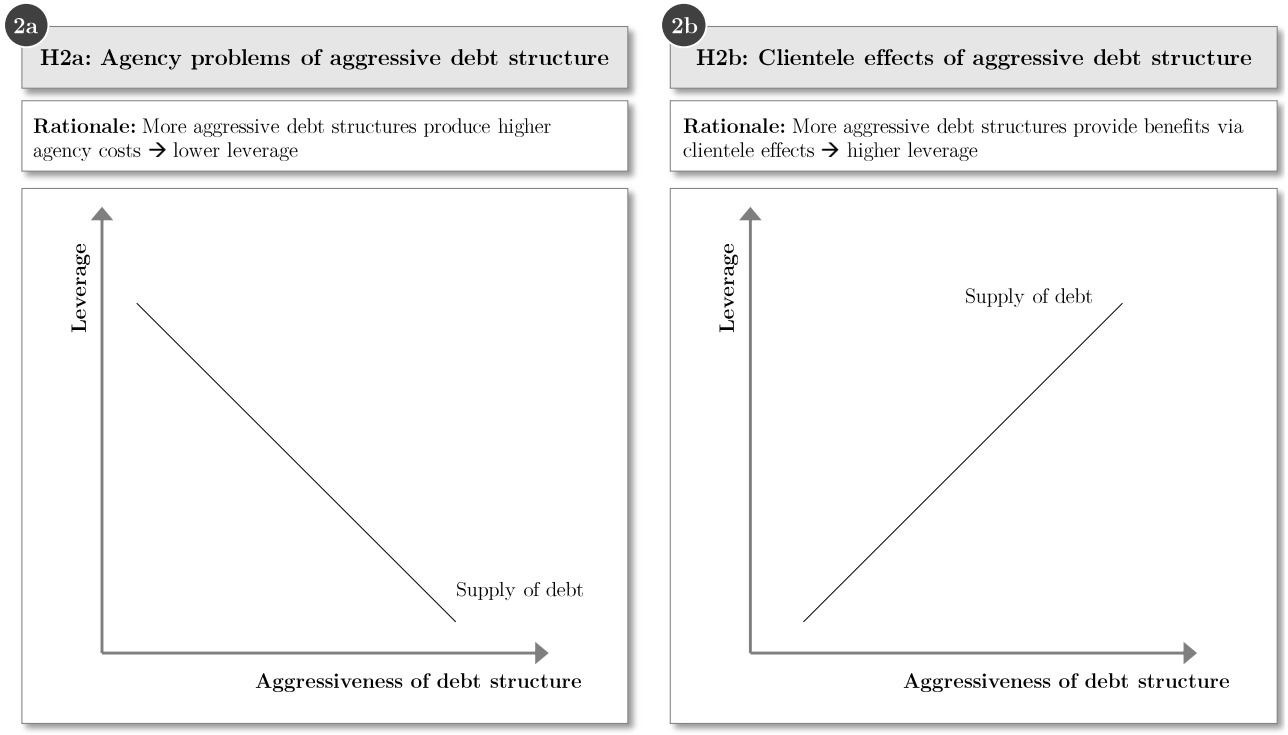
Here we discuss alternative explanations for our findings related to, firstly, Hypothesis 1, and, secondly, Hypothesis 2, both presented in section 4.2. On the former, previous work on capital structure has suggested that the negative relationship between our proxies for sensitivity to agency problems and aggressiveness of debt structure may be driven by pecking order effects. On the latter, we will be discussing primarily reverse causality as a driver of our findings.

The pecking order theory posits that only when internal funds are insufficient to cover cash flow to operations and investments will firms turn to external capital, and to debt in the first instance because of its lower sensitivity to information (Myers & Majluf, 1984). Accordingly, Fama and French (2002) suggested a negative relationship between e.g. profitability and leverage. Rauh and Sufi (2010) take the argument a step further and suggest that the pecking-order theory predicts a stronger negative relationship between profitability and the least information-sensitive debt structures, e.g. bank debt and heavily covenanted structures. Intuitively, "[i]f internal funds for investment drop, the firm should first turn most of all to the least information-sensitive types of financing. Bank debt is generally viewed as the least information sensitive, as banks write covenants into loan agreements that put borrowers into technical default" (ibid, p. 4254). As such, the prediction of the pecking-order theory constitutes an alternative to the explanation laid out in Section 4.2.1, namely that sensitivity to agency problems of targets (for instance, as proxied by low profitability which is thought to increase the propensity to take risky bets, divert remaining cash flows, and so on) drives the use of e.g. bank debt and more restrictive covenants, what we have deemed a defensive debt structure. We believe that pecking-order explanations have limited applicability in our setting of leveraged buyouts (as opposed to the broader sphere of public corporations) for the simple reason that an LBO entails a complete restructuring of the capital structure. Pecking-order theory relies on the assumption that equity holders refrain from issuing information sensitive capital securities because of its wealth destroying signalling effects. But in LBOs, the issuance of any security is not, a priori, associated with an assumption that such a security is overvalued relative to the quality of the underlying business. After all, accompanying the LBO is a relatively large equity commitment. This, in our opinion, means that, all else equal, there is little information contained about the prospect of the target in PE firms' choice of buyout debt structure. Granted, PE firms may try to arbitrage mispricing of different debt structures at buyout – in a similar vein to how the market-timing hypotheses suggests PE firms may arbitrage between debt and equity – but variation in debt structure caused by such arbitrage is likely to be orthogonal to e.g. profitability that we rather see as drivers of information sensitivity.

When it comes to the second hypothesis, the most pertinent problem is the possibility of reverse causality. The line of argument suggesting a reverse causal relationship can be summarized as follows: PE firms are targeting a certain (large) amount of leverage when conducting buyouts and to the extent

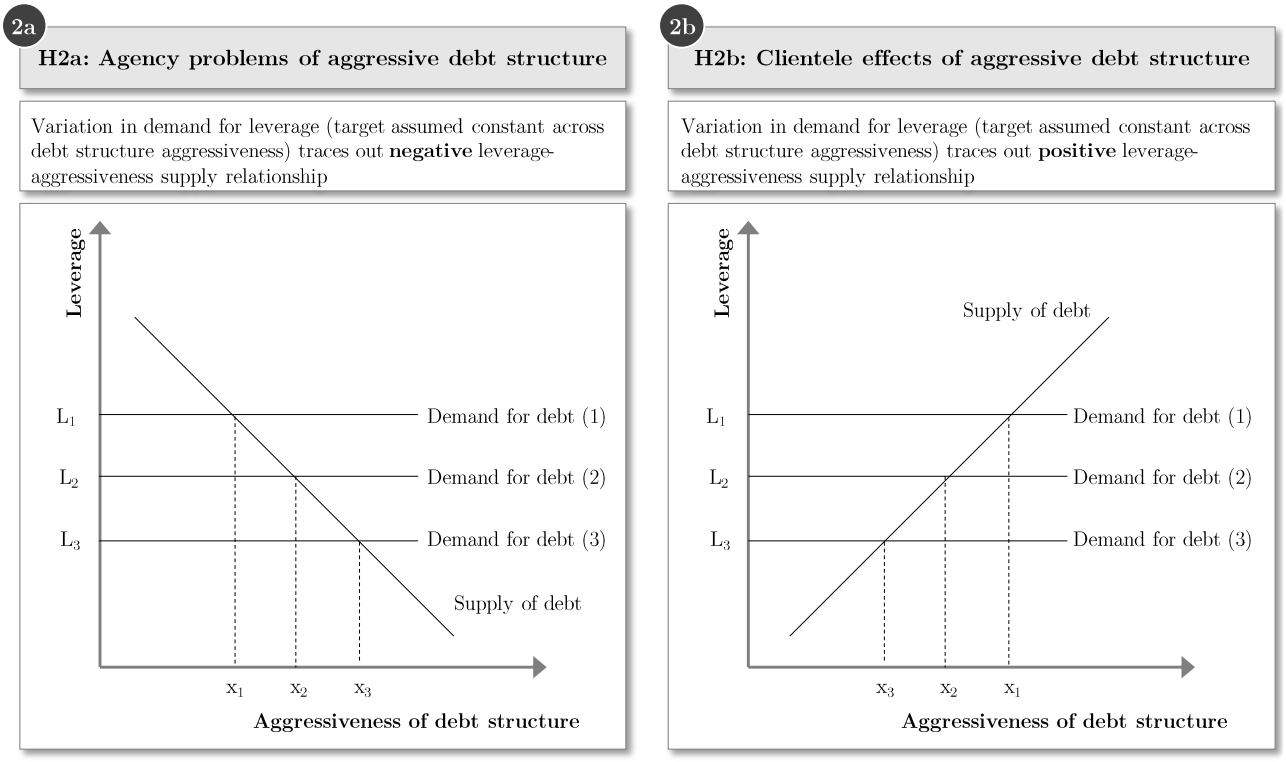
senior secured lenders are not willing to provide the desired amount of debt, PE firms will engage second lien/unsecured/subordinated debt providers to attain the incremental leverage needed to reach the targeted amount. As such, variation in the demand for leverage could be thought to drive variation in debt structure. This may be a real problem methodologically if we have more than one set of structural dynamics. One could conceive of such dynamics in terms of demand and supply from the perspective of lenders. As such, while Hypotheses 2a or 2b were not specifically positioned as either demand or supply (of leverage) related, you could argue that they primarily pertained to supply. In the first case, Hypothesis 2a posits a downward supply curve, with leverage on the Y axis and aggressiveness of debt structure on the X axis, as agency problems of aggressive debt structures lower the amount of leverage available. In contrast, Hypothesis 2b suggests and upward sloping supply curve as more aggressive debt structures provide clientele effects that increase the supply of debt. Both alternatives are depicted in Figure 7.1.

Figure 7.1: Supply of leverage as a function of debt structure



If one adopts such an analytical standpoint, an implicit assumption in our framework and analysis was that variation in leverage and debt structure aggressiveness came about from differences in PE firms' target leverage and exogenous variation therein. As such, "demand" for leverage (from the perspective of borrowers) would be constant across aggressiveness of debt structure whereas other sources of variation in demand for leverage would trace out supply of debt, as depicted in Figure 7.2.

Figure 7.2: Demand and supply of leverage as a function of debt structure – with constant demand across debt structure aggressiveness and shocks to demand

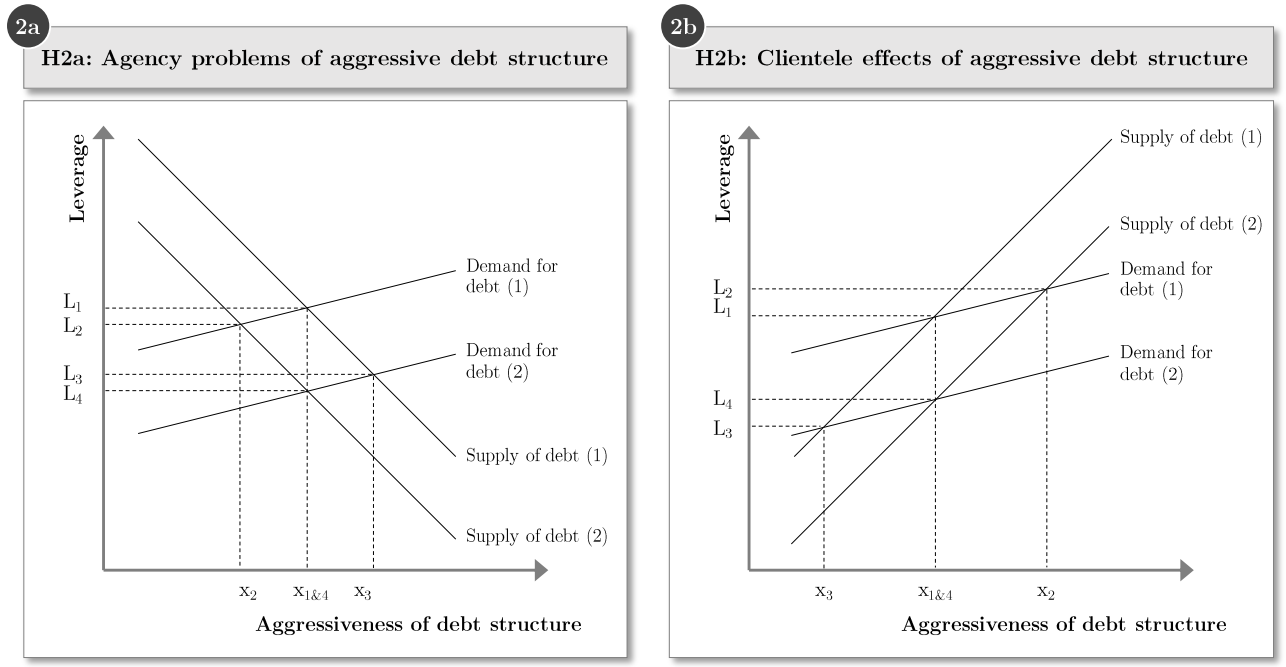


Difficulties arise if 1) demand is not constant across debt structure aggressiveness and 2) supply of debt as a function of debt structure aggressiveness starts to move around because of unobserved factors. On (1), we tend to think that demand will be upward sloping (in a figure such as the above - one could instead have high aggressiveness to the left on the axis and low aggressiveness to the right, to reflect decreasing favourability further out the axis for "buyers", such as in traditional price-quantity diagrams, which would lead to the more 'natural' downward sloping demand curve); PE firms are likely to demand more leverage if they can get such at e.g. unsecured and more loosely covenanted terms as it gives them more flexibility (and potentially more opportunities to appropriate private benefits at the cost of debt providers). Such a situation is depicted in Figure 7.3 which also includes supply shocks.

While reality is full of complexity, surpassing by several magnitudes even the depiction in Figure 7.3, we suggest that our approach of multivariate, albeit lacking simultaneous modelling, captures a fair share of the empirical dynamics. Firstly, variation in supply is likely to be controlled for. One could think of shifts to the supply curve as being driven by, among other things such as credit conditions, sensitivity of the target to agency problems; precisely what we analysed in Section 6.1 and controlled for in Section 6.2. Secondly, our experience tells us that PE firms' top priority is the amount of leverage available, which indeed leads us to believe that the elasticity of demand for leverage with respect to debt structure should be fairly inelastic. As a consequence, movements along the debt structure dimension will mostly be a result of exogenous shifts to demand in so far that target specific and credit

conditions are controlled for. Lastly, other prominent papers have modelled leverage in a single equation framework (e.g. Fama & French, 2002).

Figure 7.3: Demand and supply of leverage as a function of debt structure – with non-constant demand across debt structure aggressiveness and shocks to both supply and demand



7.2 Leverage and outcomes

7.2.1 What factors cause leverage to increase buyout pricing?

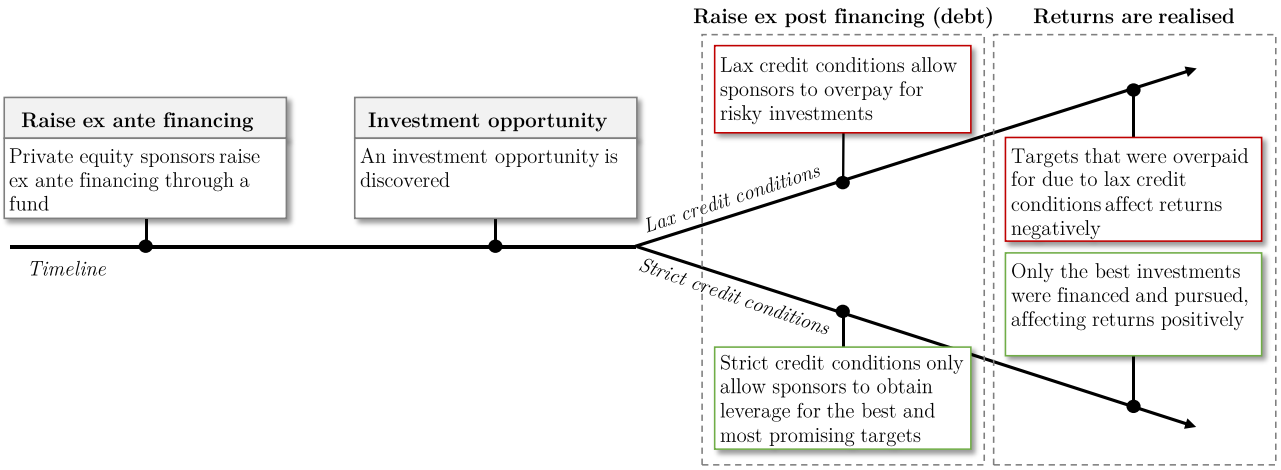
Previous literature led us to propose a hypothesis in Section 4.3 wherein a positive relationship exists between portfolio company leverage and buyout pricing. Two alternative explanations for this relationship were provided. First, the agency-view suggested that GPs have an incentive to over-leverage when debt is cheap because of their option-like payoff. Lax credit conditions allow them to do so because ex-post deal financing, in the form of debt, simply does not serve its purpose as an agency reducing constraint when debt is too abundant. The second view was based on the market-timing hypothesis which suggested that market participants arbitrage debt and equity by adjusting the extent to which equity and debt are used as means of financing. Such an arbitrage exercise should lower the cost of capital which allows PE firms to pay higher acquisition multiples.

Indeed, we found such a positive causal relationship between deal leverage and LBO pricing to exist for our sample in Section 6.3, consistent with Axelson et al. (2013). Though the results do not tell us which of the two proposed views explain the relationship, we lean towards the agency-view in explaining why higher leverage causes higher buyout prices. To see why, consider the following. First, the market-timing view implicitly assumes that capital markets are inefficient since debt and equity are mispriced relative to each other and arbitrage opportunities exist. As a consequence of mispricing in debt markets,

Collin-Dufresne et al. (2001) suggest that lenders are not properly compensated for risks during times of overheated credit conditions. In a competitive market where both lenders and borrowers are sophisticated investors, such as the market for leveraged loans, we deem that such an assumption is unlikely to hold in reality to such an extent that PE firms are able to materially exploit arbitrage opportunities. Second, suggesting that PE firms are able to successfully arbitrage debt and equity in times of lax credit conditions should imply a positive relationship between deal leverage, predicted by variations in credit conditions, on the one hand and fund returns on the other. Contrary, in Section 6.4 we find a negative relationship between leverage, predicted by variations in credit conditions, and fund returns which lead us to favour the agency-view.

Figure 7.4 sketches the agency-view on a timeline from ex ante fund raising to realization of returns. The figure is akin to the one proposed by Axelson et al. (2009) and simply illustrates the chain of events leading to poor fund performance from too lax credit conditions.

Figure 7.4: Illustrative timeline showing the effect from PE agency problems on pricing and returns



7.2.2 The multiple effects from leverage on returns

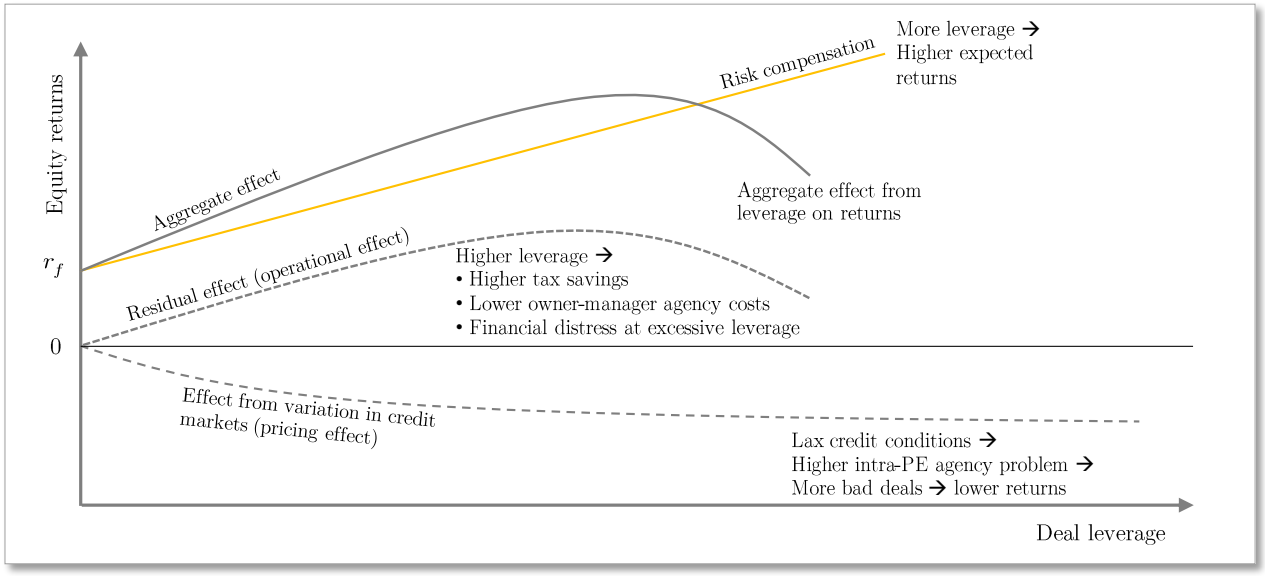
The intra-PE agency view proposed above suggests a negative relationship between deal leverage and returns since GPs, due to their option-like payoff, recklessly engage in risky investments to the detriments of fund returns. However, one of the insights gained from the analysis in Section 6.4 was that leverage has multiple effects on returns. Generally, we think that the effect from leverage on returns runs through three channels: 1) the pricing channel, 2) the operational channel, and 3) compensation for risk. The first concerns the effect on returns from over- or under-payment caused by variations in credit markets. For example, overpayment of a target facilitated by lax credit conditions will lead to a negative impact on returns. This effect is purely financial in the sense that it does not, per se, affect the operations of the target company. The second channel concerns the effect from leverage on the operations of the target and includes such benefits as tax shields from interest expenses and reduced manager-owner agency costs while the costs mainly relate to costs of financial distress.

The final effect is the positive relationship between risk and expected return pioneered by Modigliani and Miller's (1958) proposition 2. We try to disentangle these effects here.

First, a non-linear, positive relationship was found between deal leverage and fund returns, suggesting a concave-like relationship where returns are initially increasing in leverage with a diminishing effect up until a point where after higher leverage causes returns to decrease. The effect from leverage on returns can be split into two components: A component "predicted" by variations in credit conditions and a "residual" component. The first component encompasses leverage obtained due to favourable credit markets and was found to have a negative, non-linear effect on fund returns. As discussed above, this relationship was explained by the intra-PE agency view, and here the effect from leverage runs through the pricing channel meaning that cheap debt is used to overpay for deals leading to poor returns. The second component, residual leverage, encompasses leverage obtained regardless of the prevailing credit conditions. Given that PE sponsors are sophisticated investors, we expect this component of leverage to be chosen optimally at a level where the marginal benefits and costs of leverage balances each other. Here, the benefits of leverage include tax shields from interest expenses and reduced owner-manager agency costs, while the costs mainly relate to increased likelihood of financial distress. This effect runs through the operational channel. Indeed, the effect from residual leverage must be positive and high in magnitude when a negative effect was found for predicted leverage while a positive effect was found for aggregate leverage. Finally, more leverage brings about higher risk which leads to higher expected return.

The effect from the different components of leverage are sketched in Figure 7.5. The dashed line shows the negative convex relationship between *predicted* leverage and returns, brought about by agency problems between GPs and LPs that cause overpayment. The dotted line shows the positive

Figure 7.5: The different effects from leverage



(operational) effect from *residual* leverage on returns caused by tax savings and reduced agency costs between owners and managers. However, as leverage increases the costs of financial distress begins to crowd out the benefits leading to a sharp downward slope after a certain point. The solid yellow line shows the linear relationship between financial risk, brought about by leverage, and return. Finally, the solid grey line, which shows the aggregate effect from leverage on returns, is similar in slope to the dotted line but lies below it due to the negative effect from intra-PE agency costs.

One aspect we did not consider was the potential for a positive endogenous relationship between leverage and returns. That is, it is possible banks are willing to provide more debt to finance a transaction if they expect high operational improvements to materialize during the holding period of the PE sponsor. Engel et al. (2012) controlled for this by 1) including the ex-post realised operational improvements over the holding period as a proxy for the ex-ante expected improvements at entry, and 2) conducting a TSLS regression where leverage is instrumented with the high yield spread and target size. While we do not control for expected operational improvements at entry, we do control for target rating. We argue that the credit rating of the target contains information about the expected future prospects of the target given the forward-looking nature of such credit ratings from the perspective of creditors. Admittedly, better approaches to control for such an endogenous relationship may exist, such as a TSLS regression, why we urge future research to adopt such measures.

7.2.3 Does leverage lead to excessive financial distress?

We have now established that returns are increasing in leverage up to a certain point at which the costs of financial distress begin to crowd out the benefits of leverage. Here, we look closer at the relationship between leverage and financial distress.

It is well-established that excessive leverage will, at some point, lead to financial distress as the probability of default increases with leverage. The question remains whether the amount of leverage deployed by PE funds does, in fact, lead to financial distress. The results from Section 6.4 showed that the likelihood of a distressed exit route was not related to leverage for the buyouts in our sample. First, this indicates that any negative effect from leverage on returns purely works through the pricing channel for the buyouts included in our sample, as outlined above. Second, this result lead us to believe that buyout leverage is chosen "optimally" from an operational perspective. That is, in general the target company is levered up to a point where it will still be able to service its financial obligations while receiving the benefits that comes with leverage (e.g. tax and agency benefits). Which mechanism leads to such an optimal leverage structure from an operational standpoint is uncertain. First, it is possible that PE firms will choose a capital structure that is conservative enough to mitigate the risk of running into debt redemption problems which could cause the PE firm to lose their entire equity contribution. An argument against this is that the option-like payoff of PE firms will exactly incentivise them to increase the riskiness of their investments as much as possible.

Alternatively, banks/lenders are the ones that ensure that leverage is chosen optimally at the target-level as they are incentivised to provide leverage only up to a point where they know, with some certainty, that their loans will perform. We think that this explanation seems more plausible, and our results therefore underlines the importance of ex-post financing in PE buyouts. These findings also fit well into the framework provided by Axelson et al. (2009) around the financial structure of PE funds, where ex-post financing was said to reduce agency problems between GPs and LPs within PE firms.

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Chapter 8: Practical implications

The main actors that could take an interest in our findings are 1) private equity firms, both GPs and LPs, 2) debt providers such as banks and institutional lenders/investors, and 3) investment banks, incl. corporate finance and leverage finance teams. In Table 8.1 below, we state the implications of each of our main findings for these three stakeholders. The most interesting implications, in the authors' opinion, are highlighted below.

Table 8.1: Practical implications for main stakeholders from results

	Findings	Main stakeholders: Private equity firms	Debt providers	Investment banks
Debt structure and leverage	*Less agency sensitive targets have higher optimal debt structure aggressiveness*	✓ At any given time, GPs should take into account the availability and affordability of different debt structures in their target selection processes	✓ Consider how to adapt debt contracts and the governance structures associated with debt provision conditional on buyout targets' sensitivity to agency problems in order to increase relevance	✓ Sell-side banks should consider how to position targets as properly governed by suggesting improvements to internal processes and crafting a narrative ahead of soliciting interest from bidders ✓ Major investment banks with corporate finance and leverage finance departments as well as a supportive balance sheet should consider how to create synergies between advisory and financing capabilities to win buy-side mandates
	Clientele effects dominates agency effects in the debt structure-leverage relationship	✓ If aiming to finance LBOs with as much leverage as possible, PE firms should seek to structure the financing package to contain distinctive pieces appealing directly to different investor preferences rather than a single middle-of-the-road debt offering	✓ Large asset managers may consider diversifying their fund structure with different funds specializing in different debt instruments and structures to compete with more pure-play debt providers, such as mezzanine funds or, more recently, direct lenders	✓ Invest in relationships with a variety of institutional lenders/banks/debt-focused hedge funds to leverage investment banks' intermediary role as primary (debt) market makers
Leverage and outcomes	*During times of favorable credit conditions, GPs will use excessive leverage to take risky bets and 'overbid' leading to higher buyout prices to the detriment of fund returns*	✓ LPs may want to put in place governance systems, incl. alternative compensation mechanisms, to incentivize and control GP behavior in order to maximize their own returns	✓ Despite intense competition in financing markets during times of easy access to liquidity, debt providers should foster discipline in credit provision and recognize potentially perverse incentives of PE GPs	✓ Investment banks need to independently evaluate whether their fiduciary duty entails arranging buyouts and financings on behalf of GPs at potentially mispriced levels (both enterprise valuations and debt yields) or whether to push for other market clearing valuations
	Leverage unexplained by credit conditions may be positively (non-linearly) related to leverage	✓ When leverage is not driven by GP's eagerness to overinvest, PE firms should increase leverage, at least up to a point, because of tax benefits and reduction in free cash flow problems and managerial shirking ✓ PE firms should cultivate its reputation and relationships with debt providers in order to gain advantageous access to financing during times of otherwise cold credit markets where buyout deals may be available at a discount	✓ Recognize opportunities to provide financing to well respected PE firms that are unlikely to unfairly appropriate debt holder wealth ✓ Play an active role in bringing about operational improvements through management oversight in order to build long-term relationships with repeat borrowers	✓ Assist PE firms in assessing the capacity for interest payments with a view to making full use of the tax shield ✓ Investment banks should recognize potential counter-cyclicality in the benefits of leverage and work to arrange financing and buyouts precisely when market conditions are unfavorable where leverage may create real value for both borrowers and lenders
	No evidence for a relationship between leverage and the probability of distressed exit was obtained	✓ Leverage may not materially impact the worst case scenario of a wipe-out of the equity ticket ✓ But average returns, as argued above, will still depend on leverage and may be subject to intra-PE agency problems	✓ If leverage has little impact on distress, incremental effort should be spent on assessing business risk rather than financial risk (two of the main components in rating agencies' credit assessment)	✓ Investment banks' advisory work and credit analysis going into underwriting decisions should be equally focused on getting comfortable with the credit rather than just the exact leverage point

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Chapter 9: Limitations and suggestions for future research

One of the major strengths of our analysis is our unique data set of PE-backed LBOs and facility-level buyout financing composition. However, despite its strength, our data does have limitations which may have 1) necessitated a delimitation of our research subject that may not per se capture the important nuances nor the comprehensive picture, 2) resulted in invalid results due to measurement errors, and 3) manifested itself in the choice of quantitative methods. Below, we review each of these points and suggest how future research can take further steps to accommodate such limitations.

9.1 Limitations relating to delimitations of the research subject

In delimitating our research area, our analysis attempted to strike a balance between being sufficiently comprehensive to capture all material aspects of debt structure and relate it to the broader concepts of leverage, buyout pricing, and return while at the same time maintaining enough detail to capture the nuances of precisely those objects. Clearly, the balance opted for here was a combination of conscious choice and we hope that our results enrich the research area while at the same time provide a framework for further studies.

With regards to our debt structure measures, previous literature has uncovered important nuances that we fail to properly take into account. For instance, on covenants Billet et al. (2007) highlight the importance of different types of financial covenants and their relative restrictiveness in terms of headroom whereas our study simply makes a distinction as to whether a certain piece of debt is covenant lite or not.

At the same time as failing to capture potentially important details, one could question whether this thesis touches upon meaningful aspects of real and financial structures. For instance, is an examination of debt and capital structure's impact on returns necessarily what matters or ought future research to take into account concrete wealth transfers between various agents and principals, such as equity and bondholders or GPs and LPs, to answer whether agency problems lead to undue appropriation of either bondholders' or LPs' wealth? Similarly, future research could ask the question as to how different debt providers in LBO debt structures relate to each other and whether intra-creditor agency problems exist in a private-equity context. In addition, future research could emphasize the relation of objects studied here to an even broader context, such as the public companies or family-owned firms.

9.2 Limitations relating to measurement error

During our sampling procedure, we rely on labelling and reporting from various data sources, which may be inaccurate for our purposes. For instance, LCD (2019) labels loans and bonds somewhat narrowly with respect to the borrowing/issuing entity. But when this entity is a HoldCo or the like, seniority fails to capture structural subordination and, if secured, such security will be with respect to the shares in BidCo and, thus, strictly speaking not secured in any traditional sense. Obviously, such obstacles are virtually impossible to deal with in large sample studies such as this one given that proper

identification of contractual and structural conditions without reliance on secondary source material would require access to and processing capacity of a large amount of bond and loan documentation that are often not disclosed via any widely distributed public channel.

In addition, problems with data availability also means that we proxy deal performance by a fund return measure. Using the IRR at the fund level, as argued earlier, presents two problems as a proxy for deal performance. Firstly, fund returns are not necessarily a good proxy for deal returns as PE firms may apply different financial policies across different portfolio acquisitions depending on their characteristics. Secondly, the IRR measure does not take into account 1) time horizon and 2) risk. Both are straightforward textbook concepts; in the first case, being able to generate a high return over a longer period of time is superior to generating abnormal returns for only a few periods (Berk & DeMarzo, 2017). Secondly, expected returns are increasing in leverage as increased financial risk requires a premium, which is why, for instance, Engel et al. (2012) utilize risk-adjusted returns taking into account the volatility of returns. Other researchers have used so-called public-market-equivalent measures that benchmark returns taking into account risk and time series effects (Axelson et al., 2013). Due to lack of access, such an approach could not be adopted here, why we encourage future research to exploit more sophisticated measures of performance, or in other ways approximate real effects such as wealth transfers suggested above.

Lastly, our imputation and winsorizing approaches may also introduce biases in our data that could skew results. Suppose the tails of the distributions governing our empirical setting contains important information for the understanding of underlying dynamics. In that case, cutting off the far end of the tails and replacing them with less extreme values distorts findings and ignores potentially important variation. In addition, from a statistical point of view, limiting such variation may bias standard errors and, as a consequence, statistical significance. As argued in Section 5.3, however, most of the extreme values observed in our data may be brought about by typographical errors or caused by low denominators in the case of ratios. Nonetheless, future research could take further steps to remedy biases brought about by outliers via more sophisticated quantitative modelling of tail events and observations.

9.3 Limitations relating to the choice of quantitative methods

The quantitative workhorse throughout most of the thesis was Ordinary Least Squares. While OLS remains the predominant quantitative method in our field of research, it faces several inadequacies in a number of the applications as discussed in Section 6.1. For instance, OLS is not conceptually designed to handle binary dependent variables, why we complement OLS with the probit model, or fractional variables. On the latter, other methods such as the Tobit model (Maddala, 1991), beta distributions (Kieschnick & Mccullough, 2003), quasi-likelihood estimation (Papke & Wooldridge, 1996), and two-step approaches (Greene, 2000) have been proposed as alternatives. In so far that any of such methods receive further support and more widespread application in the empirical literature, future research could apply these methods to the study of fractional measures in capital and debt structure research.

Moreover, as discussed throughout the thesis, endogeneity may bias our results. Where correlation with the error term were believed to present the biggest problems, i.e. in 6.3 and 6.4, we opted to instrument leverage in a 2SLS set-up in an attempt to unbias coefficient estimates. We believe that we were largely successful in our approach, but it may be fruitful for future research to instead utilize simultaneous equation modelling to sort out endogeneity problems and provide additional evidence on the relationships examined here. But more sophisticated quantitative methods similarly require assumptions about underlying dynamics, endogeneity, and which exogenous variables can assist in causal identification. Here, the framework proposed in this thesis may help guide such modelling efforts.

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Chapter 10: Conclusion

Our problem statement and associated research questions put us on track to investigate the drivers and consequences of leverage in a private equity backed leveraged buyout context which had previously only been explored in a scattered and inconclusive body of research. Based on these scattered lines of research, as well as a review of the industry context and an in-depth study of a particular LBO case, this thesis has put forth an encompassing conceptual framework and tested its major implications. Toward this end, we collected a unique data set of 972 leveraged buyouts, incl. target financials, valuation, detailed buyout financing structure, as well as private equity fund returns of the buying fund.

The proposed framework, broadly speaking, has two parts with leverage at the intersection. The first concerns drivers of leverage while the latter concerns its consequences. On the former, whereas traditional capital structure theory has failed to explain leverage in LBOs according to Axelson et al. (2013), we propose that the understudied notion of debt heterogeneity may be important. As such, we looked at variations in a number of different debt structure elements, including debt instruments and characteristics such as seniority, security, and covenants. Here, we put forth the concept of debt structure 'aggressiveness' which was intended to serve as a unifying dimension applicable to all debt structure elements. Aggressiveness was defined in terms of the protection afforded to lenders/debt holders with a defensive structure providing ample protection for lenders in terms of seniority, security, covenants, and incentives via concentrated lenders/debt investors. An aggressive structure, on the other hand, may also feature subordinated, unsecured, or lower ranking pledges, as well as weak covenant protection and dispersed lending.

Having defined the construct of debt structure aggressiveness, our analysis of debt heterogeneity proceeded along two paths. The first leg studied the antecedents of debt structure. Here, we found that riskiness and, in particular, the extent to which a buyout target is exposed to the risk of agency problems, as proxied by size and profitability, are significant drivers of debt structure aggressiveness. Targets less exposed to agency problems are more likely to use debt instruments that are widely syndicated, such as TLBs and bonds, which have multiple seniority and security tiers, and which are lightly covenanted. We found this to be the case at high levels of statistical significance controlling for a range of variables measuring credit, valuation, and macroeconomic conditions as well as controlling for year, country, and industry variations. While our results could also be explained by a modified pecking-order theory as per Rauh and Sufi (2010), the context where signalling and market prices of equity and debt are less relevant suggests to us that a story in which PE firms respond to targets' exposure to agency problems in choosing among available debt structures is the most consistent with the evidence.

The second leg concerned the relationship between debt structure and leverage. Here, researchers have held that more protection is needed when leverage is higher because, all else equal, agency problems

are more severe. For instance, Diamond (1991) suggests that concentrated lending is preferable from a monitoring perspective, Rajan and Zingales (1995) links the availability of collateral to higher leverage, and Bradley and Roberts' (2015) Agency Theory of Covenants argue that more restrictive covenants are needed when leverage is higher. We do not find it to be the case that defensiveness of debt structure is associated positively with leverage for any of our debt structure elements. In contrast, we detected a statistically significant (at the 1% level) positive relationship between the presence of widely distributed debt instruments such as TLBs, TLOs, and bonds, and leverage. Similarly, there is strong evidence to indicate that the use second or lower lien debt is positively associated with leverage. Somewhat surprisingly, there is also some evidence, although rather weak, that the use of covenant lite and unsecured debt is associated positively with leverage. Clearly, these findings contradict the agency-based explanation and, rather, seem consistent with a story based in so-called clientele effects. We generalise the idea of tax clienteles found by, for instance, Elton and Gruber (1970) and suggest that clienteles may also arise due to a number of other factors such as regulation or investor preferences. Ultimately, different risk-return requirements across different investor clienteles mean that a debt structure with multiple layers, each appealing to different specialized investors, may unlock additional funding and thereby bring up aggregate debt. Indeed, the finding that leverage, on average, is higher for debt structures featuring both first and second lien secured pieces supports this view.

The second part of our framework, addressing our second research question, concerns leverage's impact on LBO outcomes. Here, we found strong support for a positive relationship between leverage and buyout pricing when controlling for endogeneity issues in an instrumental variable regression set-up. Axelson et al. (2013) claim this is caused by intra-PE agency problems whereby GPs are personally incentivised to use excessive leverage and overpay for deals when credit conditions are favourable because their own expected payoff is option-like with respect to fund performance. An alternative explanation found in Engel et al. (2012) is that PE firms engage in market-timing whereby capital markets are arbitraged such that more debt will be employed when mispriced. If value creation stemming from such timing practices is captured by the target, this story is also consistent with the evidence.

Going a step further, however, and considering leverage's impact on subsequent equity returns, the two stories, i.e. intra-PE agency problems and market-timing, have diverging implications. Axelson et al. (2013) and Engel al. (2012) have presented evidence on a positive and negative, respectively, relationship. We initially found a positive non-linear relationship between leverage and equity returns, although only marginally significant. But, when we split leverage into a portion predicted by credit market conditions and residual leverage, we found that the portion of leverage predicted by credit markets has a negative impact on equity returns. This suggests that there may, in fact, be intra-PE agency problems driving returns lower when credit conditions are favourable. Equally, residual leverage has a positive effect on returns, at least initially, potentially owing to tax benefits of debt and reductions in e.g. free cash flow problems. Lastly, we failed to detect a relationship between the use of leverage at buyout and subsequent distressed exit by the PE firm which provides further evidence of the notion

that any negative impact of leverage on equity works through deal selection and acquisition prices rather than through financial distress.

Notwithstanding potential problems such as reverse causality, multicollinearity, heteroskedastic (and potentially clustered) standard errors, omitted variable biases, representativeness issues, and alternative theoretical explanations – all problems that we have surveyed and dealt with to the extend practically possible – we, broadly speaking, found support for the proposed conceptual framework and the associated hypotheses. This has several implications. Academics may fruitfully apply the construct of debt structure aggressiveness as well as the broader conceptual framework linking sensitivity to agency problems, debt structure, leverage, buyout pricing, and equity returns in future research. As such, a new avenue for research that, on the one hand, recognizes debt heterogeneity and, on the other hand, links diverse debt structure elements together have opened up. For practitioners, the implications are equally important. In a normative sense, the first part of our analysis suggests that 'optimal' debt structure aggressiveness is contingent on sensitivity to agency problems, which should guide private equity firms and lenders as well as structuring investment banks. Similarly, structuring should take into account target leverage. The second part of our analysis suggests that PE firms, if their aim is to attain as much leverage as possible, should structure debt aggressively but that LPs may consider adapting governance systems to reduce unnecessary risk-taking by GPs. Lastly, in so far intra-PE agency problems are properly dealt with, PE firms, lenders, and investment banks may advantageously work together to increase leverage to achieve higher returns with no material consequences for the risk of distress.

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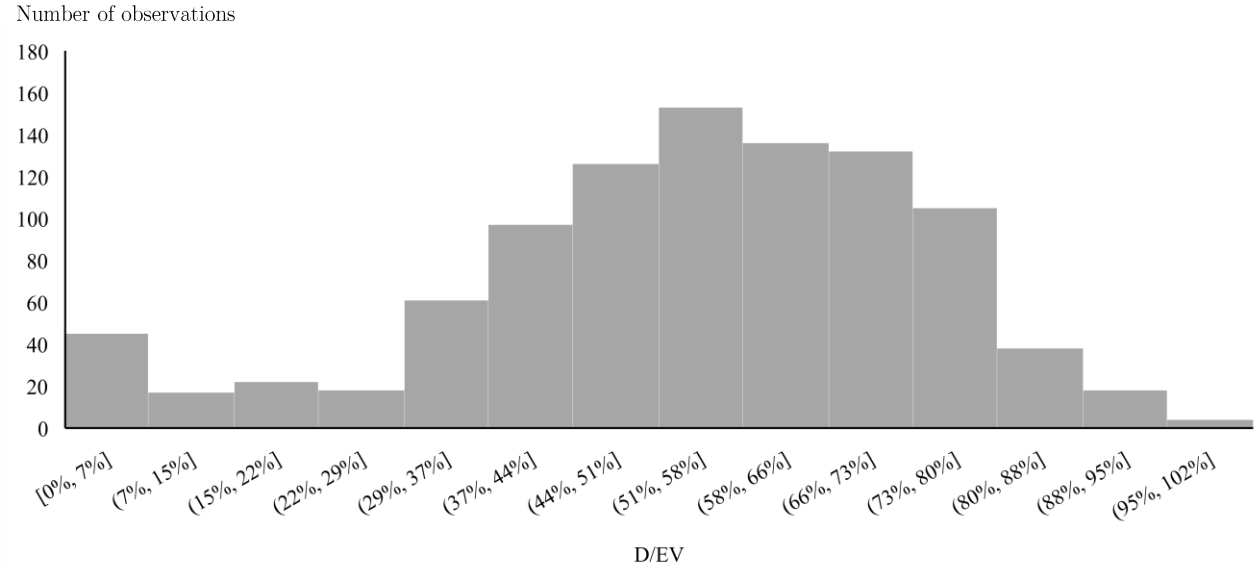
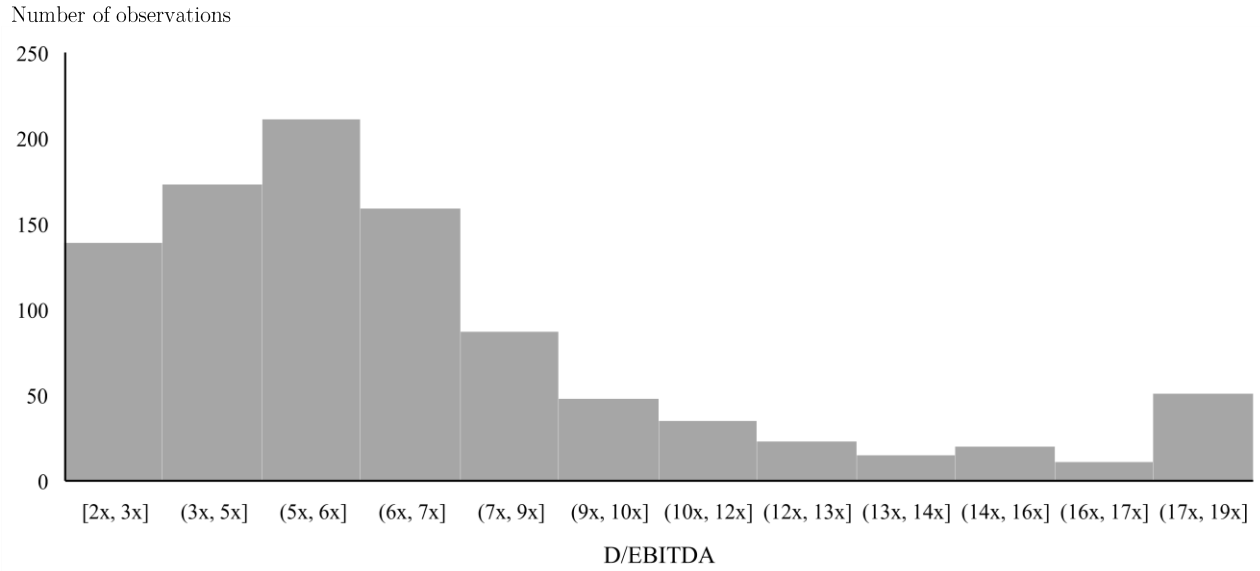
Appendix A: Distribution of sample leverage

Sample distribution – D/EV



Note: Constructed from final sample after winsorization

Sample distribution – D/EBITDA



Note: Constructed from final sample after winsorization

Appendix B: Literature review - Early capital structure theory

Early Capital Structure Theory: Modigliani-Miller

The beginning of capital structure theory is usually dated to Modigliani and Miller's (1958) seminal paper. The authors (MM) established two well-known propositions, the first being that the weighted average cost of capital is independent from capital structure and the second that the cost of equity is increasing in the relative proportion of debt financing owing to the increased financial risk leverage brings. Surely, the novelty the MM Propositions lies in their relation to each other. MM observed that "cheap" debt increases the volatility of equity holders' residual claim, in turn giving rise to higher cost of equity that exactly offset the benefit of lower yielding debt financing. Herein lies a reference to the asset pricing/capital market theory literature that deals, in particular, with the relationship between risk and return. The asset pricing literature, which today largely equates to CAPM-related and factor modelling work, precisely models precisely this relationship.

In the context of our research, for PE-funds the MM Propositions suggest that a priori a positive relationship between leverage and returns should be expected. It also provides us with the basic intuition explaining why certain debt instruments, such as subordinated claims, unsecured, covenant lite, or debt more generally in cases of high leverage, will demand higher returns (i.e. higher cost of debt) because the holders of such instruments, all else equal, face more risk in relation to the payment of coupons and repayment of principal. In the context of LBOs, the fairly small equity cheque means that a large portion of risk is transferred to debt holders.

In addition to the two MM propositions, Modigliani and Miller (1958) also established the conditions under which these apply. In particular, MM imposed perfect capital markets (no taxes, transaction costs, or information asymmetries) and rationality. The relaxation of these assumptions has been the focus of later literature. Agency theory has played a large role in these efforts, particularly with regards to information asymmetry. Two early advances, distinct from agency theory, in the capital structure literature pertain to the work on 1) tax benefits of debt, and 2) financial distress costs. Each are surveyed briefly below.

Tax benefits of debt

The fact that interest payments on debt are tax deductible in most tax jurisdictions present a normative deviation from the Modigliani-Miller world. Incidentally, it was Modigliani and Miller (1963) themselves who were among the first to make this clear and show how, on an after-tax basis, the weighted average cost of capital is decreasing in leverage, up to a point at least.

In reality, several particularities make the relationship more complex. Miller (1977) were among the first to make the argument that personal taxes may neutralize the advantage of debt most forcefully. He argues that if debt investors pay higher taxes on interest revenue than equity investors pay on

dividends or share appreciation (differential taxation between dividends and capital gains is beyond the scope of this discussion), then the before-tax required return on debt will be higher and counteract the effect of interest deductibility at the corporate level. This may be the case when considering personal investors, but in our case, both equity and debt providers are institutions whose tax rates may have no relation to individuals. There is also reason to believe that such sophisticated investors make use of various holding structures to reduce taxes at the investor level. Lastly, it remains common practice for both banks pitching takeovers as well as internally at PE firms to model tax shields in enterprise valuations.

Another moderating factor is the earnings capacity of the firm. Simply, if there are no earnings before interest, there are no taxes to be saved. However, this should be understood in a fairly dynamic manner as many tax jurisdictions operate with various tax loss carry back and forward rules, such that losses in any given year may give rise to tax refunds in later years with losses, or tax breaks on earnings in subsequent years. Given the high leverage ratios in LBOs, one may expect that the earnings capacity of firms and the higher yields required by LBO debt investors, means that interest tax deductibility is not fully exploited. On the other hand, unlike venture capital firms, PE funds tend to favour more mature firms with proven track records and cash flow predictability, suggesting that targets are more likely to have earnings potential sufficient to take advantage of interest tax deductibility.

Extant literature has examined the impact of tax benefits on LBO enterprise valuation directly. In particular, when acquisition markets are reasonably competitive, some, if not all, of the present value of future tax savings will be shared with target shareholders through higher buyout pricing (Bull, 1989). Knauer et al. (2014) estimate that 20% of buyout Enterprise Value (EV) is accounted for by the tax shield.

The authors, whose research setting is that of a change to the marginal tax deductibility laws in Germany, also suggest, however, that incremental changes to the tax benefits of debt have little impact on PE-activity. If the value creation (for buyers and sellers, not the government) associated with tax shields falls mostly to the target shareholders, then most of the abnormal return generated must come from other aspects of financial or operational policies under the ownership of the sponsor. It is unclear to us, and Knauer et al. (2014) do not provide any insights here, why expected gains of such other measures would not also be priced into the buyout transaction. In other words, the application of Bull's (1989) argument of value sharing through competitive acquisition markets seems to be selective.

Financial distress and bankruptcy costs

In the limit, the presence of tax benefits of debt implies that firms should be 100% debt financed. In traditional trade-off theories of capital structure decisions, the tax benefits of debt is balanced by the *cost of financial distress* (Myers, 2001). The simplest textbook definition of financial distress is "[w]hen a firm has trouble meeting its debt obligations" (Berk & DeMarzo, 2017, p. 583). As hinted at earlier, firms using debt financing has a number of obligations, including interest payments and principal repayments, but also the adherence to the suit of covenants contained in e.g. loan or debt

documentation. Breaching such obligations constitutes an event of default which may lead to bankruptcy. In any case, the transfer of certain rights, maybe even legal ownership, to debt providers is triggered under default.

Quite intuitively, default or bankruptcy is likely encountered on the back of large operational deficits and associated significant value destruction. As a consequence, equity holders and maybe even debtholders are likely to face serious losses. Stiglitz (1969) importantly showed, however, that a positive probability of bankruptcy does not change Modigliani and Miller's (1958) propositions under perfect capital markets. Although Stiglitz' (1969) proof follows slightly different lines, the intuition is quite simple; absent transaction cost, bankruptcy simply causes a transfer of ownership but does not impose any additional costs and the losses in question pertains to deteriorations in the business. The losses highlighted above are the same whether fully equity financed or partly debt financed. Debt simply introduces sharing of the losses between equity and debt holders as well as a transfer of residual claim rights to debt holders in case of bankruptcy.

In practice, capital markets are not perfect of course. Analytically, it is conventional to distinguish between *direct* and *indirect* costs of financial distress (Berk & DeMarzo, 2017). The direct cost are those costs that are obviously related to the bankruptcy proceedings, and include "lawyers' and accountants' fees, other professional fees, and the value of the managerial time spent in administering the bankruptcy" (Warner, 1977, p. 338). Bankruptcy can be a messy affair with large sums of money paid by both creditors and the companies for various counselling services. At the upper end, Baxter's (1967) estimate of 20% of firm value being lost towards direct cost of financial distress was an oft cited finding in the early literature on financial distress. It has subsequently been emphasized that Baxter's (1967) data was hardly representative in that it mostly concerned *individual* bankruptcies (Miller, 1977). Warner (1977), who examined bankruptcies in the railroad industry, found that the total cost of bankruptcy amounted to around 5% of pre-filing firm value.

Indirect cost of financial distress has a slightly more holistic interpretation in that it captures all those costs that, in a second order sense, are incurred or, by virtue of being expected to occur, imposes an upfront cost or loss of revenue, because there is a risk of bankruptcy. Firstly, certain groups of stakeholders will scale back relations or hold on to resources in their contracts with firms near bankruptcy. Berk and Demarzo (2017) highlights 1) customers, who may worry about a firms' ability to provide e.g. after sale service, 2) suppliers, who may hesitate to deliver supplies on credit, 3) employees, who are incentivised to find employment with companies less at risk of failing, and 4) receivables, as collecting receivables becomes harder when debtors feel less of an incentive to uphold a reputation of timely payment. The authors also point out fire sales and inefficient liquidation as well as the potential financial distress costs to creditors as a function of expected losses on debt extended to the firm. The magnitude of indirect financial distress costs is hard to determine owing to identification issues. Andrade and Kaplan (1998) provided a highly cited estimate of 10-20% of firm value for firms that enter financial distress. As a consequence, it is widely regarded that indirect

financial distress costs may be several orders of magnitude larger than the direct cost of financial distress

Appendix C: Literature review - Introduction to the lines of research dealing with different debt structure elements

Debt instrument

Agency theory has provided the backdrop for the literature dealing with the difference between different debt instruments. As a consequence, focus of such research has been on what types of lenders or investors buy which debt instruments and how well positioned they are at governing the agency relationship vis a vis equity. The literature's treatment has tended to compare 'bank' debt with 'public' debt, which in most cases amount to a distinction between loans and bonds. In the leveraged space, however, banks' role in both loans and bonds have increasingly been intermediary, with also loans getting distributed to institutional investors. As alluded to in 2.2.2, banks' role as lender is still seen in leveraged loans where amortizing debt (TLAs) and revolvers usually remain on banks' balance sheet, and banks may keep a significant commitment in any given institutional term loan. HY bonds, on the other hand, are almost entirely placed with various asset managers, including mutual funds and pension funds. We identify two factors pertaining to debt investor characteristics of different debt instruments that are likely going to have an impact on leverage and debt structure; 1) monitoring incentives, and 2) supply factors.

A central tenet of financial intermediation theory is that banks have a relative advantage over distributed debt providers in lowering agency problems of debt (Diamond, 1991; Rajan, 1992). Park (2000) developed a model of moral hazard that implied the optimality of having concentrated lending at the senior level to provide the best incentives to monitor. This is particularly the case in highly leveraged situations, where severe collective action problems arise if lending is highly distributed or junior. Intuitively, the incentive to protect firm value is greater if the benefit befalls to oneself, which will predominantly be the case when there are fewer lenders and for the lenders whose claims are senior. In support of this view, Sufi (2007) provides evidence that lead banks in syndicated loan transactions retain larger shares of the loan and forms more concentrated syndicates when agency problems are more severe. In terms of impact, Lookman (2009) found the proportion of debt being bank financed to be positively related to hedging activity.

In addition to monitoring advantages, concentrated bank lending is claimed to be more efficient in restructuring or liquidation situations given that fewer parties have to be consulted and in agreement (Bolton & Freixas, 2000). The disadvantage of bank debt is the informational monopoly that such tends to create and which can lead to various forms of rent extractions via e.g. increased interest rates or imposition of various forms of control (Rajan, 1992). Faulkender and Petersen (2006) argue that such costs are particularly important when firms' reliance on bank financing is more a result of a lack of access to public debt markets rather than the inherent preferability of bank financing. The authors claim that previous literature has been preoccupied with demand for debt and failed to recognize that firms may be unable to issue additional debt because of various market imperfections such as

information asymmetries or investment distortions. Faulkender and Petersen (2006, p. 48) argues that comparing "firms that are able to borrow from the bond market with those that cannot, we will find that firms with access to the bond market have more leverage".

Security

Theoretical work on security is found in Binsbergen, Graham, and Yang (2010) who model the impact of, among other things, collaterability on the marginal cost of debt. They find that collaterability, e.g. the extent of tangible assets, causes a parallel downward shift of the marginal cost of debt curve.

In the literature on bankruptcy proceedings, Weiss (1990) finds that in violations of secured creditors' claims rarely occur but that violations of the priority of claims are common among unsecured creditors and, interestingly, between unsecured creditors and equity holders. A strand of literature deals with how debt structure impacts the likelihood of ending up in Chapter 11 bankruptcy as opposed to conducting an out-of-court debt restructuring. Asquith, Gertner, and Scharfstein (1994) review this literature and finds that secured creditors will generally be lenient early in such a process but more likely to push for costly bankruptcy later in the process since they have some security that their claims will be rewarded. Unsecured creditors are more likely to seek debt restructuring and, if creditors are not very concentrated, they may seek to free-ride on other creditors' resolution efforts.

In terms of security's overall impact on agency costs, Rajan and Zingales (1995) suggest that secured debt is associated with lower agency costs because the security of collateral makes it harder for equity holders to appropriate debt holders' claim. On the other hand, reduced collateral may lead to tighter credit limits which, in turn, reduces the need for monitoring (Cerqueiro et al., 2016).

Seniority

While corporate capital structure studies have largely focused on aggregate debt, a fairly extensive literature developed following the financial crisis dealing with risk in the banking system that extensively surveyed the importance of banks' capital structure. On subordinated debt, several authors have found that the presence of subordinated debt providers fosters market discipline, which refer to the ability of investor to monitor as well as influence risk taking. It has been shown that subordinated debt yields are sufficiently sensitive to changes in underlying risks to provide the necessary precondition for effective monitoring via price signalling (Zhang et al., 2014). Evanoff et al.'s (2011) findings, however, indicate that the market for subordinated debt needs to be sufficiently deep for such signals to work effectively, and we speculate that this might not be the case for high yield issuers. For banks, Ashcraft (2008, p. 554) finds that subordinated debt is associated with a reduced probability of future financial distress or bankruptcy and concludes that the presence of sub-debt holders seem to be "effective in limiting moral hazard". Similarly, Belkhir (2013) documents a relationship between the proportion of sub-debt to total liabilities and the use of derivatives for hedging purposes. Stanton (1998), whose model predictions are broadly in-line with the above findings, frame the results in terms

of the well-known over- and underinvestment problems. Specifically, she posits that the presence of subordinated debt reduces the overinvestment problem but increases the underinvestment problem.

In sum, there is some indication that subordinated debt adds a protective layer to the governance structure. The next question to consider is then whether strengthened monitoring and influence by subordinated debt holders is a detriment or advantage to the equity-invested PE funds. On the one hand, reductions in overinvestment problems and other wealth transfers from debtholders to equity holders (or risk transfers from equity to debt) seem suboptimal from the perspective of equity holders. On the other hand, the monitoring role of subordinated debt holders, as well as reductions in financial slack brought about by the sizeable interest claims of sub-debt, may bring about improvements in operating performance that outweighs the private benefits that PE-funds could otherwise have extracted in their agency role vis a vis debt investors. Chen et al. (2004) found that the presence of sub-debt in banks was associated with higher stock returns in their event study, lending support for the latter view. We, however, tend to believe that in our case, where a strong and experienced monitor is already present in the shape of PE-fund, the relative operational performance benefits from sub-debt will be fairly minute.

Determining empirically any causal relationship between the use of sub-debt and PE fund returns is likely to present severe methodological obstacles. In particular, confounding factors may drive both variables. Rauh and Sufi (2010) find that firms of lower credit quality are more likely to use subordinated debt, and the authors put forth a somewhat normative interpretation of their findings, suggesting that sub-debt is used as a tool to reduce incentive conflicts echoing the spirit of some of the works cited above. We volunteer another interpretation; worse credits are more likely to have to resort to higher-yielding subordinated liabilities because of senior lenders' unwillingness to provide the amount of debt needed to finance the buyout. If the higher cost of debt and the relatively poorer credit quality is not properly reflected in buyout pricing, we are likely to identify a negative relationship between the use of subordinated debt and PE-fund returns.

Lastly worth noting is that somewhat of a disconnect has developed between the perspectives of practitioners and that of academics on the topic subordinated debt. To a large extent, the academic literature tends to rely on agency theory to explain the role and existence of subordinated debt, focusing on how the elevated risks attached to sub-debt increase monitoring incentives of investors in such instruments that, in turn, provides a disciplining/moral hazard reducing effect (e.g. Chen et al., 2004; Rauh & Sufi, 2010; Stanton, 1998). Practitioners, on the other hand, have a much more straightforward explanation for the extensive use of subordinated debt; senior lenders and certain institutional debt investors are unwilling, or unable, to provide the amount of leverage, on a senior basis, preferred by PE firms. As a consequence, PE firms engage other pockets of funding that are more partial to risky lending and therefore willing to lend money at riskier terms in exchange for higher returns. According to Rizzi (64 2016), the market for leveraged finance has developed to encompass a range of financing instruments with reduced seniority, collateral, and covenants, where "the aim of the PE issuers of such

instruments has generally been to increase the debt capacity of their portfolio companies". This development has come exactly as a result of sponsors' demand for amounts of leverage that banks have not been willing or able to provide due to regulations.

Covenants

Intuitively, the extent and strength of the covenant package behaves much like the monetary cost of funding, i.e. the yield, in the sense that supply and demand of financing jointly determines the amount of leverage and the covenant package that characterizes the equilibrium (Bradley & Roberts, 2015). As such, two opposing forces are at play in the relationship between covenant strength and the amount of debt used to finance buyouts. On the one hand, we expect lenders to be more willing to provide large amounts of leverage if the associated covenant suite is extensive and restrictive. At the same time, PE funds are likely to favour more aggressive debt policies if covenant conditions are laxer. We thus expect the relationship between leverage and covenant strength to be confounded by the general credit market conditions. For instance, during hot credit markets, the eagerness of banks and institutional investors to provide financing will drive leverage higher as funding costs go down while, simultaneously, covenants are likely to loosen.

Controlling for credit conditions, Achleitner et al. (2012) argue that there are two factors driving the covenant setting of PE-sponsored loans; 1) information asymmetry costs (here we focus on information asymmetry pre-lending), and 2) financial risk and the risk of agency problems at high leverage levels. While the authors examine the explanatory power of the two factors with regards to the difference in covenant settings between LBOs and non-sponsored loans, we use the framework to characterise the relationship between the covenant setting and LBO leverage.

Achleitner et al. (2012) propose that when information asymmetries are extensive, covenants can be used to effectively guard against lack of information with maintenance tests providing early warnings if risks are escalating. Smith and Warner (1979) show that when circumstances are complicated and opaque, stronger covenants reduce transaction costs, or contracting costs, as less time on information gathering and processing as well as negotiation is needed on the part of lenders. Demerjian (2017) empirically finds that ex ante uncertainty is associated with stronger covenants. But how does information asymmetry vary with leverage? On the one hand, we believe that higher debt quantum, all else equal, incentivise providers to conduct more thorough due diligence and thereby reduce information asymmetries. As a consequence, the need for highly restrictive covenants is lessened. On the other hand, the more leverage a sponsor seeks to raise, the more valuable covenants become to debt investors precisely because they substitute for costly due diligence and monitoring, i.e. what we just argued is increasing in leverage.

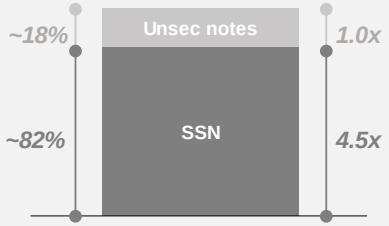
Achleitner et al. (2012) posit that increasing financial risk, and risk of agency problems, associated with higher leverage is another driver of the covenant setting. Moreover, at high leverage levels certain agency problems start to occur between debt- and equity-holders. Bradley and Roberts (2015) suggest that covenants are largely a function of the need to rein in such agency problems and coin the term

Agency Theory of Covenants (ATC). Consensus in the literature seems to be that covenants are effective in limiting agency problems between debt- and equity-holders at high leverage levels, particularly overinvestment problems. Chava and Roberts (2008) finds that once a covenant is breached, Capex is reduced significantly relative to its pre-violation level. As a side note, Gilje (2016) surprisingly finds that firms near financial distress reduce risk-taking, as opposed to increase risk-taking as predicted by agency theory. The author does, however, find that such risk reduction is more pronounced for firms with tighter covenants. In line with the information asymmetry argument, the financial risk and associated risk of agency problems seem to suggest that giving lenders more comfort in terms of stronger covenants allow sponsors to take out more funding.

Appendix D: Menu of debt structure alternatives

Hypothetical proposed menu of alternative debt structures

Aggressive debt structures

	1 Senior Bank Club			2 Distributed CovLite TLB			3 Senior Secured notes		
Leverage	4.0x			5.0x			5.5x		
Structure									
Indicative Terms	TLA	TLB	RCF	TLB	2nd lien	RCF	Secured Notes	Unsecured Notes	SSRCF
Maturity	6 years	7 years	6 years	7 years	8 years	6 years	5 years	5 years	4 years
Indicative pricing (IBOR+)	+350 bps	+400 bps	+350 bps	+425 bps	+700 bps	+350 bps	+600 bps	+800 bps	+400 bps
OID	-	-	-	99.5	99	-	100	100	-
Floor	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non-call provision	-	-	-	Soft call 6m @ 101	-	-	Non-call 2 years	Non-call 2 years	-
Ranking	Senior secured	Senior secured	Senior secured	Senior secured first lien	Senior secured second lien	Senior secured first lien	Senior secured	Senior unsecured	Super senior
Rating assumption	Unrated			TLB: B / B2 / B			Senior secured note; B / B2 / B		
Covenant	Leverage and ICR with headroom to be agreed			Standard international covenant lite incurrence based			Standard international HY bond package incl. incurrence covenants		
Min. equity	RCF and Term Loans to benefit, among others, from first ranking security over material assets and share pledges			RCF and Term Loans to benefit, among others, from first ranking security over material assets and share pledges			SSRCF and Sec. Notes to benefit from first ranking security over material assets and share pledges		

Appendix E: Definition of variables and overview

Definition of variables

Since our final data set contains 38 variables, this section aims to provide an overview to these variables and some reasoning to why they are included. Generally, our statistical analyses will include a set of variables of interest which will be the focus of the analysis and interpretation. A set of control variables will also be included to control for external factors and potential lurking variables that could affect the interpretation of the tested relationships. Each group is presented below.

Variables of Interest

The variables of interest are used to test the hypotheses set forth in Section 4.2 and 4.3 and will therefore be the focus of analysis. We divide our variables of interest into three categories: 1) debt-specific variables, 2) transaction-specific variables, and 3) return-specific variables.

Debt-specific variables

We include various variables specific to the structure and characteristics of facilities in the debt package. These include the proportion of the total debt package that is 1) financed by different debt instruments, 2) unsecured, 3) subordinated, 4) lower-lien pledge (defined as liens lower than first lien), 5) CovLite, and 6) syndicated. We refer to (2)-(6) collectively as debt characteristics. We calculate these proportions using facilities amounts (characterised by the above factors) relative to the total debt package. In addition, we include a set of dummies indicating whether a specific instrument or debt characteristic (same as above) is included in the debt structure. Accordingly, we are measuring both the fractional importance of various debt instruments and characteristics and also their mere presence.

The debt instruments considered include 1) TLAs, 2) TLBs, 3) TLOs, 4) bonds, and 5) mezzanine. As discussed in the literature review, the importance of debt instrument type largely comes down to who buys them and, as indicated in Section 2.2.2, TLAs are mainly placed with banks while institutional investors are the largest takers of TLBs and TLOs as well as bonds. As such, TLAs proxy for a defensive debt structure while TLBs, other term loans, and bonds proxy for an aggressive structure. Similarly, mezzanine capital, owing to its deeply subordinated nature, is also proxying an aggressive structure.

We are including direct measures of contractual seniority as well as security and security ranking. We proxy covenant strength with a CovLite measure, which as discussed in Section 2.2.3.4 is an accessible and encompassing classification of the covenant suite. The syndicated variable is included as an additional measure of distribution to complement debt instrument type. Note that we are defining the debt characteristics in terms of their aggressive values, e.g. unsecured as opposed to secured, subordinated as opposed to senior, lower lien as opposed to first lien, and so on. The reason, as laid out in Section 2.2.3, is that virtually all LBO financing packages include senior secured (first lien) debt. As such, what deviates from the "basis" is whether any junior pieces are added on top of the debt structure. This becomes particularly important when calculating the dummies since a dummy

indicating the presence of a senior debt piece would practically be one in all debt structures in the sample.

Target-specific variables

We include a numeric scale indicating the target's rating where credit quality is increasing in the scale. Further, logged values of target revenue and EBITDA margin are included. In Section 6.1, these variables are used as part of the main explanatory variables to predict the aggressiveness of the debt structure, as we hypothesise that these provide a good proxy for the target's sensitivity to agency costs.

Transaction-specific variables

Transaction-specific variables include variables that measure transaction pricing and deal leverage. We use (EV/EBITDA) as a measure of transaction pricing, where EBITDA is from last fiscal year before the transaction. As discussed in Section 2.1.3, this is the most adopted measure of buyout pricing in the industry. We use logged values to control for extreme outliers. The measure is obtained from Mergermarket for all cases.

We use two measures of leverage in our analysis. First, we use D/EBITDA at investment entry which is the most widely adopted measure of deal leverage by industry practitioners. Second, we use total buyout debt to enterprise value (D/EV). There are notable differences between the two measures of leverage. According to Engel et al. (2012, p. 468) "*D/EBITDA is often seen as the most important leverage parameter in LBOs as it mirrors the debt redemption capacity of a buyout target*". This means that D/EBITDA is a better measure of the burden of debt on the operations of the company. On the other hand, D/EV better represent the leverage effect on equity returns as it replicates the formula for financial gearing. The amplifying effect from leverage on equity returns should therefore be captured by D/EV. We use logged values of D/EBITDA to control for extreme observations. Since D/EV is a normalized measure that is bound by 0 and 1, we do not worry about outliers for this variable.

Notably, the measure of debt going into the calculation of the above ratios will be the sum of the notional values of the individual drawn instruments. Needless to say, a large part of the reason for sampling the individual facilities financing a leveraged buyout was the need for an independent calculation of aggregate debt upon acquisition since such a measure is rarely available. In this measure, undrawn debt such as revolving credit facilities or capex lines, will not be included (see for instance the calculation of debt in the TDC 2005 LBO in Section 3.2), the reason being that if such debt was drawn (and included), it would increase enterprise value by unlocking further cash flows to be discounted.

Return-specific variables

Private equity fund-level returns are used as a proxy for transaction-level returns from a specific buyout, measured by the funds IRR. The IRR measures the private equity fund's rate of return on its equity investment on an annual basis. Further, it is calculated based on the timing of cash flows to equity holders, which makes it preferable to other measures often applied by the industry. However, it

does not adjust for financial risk which means that the measure is not a risk-adjusted measure of return. In line with traditional capital structure theory and in accordance with the capital asset pricing model, we should therefore expect a positive relationship between financial risk and return. However, since it is notoriously hard to measure the riskiness of private equity assets since they are not marked to market, we deem the IRR the most appropriate, and most available, measure of private equity returns.

Control Variables

We include a set of control variables to control for potential relationships between the error term and lurking variables. We separate these control variables into 1) target-specific variables, 2) sponsor-specific variables, and 3) macroeconomic variables.

Target-specific variables

Except for section 6.1, target specific variables will work as control variables, controlling for any effects that may be associated with target characteristics. These include logged values of revenue and EBITDA margin as well as country and industry controls.

Sponsor-specific variables

Sponsors-specific variables are included to control for any sponsor characteristics that may otherwise affect the result. For example, it could be that sponsor characteristics, such as size and experience, play a role in how much leverage can be obtained in a buyout transaction. We include private equity experience measured as years since inception of the private equity firm from the year of the buyout, fund size, the fund number since the first fund was raised, and a variable indicating the type of buyout (e.g. regular buyout, public-to-private or secondary buyout). These variables are mainly included to control for any characteristics of the deal that could affect debt capacity and pricing of the buyout.

Credit and valuation conditions

Credit and valuation conditions are included to control for variations in capital markets that may affect the dependent variable in our statistical analyses. We include the high yield spread, measured as the local asset swap spread, to control for variations in credit conditions across time. The U.S. asset swap spread is used for North American targets while the Euro asset swap spread is used for European targets. The Fed tightening index is also included to control for variations in the tightness of the credit market. Finally, the S&P 500 average EV/EBITDA multiples are included to control for public market valuations that may capture investor sentiment and the economy-wide discount rate. All variables pertaining to credit and valuation conditions are on a monthly basis.

Macroeconomic variables

Macroeconomic variables are included to control for variation in macroeconomic conditions not captured by the credit and valuation variables. We include the yield on the 10-year treasury bond, the 3-month LIBOR rate, the local inflation rate and the local GDP growth rate (YOY). The first three variables are monthly data, while GDP growth is on a quarterly basis.

Variables of Interest	Definition	Source
1. Debt/Loan-specific variables		
TLA	The proportion of the total debt[3] package that is a term loan A or a dummy variable indicating the presence of term loan A in the total debt package.	LPC DealScan
TLB	The proportion of the total debt[3] package that is a term loan B or a dummy variable indicating the presence of term loan B in the total debt package.	LPC DealScan
TLO	The proportion of the total debt[3] package that is a term loan other than A or B or a dummy variable indicating the presence of term loan not classified as A or B in the total debt package.	LPC DealScan
Mezzanine	The proportion of the total debt[3] package that is a mezzanine facility or a dummy variable indicating the presence of mezzanine facility in the total debt package.	LPC DealScan
Bond	The proportion of the total debt[3] package that are bond or a dummy variable indicating the presence of bonds in the total debt package	LPC DealScan / S&P's LCD
Unsecured	The proportion of the total debt package[4] that is unsecured or a dummy variable indicating the presence of an instrument with unsecured characteristics.	LPC DealScan
Lower liens	The proportion of the total debt package[3] that contains a facility with a lower lien than first lien lenders or a dummy variable indicating the presence of an instrument with lower lien characteristics.	LPC DealScan / S&P's LCD
Subordinated	The proportion of the total debt package[3] that is subordinated or a dummy variable indicating the presence of an instrument with subordinated characteristics.	LPC DealScan
CovLite	The proportion of the total debt package[3] that is classified as covenant lite or a dummy variable indicating the presence of an instrument with covenant lite characteristics.	S&P's LCD
Syndicated	The proportion of the total debt[3] package that is syndicated.	LPC DealScan
2. Transaction-specific variables		
EV/EBITDA (log)	The log of the enterprise value/EBITDA transaction multiple.	Mergermarket
Debt/EBITDA (log)	The log of the total debt package[3]/EBITDA deal leverage multiple. Debt is calculated as the total debt package obtained from LPC DealScan. EBITDA is for the last fiscal year before the buyout, obtained from Mergermarket.	Mergermarket / LPC DealScan
Debt/EV	The total debt as proportion of enterprise value at time of transaction. Total debt is calculated as the total debt package[3] obtained from LPC DealScan. Enterprise value is obtained from Mergermarket.	Mergermarket / LPC DealScan
3. Return-specific variables		
Fund IRR	The internal rate of return for the acquiring private equity fund	Preqin

Control Variables	Definition	Source
1. Target-specific variables		
Target rating	A dummy variable that takes the value 1 if the target firm has a credit rating.	S&P's LCD
Target revenue (log)	Revenue of target firm for the last year available before the buyout. Logged values.	Mergermarket

[4] Total debt package excludes contingent debt. Contingent debt includes revolving credit facility, acquisition facility, capex facility, earn-out facility etc.

EBITDA margin (log)	EBITDA margin of the target firm for the last year available before the buyout. Logged values.	Mergermarket
Country effects	Country of incorporation of the target firm. There are 25 different countries in total.	Mergermarket
Industry effects	Industry that the target firm operates in. There are 25 different industries in total.	Mergermarket
2. Sponsor-specific control variables		
Entry deal type	Type of transaction through which the financial sponsor acquired the target firm. Can either be a buyout (Buyout), a public-to-private (P2P), or a secondary buyout (SBO).	Preqin
Exit deal type	Type of transaction through which the financial sponsor eventually exited the target firm. Can be either an initial public offering (IPO), a secondary buyout (SBO), a trade sale (TS), or a distressed exit where the target firm enters bankruptcy or the sponsor's equity stake is transferred to debt holders (Distressed).	Preqin
PE experience (years)	Private equity firm's experience in number of years. Calculated as the number of years since the inception of the involved sponsor from year of the transaction.	Preqin
PE experience (fund number)	Number of the fund involved in the buyout, counted as number of funds raised since inception of private equity firm.	Preqin
PE experience (log fund size USD)	Size of the private equity fund involved in the buyout in USDm.	Preqin
3. Macroeconomic variables		
Local HY spread	The spread that needs to be added to the swap curve in order for present value of the bond's cash flows to equal the current price of the bond for each point on the yield curve. Monthly data.	Bloomberg (H0A0 – USD assetswapspread; HE00 – EUR assetswapspread)
Inflation	Year-over-year inflation rate for the month of the buyout. The U.S. inflation rate is used for North American targets while the Euro area inflation rate is used for European targets. Monthly data.	Bloomberg (CPI YOY Index; ECCPEMUY Index)
Local GDP growth	The year-over-year GDP growth rate for the quarter of the buyout. The U.S. GDP growth rate is used for North American targets while the Euro area GDP growth rate is used for European targets. Quarterly data.	Bloomberg (GDP CYOY Index; EUGNEMUY Index)
UST 10y yield	The 10-year U.S. treasury yield to maturity. Monthly data.	Bloomberg (USGG10YR Index)
USD 3m Libor	The USD 3m Libor rate. Monthly data.	Bloomberg (US0003M Index)
Fed tightening index	Fed tightening index. Defined as net % of domestic U.S. respondents tightening loan standards for commercial and industrial loans for large and medium firms. Quarterly data.	Bloomberg (SLDETIGT Index)
Public market valuation	The enterprise value to trailing twelve-month EBITDA for the aggregate S&P 500.	Bloomberg (SPX Index - CURRENT_EV_TO_T12M_EBITDA)

Appendix F: Preview of data set

Preview of data set showing the variables for each case (buyout)

	Target specific							Leverage and pricing			Sponsor and deal specific						Debt instruments					Debt characteristics						Credit and valuation			Macroeconomic variables			
Year	Target country	Target sector	Target rating	Target revenue (USDm)	Target EBITDA	EBITDA margin	Target EV	Debt/EV	Debt/ EBITDA	EV/ EBITDA	Entry deal type	Exit type	Fund IRR	Fund Size	PE experience	Fund No	TLA (proportion)	TLB (proportion)	TLO (proportion)	Mezzanine (proportion)	Bond (proportion)	Unsecured (porportion)	Senior (proportion)	Subordinated (proportion)	Lower lien (proportion)	CovLite (proportion)	Syndicated (proportion)	HY spread (bp)	SP 500 EV/EBITDA	Fed TI	Inflation (%)	GDP growth (%)	UST 10-year (%)	USD Libor (%)
2013	USA	Computer so	9	2'172	769	35%	6'535	84.1%	7.2x	8.5x	P2P	SBO	NA	601	29	6	0.0%	70.5%	0.0%	0.0%	29.5%	29.5%	100.0%	0.0%	29.5%	70.5%	100.0%	416	9.9x	-18.1	1.4	1.3	2.1282	0.27525
2013	Germany	Chemicals ar	8	170	92	54%	739	57.8%	4.6x	8.1x	Buyout	SBO	14.9%	5'280	37	9	0.0%	80.1%	19.9%	0.0%	0.0%	0.0%	100.0%	0.0%	19.9%	100.0%	100.0%	384	9.8x	-18.1	1.2	-0.4	1.6717	0.2731
2013	USA	Telecommun	NA	80	16	20%	235	55.2%	8.0x	14.4x	P2P	TS	17.0%	1'800	8	3	0.0%	71.2%	28.8%	0.0%	0.0%	0.0%	100.0%	0.0%	28.8%	0.0%	100.0%	413	9.8x	-18.1	1.1	1.3	1.6717	0.2731
2013	Germany	Computer so	9	934	399	43%	4'055	70.1%	7.1x	10.3x	Buyout	TS	20.5%	14'156	32	5	0.0%	59.8%	0.0%	0.0%	40.2%	24.1%	75.9%	24.1%	40.2%	0.0%	100.0%	384	9.8x	-18.1	1.2	-0.4	1.6717	0.2731
2013	France	Consumer	8	462	87	19%	850	45.8%	4.5x	9.9x	Buyout	TS	5.6%	2'000	37	NA	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	384	9.8x	-18.1	1.2	-0.4	1.6717	0.2731
2013	Denmark	Transportatio	NA	555	55	10%	520	55.3%	5.2x	9.5x	SBO	TS	16.0%	4'609	24	8	40.0%	60.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	384	9.8x	-18.1	1.2	-0.4	1.6717	0.2731
2013	United Kingc	Medical	NA	228	25	11%	279	50.6%	5.7x	11.3x	SBO	TS	14.4%	6'367	29	4	30.0%	70.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	384	9.8x	-18.1	1.2	-0.4	1.6717	0.2731
2013	Germany	Consumer	NA	668	47	7%	108	12.1%	0.3x	2.4x	Buyout	NA	NA	385	11	2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	428	9.7x	-19.1	1.7	-1.2	1.8486	0.2826
2013	USA	Industrial pro	8	2'355	437	19%	3'850	77.9%	6.9x	8.8x	P2P	IPO	21.3%	9'000	37	NA	0.0%	80.8%	0.0%	0.0%	19.2%	19.2%	100.0%	0.0%	19.2%	80.8%	100.0%	438	9.7x	-19.1	1.5	1.6	1.8486	0.2826
2013	USA	Consumer	8	742	64	9%	549	64.7%	5.5x	8.6x	P2P	NA	NA	1'000	2	1	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	438	9.7x	-19.1	1.5	1.6	1.8486	0.2826
2013	USA	Consumer	15	11'649	1525	13%	27'131	53.7%	9.6x	17.8x	P2P	TS	NA	1'000	9	3	0.0%	78.7%	0.0%	0.0%	21.3%	0.0%	100.0%	0.0%	21.3%	65.2%	100.0%	453	9.4x	-19.1	2	1.6	1.8756	0.2871
2013	United Kingc	Consumer	NA	140	33	24%	474	42.9%	6.2x	14.8x	NA	NA	NA	NA	NA	NA	30.8%	69.2%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	428	9.4x	-19.1	1.9	-1.2	1.8756	0.2871
2013	USA	Computer	10	56'940	4156	7%	20'169	42.6%	2.1x	4.9x	P2P	IPO	19.7%	9'400	14	3	0.0%	82.5%	0.0%	0.0%	17.5%	0.0%	100.0%	0.0%	17.5%	82.5%	100.0%	453	9.4x	-19.1	2	1.6	1.8756	0.2871
2013	Italy	Internet	8	386	192	50%	1'488	70.6%	5.5x	7.8x	SBO	IPO	20.5%	14'597	32	8	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	70.5%	29.5%	100.0%	0.0%	100.0%	429	9.4x	-19.1	2	-1.2	1.9849	0.298
2012	USA	Financial Ser	8	384	56	15%	630	55.4%	6.2x	11.2x	P2P	SBO	13.7%	1'100	25	NA	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	100.0%	491	9.0x	-7.4	1.7	1.5	1.7574	0.306
2012	USA	Services	NA	407	45	11%	502	54.7%	6.2x	11.3x	NA	NA	NA	NA	NA	NA	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	491	9.0x	-7.4	1.7	1.5	1.7574	0.306
2012	United Kingc	Consumer	NA	1'108	92	8%	1'554	45.8%	7.8x	16.4x	Buyout	IPO	27.1%	5'000	34	8	27.2%	72.8%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	444	9.0x	-7.4	2.2	-1.1	1.7574	0.306
2012	USA	Financial Ser	NA	NA	38	NA	325	69.2%	5.9x	8.5x	SBO	NA	14.0%	2'600	26	14	0.0%	77.8%	22.2%	0.0%	0.0%	0.0%	100.0%	0.0%	22.2%	0.0%	100.0%	518	9.0x	-7.4	1.8	1.5	1.6156	0.3105
2012	USA	Internet	8	2'292	327	14%	2'398	67.1%	4.9x	7.3x	Buyout	NA	NA	NA	22	NA	0.0%	50.3%	0.0%	0.0%	49.7%	0.0%	100.0%	0.0%	49.7%	50.3%	100.0%	518	9.0x	-7.4	1.8	1.5	1.6156	0.3105
2012	United Kingc	Real Estate	6	257	223	87%	5'091	17.0%	3.9x	23.0x	SBO	NA	NA	6'992	18	3	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	0.0%	100.0%	100.0%	0.0%	100.0%	473	9.0x	-7.4	2.2	-1.1	1.6156	0.3105
2012	Germany	Computer so	8	1'296	104	8%	991	81.2%	7.8x	9.7x	SBO	TS	22.2%	2'061	21	12	0.0%	67.1%	0.0%	0.0%	32.9%	32.9%	100.0%	0.0%	32.9%	67.1%	100.0%	473	9.0x	-7.4	2.2	-1.1	1.6156	0.3105
2012	USA	Internet	8	400	112	28%	1'310	74.0%	8.6x	11.7x	P2P	SBO	11.0%	14'386	27	16	0.0%	69.1%	0.0%	0.0%	30.9%	30.9%	100.0%	0.0%	30.9%	69.1%	100.0%	516	9.0x	-7.4	2.2	1.5	1.6901	0.31275
2012	Italy	Consumer	NA	290	44	15%	347	41.8%	3.3x	7.8x	P2P	TS	12.8%	3'467	40	5	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	495	9.0x	-7.4	2.5	-1.1	1.6901	0.31275
2012	Germany	Consumer	8	4'431	259	6%	2'123	52.8%	4.3x	8.2x	P2P	SBO	19.3%	11'016	28	28	23.5%	52.9%	0.0%	23.5%	0.0%	23.5%	76.5%	23.5%	23.5%	0.0%	76.5%	495	9.0x	-7.4	2.5	-1.1	1.6901	0.31275
2012	United Kingc	Energy	NA	593	145	24%	1'293	27.0%	2.4x	8.6x	Buyout	NA	NA	4'000	36	NA	40.9%	59.1%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	534	9.1x	-7.6	2.6	-0.9	1.6335	0.3585
2012	Netherlands	Consumer	NA	3'445	193	6%	1'391	57.3%	4.1x	7.2x	P2P	TS	20.0%	8'488	28	26	27.5%	72.5%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	534	9.1x	-7.6	2.6	-0.9	1.6335	0.3585
2012	USA	Medical	8	NA	71	NA	500	55.0%	3.9x	7.0x	SBO	NA	13.2%	5'020	12	3	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	523	9.1x	-7.6	2	2.5	1.6335	0.3585
2012	Canada	Industrial pro	9	1'224	126	10%	1'024	24.4%	2.0x	8.1x	P2P	SBO	13.4%	856	43	NA	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	100.0%	523	9.1x	-7.6	2	2.5	1.6335	0.3585
2012	USA	Computer se	8	341	30	9%	994	65.4%	21.9x	33.5x	P2P	TS	39.2%	1'275	32	10	0.0%	69.2%	30.8%	0.0%	0.0%	0.0%	100.0%	0.0%	30.8%	0.0%	100.0%	538	9.1x	-7.6	1.7	2.5	1.5484	0.41825
2012	USA	Chemicals ar	9	2'758	130	5%	926	70.7%	5.0x	7.1x	P2P	NA	-9.2%	8'821	29	12	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	538	9.1x	-7.6	1.7	2.5	1.5484	0.41825
2012	Germany	Manufacturing	NA	342	55	16%	623	45.0%	5.1x	11.7x	SBO	NA	14.6%	8'412	26	9	6.7%	62.8%	0.0%	30.5%	0.0%	30.5%	69.5%	30.5%	30.5%	0.0%	69.5%	553	9.1x	-7.6	2.6	-0.9	1.5484	0.41825
2012	France	Consumer	NA	208	66	32%	539	47.8%	3.9x	8.3x	Buyout	SBO	17.2%	3'062	44	4	39.0%	61.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	39.0%	593	8.9x	-7.6	2.4	-0.9	1.4679	0.4426
2012	France	Consumer	NA	1'037	97	9%	982	52.6%	5.3x	10.7x	SBO	NA	4.4%	1'907	8	3	16.7%	57.1%	0.0%	26.2%	0.0%	26.2%	73.8%	26.2%	26.2%	0.0%	100.0%	593	8.9x	-7.6	2.4	-0.9	1.4679	0.4426
2012	Germany	Industrial auto	NA	90	24	27%	1'053	31.8%	14.0x	47.7x	SBO	NA	14.9%	4'934	36	9	30.2%	69.8%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	593	8.9x	-7.6	2.4	-0.9	1.4679	0.4426
2012	United Kingc	Services	NA	246	110	45%	1'679	52.2%	8.0x	15.1x	SBO	TS	24.8%	8'900	28	7	14.2%	55.8%	0.0%	30.1%	0.0%	30.1%	69.9%	30.1%	30.1%	0.0%	69.9%	593	8.9x	-7.6	2.4	-0.9	1.4679	0.4426
2012	USA	Computer so	9	444	94	21%	1'057	65.7%	7.4x	11.2x	P2P	istressed	NA	NA	11	NA	0.0%	64.0%	0.0%	0.0%	36.0%	36.0%	100.0%	0.0%	36.0%	0.0%	100.0%	551	8.9x	-7.6	1.4	2.5	1.4679	0.4426
2012	Germany	Medical	8	860	205	24%	2'249	62.7%	6.9x	11.4x	SBO	TS	17.5%	6'017	18	13	0.0%	66.2%	0.0%	33.8%	0.0%	33.8%	66.2%	33.8%	33.8%	0.0%	66.2%	603	8.8x	-9.5	2.4	-0.8	1.6449	0.4606
2012	USA	Consumer	8	1'853	261	14%	2'690	67.8%	7.0x	10.3x	SBO	IPO	8.1%	8'100	38	6	0.0%	61.6%	0.0%	0.0%	38.4%	38.4%	100.0%	0.0%	38.4%	61.6%	100.0%	569	8.8x	-9.5	1.7	2.4	1.6449	0.4606
2012	USA	Services	9	1'249	108	9%	1'124	32.5%	3.4x	10.4x	P2P	TS	8.0%	20'300	26	12	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	0.0%	100.0%	0.0%	100.0%	607	8.3x	-9.5	1.7	2.4	1.5578	0.46685
2012	Switzerland	Consumer	NA	NA	126	NA	1'255	39.0%	3.9x	10.3x	SBO	NA	11.9%	1'100	13	4	30.2%	69.8%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	666	8.3x	-9.5	2.4	-0.8	1.5578	0.46685
2012	Belgium	Financial Ser	NA	443	38	9%	270	39.3%	2.8x	7.2x	Buyout	NA	NA	NA	7	NA	60.3%	39.7%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	666	8.3x	-9.5	2.4	-0.8	1.5578	0.46685
2012	Sweden	Construction	NA	1'566	98	6%	859	51.0%	4.5x	8.8x	Buyout	IPO	10.4%	10'707	28	20	31.9%	68.1%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	666	8.3x	-9.5	2.4	-0.8	1.5578	0.46685
2012	USA	Computer so	8	NA	45	NA	675	51.1%	7.7x	15.0x	Buyout	TS	NA	3'250	32	10	0.0%	66.7%	33.3%	0.0%	0.0%	0.0%	100.0%	0.0%	33.3%	100.0%	100.0%	607	8.3x	-9.5	1.7	2.4	1.5578	0.46685
2012	France	Consumer	NA	246	38	15%	256	47.5%	3.2x	6.7x	SBO	NA	NA	999	10	2	54.1%	23.5%	0.0%	22.4%	0.0%	22.4%	77.6%	22.4%	22.4%	0.0%	77.6%	666	8.3x	-9.5	2.4	-0.8	1.5578	0.46685
2012	USA	Consumer	8	3'462	105	3%	1'748	17.5%	2.9x	16.7x	P2P	istressed	NA	5'500	12	4	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	100.0%	607	8.3x	-9.5	1.7	2.4	1.5578	0.46685
2012	USA	Leisure	8	1'239	133	11%	1'040	58.2%	4.6x	7.8x	P2P	TS	2.6%	2'100	7	3	0.0%	50.4%	0.0%	0.0%	49.6%	49.6%	100.0%	0.0%	49.6%	0.0%	100.0%	607	8.3x	-9.5	1.7	2.4	1.5578	0.46685
2012	United Kingc	Medical	7	NA	155	NA	1'339	60.7%	5.2x	8.3x	Buyout	TS	NA	7'128	18	3	0.0%	0.0%	0.0%	0.0%	100.0%	33.3%	100.0%	0.0%	100.0%	0.0%	100.0%	604	8.8x	-9.5	2.6	-0.8	1.9137	0.46585
2012	USA	Computer so	8	185	46	25%	326	67.5%	4.8x	7.1x	P2P	SBO	38.3%	912	24	6	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	535	8.8x	-9.5	2.3	2.4	1.9137	0.46585
2012	United Kingc	Computer so	8	604	117	19%	2'251	75.3%	14.4x	19.7x	P2P	TS	18.9%	3'467	12	4	0.0%	63.1%	36.9%	0.0%	0.0%	0.0%	100.0%	0.0%	36.9%	0.0%	92.6%	562	8.9x	-6.9	2.7	-0.4	2.2088	0.46815
2012	USA	Automotive	8	451	76	17%	505	66.3%	4.4x	6.6x	SBO	TS	23.4%	4'057	20	6	0.0%	70.1%	29.9%	0.0%	0.0%	0.0%	100.0%	0.0%	29.9%	100.0%	100.0%	533	8.9x	-6.9	2.7	2.7	2.2088	0.46815
2012	United Kingc	Consumer	9	3'831	301	8%	2'273	60.6%	4.6x	7.7x	NA	NA	NA	NA	NA	NA	34.9%	65.1%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	562	8.9x	-6.9	2.7	-0.4	2.2088	0.46815
2012	Sweden	Construction	NA	2'981	249	8%	2'398	53.1%	5.1x	9.4x	SBO	IPO	20.5%	14'324	31	5	46.9%	53.1%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	574	8.7x	-6.9	2.7	-0.4	1.9705	0.48425
2012	USA	Computer se	7	1'024	338	33%	3'178	18.9%	1.8x	9.4x	SBO	IPO	20.0%	8'795	28	NA	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	0.0%	100.0%	0.0%	100.0%	533	8.7x	-6.9	2.9	2.7	1.9705	0.48425
2012	Denmark	Industrial pro	NA	183	30	16%	264	46.6%	4.1x	8.8x	SBO	NA	19.1%	2'617	9	3	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	651	8.4x	-6.9	2.7	-0.4	1.7971	0.54235
2012	United Kingc	Industrial pro	NA	155	33	21%	236	49.2%	3.5x	7.5x	Buyout	IPO	9.1%	2'800	11	3	40.0%	60.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	651	8.4x	-6.9	2.7	-0.4	1.7971	0.54235
2012	United Kingc	Computer so	NA	NA	120	NA	1'390	49.1%	5.7x	11.7x	SBO	SBO	NA	8'505	35	4	17.4%	54.7%	0.0%	27.9%	0.0%	27.9%	72.1%	27.9%	27.9%	0.0%	72.1%	651	8.4x	-6.9	2.7	-0.4	1.7971	0.54235
2012	USA	Energy	7	328	173	53%	1'050	30.0%	1.8x	6.1x	NA	NA	NA	NA	NA	NA	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	587	8.4x	-6.9	2.9	2.7	1.7971	0.54235
2011	USA	Industrial pro	9	229	53	23%	430	64.0%	5.2x	8.1x	NA	NA	NA	NA	NA	NA	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	621	8.2x	5.4	3	1.6	1.8762	0.581
2011	USA	Chemicals ar	9	957	213	22%	1'435	68.5%	4.6x	6.9x	SBO	IPO	13.0%	1'815	21	10	0.0%	51.6%	0.0%	0.0%	48.4%	0.0%	100.0%	0.0%	48.4%	51.6%	100.0%	621	8.2x	5.4	3	1.6	1.8762	0.581
2011	USA	Computer so	9	487	73	15%	823	57.7%	6.5x	11.2x	P2P	SBO	44.7%	823	31	9	0.0%	75.8%	24.2%	0.0%	0.0%	0.0%	100.0%	0.0%	24.2%	0.0%	100.0%	621	8.2x	5.4	3	1.6	1.8762	0.581
2011	United Kingc	Industrial pro	NA	801	45	6%	386	55.9%	4.8x	8.6x	SBO	NA	4.5%	4'034	26	6	40.0%	60.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	717	8.1x	5.4	3	0.5	2.068	0.52889
2011	USA	Medical	8	286	48	17%	371	55.2%	4.3x	7.8x	P2P	NA	23.0%	807	23	6	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	668	8.1x	5.4	3.4	1.6	2.068	0.52889
2011	USA	Leisure	8	978	103	10%	1'145	49.3%	5.5x	11.2x	Buyout	NA	16.0%	1'530	23	5	0.0%	66.4%	0.0%	0.0%	33.6%	33.6%	100.0%	0.0%	33.6%	0.0%	100.0%	668	8.1x	5.4	3.4	1.6	2.068	0.52889
2011	USA	Consumer	8	1'424	145	10%	1'531	50.6%	5.3x	10.6x	P2P	NA	22.0%	3'510	14	3	0.0%	67.7%	0.0%	0.0%	32.3%	32.3%	100.0%	0.0%	32.3%	67.7%	100.0%	620	8.1x	5.4	3.5	1.6	2.1133	0.42944
2011	USA	Biotechnolog	9	1'363	254	19%	3'416	59.3%	8.0x	13.5x	P2P	istressed	13.0%	13'700	24	25	0.0%	71.6%	0.0%	0.0%	28.4%	28.4%	100.0%	0.0%	28.4%	0.0%	100.0%	620	8.1x	5.4	3.5	1.6	2.1133	0.42944
2011	Israel	Computer so	8	142	21	15%	359	55.8%	9.6x	17.2x	Buyout	TS	NA	3'250	31	10	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	726	7.5x	-5.9	3.9	0.9	1.9154	0.37433
2011	USA	Internet	8	130	37	28%	429	58.3%	6.8x	11.7x	P2P	SBO	11.0%	15'950	26	16	0.0%	70.0%	30.0%	0.0%	0.0%	0.0%	100.0%	0.0%	30.0%	0.0%	100.0%	646	8.1x	-5.9	3.8	0.9	2.2234	0.32722
2011	USA	Computer se	8	1'002	268	27%	3'013	53.1%	6.0x	11.2x	P2P	TS	NA	15'114	26	16	0.0%	76.5%	0.0%	0.0%	23.5%	23.5%	100.0%	0.0%	23.5%	0.0%	100.0%	646	8.1x	-5.9	3.8	0.9	2.2234	0.32722

972 buyouts with 35 variables

Appendix G: Regression output - Drivers of debt instruments

OLS regression results – Drivers of debt instruments

	Dependent variable: Debt instrument proportion of debt package - OLS specification									
	(1) TLA	(2) TLA	(3) TLB	(4) TLB	(5) TLO	(6) TLO	(7) Mezzanine	(8) Mezzanine	(9) Bond	(10) Bond
Target specific										
Target rating[1]	0.061***	0.035***	-0.026*	0.009	-0.005	-0.005	-0.025***	-0.035***	-0.016	-0.014
	(0.011)	(0.01)	(0.014)	(0.013)	(0.008)	(0.008)	(0.004)	(0.005)	(0.01)	(0.011)
Target revenue (log)	-0.064***	-0.040***	0.018*	-0.013	-0.024***	-0.024***	-0.002	0.006**	0.073***	0.070***
	(0.007)	(0.006)	(0.01)	(0.009)	(0.007)	(0.006)	(0.003)	(0.003)	(0.007)	(0.008)
EBITDA margin (log)	-0.034***	-0.024***	0.026	0.011	-0.029***	-0.023**	0.007	0.014***	0.038***	0.031**
	(0.011)	(0.009)	(0.018)	(0.015)	(0.011)	(0.01)	(0.005)	(0.005)	(0.014)	(0.013)
Credit and valuation conditions										
Local HY spread[2] (assetswapspread)	0.0003***	0.001***	-0.0002**	-0.001***	-0.0002***	-0.00001	0.0001**	0.0002***	-0.0001	-0.0004***
	(0.00005)	(0.0001)	(0.0001)	(0.0002)	(0.00005)	(0.0001)	(0.00003)	(0.0001)	(0.00005)	(0.0001)
Fed tightening index		-0.003***		0.004**		0.001		-0.0002		-0.0004
		(0.001)		(0.002)		(0.001)		(0.001)		(0.001)
Public market valuation (sp_ev_ebitda)		0.025		0.01		0.007		0.015		-0.052**
		(0.018)		(0.033)		(0.022)		(0.009)		(0.026)
Macro economic variables										
UST 10y yield		-0.003		-0.016		0.012		0.018*		-0.018
		(0.02)		(0.034)		(0.021)		(0.01)		(0.032)
USD 3m Libor		0.024		0.012		-0.023		0.001		-0.014
		(0.019)		(0.027)		(0.021)		(0.009)		(0.022)
Local inflation[2]		0.008		-0.015		-0.011		-0.0002		0.013
		(0.013)		(0.019)		(0.013)		(0.005)		(0.016)
Local GDP growth[2]		-0.026***		0.015		0.014		-0.0003		0.002
		(0.007)		(0.012)		(0.01)		(0.004)		(0.01)
Constant	-0.155*	-0.076	0.769***	0.6	0.328***	0.028	0.252***	-0.006	-0.109	0.558
	(0.09)	(0.446)	(0.115)	(0.615)	(0.061)	(0.357)	(0.032)	(0.139)	(0.081)	(0.414)
Country controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Industry controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	963	963	963	963	963	963	963	963	963	963
R^2	0.17	0.488	0.013	0.357	0.042	0.178	0.051	0.402	0.083	0.196
Adjusted R^2	0.166	0.443	0.009	0.3	0.038	0.105	0.047	0.349	0.079	0.125

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) We use Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

Appendix H: Regression output - Drivers of debt characteristics

OlS Regression results: Drivers of debt characteristics

Panel A: Dummy OLS regression

	Dependent variable: Debt characteristic dummy - OLS specification									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Unsecured	Unsecured	Lower liens[4]	Lower liens[4]	Subordinated	Subordinated	Covlite	Covlite	Syndicated	Syndicated
Target specific										
Target rating[1]	-0.092***	-0.109***	-0.158***	-0.145***	-0.060***	-0.096***	-0.095***	-0.024*	-0.018**	-0.036***
	(0.015)	(0.018)	(0.02)	(0.022)	(0.018)	(0.018)	(0.017)	(0.013)	(0.008)	(0.009)
Target revenue (log)	0.142***	0.144***	0.114***	0.105***	0.017	0.044***	0.110***	0.078***	0.028***	0.028***
	(0.013)	(0.014)	(0.014)	(0.015)	(0.014)	(0.012)	(0.013)	(0.011)	(0.007)	(0.007)
EBITDA margin (log)	0.157***	0.161***	0.086***	0.096***	0.029	0.057***	0.084***	0.062***	0.020*	0.022**
	(0.021)	(0.021)	(0.023)	(0.024)	(0.023)	(0.019)	(0.024)	(0.019)	(0.011)	(0.011)
Credit and valuation conditions										
Local HY spread[3] (assetswapspread)	0.0002**	0.0005*	-0.0003***	0.001***	-0.0002	0.001***	-0.0002**	0.0002	-0.0001	0.0001
	(0.0001)	(0.0003)	(0.0001)	(0.0003)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Fed tightening index		-0.004*		-0.004*		0.0001		-0.006***		-0.003***
		(0.002)		(0.002)		(0.002)		(0.002)		(0.001)
Public market valuation (sp_ev_ebitda)		-0.06		0.008		0.022		-0.033		0.014
		(0.047)		(0.053)		(0.038)		(0.04)		(0.022)
Macro economic variables										
UST 10y yield		0.098**		0.098*		0.084**		-0.013		-0.027
		(0.05)		(0.056)		(0.041)		(0.04)		(0.029)
USD 3m Libor		0.021		0.022		0.079*		0.03		0.019
		(0.04)		(0.049)		(0.043)		(0.027)		(0.015)
Local inflation[3]		0.002		-0.017		-0.008		-0.049**		-0.002
		(0.028)		(0.029)		(0.024)		(0.021)		(0.011)
Local GDP growth[3]		-0.005		0.043**		-0.016		-0.02		0.018**
		(0.019)		(0.019)		(0.017)		(0.015)		(0.008)
Constant	0.345**	-0.009	1.510***	-0.29	0.783***	-0.402	0.580***	0.2	0.989***	1.115***
	(0.135)	(0.693)	(0.177)	(0.895)	(0.156)	(0.631)	(0.152)	(0.581)	(0.06)	(0.334)
Country controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Industry controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	972	972	972	972	972	972	972	972	972	972
R^2	0.121	0.225	0.112	0.258	0.017	0.429	0.084	0.466	0.023	0.179
Adjusted R^2	0.118	0.157	0.108	0.193	0.013	0.379	0.08	0.42	0.019	0.107

Panel B: Proportions of debt package OLS regression

	Dependent variable: Debt characteristic proportion of debt package - OLS regression									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Unsecured	Unsecured	Lower liens[2]	Lower liens[2]	Subordinated	Subordinated	Covlite	Covlite	Syndicated	Syndicated
Target specific										
Target rating[1]	-0.032***	-0.033***	-0.050***	-0.051***	-0.020***	-0.029***	-0.088***	-0.024**	-0.012	-0.032***
	(0.007)	(0.008)	(0.01)	(0.011)	(0.006)	(0.006)	(0.014)	(0.01)	(0.008)	(0.009)
Target revenue (log)	0.047***	0.045***	0.059***	0.057***	0.004	0.009**	0.081***	0.052***	0.024***	0.025***
	(0.006)	(0.005)	(0.007)	(0.008)	(0.004)	(0.004)	(0.011)	(0.009)	(0.008)	(0.008)
EBITDA margin (log)	0.056***	0.050***	0.029*	0.028*	0.017**	0.020***	0.064***	0.040**	0.017	0.019
	(0.01)	(0.009)	(0.015)	(0.014)	(0.008)	(0.006)	(0.021)	(0.016)	(0.011)	(0.012)
Credit and valuation conditions										
Local HY spread[2] (assetswapspread)	0.0001*	0.00001	-0.0001	-0.0001	-0.00003	0.0001*	-0.0002***	0.0002	-0.0001	0.0001
	(0.00004)	(0.0001)	(0.0001)	(0.0002)	(0.00003)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Fed tightening index		-0.001		-0.001		0.0001		-0.005***		-0.003**
		(0.001)		(0.001)		(0.001)		(0.002)		(0.001)
Public market valuation (sp_ev_ebitda)		-0.037**		-0.031		0.007		-0.023		0.012
		(0.019)		(0.028)		(0.012)		(0.034)		(0.023)
Macro economic variables										
UST 10y yield		0.045**		0.028		0.013		-0.01		-0.033
		(0.018)		(0.032)		(0.012)		(0.033)		(0.03)
USD 3m Libor		-0.016		-0.035		0.008		0.01		0.01
		(0.015)		(0.024)		(0.013)		(0.023)		(0.017)
Local inflation[2]		0.009		0.023		0.006		-0.028*		-0.006
		(0.014)		(0.018)		(0.008)		(0.017)		(0.012)
Local GDP growth[2]		0.001		0.015		-0.010*		-0.01		0.026***
		(0.009)		(0.011)		(0.005)		(0.013)		(0.008)
Constant	0.132**	0.309	0.363***	0.508	0.249***	0.028	0.626***	0.235	0.946***	1.181***
	(0.058)	(0.239)	(0.088)	(0.461)	(0.052)	(0.168)	(0.125)	(0.497)	(0.063)	(0.346)
Country controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Industry controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	963	963	963	963	963	963	972	972	963	963
R^2	0.09	0.247	0.062	0.181	0.022	0.35	0.075	0.474	0.015	0.176
Adjusted R^2	0.087	0.181	0.058	0.108	0.018	0.293	0.071	0.429	0.011	0.104

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) We use Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

Appendix I: Regression output - Debt instruments' impact on leverage

OLS regression results: Using debt instruments' proportions of total debt

	Dependent variable: Leverage ratios									
	(1) D/EBITDA	(2) D/EBITDA	(3) D/EBITDA	(4) D/EBITDA	(5) D/EBITDA	(6) D/EV	(7) D/EV	(8) D/EV	(9) D/EV	(10) D/EV
Debt instrument (proportions)										
TLB	0.292***	-0.087	0.276***	0.027	-0.066	3.706	-4.559	1.48	-0.385	-3.439
	(0.097)	(0.109)	(0.096)	(0.105)	(0.115)	(3.044)	(3.583)	(3.147)	(3.57)	(3.964)
TLO	0.463***	0.117	0.388***	0.141	0.054	11.771**	3.263	10.129**	8.983*	5.076
	(0.15)	(0.138)	(0.148)	(0.15)	(0.141)	(4.752)	(4.766)	(4.757)	(5.299)	(5.266)
Mezzanine	0.602*	0.122	0.447	0.457	0.27	20.667*	12.858	15.15	16.773	10.76
	(0.308)	(0.282)	(0.306)	(0.338)	(0.317)	(12.05)	(11.843)	(12.114)	(12.553)	(12.392)
Bond	0.346***	0.042	0.425***	0.174	0.153	17.286***	10.053***	14.553***	11.381***	10.123**
	(0.104)	(0.113)	(0.107)	(0.115)	(0.119)	(3.384)	(3.703)	(3.607)	(3.946)	(4.09)
Target specific										
Target rating[1]			-0.129***	-0.027	0.003			-2.273***	-1.241	-0.759
			(0.028)	(0.028)	(0.028)			(0.762)	(0.819)	(0.786)
Target revenue (log)			-0.080***	-0.160***	-0.163***			1.057	0.843	0.878
			(0.019)	(0.02)	(0.02)			(0.651)	(0.685)	(0.683)
EBITDA margin (log)			-0.113***	-0.201***	-0.215***			1.951*	1.337	1.654
			(0.031)	(0.032)	(0.031)			(1.028)	(1.047)	(1.016)
Deal and PE-characteristics										
P2P (dummy)				0.128***	0.100**				0.055	0.529
				(0.04)	(0.04)				(1.378)	(1.414)
SBO (dummy)				0.054	0.03				-2.157	-2.298
				(0.04)	(0.041)				(1.392)	(1.409)
PE experience (years)				0.0001	-0.001				-0.004	-0.024
				(0.002)	(0.002)				(0.057)	(0.056)
PE experience (fund number)				0.003	0.001				-0.018	-0.139
				(0.003)	(0.003)				(0.128)	(0.134)
PE experience (log fund size USD)				0.121***	0.104***				-0.124	-0.232
				(0.021)	(0.02)				(0.691)	(0.696)
Credit and valuation conditions										
Local HY spread[2] (assetswapspread)				-0.001***	0.0002				-0.006	0.014
				(0.0002)	(0.0003)				(0.007)	(0.012)
Fed tightening index				-0.001	-0.001				-0.165***	-0.170*
				(0.001)	(0.003)				(0.051)	(0.101)
Public market valuation (sp_ev_ebitda)				-0.02	-0.031				-0.668	-0.734
				(0.014)	(0.056)				(0.476)	(2.013)
Macro economic variables										
UST 10y yield				-0.134***	-0.004				-1.702*	-0.367
				(0.03)	(0.054)				(1.022)	(2.083)
USD 3m Libor				0.073***	0.099*				1.585**	0.881
				(0.02)	(0.054)				(0.688)	(1.94)
Local inflation[2]				-0.02	-0.035				0.009	-0.852
				(0.019)	(0.03)				(0.649)	(1.013)
Local GDP growth[2]				-0.021	0.007				0.026	-0.332
				(0.016)	(0.021)				(0.565)	(0.823)
Constant	1.502***	1.304***	2.875***	2.419***	0.538	49.482***	31.274***	67.415***	73.873***	47.032
	(0.087)	(0.435)	(0.266)	(0.339)	(0.94)	(2.692)	(11.526)	(7.355)	(11.389)	(34.189)
Country controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Industry controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Year controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Observations	963	963	963	900	900	931	931	931	871	871
R^2	0.022	0.276	0.105	0.243	0.369	0.049	0.192	0.061	0.103	0.207
Adjusted R^2	0.018	0.218	0.099	0.226	0.302	0.045	0.124	0.053	0.083	0.118

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) We use Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

Appendix J: Regression output – Debt characteristics' impact on leverage

OLS regression results: Using debt characteristics' proportions of total debt

	Dependent variable: Leverage ratios									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	D/EBITDA	D/EBITDA	D/EBITDA	D/EBITDA	D/EBITDA	D/EV	D/EV	D/EV	D/EV	D/EV
Debt characteristic (proportions)										
Unsecured	0.068	0.083	0.221	0.157	0.236*	6.396	7.267	6.034	5.206	7.092
	(0.123)	(0.12)	(0.135)	(0.135)	(0.13)	(4.807)	(4.552)	(5)	(4.858)	(4.734)
Lower liens[2]	0.161**	0.083	0.190**	0.154**	0.166**	13.107***	12.080***	12.834***	12.977***	13.092***
	(0.079)	(0.079)	(0.076)	(0.076)	(0.076)	(2.586)	(2.55)	(2.61)	(2.746)	(2.664)
Subordinated	0.419**	0.313*	0.299	0.373*	0.274	10.626	8.758	8.61	7.081	7.707
	(0.178)	(0.187)	(0.183)	(0.2)	(0.198)	(7.521)	(7.503)	(7.539)	(8.054)	(7.814)
Covlite	0.316***	0.117**	0.338***	0.254***	0.187***	5.932***	4.443**	5.319***	6.321***	4.709**
	(0.047)	(0.055)	(0.047)	(0.049)	(0.053)	(1.544)	(1.931)	(1.614)	(1.723)	(1.94)
Syndicated	-0.041	0.139	0.017	0.114	0.213***	6.221**	8.296***	6.261***	5.916**	8.354***
	(0.087)	(0.09)	(0.078)	(0.072)	(0.078)	(2.428)	(2.509)	(2.418)	(2.549)	(2.644)
Target specific										
Target rating			-0.102***	-0.039	-0.014			-1.553**	-0.812	-0.401
			(0.023)	(0.024)	(0.025)			(0.645)	(0.701)	(0.744)
Target revenue (log)			-0.112***	-0.181***	-0.180***			0.033	-0.167	0.005
			(0.019)	(0.019)	(0.019)			(0.624)	(0.65)	(0.667)
EBITDA margin (log)			-0.133***	-0.211***	-0.225***			1.19	0.849	1.192
			(0.031)	(0.031)	(0.03)			(0.997)	(1.008)	(1.022)
Deal and PE-characteristics										
P2P (dummy)				0.103***	0.082**				-0.811	-0.083
				(0.039)	(0.04)				(1.358)	(1.385)
SBO (dummy)				0.044	0.007				-2.609*	-3.531**
				(0.038)	(0.04)				(1.35)	(1.409)
PE experience (years)				0.00004	-0.001				0.005	-0.026
				(0.002)	(0.002)				(0.056)	(0.056)
PE experience (fund number)				0.003	0.002				-0.037	-0.176
				(0.003)	(0.003)				(0.123)	(0.131)
PE experience (log fund size USD)				0.119***	0.103***				-0.269	-0.29
				(0.02)	(0.019)				(0.692)	(0.682)
Credit and valuation conditions										
Local HY spread[3] (assetswapspread)				-0.001***	0.0002				-0.002	0.013
				(0.0002)	(0.0003)				(0.007)	(0.011)
Fed tightening index				-0.001	0.001				-0.172***	-0.11
				(0.001)	(0.003)				(0.052)	(0.099)
Public market valuation (sp_ev_ebitda)				-0.032**	-0.005				-0.863*	-0.442
				(0.014)	(0.053)				(0.485)	(1.95)
Macro economic variables										
UST 10y yield				-0.082***	-0.004				-0.486	-0.681
				(0.029)	(0.052)				(1.006)	(2.007)
USD 3m Libor				0.068***	0.094*				1.760***	0.952
				(0.019)	(0.052)				(0.671)	(1.884)
Local inflation[3]				-0.034*	-0.02				-0.514	-0.798
				(0.018)	(0.031)				(0.626)	(1.008)
Local GDP growth[3]				-0.027*	0.01				-0.48	-0.613
				(0.015)	(0.021)				(0.552)	(0.794)
Constant	1.694***	1.138***	2.919***	2.461***	0.183	44.732***	21.407*	60.016***	67.825***	39.347
	(0.084)	(0.415)	(0.212)	(0.302)	(0.895)	(2.377)	(11.179)	(6.021)	(10.637)	(34.613)
Country controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Industry controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Year controls	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Observations	963	963	963	900	900	931	931	931	871	871
R^2	0.085	0.285	0.166	0.287	0.401	0.082	0.218	0.092	0.135	0.235
Adjusted R^2	0.08	0.226	0.158	0.27	0.335	0.077	0.15	0.083	0.114	0.147

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) We use Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

Appendix K: Regression output – Leverage's impact on returns

OLS regression results: Leverage's impact on returns using D/EBITDA

	Dependent variable: Fund returns				
	(1)	(2)	(3)	(4)	(5)
	Fund IRR	Fund IRR	Fund IRR	Fund IRR	Fund IRR
Leverage variables					
Log D/EBITDA	0.011	0.019**			
	(0.007)	(0.009)			
D/EBITDA			0.003	0.003	
			(0.003)	(0.004)	
(D/EBITDA)^2			-0.0001	-0.00004	
			(0.0002)	(0.0002)	
D/EBITDA Quartile 1					-0.006
					(0.013)
D/EBITDA Quartile 2					-0.005
					(0.011)
D/EBITDA Quartile 3					0.01
					(0.011)
Pricing variables					
EV/EBITDA entry multiple		-0.017		-0.019	-0.005
		(0.012)		(0.013)	(0.012)
Target specific					
Target rating[1]	-0.012***	-0.009**	-0.012***	-0.010**	-0.009**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Target revenue (log)	0.009**	0.007*	0.009**	0.008**	0.007*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
EBITDA margin (log)	0.003	-0.0004	0.003	0.0005	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Deal and PE-characteristics					
P2P (dummy)	-0.007	-0.004	-0.007	-0.005	-0.003
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
SBO (dummy)	-0.005	-0.001	-0.005	-0.002	-0.002
	(0.01)	(0.009)	(0.01)	(0.01)	(0.009)
PE experience (years)	0.001**	0.001*	0.001**	0.001*	0.001*
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)
PE experience (fund number)	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
PE experience (log fund size USD)	-0.012**	-0.013***	-0.012**	-0.013**	-0.012**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Credit and valuation conditions					
Local HY spread[2] (assetswapspread)	0.0002***	0.0001***	0.0002***	0.0001***	0.0001***
	(0.00003)	(0.00004)	(0.00003)	(0.00004)	(0.00004)
Fed tightening index	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0003)
Public market valuation (sp_ev_ebitd	0.015***	0.018***	0.015***	0.018***	0.018***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Macro economic variables					
UST 10y yield		0.005		0.005	0.005
		(0.007)		(0.007)	(0.007)
USD 3m Libor		-0.011***		-0.011***	-0.010**
		(0.004)		(0.004)	(0.004)
Local inflation[2]		0.005		0.004	0.005
		(0.004)		(0.004)	(0.004)
Local GDP growth[2]		-0.011***		-0.012***	-0.012***
		(0.003)		(0.003)	(0.003)
Constant	0.03	0.102	0.037	0.132	0.099
	(0.092)	(0.095)	(0.094)	(0.1)	(0.104)
Country controls	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes
Year controls	No	No	No	No	No
Observations	667	667	667	667	667
R^2	0.216	0.248	0.215	0.248	0.247
Adjusted R^2	0.145	0.174	0.143	0.172	0.17

*Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions. Significance levels: *p<0.1; **p<0.05; ***p<0.01*

Appendix L: Regression output – Likelihood of financial distress

Probit regression results: Likelihood of financial distress using D/eBITDA

	Dependent variable: Distressed exit				
	(1) Distressed	(2) Distressed	(3) Distressed	(4) Distressed	(5) Distressed
Leverage variables					
Log D/EV	0.111	0.079			
	(0.152)	(0.156)			
D/EV			-0.023	-0.014	
			(0.015)	(0.016)	
(D/E)^2			0.0003*	0.0002	
			(0.0001)	(0.0001)	
D/E Quartile 2					-0.275
					(0.195)
D/E Quartile 3					0.111
					(0.178)
D/E Quartile 4					0.078
					(0.176)
Target specific					
Target rating[1]	0.028	-0.057	0.04	-0.048	-0.04
	(0.074)	(0.08)	(0.075)	(0.081)	(0.081)
Target revenue (log)	-0.014	-0.014	-0.041	-0.03	-0.033
	(0.063)	(0.067)	(0.064)	(0.068)	(0.067)
EBITDA margin (log)	0.069	0.079	0.046	0.068	0.057
	(0.102)	(0.111)	(0.102)	(0.111)	(0.112)
PE-characteristics					
PE experience (years)	-0.008	-0.003	-0.008	-0.003	-0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
PE experience (log fund size USD)	0.057	0.153**	0.073	0.160**	0.161**
	(0.069)	(0.074)	(0.069)	(0.074)	(0.074)
Credit and valuation conditions					
Local HY spread[2] (assetswapspread)		0.001		0.001	0.001
		(0.001)		(0.001)	(0.001)
Fed tightening index		-0.003		-0.003	-0.003
		(0.005)		(0.005)	(0.005)
Macro economic variables					
UST 10y yield		0.287***		0.283**	0.301***
		(0.11)		(0.111)	(0.113)
USD 3m Libor		0.052		0.052	0.044
		(0.072)		(0.072)	(0.073)
Local GDP growth[2]		0.104		0.102	0.108
		(0.066)		(0.066)	(0.066)
Constant	-2.113**	-3.845***	-1.389	-3.354***	-3.705***
	(1.036)	(1.153)	(0.893)	(1.031)	(0.952)
Country controls	No	No	No	No	No
Industry controls	No	No	No	No	No
Year controls	No	No	No	No	No
Observations	931	931	931	931	931

Note: heteroskedasticity robust standard errors (1) a higher rating means higher credit quality (2) We use Eurozone HY spread/inflation/GDP growth rates for targets based in Western Europe and US HY spread/inflation/GDP growth rates for targets based in North America or other regions
*Significance levels: *p<0.1; **p<0.05; ***p<0.01*