The Determinants of Leverage in Buyouts Before and After the Financial Crisis of 2008

An examination of U.S. leveraged buyouts from 1998 to 2015

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Abstract

The number of leveraged buyouts has grown tremendously in both size and frequency during the last decades. Therefore Private Equity firms are large and important players in capital markets, why it is interesting to examine the motivation behind their financing choices. The purpose of this thesis is to examine what factors determine leverage in LBOs and if the effect differ after the financial crisis of 2008. Using a sample of 310 LBOs from 1998 to 2015, and a matched sample of public companies, we find evidence that LBO leverage is primarily driven by time-series variation in debt market conditions. Cross-sectional factors suggested by the trade-off theory and the pecking order theory, do not apply for LBOs. We find no significant effect suggesting that the factors determining leverage differ for LBOs after the crisis. However, the results suggest, contrary to before the crisis, that the sample of matched public companies have a countercyclical rather than pro-cyclical relation to debt market conditions post-crisis. This infers that the effect of the determinants of public leverage are closer to the effect of the determinants of LBO leverage post-crisis.

Keywords: Leveraged Buyout, Private Equity, Capital Structure, Financial Crisis of 2008, Credit Spread

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1 Introduction

The phenomenon of leveraged buyouts has grown tremendously during the last decades, becoming an important feature in financial markets. The definition of a leveraged buyout (henceforth LBO) is that a financial sponsor, often a private equity firm (henceforth PE firm), acquires a majority stake in a target company by investing a small portion of equity and a relatively large portion of leverage. Hence, PE firms are large and very important players in capital markets, why it is interesting to examine the motivation behind their financing choices.

This examination estimates what determines leverage in LBOs and how they differ before and after the financial crisis of 2008 in the U.S. We examine this by predicting the relation between LBO leverage to a matched sample of public companies' median measures that are based on year, quarter and Fama-French 12 industry. The framework followed throughout the examination is similar to the one used in the research paper by Axelson et al. (2008). We use their findings as a benchmark to observe if the same determinants of LBO leverage still apply to our sample before delving deeper into how these determinants might differ in the period following the financial crisis of 2008.

Previous empirical work has mostly been devoted to explain the capital structure of public companies and less focus has been devoted to explain the capital structure of other types of firms, such as LBOs. However, classical theories such as the trade-off theory and the pecking order theory (Myers and Majluf 1984) are built on the assumption that leverage is driven by company-specific characteristics (Myers, 2001). This infers that there should be a relation between LBOs and matched public companies' leverage if their underlying assets are similar. Furthermore, both the trade-off theory and pecking order theory gives a rather static view of capital structure. Further research has been devoted to explain how the choice of capital structure is affected by market-wide factors such as mispricing in debt and equity markets which Baker and Wurgler (2002), Kaplan and Strömberg (2008) and Korajczyk and Levy (2003) give evidence for. Another market-wide factor that affects the dynamics of capital structure but that has been devoted limited research, is a shock to the economy, as in the case of a financial crisis. Halling, Yu, and Zechner (2014), predict that leverage of public companies becomes countercyclical and adjusts slower during recessions.

This examination contributes to previous research as the sample includes transactions that covers a more recent time frame than previous research. Further, we try to fill the gap in prior empirical work by examining how the dynamics of determinants of leverage in LBOs differ after the recent financial crisis of 2008.

In summary, we can predict that LBO leverage is primarily driven by time-series variation in debt market conditions and that the trade-off theory and pecking order theory do not apply for these types of firms. We also infer that there is no cross-sectional relation between LBO leverage and the sample of matched public companies. The leverage of matched public companies is to a larger extent driven by cross-sectional estimates such as industry affiliation and company-specific characteristics. We also document that the recent financial crisis of 2008 has affected the determinants for both LBOs and matched public companies. However, we can only with significance predict this for the sample of public firms and not for LBOs. Moreover, an interesting finding is that matched public companies' capital structure become more similar to LBOs after the crisis than prior. Matched public companies' leverage changes from being pro-cyclical to debt market conditions to become rather countercyclical, which is already documented for LBOs.

These findings should pave the way for further research on what additional factors which can explain the leverage of LBOs that are not captured by our model, as these types of companies' capital structure seem to be determined by other factors than previous empirical work suggests. Finally, more research should be devoted to how the dynamics of capital structure choice are affected by external factors, such as shocks to the economy.

2 Leveraged Buyouts

2.1 History

Leveraged buyouts emerged in the U.S. in the beginning of the 1980's as a consequence of severe restructurings in U.S. financial markets at the time. The phenomenon of LBOs rapidly grew, both in frequency and size, and soon spread to the rest of the world, becoming an important feature in financial markets. The definition of a leveraged buyout is that a financial sponsor, often a private equity firm, acquires a target company by investing a small portion of equity and a relatively large portion of leverage to acquire a majority stake of a target company. It is common that acquisitions are financed with debt to equity ratios ranging between 60-90 % (Kaplan, and Strömberg, 2008).

Jensen (1989) was early a proponent for this type of transaction and highlighted that LBOs improves managerial incentives as the high levels of leverage decreases the agency costs associated with companies that have large free cash flows and that the financial distress costs associated with high levels of leverage in LBOs are not large. He predicted that LBOs would become a dominant corporate organizational form in the future, due to its superior governance as a result of the high levels of leverage. However, LBOs, at the time mostly consisting of Going Private transactions, almost totally disappeared when the junk bond market crashed in the late 1980s. As a result, a large number of highly levered LBOs ended up in financial distress and bankruptcy. LBOs lost their reputation and PE firms shifted their focus from Going Private transactions to invest primarily in divisions and private firms (Kaplan, and Stein, 1991). However, PE firms soon regained their reputation and Going Private transactions started to increase again in the mid-2000s. In 2006-2007, just before the financial crisis, LBOs accounted for record high numbers and represented 30 % of all M&A transactions in the U.S.

2.2 LBO Deal Structure

As mentioned previously, the definition of a LBO is that a PE firm acquires a majority stake of a target company by financing the acquisition with a large portion of leverage relative to equity. The debt to equity ratio used to finance the transaction normally ranges between 60 % to 90 % and the target company's assets are usually posted as collateral (Kaplan, and Strömberg 2008). If the target company is public, the case of a Going Private transaction, the PE firm generally pays a premium of 15-50 % over the stock price (Bargeron et al, 2007).

PE firms generate returns on their investments by acquiring a portfolio of target companies, followed by implementations of operating and financial restructurings in order to increase profitability of the target companies in the portfolio. Finally, they resell the target companies at a hopefully higher value, called exit multiple. The return of the investments is measured by the internal rate of return (IRR). The general goal is to achieve an IRR of approximately 20 % per year during the investment horizon, that normally ranges between five to ten years. Leverage is an important component in realizing returns, as using more leverage over equity in the initial investment can boost returns (Kaplan and Schoar, 2005).

The PE firm act as a General Partner (GP) and execute the investments while its investors have a role as Limited Partners (LP) by providing capital. This relationship is quite different from that between management and shareholders in public companies. Limited Partners are usually institutional investors and wealthy individuals. The contract between the GP and LPs is arranged that the LPs commit to provide a certain amount of capital and the PE firm has around five years to invest the capital in a portfolio of target companies. Further, the GP then has an additional five to eight years to return the capital to its investors. The contract between the GP and LPs normally includes several covenants on how the GP is allowed to invest the capital (Metrick, and Yasuda, 2010).

The leverage used to finance the acquisition of a LBO target normally consists of several different types of debt instruments. The most common division is between senior and subordinated debt. Senior debt consists of senior secured bank debt which is arranged by a bank or investment bank. These loans are often syndicated for larger deals, where the loan is stripped and sold to different investors, such as hedge funds. The subordinated debt is normally junior and unsecured, consisting of high-yield bonds and mezzanine debt. Each tranche of debt have different maturities and repayment term periods (Demiroglu and James, 2007).

2.3 The Financial Crisis of 2008

In the mid-summer of 2007, the U.S. economy was hit by one of the most severe financial crisis since the Great Depression. The crisis quickly spread to the rest of the world and the period was followed by extreme financial turmoil caused by acute liquidity and credit crunch in the economy. The crisis was mainly due to the meltdown of subprime mortgages which in turn raised concerns about the solvency and liquidity of financial institutions, followed by the default of Lehman Brothers and several other financial institutions. This resulted in total banking panic. As a result, several government actions were implemented to improve the

liquidity and solvency of the financial sector and the turmoil calmed some. However, a majority of asset classes and commodities fell dramatically in price and the cost of corporate banking rose substantially as credit spreads peaked. The volatility in financial markets rose to levels that had rarely been seen before and credit spreads functioned as an important measure of strains in the financial systems (Ivashina, and Scharfstein, 2010).

LBO activity in the U.S. dropped from extreme activity in numbers of transactions and in total transaction value following the financial crisis. In 2007 LBO activity relative to M&A transactions in the U.S. was 30 % worth of $391,1 billion and then dropped to 4,7 % and $28,8 billion (Capital IQ, 2015).

3 Theoretical Framework and Previous Research

In this section we will motivate the empirical framework used, by exploring the theoretical frameworks that have been proven in prior research to have an explanatory power in determining capital structure choices. We will also describe the theoretical frameworks that provides other interesting insight that potentially can explain if the determinants of leverage differ after the financial crisis of 2008.

3.1 Theories about the Determinants of Capital Structure

3.1.1 Theory 1: Leverage is Determined by Firm Characteristics

In previous literature, there are two main theories that have been proven to explain capital structure of companies. The first is the trade-off theory which predicts that the optimal capital structure is chosen to offset the financial distress and agency costs associated with debt, to the agency benefits as well as the benefit of the tax-shield created by the interest costs of debt (Berk, and DeMarzo, 2014). Agency benefits give firms the incentive to use debt financing rather than equity for three main reasons. First, using debt financing rather than equity implies that the original owners of the company will have incentives of doing what is best for the company since they will suffer themselves if they make bad decisions. Secondly, using debt financing will reduce wasteful investments since high levels of leverage will force management to use excess free cash flows to pay for future interest payments. Furthermore, using high levels of leverage will make management more committed to pursue important strategies since a constant threat of financial distress prevails. Agency costs are the costs due to the conflict between shareholders and management of having different motives in how to maximize the value of the company. The optimal capital structure of a company is when the marginal costs of leverage is just offset by the marginal benefits.

Myers (2001) infer that the capital structure of a given firm will heavily depend on the characteristics of a firm's underlying assets and that more profitable firms with higher and more stable cash flows will have higher levels of leverage as they have a lower probability of default and consequently can take more advantage of the benefits of leverage suggested by the trade-off theory.

Lemmon, Roberts, and Zanders (2008) predicts that debt levels of public companies are stable and tend to persist around 20 years, which implies that the capital structure of public companies is time-invariant and that variances in capital structure is better explained by cross-sectional factors such as company-specific characteristics and industry affiliation.

The second theory that is often used in symbiosis with the trade-off theory is the pecking order theory which suggests that firms in general will choose leverage over equity for financing. This reason is that issuance of securities is costlier than debt due to information asymmetries, which causes the company to temporarily deviate from its optimal capital structure, predicted by the trade-off theory (Myers and Majluf 1984). This infers that for companies that historically have been profitable and as a result have not urged to raise any capital by issuing new securities and have excess cash to pay off parts of the debt. As a result these companies will have lower debt levels than optimal as they do not fully exploit the debt tax shield and agency benefits of debt, as the probability of financial distress is much lower for these types of firms.

If the trade-off theory holds, we would expect that both LBO and public companies choose their capital structure by the same premises, as the same type of firm should have a similar optimal capital structure if their underlying assets are similar. The pecking order theory is less applicable on the sample of LBOs as their capital structure is observed at the time of the transaction and as a result we cannot observe how their capital structure evolves over time. However, we control for this effect for the sample of public companies as a robustness check. Another concern is whether LBOs are only targeted towards a certain type of companies who belongs to industries that experiences high cash flows, slower growth prospects, lower R&D expenses and less regulation also called the "industry hypothesis" by Ambrose and Winters (1992). They document that there is only weak evidence for LBO concentration of industry and that it is rather company-specific factors that are the primary motivating forces for most LBOs.

We confirm these findings as the sample covers all industries in the Fama-French 12 industry classification except financial companies which are excluded from the sample. Secondly, by matching the sample of LBOs with matched public median measures based on the same industry, year and quarter, this theory suggests that we would expect a relation between the leverage of LBOs and matched public companies. Thus, we test for this possibility by using five different proxies for company-characteristics, in line with the trade-off and pecking order theory, that have been proven to explain capital structure in previous research as documented by Ambrose and Winters (1992), Myers (1992), (Roden, and Lewellen, 1995) among others.

3.1.2 Theory 2: Leverage is Determined by Time-Varying Factors

The patterns of LBO activity suggests that macroeconomic factors such as debt market conditions may have an effect on the activity of LBOs and therefore also have a connection with the choice of capital structure (Opler, and Titman 1993). Kaplan and Strömberg (2008) infer that PE firms take advantage of when the cost of debt is relatively low compared to the cost of equity, in other words, when there exist mispricing in debt and equity markets. Baker and Wurgler (2002) argument that public companies also take advantage of market mispricing in debt and equity markets and that companies with higher leverage are companies that raised funds when their market value of equity was low and that companies with lower levels of leverage raised funds when their market value of equity was high. This implies that public companies' current capital structure is highly persistent to historical market values of equity. Additionally, Graham and Harvey (2001), give evidence that public companies are less likely to exploit the opportunities of mispricing in debt markets as they prioritize the value of financial flexibility and are very concerned about the possible financial distress costs associated with higher levels of leverage.

These findings suggests that PE firms take more advantage of mispricing in debt and equity markets than public companies and that LBO leverage is to a higher extent driven by debt market conditions measured by the credit spread, rather than the characteristics of the given company predicted by the trade-off theory. If this holds, we would expect LBO activity to be more pro-cyclical to current debt market conditions measured by the credit spread. Contradictory, public companies, do not seem to exploit this advantage of market mispricing to the same extent as LBOs.

It was previously believed that interest rate terms best predicts the activity in an economy. However, Mody and Taylor (2003) emphasizes and give evidence, by studying the U.S market, that differences in the credit spread, the difference between high-yield bond rates and treasury bond rates, is what really explains the activity and capital flows in an economy. Gertler and Lown (1999) have similar findings and argue that the credit spread has a significantly better explanatory power in explaining business cycles and also give evidence that the high-yield spread outperforms other financial indicators such as the term spread and paper-bill spread.

Finally, all these theories discussed about capital structure departs from Modigliani and Miller's (1958) paradigm of frictionless financial markets, where the choice of capital structure is solely the results of the demand for leverage of the individual company.

3.2 Theories about Leverage and Shocks to the Economy

While a lot of research has been devoted to explain the capital structure of companies, less focus has been on how these theories and their determinants are affected by shocks to the economy such as in the case of a financial crisis followed by a subsequent recession. However, we found some relevant literature that applies to this area, such as Gilchrist and Zakrajsek (2011), who find evidence that shocks to the credit spreads caused by the state of the economy, as in the case of the financial crisis of 2008, will deteriorate the capital position of financial intermediaries and cause an increase in the cost of debt financing as the credit spreads becomes wider, resulting in a subsequent reduction in economic activity. As credit spreads becomes wider and the economic activity falls due to the recession, monetary policy will be eased to stimulate the economy. This is made by a decrease in the U.S. Federal Reserve's interest rate which in turn decreases the U.S. LIBOR, the lending rate between banks. Despite this monetary easing, stock markets tends to fall sharply due to shock. These findings complement Baker and Wurgler's (2002) theory about debt and equity market mispricing and choice of capital structure previously described.

Halling, Yu, and Zechner (2014) delves deeper into how the dynamics of capital structure evolves over the business cycle and how the main determinants of capital structure are affected by significant shocks as in the case of a financial crisis. They document that public companies' leverage is rather countercyclical in recessions with leverage ratios being higher but adjusting slower than when the economy is in expansion. This is explained by, that a recession affects the dynamics behind capital structure theories such as companies' cash flows. Moreover, equity capital of financial intermediaries is reduced, equity valuation levels and the term structure changes among others. This gives rise to variations in the demand of a company's optimal capital structure over the business cycle. This is also documented by Korajczyk and Levy (2003).

Collin-Dufresne, Goldstein, and Martin (2001) explain that the determinants behind changes in the credit spread is to a higher extent driven by a common systematic factor that does not apply to the individual firm. This infers that all individual companies and their capital structure should be affected similarly by changes in the credit spread.

These findings suggest that we would expect leverage to be higher as a result of a financial crisis and the subsequent recession for both LBOs and matched public companies. Contradictory, as observed in previous research, LBOs seems to experience lower levels of activity and leverage when the credit spread is wider as during a recession.

4 Research Question

Based on relevant theories we develop a research question in line with the main framework used in the research paper by Axelson et al, (2008) that is followed throughout this examination. They predict that there is no cross-sectional relation between leverage of LBOs to the matched sample of public companies. Instead, they document that LBO leverage seems to be driven by time-series variation related to debt market conditions. Matched public companies, on the other hand, seems to be driven by company-specific characteristics as predicted by the trade-off theory and previous empirical work. Additionally, we further develop the model with the empirical framework on how capital structure differ due to shocks to the economy such as the financial crisis in 2008. This resulted in the following research question:

What are the determinants of leverage in leveraged buyouts, and do they differ after the crisis compared to the pre-crisis period?

5 Data Collection

5.1 Sample Design and Collection of Data

The initial data sample was retrieved by combining the databases Capital IQ and SDC Platinum which both offer information about M&A transactions. From Capital IQ, the primary source, we chose all M&A transactions that were classified as "leveraged buyout", "management buyout" or "Going Private" that were announced and completed between January 1990 and December 2015. As the examination is limited to the geographical area of the United States, we only selected companies targeted in the U.S., however, the acquiring company could be from any part of the world. We made this restriction as the leverage used to finance a transaction is normally syndicated in the origin country (in this case the U.S.) and seldom cross-sectional between countries (Gadanecz, 2004). We also limited the examination to only include acquiring companies with a Standard Industry Classification Code (SIC) starting with six, which are firms classified as financial companies.

From SDC Platinum, we performed the same procedure as with Capital IQ but chose all M&A transactions classified as "leveraged buyout". Both Capital IQ and SDC Platinum mainly contains information about the transactions, such as the identity of the target and the acquirer(s), its industry, the transaction value and for a subsample there is also information about the valuation financials and in some cases LTM (last twelve months) financials of the target. To calculate the earnings and leverage measures, we required financial information about the transaction such as the earnings before interest, taxes, depreciation and amortization (EBITDA), transaction value (enterprise value, EV) and the leverage used to finance the transaction. The initial sample was unfortunately enormously reduced due to the lack of available data, which is mainly due to fact that the acquirer in an LBO is exempted from public disclosure requirements. After only keeping the transactions that included information about the EBITDA and transaction value (EV) of the target, we had a sample of 596 transactions.

As only a handful of these transactions included information about the debt financing, we used LPC/Dealscan to obtain additional information about the leverage packages used in the transactions. Every transaction was matched on the name of the target company and the announcement date of the transaction to the LPC/Dealscan sample's company name and deal active date of the loan package. We were able to match 431 out of 596 transactions after excluding loan packages that did not finance the original LBO transaction (i.e., refinancing, recapitalization and loans financing subsequent acquisitions made by the LBO target). Moreover, LPC/Dealscan primarily provides information on the

bank portion of the financing and in a few cases the subordinated debt. By using the database Mergent and the comments on the transactions provided by Capital IQ, we were able to find additional information about other types of subordinated debt, mainly senior and subordinated notes and mezzanine debt for a subsample of the transactions. Finally, we manually combined the capital structure and earnings information from the different databases and controlled that the name of the target, dates and LTM sales revenue matched. We excluded any transactions that did not match or had missing values and attained a final data sample of 310 LBO transactions in the U.S. from 1998 to 2015.

To analyze the relation of leverage between LBOs and matched public companies, we also needed financial information about public companies in the U.S. from 1998 to 2015. We obtained this data from Compustat North America to calculate the different earnings and leverage measures. We included five U.S. stock exchanges: American Stock Exchange, OTC Bulletin Board, Nasdaq NMS, New York Stock Exchange and Pacific Exchange.

After calculating each leverage measure for all public observations per company based on an average of the year-end financial statement between two consecutive years, we created median values for each earnings and leverage measure based on year, quarter and Fama-French 12 industry classification. The industry portfolio classification is based on grouping different SIC codes into industry portfolio groups (Kenneth R. French, 2016). We chose the Fama-French 12 industry classification over larger groups of classifications as our sample is relatively small and that all industries need to be well represented to give an accurate prediction of leverage. We also excluded all observations with negative EBITDA as they are not meaningful when considering valuation multiples. After doing this, we were able to match each LBO transaction's completion date with a corresponding matched public median value based on year, quarter and industry. We made this matching process to explore if it is the same factors that determines LBO leverage as for their corresponding matched public median values predicted by the theoretical framework on capital structure.

To test how potential selection biases might have affected the results, we used pre-LBO and public adjusters' earnings and leverage measures. Pre-LBO leverage is only available for Going Private transactions which are companies that previous to the LBO transaction were public and listed on a stock exchange. By using Compustat North America and the CIK codes of the LBO targets, we were able to obtain the last financial statement before the LBO transaction for a subsample of 37 LBO target companies.

Public adjusters are defined as public companies that have adjusted their capital structure, measured as total debt divided by total assets, by more than ten percent in absolute value between two consecutive years. The sample of public adjuster companies is then divided into median values using the same procedure as previously used on the full sample of public companies, by creating median values based on each year, quarter and Fama-French 12 industry classification.

The main measure of macroeconomic and debt market conditions is the BofA Merrill Lynch U.S. High Yield Index over the U.S 3 month LIBOR, defined as the U.S high-yield spread. The high-yield spread measures the credit risk premium of leverage. The credit spread has in previous research been proven to have the best market-wide explanatory power on capital structure. The U.S. 3 month LIBOR is used instead of the Treasury Index as LIBOR both absorbs the effect of the Treasury index and the risk premium between banks, which taken together explain debt market conditions better.

5.2 Sample Characteristics

The final sample of 310 LBO transactions ranging from 1998 to 2015 covers five different types of leveraged buyouts, see Appendix table AI for further description on the different types and their representativeness in the sample. Unfortunately, we could not identify the type of LBO transaction for a subsample of 25 transactions, referred as "LBO type unspecified". Of the 12 Fama-French industries, all industries are represented except for industry 11 which are financial companies with a Standard Industry Classification Code starting by six. We exclude this group of companies from the sample as this industry group often experiences higher levels of leverage that does not have the same meaning as for non-financial companies, where high levels of leverage is more likely to be an indicator of financial distress (Fama and French 1992). See Appendix table AII for descriptions on the different industries and their representativeness in the sample. Of the 310 LBO transactions 68,3 % (212) LBO transactions were completed prior to the financial crisis of 2008 and 31,7 % (98) LBO transactions were completed after the financial crisis defined as 2009-2015.

The coverage of Compustat North America only covers information on U.S. public companies from 1998, why the time frame is limited to 1998-2015. Moreover, the number of transaction are quite evenly distributed between the years. However, 2006 and 2007 are the largest groups and represents 24 % of the whole sample, which is in line with how the activity levels of LBOs in the U.S. has evolved over time, reported by Capital IQ, (2015). Below are descriptive statistics on leverage and valuation measures for both LBOs

and matched public median measure. The sample is divided into before and after the financial crisis.

Table I
Descriptive Statistics on LBO and Matched Public Companies
Leverage and Deal Pricing

This table displays the transaction value (enterprise value), valuation multiple, and leverage measures for the sample of LBOs and matched public median values, both before and after the financial crisis of 2008. After the financial crisis is defined as 2009-2015. Measures are (1) enterprise value in millions USD, (2) enterprise value divided by earnings before interest, taxes, depreciation, and amortization (EV/EBITDA), (3) debt divided by EBITDA (D/EBITDA), and (4) debt divided by enterprise value (D/EV).

	EV				EV/EBITDA			
	N	Mean	Median	Std Dev	N	Mean	Median	Std Dev
LBO Pre-Financial Crisis	212	2367,089	638,956	5895,260	212	9,493	8,567	4,597
LBO Post-Financial Crisis	98	1573,530	817,721	1840,675	98	11,249	9,864	5,643
Public Pre-Financial Crisis	212	359,234	301,898	363,853	212	4,877	6,734	7,480
Public Post-Financial Crisis	98	899,578	759,767	711,103	98	8,630	9,236	6,346

	D/EBITDA				D/EV			
	N	Mean	Median	Std Dev	N	Mean	Median	Std Dev
Pre Financial Crisis	212	5,574	4,554	3,854	212	0,622	0,588	0,338
Post Financial Crisis	98	7,306	6,128	5,122	98	0,666	0,590	0,359
Public Pre-Financial Crisis	212	0,885	0,816	1,050	212	0,043	0,016	0,132
Public Post-Financial Crisis	98	0,963	0,752	0,948	98	0,089	0,076	0,115

First of all, there is a high standard deviation for all measures which is due to the enormous differences in size between smaller and larger deals that are represented in the sample even after winsorizing all variables. As can be observed, valuation multiples (EV/EBITDA) are higher after the crisis than prior for both samples. The leverage measure D/EBITDA is higher as well after the crisis than prior for LBOs. This is also true for matched public companies.

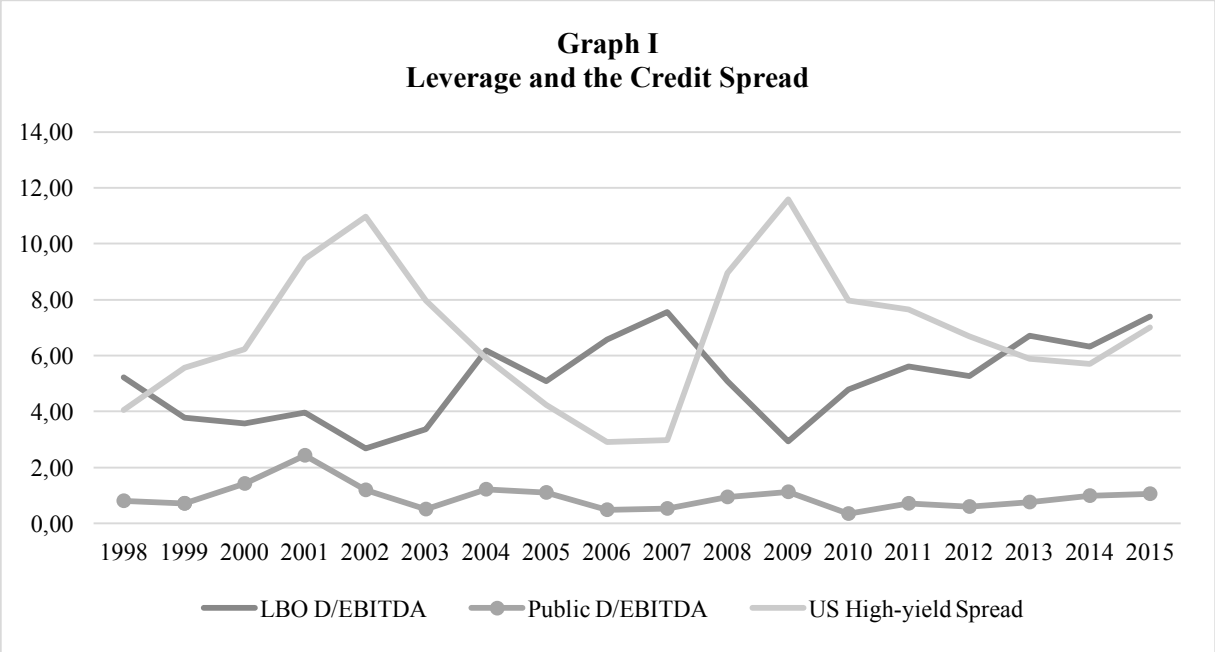

Figure I - Leverage and Credit Spreads

This figure present time-series data on the average high-yield spread and leverage for LBOs and matched public companies. As can be observed in the figure, leverage for LBOs is more volatile to debt market conditions than matched public median leverage. Moreover, LBO leverage seem to be more countercyclical to debt market conditions, while matched public companies seem be more pro-cyclical. However, after the financial crisis in 2007-2008, the credit spread first peaks and then becomes less wide. Moreover, the pattern of public leverage subsequent to the crisis seems to follow a more similar path as LBOs. This infers that both LBO and matched public companies' leverage is higher following the crisis, but that public companies adjust slower. Another interesting observation is that leverage for both LBOs and matched public companies are close to the same levels after the crisis as just prior, despite the higher credit spread following the crisis. This observation implies that the credit spread seems to have a diminishing effect on leverage after the crisis, especially in the years following 2012/2013.

6 Data Treatment and Variables

6.1 Dependent Variables

We use one main measure of leverage as dependent variable in the regressions of LBO and matched public median leverage; net debt divided by earnings before interest, taxes, depreciation and amortization (henceforth D/EBITDA). The motivation to use D/EBITDA, is that net debt divided by free cash flows measured as EBITDA is a main measure for a company's capability to bear the debt incurred in the LBO (Lewellen, Roden 1995). Net debt for LBO transactions is defined as debt, both senior secured debt such as term loans and bridge loans but also, subordinated debt that can take a variety of forms such as mezzanine debt, senior and subordinated notes and bonds. Moreover, almost all of the transactions include contingent debt which consist of revolving credit facilities, stand-by letters and acquisition lines of credit. We exclude contingent debt from the calculation of total debt as these are loan tranches that are not put in place at the time of the LBO transaction, but rather to fund future and subsequent investments of the LBO firm such as future acquisitions of assets, working capital and expenditures (Axelson et al. (2008). We can also identify preferred equity as financing in a handful of deals. Preferred equity is a hybrid security lying somewhere in between common stock and senior debt and is therefore excluded from the definition of LBO debt as well (Hovakimian, Opler, and Titler, 2001). We also assume that the existing debt of the target prior to the transaction is paid off as part of the deal which is the usual case. See Appendix table AIII for description on the debt structure of LBOs before and after the financial crisis of 2008 and Appendix table AIV for the definition of each measure used.

For the matched sample of public companies, net debt is defined as long-term debt, including the part due in one year, minus cash and short term investments. Enterprise value is defined as the market value of outstanding shares plus net debt. The matched public median measures for each year, quarter and industry is calculated as an average per quarter by using the financial statement between two consecutive years. Below is descriptive statistics on the dependent variables used in the simple and multiple regressions.

Table II
Descriptive Statistics on Dependent Variables

This table displays descriptive statistics on the dependent variables used in the simple and multiple OLS regressions. Matched public median values are retrieved from Compustat North America in the same industry, year and quarter as LBO transactions. Public Adjusters are public companies that have changed their debt-to-book value more than 10 % in absolute value between two consecutive years. Pre-LBOs are companies that were listed on a stock exchange prior to the LBO transaction. See Appendix, table AIV for further description on the definitions of the different measures.

Dependent Regression Variable	N	Mean	Min	25th Percentile	Median	75h Percentile	Max
LBO Variable							
LBO log D/EBITDA	310	1,579	-0,663	1,184	1,602	2,026	3,202
Public Variable							
Public log D/EBITDA	273	-0,177	-5,208	0,418	0,589	0,782	1,940
Public Adjusters Variable							
Public Adjusters log D/EBITDA	247	-0,458	-4,313	-0,991	-0,322	0,146	1,731
Pre-LBO Variable							
Pre-LBO log D/EBITDA	30	0,413	-2,893	-0,266	0,571	1,394	2,514

6.2 Independent Variables

6.2.1 Primary Independent Variables

We use two primary independent variables in order to estimate the determinants and the relation of leverage between LBOs and matched public companies. To explore to what extent leverage is estimated by a cross-sectional effect, dummies are created for each industry represented by the Fama-French 12 industry classification. To explore to what extent leverage is driven by debt market conditions, the U.S. high-yield spread is used as an independent primary variable.

6.2.2 Control Independent Variables

We also add several independent control variables to explore more rigorously the determinants of leverage. For the sample of matched public companies we calculate the median value per year, quarter and industry for five proxies that are based on underlying company-specific factors that have been documented to determine leverage within the theoretical framework. Specifically, we estimate leverage as a function of (1) market-to-book ratio as a proxy for growth opportunities, (2) sales divided by property, plant and equipment as a proxy for asset turnover, (3) R&D expense divided by sales as a proxy for intangible assets, (4) return on invested capital (ROIC) as a proxy for profitability and finally, (5) the standard deviation of ROIC as a proxy for the operating risk of a firm. See Appendix table AIV for the definition of each proxy.

We also add control independent variables for the type of LBO by creating dummies for the six different types of LBOs. We also examine if the size of a LBO transaction measured as the transaction value (EV) has any explanatory effect on leverage by creating dummies for the four quartiles of transaction value (EV).

To estimate if the determinants of leverage differ as a result of the financial crisis of 2008, we also create a dummy for the period post-financial crisis. Post-financial crisis is defined as the years following the crisis, 2009-2015. Moreover, we also add interactions terms by multiplying all independent variables with the dummy representing the period following the financial crisis. Finally, due to missing values in several of the independent variables, the sample was reduced to 266 transactions when performing this regression. Below is descriptive statistics on the independent variables used in the simple and multiple regressions.

Table III
Descriptive Statistics on Independent Regression Variables

This table displays descriptive statistics on the independent variables used in the simple and multiple OLS regressions. Matched public median values are retrieved from Compustat North America and grouped into the same industry, year and quarter as LBOs. Public Adjusters are public companies that have changed their debt-to-book value more than ten percent in absolute value between two consecutive years. Pre-LBOs are companies that were public and listed on a stock exchange prior to the LBO transaction. See Appendix, table AIV for further description and the definitions of the different measures.

Independent Regression Variable	N	Mean	Min	25th Percentile	Median	75h Percentile	Max
LBO Variable							
LBO EV	310	2116,222	31,840	295,890	709,150	1691,900	33826,470
Macro Variable							
U.S. High-yield Spread	310	5,861	2,130	4,017	5,797	7,273	11,436
Public Variables							
Public log D/EBITDA	247	-0,458	-4,313	-0,991	-0,322	0,146	1,731
Public Market/Book	310	2,366	-0,834	1,732	2,158	2,627	11,893
Public Sales/PPE	310	2,968	0,488	2,198	2,880	3,563	9,686
Public R&D/Sales	302	0,285	0,000	0,034	0,063	0,126	7,119
Public ROIC	310	0,029	-0,935	0,029	0,078	0,115	0,244
Public Earnings Volatility	299	0,115	0,022	0,051	0,072	0,109	1,605
Public Adjusters Variable							
Public Adjusters log D/EBITDA	247	-0,458	-0,244	-0,013	0,029	0,071	0,473
Pre-LBO Variable							
Pre-LBO EV	37	1343,439	-0,521	143,628	552,135	1604,866	6486,987

7 Statistical Method

In this section we present the statistical and econometric model applied in the empirical analysis. To describe the statistical models used, we begin by presenting the analyses made using an Ordinary Least Squares (OLS) regression. Further, a number of the underlying assumptions of the OLS regression are tested and adjusted on the data for the regressions. Finally, the main regression model is presented.

7.1 The Ordinary Least Squares Regression

The ordinary least squares regression model (henceforth OLS) is used to estimate if the previously described independent variables have any explanatory power on determining leverage of LBOs and matched public companies. First, to estimate the determinants and the relation between LBO and matched public companies leverage, in line with Axelson et al. (2008), we measure the explanatory power of cross-sectional and time-series factors have on leverage for both samples. An OLS regression is most appropriate for these types of empirical analyses since it minimizes the sum of squared residuals. We first perform a simple OLS regression to predict how the primary independent variables determines leverage in LBOs and matched public companies. We then explore this more rigorously by performing multiple OLS regressions to explain how various independent control variables determines leverage for LBOs and if the explanatory power of independent variables have changed after the financial crisis of 2008.

The OLS regression estimates the linear function in a credible manner, which is closely to the observed values of the sample. After obtaining an OLS regression we can observe a predicted value for each explanatory variable that is interpreted as the beta coefficient. The explanatory variable's coefficient measures the change in the dependent variable as a result of a one-unit change in the explanatory variable, holding every other independent variable fixed. The OLS regression model is based on a few assumptions that have to hold in order for the results to have explanatory power.

Kept in mind is the limitation and weakness of the simple OLS regression model as an empirical tool, since leverage is most likely explained by more than one variable. However, in combination with the simple regression model, the multiple regression model acknowledges this limitation in terms of explanatory power.

7.2 The Underlying Assumptions of the OLS Regression

Five assumptions have to hold in order for the simple and multiple regressions to be suitable and applicable to the data, known as the Gauss-Markov theorem (Wooldridge, 2009). The five assumptions are applicable for both the simple regression and the multiple linear regression model. Firstly, in a population model the relation of the dependent and independent variables must satisfy a linear relationship. Secondly, the assumption that the sample is randomly selected from the population has to hold. Thirdly, there cannot exist any perfect collinearity between any of the variables in the model. This means that there cannot be two variables or more that have perfect correlation between each other. Furthermore, the error term in the regression model is assumed to have an expected value of zero. Lastly, the fifth assumption of the regression model assumes that the error term u has the same variance no matter the value of the explanatory variables, which implies that the data sample is homoskedastic. We perform several tests, both visually and in Stata, to control if the data sample satisfies these assumptions. In order to apply the OLS regression, the assumption of unbiasedness has to hold as well, which is true if the first four assumptions of the Gauss-Markov theorem are satisfied. This suggests that including an irrelevant variable in a model has no effect on the unbiasedness of the intercept and other slope estimators. If the five Gauss-Markov assumptions hold, the OLS estimators are the best linear unbiased estimators (BLUEs).

7.3 Tests and Adjustments to Satisfy the Gauss-Markov Theorem

To test if the assumptions previously described are satisfied, we perform tests for multicollinearity, correlation, linear relationship and homoskedasticity. The assumption of a random sample is not controlled for but is assumed to hold. After completing the tests, the data satisfy all of the assumptions except for the assumption of linearity. The performed Breusch-Pagan test in Stata, to test if sample is heteroskedastic or homoskedastic, concluded that the sample is homoskedastic and thus H0 could not be rejected. Regarding the assumption of linearity a scatter diagram was constructed to visually determine the relationship between the dependent and independent variables. The conclusion was made that the dependent variable does not have an exact linear relationship with its independent variables, rather a diminishing relationship.

As there is no linear relationship between the dependent and independent variables, we perform a log-level regression by using the logarithm of the dependent variable and keep the raw values of the independent variables since this examination predicts the

constant percentage increase or decrease in Y (dependent variable) depending on an increase or decrease in X (independent variable). The reason why we use logarithmic transformation for the dependent variable is because the relationship with the independent variables is not completely linear. Thus, using a log-level regression makes the relationship between the dependent and independent variables non-linear while still preserving the linear model, i.e. in reality the independent variable will have a diminishing impact on Y when X increases[1].

The data has a large spread with many outliers in both directions that might affect the results in an inaccurate way. In order to adjust for this, we chose to winsorize all variables used in the regressions by winsorizing the top 1% and bottom 99% for all variables, both dependent and independent. Even though the Breusch-Pagan test estimated that our sample is homoskedastic, we perform robust regressions since the OLS regression is very sensitive to outliers and thus it will be more accurate for our model.

Finally, to measure if the determinants of leverage differ after the financial crisis of 2008, we use interaction terms to estimate this effect.

7.4 Baseline Model for OLS Regressions

As described previously, we use one main dependent variable and two primary independent variables. Several additional control variables are also added to the model to explore the research question more rigorously. Below is the main model used in the multiple linear OLS regression including all, both primary and control, independent variables. See Appendix table AIV for further description on the definitions of the different variables.

$$Log\left(\frac{D}{EBITDA}\right) = \beta_0 + \beta_1(High - Yield\ Spread_i) + \beta_2 \log\left(median\frac{D}{EBITDA_i}\right) + \beta_3\left(median\frac{Market}{Book}Value_i\right) + \beta_4\left(median\frac{Sales}{PPE}_i\right) + \beta_5(median\ R\&D/Sales_i) + \beta_6(median\ ROIC_i) + \beta_7(median\ Earnings\ Volatility_i) + \varepsilon_i$$

[1] Tutor meeting with Per-Olov Edlund, may 11th 2016

8 Empirical Results

In this section we present the results of the simple and multiple OLS regressions performed. In the first section, we test if the leverage of LBOs and matched public companies have any relation to each other and if leverage is determined by the same factors as Axelson et al. (2008) predicts, by using the two primary independent variables. Secondly, we perform an additional multiple regression and include several independent control variables, to more closely examine the determinants of LBO leverage. Thirdly, we redo the same multiple regression including the same primary and control independent variables as previously, but also adding a dummy for the years, 2009-2015, defined as "post-financial crisis" to determine whether the determinants of leverage differ after the crisis. The result of the first two regressions are in line with the results of Axelson et. al (2008) and we can confirm that the same determinants of leverage apply to the sample. The result of the third regression, that includes a dummy for the period post-financial crisis give various results described below. Lastly, we lay out potential alternative explanations along with possible biases that might affect the results.

8.1 Determinants of LBO versus Matched Public Companies' Leverage

In the first regression we test if leverage of LBOs and matched public companies have any relation to each other and if leverage is determined by the same cross-sectional and time-series factors.[2] The results confirms the same findings as Axelson, et al (2008), that there is no relation between LBO and public leverage. LBO leverage is primarily explained by time-series variation estimated by the U.S. high-yield spread. Contradictory, public companies' leverage seems to primarily be driven by cross-sectional estimates, defined by industry. Table IV displays these findings, where columns (1) and (3) displays the first simple regression estimating leverage as a function of the U.S. high-yield spread. As observed, LBOs have a negative coefficient while public companies have a positive, significant for both samples. This implies that LBO leverage is more countercyclical while public leverage is rather pro-cyclical to debt market conditions. A potential explanation for the strong countercyclical

[2] $Log\ (\frac{D}{EBITDA}) = \beta_0 + \beta_1(High - Yield\ Spread_i) + \varepsilon_i$

[2] $Log\ (\frac{D}{EBITDA}) = \beta_0 + \beta_1(High - Yield\ Spread_i) + \beta_2(FamaFrench\ 12_i) + \varepsilon_i$

[2] $Log\ public\ (\frac{D}{EBITDA}) = \beta_0 + \beta_1(High - Yield\ Spread_i) + \varepsilon_i$

[2] $Log\ public\ (\frac{D}{EBITDA}) = \beta_0 + \beta_1(High - Yield\ Spread_i) + \beta_2(FamaFrench12_i) + \varepsilon_i$

relation between LBO leverage and the high-yield spread could be as Axelson et al. (2008) explains, that when the spread is low, firms are able to pay interest on higher principals with the same cash flows. However, this should also apply to public firms and as seen in the results, public leverage is highly pro-cyclical to the high-yield spread why this explanation does not hold.

Additionally, the R-squared value in the simple regression is remarkably higher for LBOs than for public firms. This also implies that debt market conditions have a higher explanatory power for LBO leverage but minor for matched public companies. When combining the two primary independent variables in the multiple regression, columns (2) and (4), the results suggests that the U.S high-yield spread and industry dummies increases the explanatory effect of the model, as the R-squared increases for both samples, although significantly higher for the matched public companies. This implies that the cross-sectional effect of industry has a much better explanatory power for the public companies than for LBOs. The R-squared value measures how close the observations are to the fitted regression line and thus a higher value implies that the model predicts the values more precisely. Thus, the R-squared value measures how well the independent variables estimates the variance in the dependent variable. To investigate this issue more rigorously, we add the independent control variables in the next section to develop the model further. Finally, as in the simple regression, LBOs experiences a negative coefficient while it is positive for public companies, significant for both samples which confirms the findings described in this section.

Table IV
Determinants of LBO versus Matched Public Company Leverage Prior to the Financial Crisis of 2008

This table shows the result from the simple and multiple OLS regression of LBOs and matched public median leverage on the U.S. High-yield spread (U.S. High-yield Index over U.S. LIBOR) and fixed effects for industry, based on the Fama-French 12 industry classification.

	(1) LBO log D/EBITDA	(2) LBO log D/EBITDA
U.S. High-yield Spread	-0,0982***	-0,0836***
	(0,0177)	(0,0194)
Industry Fixed Effect	No	Yes
No. of Observations	310	310
R-squared	0,111	0,179
	(3) Public log D/EBITDA	(4) Public log D/EBITDA
U.S. High-yield Spread	0,0559**	0,0476**
	(0,0218)	(0,0197)
Industry Fixed Effect	No	Yes
No. of Observations	273	273
R-squared	0,044	0,299

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The reason why we experience different R-square values than Axelson et. al (2008), is not very surprising as this examination focus on a smaller geographical area and a different time period. However, we took this into account by only including the sample that is dated until 2008 when performing the comparison with their results. However, their sample dates back until 1980 while our sample begin in 1998, which could also explain the small differences between the results.

8.2 Determinants of LBO Leverage

In the second part of the regressions, we develop the model further by adding independent control variables that in previous empirical work have been proven to explain capital structure. When performing these multiple linear OLS regressions[3], we again obtain similar results as Axelson et. al (2008) obtained on their U.S. sample. As in the previous section, we only include the sample dating until 2008 to have a sample as similar as possible to the benchmark. See Appendix table V for the results.

For matched public companies, the results document that only the high-yield spread and the independent control variables of asset turnover (Sales/PPE) and earnings volatility are significant for matched public companies. The not significant results, might be due to that the sample is relatively small compared to the number of independent variables.

In the case of the estimate R&D/sales, data on R&D expenses were unavailable for a majority of the matched public companies which might also explain the weak significance. The positive and significant coefficient of the high-yield spread suggests that matched public firms have a pro-cyclical relationship to debt market conditions. However, despite the weak significance, these findings are in line with previous empirical work, that leverage decreases with operating risk and asset intangibility, consistent with the trade-off theory, and documented by the negative and significant coefficients of the proxies. For LBOs on the other hand, the matched proxies have no explanatory effect on leverage, and the high-yield spread is the only significant determinant of leverage on a 99 % conventional level. When

[3] $Log\left(\frac{D}{EBITDA}\right) = \beta_0 + \beta_1(High - Yield\ Spread_i) + \beta_2 \log(median \frac{D}{EBITDA_i}) + \varepsilon_i$

$$Log\left(\frac{D}{EBITDA}\right) = \beta_0 + \beta_1(High - Yield\ Spread_i) + \beta_2\left(median\frac{Market}{Book}value_i\right) + \beta_3\left(median\frac{Sales}{PPE}value_i\right) + \beta_4\left(median\frac{R\&D}{Sales}value_i\right) + \beta_5(median\ ROIC_i) + \beta_6(median\ Earnings\ Volatility_i) + \varepsilon_i$$

$$Log\left(\frac{D}{EBITDA}\right) = \beta_0 + \beta_1(High - Yield\ Spread_i) + \beta_2 \log(median \frac{D}{EBITDA_i}) + \beta_3'(Type\ of\ Transaction_i) + \varepsilon_i$$

$$Log\left(\frac{D}{EBITDA}\right) = \beta_0 + \beta_1(High - Yield\ Spread_i) + \beta_2\left(median\frac{Market}{Book}value_i\right) + \beta_3\left(median\frac{Sales}{PPE}value_i\right) + \beta_4\left(median\frac{R\&D}{Sales}value_i\right) + \beta_5(median\ ROIC_i) + \beta_6(median\ Earnings\ Volatility_i) + \varepsilon_i$$

examining if size (measured by EV) of a LBO deal, and if the type of transaction have any explanatory effect on leverage, these results are not significant and we cannot draw the conclusion that the size or type of transaction determines LBO leverage on any conventional level.

In conclusion, we can to some extent confirm that public leverage is estimated by the factors related to the trade-off and pecking order theory. Finally, LBO leverage is significantly determined by current debt market conditions estimated by the U.S. high-yield spread.

8.3 Determinants of LBO Leverage Before and After the Financial Crisis of 2008

To answer the research question we conduct a third regression to measure whether the determinants of LBO leverage have different explanatory power after the financial crisis of 2008 than before. The results, documents that the dummy defined as post financial crisis is significant on a 99% conventional level for the matched sample of public companies, which predicts that public leverage is higher after the crisis than before. Moreover, the interaction terms are significant for a majority of the independent variables for matched public companies. However, for the sample of LBOs, none of the interaction terms results in statistically significant results and we cannot draw any statistical conclusion if any of the determinants of LBO leverage differ after the crisis.

For matched public companies, the coefficient of the U.S. high-yield spread is estimated to have changed from being positive to negative after the crisis, which implies that the leverage of matched public companies has changed from a pro-cyclical to a countercyclical relation to debt market conditions after the crisis measured by the negative coefficient of the credit spread. The beta coefficient prior the crisis was 0,0666 and the beta coefficient after the crisis is -0,1344, with a significant difference of 99%[4]. Moreover, in absolute terms, the effect of the high-yield spread has as well diminished and the effect of leverage as a function of the credit spread seems to have weaken after the crisis. The results, infer that leverage of matched public companies can be predicted to move closer in relation and reacts more similar to changes in the U.S. high-yield spread as LBOs after the crisis.

[4] Calculated by adding the interaction term for post financial crisis and high yield spread with the coefficient for high yield spread prior the financial crisis (0,0666+(-0,201)= - 0,1344).

However, we cannot infer that LBO leverage is moving closer to the matched public sample due to lack of significance on any conventional level.

For the proxies, it can be predicted that the coefficient of asset turnover (Sales/PPE), has become negative to a higher extent after the crisis and thus the leverage of matched public companies reacts more strongly to the level of asset turnover after the crisis. This is based on the empirical theory that higher asset turnover implies lower leverage. Another interesting result is that the proxy for intangible assets' (R&D/Sales) coefficient after the crisis has changed by -7,495, with a significant difference of 99% (from -0,00295 to -7,50). However, this may not be a real effect since we did not obtain data of R&D expense for a majority of the sample and the real effect may not be as strong as suggested by the results.

As concluded previously, we cannot draw any conclusion whether the determinants of LBO leverage differ after the crisis due to lack of significance. Moreover, LBO leverage as a function of transaction size (EV) and transaction type were already not significant in the earlier regressions and do not yield any explanatory power in these regressions either. One explanation that the results are not significant for LBOs is the small sample size relative to the number of independent variables, as highlighted previously. Moreover, a larger sample increases the possibility of obtaining significant results as it more reliably reflects the population mean[5]. However, albeit not significant on any conventional level, these results suggests that several of the independent variables of LBOs and matched public companies differ after the financial crisis of 2008.

To conclude, whether the determinants of leverage differ after the financial crisis or not is only predicted significantly for matched public companies and not for LBOs. However, as we can observe in the descriptive statistics and in Figure 1, LBO leverage is higher after the crisis than prior despite the wider credit spread, but the model is unable to capture the true estimates for this observation. In the next section we discuss what alternative explanations and selection biases that might have affected the results.

[5] Tutor meeting with Per-Olov Edlund, 11th May 2016

Table V
Determinants of LBO Leverage Prior and After the Financial Crisis of 2008

This table shows the results from the third multiple linear OLS regression where we include interaction terms to estimate the determinants of leverage after the financial crisis.

	(1)	(2)
Winsorized Variables	LBO log D/EBITDA	Public log D/EBITDA
U.S. High-yield Spread	-0.0529***	0.0666***
	(0.0189)	(0.0212)
Public log D/EBITDA	-0.209***	
	(0.0610)	
Public Market/book	0.0784	-0.148
	(0.0545)	(0.0911)
Public Sales/PPE	-0.0524	-0.148***
	(0.0393)	(0.0562)
Public R&D/Sales	-0.00759	-0.00295
	(0.0490)	(0.0402)
Public ROIC	0.136	-0.611
	(0.298)	(0.423)
Public Earnings Volatility	-0.244	-1.308***
	(0.355)	(0.470)
Post-financial crisis dummy	0.451	1.811***
	(0.722)	(0.604)
Interaction term: U.S High-yield spread	0.00337	-0.201***
	(0.0683)	(0.0609)
Interaction term: Public log D/EBITDA	0.101	
	(0.114)	
Interaction term: Public Market/book	-0.135	0.0378
	(0.110)	(0.129)
Interaction term: Public Sales/PPE	-0.183	-1.003***
	(0.387)	(0.323)
Interaction term: Public R&D/Sales	0.0629	-7.495***
	(2.001)	(1.792)
Interaction term: Public ROIC	-	-
Interaction term: Public Earnings Volatility	1.537	3.324
	(3.542)	(3.078)
Constant	1.756***	0.420*
	(0.234)	(0.254)
Observations	266	266
R-squared	0.262	0.409

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

9 Alternative Explanations and Selection Biases Affecting the Results

9.1 Implications of Predicted LBO Leverage

In a typical LBO transaction, the future excess cash flows generated by the acquired firm are used to pay down the debt that was initially used to finance the acquisition. This implies that there is a risk that the PE firm use higher levels of leverage to finance the acquisition and that the optimal capital structure will be reached at a later point in time when some of the leverage have been amortized and that the optimal capital structure of a LBO is not chosen at the time of the transaction. Unfortunately, we did not have the data available to explore this issue further. However, Axelson et al. (2008) tested for this possibility by redoing the same regression using the predicted debt 5 years after the LBO transaction. This robustness check also confirmed that there is no relation between the predicted capital structure of LBOs and matched public companies. As this examination yields similar results in previous regressions, we assume that this would also hold for the sample of LBOs as well.

9.2 Implications of Pre-LBO Leverage

In line with the implications of predicted LBO leverage is the possibility that despite even if we divided the LBO transactions and public companies and matched them based on year, quarter and Fama-French 12 industry, there could still be a risk for heterogeneity in the debt capacity of LBOs despite this matching and grouping process. As companies targeted for an LBO are required to have the capacity to take on the high debt financing as a result of the transaction, it exists a probability that the acquirers are more likely to choose target companies within a year, quarter and industry that have higher debt capacity than other ones. This might imply that the LBO sample is biased towards a certain type of companies that can bear higher levels of debt (Axelson et al., 2008). We controlled for this possibility by using a subsample of pre-LBO leverage for the number of Going Private transactions where this financial information is available. Unfortunately we were only able to find this information on a subsample of 37 companies which is a very small sample to be able to perform accurate empirical analysis. The results of this robustness check after redoing the same regressions with sample of Pre-LBOs, as predicted, did not yield any significant results neither before nor after the crisis and we cannot draw any conclusion how this potential selection bias might have affected the results.

9.3 Implications of Public Adjusters' Leverage

We also controlled for the possibility that the sample of public companies might not have reached their optimal capital structure at the time of the observation. As adjusting its capital structure significantly is very costly for companies, we can expect that companies do this very infrequently and when doing so, the change is most likely to be persistent and the change can be viewed to be within an optimal range (Leary and Roberts 2005). This might have affected the results as a company might have changed its capital structure significantly after the financial crisis to reach its optimal capital structure rather than as a result of the crisis itself, as the results documents for the sample of matched pubic companies. To control for this issue, we constructed a sample of public adjuster companies that were defined as public companies that have changed their capital structure more than ten percent in two consecutive years in absolute value. The results of the robustness check after redoing the same regressions with sample of matched public adjusters does not yield any significant results neither before nor after the crisis and we cannot draw any conclusion how this potential selection bias might have affected the results.

10 Conclusion

This examination explore what determines leverage in LBOs and how the determinants differ after the financial crisis of 2008 in the U.S. We examine this by first comparing LBO leverage to a matched sample of public companies based on year, quarter and Fama-French 12 industry. If previous empirical framework holds, there should be a relation between LBOs' and matched public companies' leverage. Contradictory, in the first regression, we find no cross-sectional relation between LBO leverage and matched public companies. Instead we observe that matched public companies' leverage is primarily determined by cross-sectional factors estimated by industry affiliation and company-specific characteristics, in line with the trade-off theory and the pecking order theory. For LBO leverage, on the other hand, these theories have no explanatory power. Instead, LBO leverage is primarily determined by time-series variation in debt market conditions. This lack of relation suggests that there are different factors that determines the capital structure decision of public companies than of PE firms executing a LBO. Since LBOs have a countercyclical relation to the U.S. high-yield spread, it implies that an important factor is the availability and price of debt when choosing capital structure.

Secondly, when examining if the factors determining leverage differ after the financial crisis of 2008, we cannot conclude with certainty if this is true for LBOs. However, matched public companies' relation to the high-yield spread have changed from a highly pro-cyclical relationship, in line with the trade-off theory, to a countercyclical relationship. That public leverage becomes rather countercyclical when the economy is hit by shocks, such as in the case of a financial crisis, is in line with previous empirical work. This suggests that the determinants of leverage of LBOs and matched public companies have a similar relation to debt market conditions, measured by the high-yield spread, after the crisis.

As the descriptive statistics and figure I implies, leverage after the financial crisis of 2008 is higher than prior for both LBOs and matched public companies despite the wider high-yield spread as a result of the crisis, which draw our attention. The relation to debt market conditions, seems to have diminished after the crisis also predicted by the significant results for the matched public companies. However, we could not draw any significant prediction if the determinants of leverage of LBOs differ after the crisis. This could be due to that the observed diminished effect of the high-yield spread seem to be stronger the years following 2012/2013 and it is possible that our model is not able to capture this effect fully due to high differences within the years defined a post-financial crisis.

We also performed robustness checks to predict if any selection biases might have affected the results. However, we could not reject this possibility which implies that our results might be biased due to measurement concerns of the observations both for LBOs and matched public companies.

For further work on the subject, as the model does not capture to a full extent what determines leverage of LBOs, there seems to be additional explanatory determinants not covered in this thesis. Hence, we suggest that further research should be devoted to predict other potential determinants, such as regulatory changes in financial markets, additional macroeconomic factors and how PE firms in terms of ability to raise capital, determines leverage used in LBOs. Finally, that LBOs are exempted from public disclosure requirements makes it difficult to capture the relevant information needed.

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12 Appendix

Table AI
LBO Targets by Year and Type of Transaction

This table shows the distribution of LBO transactions by year and type of transaction. The definition of the different types of transaction are as follow, (1) divisional is a buyout of a division of a larger company, (2) going private is when the target was public and listed on a stock exchange at the time of the buyout, (3) management buyout is when management acquires a large portion of a company from either the parent company or private owners, (4) private companies where already independent and private at the time of the buyout, (5) secondary buyout is when the target was owned by another financial sponsor (PE firm) at the time of the buyout, (6) 25 of transactions where labeled as LBOs but we could not identify the type of transaction.

Year	Divisional	Going Private	Management Buyout	Private Company	Secondary Buyout	LBO Unspecified	Total	Year as % of Total
1998	4	2	0	5	0	2	13	4%
1999	2	8	0	7	1	2	20	6%
2000	3	4	0	13	2	1	23	7%
2001	2	2	0	4	1	0	9	3%
2002	2	2	3	3	1	1	12	4%
2003	1	2	0	7	3	1	14	5%
2004	1	0	4	3	4	3	15	5%
2005	1	4	2	9	3	3	22	7%
2006	1	8	3	12	2	3	29	9%
2007	2	13	5	22	2	1	45	15%
2008	1	1	0	7	1	0	10	3%
2009	0	2	0	3	1	0	6	2%
2010	2	3	0	10	1	0	16	5%
2011	2	1	0	14	2	3	22	7%
2012	1	2	2	6	3	1	15	5%
2013	1	7	1	5	1	2	17	5%
2014	2	4	0	2	1	2	11	4%
2015	1	7	0	2	1	0	11	4%
Total	29	72	20	134	30	25	310	100%
Type as % of Total	9%	23%	6%	43%	10%	8%	100%	

Table AII
LBO Targets by Primary Fama-French 12 Industry Classification

This table displays the distribution of LBOs across the Fama-French 12 industry classification. Industry 11 "money and finance" is excluded from the sample as these type of companies have another motivation for using leverage than non-financial companies. The Fama-French industry classification is based on grouping Standard Industry Classification Codes (SIC) into portfolios and is continuously updated. The classification used was retrieved in May, 2016.

Industry	Fama-French 12	Number of Transactions	% of Total
Consumer Non-Durables	1	32	10,3%
Consumer Durables	2	10	3,2%
Manufacturing	3	37	11,9%
Energy - Oil, Gas and Coal Extraction	4	1	0,3%
Chemicals and Allied Products	5	7	2,3%
Business Equipment	6	52	16,8%
Telecom	7	10	3,2%
Utilities	8	5	1,6%
Retail	9	59	19,0%
Healthcare	10	37	11,9%
Money and Finance	11	0	0,0%
Other	12	60	19,4%
	Total	310	100%

Table AIII
The Structure of LBO Debt Before and After the Financial Crisis of 2008

This table displays the structure of the debt employed for the sample of LBOs, both prior and after the financial crisis of 2008. The main division is between senior bank debt and subordinated debt. Senior debt is usually divided into tranches with different seniorities, maturities and interest rates. Term A is normally amortizing, while term B is not. Subordinated debt can take a variety of forms such as mezzanine and second lien debt. Bonds are usually divided between senior and high-yield junior debt. The composition of debt prior and after the financial crisis have changed to some extent. Non-amortizing term A loans seems to have decreased in frequency and mezzanine/second lien debt is more frequently used after the crisis than prior.

LBO Debt Structure 1998-2008		
	Exists in % of LBO transactions	% of total Debt
Senior Bank Debt		
Term loan A	31%	8,7%
Term loan B	95%	26,6%
Term loan C	8%	2,1%
Term loan D	0,5%	0,1%
Term loan unspecified	30%	8,5%
Bridge loan	21%	5,9%
Subordinated Debt		
Mezzanine/Second Lien	7%	1,8%
Bonds		
Senior Secured	3%	0,9%
Senior Unsecured	12%	3,3%
Subordinated	36%	10,0%
Contingent Debt		
Revolver	94%	26,4%
Other Facilities	16%	4,4%
Preferred Equity	1%	0,4%
Unspecified Debt	3%	0,8%

LBO Debt Structure 2009-2015		
	Exists in % of LBO transactions	% of total Debt
Senior Bank Debt		
Term loan A	7%	1,7%
Term loan B	97%	23,4%
Term loan C	0%	0,0%
Term loan D	0%	0,0%
Term loan unspecified	40%	9,6%
Bridge loan	19%	4,7%
Subordinated Debt		
Mezzanine/Second Lien	29%	6,9%
Bonds		
Senior Secured	8%	2,0%
Senior Unsecured	11%	2,7%
Subordinated	2%	0,5%
Contingent Debt		
Revolver	92%	22,2%
Other Facilities	1%	0,3%
Preferred Equity	4%	1,0%
Unspecified Debt	3%	0,7%

Table AIV
Definitions of Earnings and Leverage Measures

This table displays the definitions for each of the measures used in the regressions and how they have been calculated. Data on public companies is primarily retrieved from Compustat North America, while data on LBOs is retrieved using a combination of Capital IQ, SDC Platinum, LPC/Dealscan and Mergent.

LBO	*Definition*
Total Debt	Senior and subordinated debt excluding contingent debt and preferred equity
Enterprise Value (EV)	Transaction value
EBITDA	LTM Earnings before interest, taxes, depreciation and amortization
D/EBITDA	Total Debt/LTM Earnings before interest, taxes, depreciation and amortization
D/EV	Total Debt/Transaction Value (EV)
EV/EBITDA	Valuation multiple
Matched Public Companies, Public Adjusters and Pre-LBO	*Definition*
Net Debt	Long term debt including the part due in one year - cash and short term investments
Enterprise Value (EV)	Market value of equity + net debt
EBITDA	Earnings before interest, taxes, depreciation and amortization
Median D/EBITDA	Median value of net debt/earnings before interest, taxes, depreciation and amortization based on year, quarter and industry
Median D/EV	Median value of net debt/enterprise value based on year, quarter and industry
Median EV/EBITDA	Median value of enterprise value/earnings before interest, taxes, depreciation and amortization based on year, quarter and industry
Market-to-Book ratio	Market value of equity / book value of total assets
Sales/PPE	Sales revenue/book value of property, plant and equipment
R&D/Sales	R&D expense/sales revenue
ROIC (Return on Invested Capital)	Earnings before interest and taxes (EBIT)/(book value of equity + long-term debt)
Earnings volatility of ROIC	Standard deviation of return on invested capital (ROIC) calculated on several years

Table AV
Determinants of LBO Leverage

This table shows the result of the multiple linear OLS regression of LBO leverage on matched median public company estimates, the U.S. high-yield spread, transaction type and size of transactions as controls. Public measures are calculated median values based on year, quarter and Fama-French 12 industry as the corresponding LBO transaction.

Winsorized Variables	(1) LBO log D/EBITDA	(2) LBO log D/EBITDA	(3) LBO log D/EBITDA	(4) Public log D/EBITDA
U.S. High-yield Spread	-0.0767***	-0.0846***	-0.0620***	0.0666***
	(0.0194)	(0.0192)	(0.0184)	(0.0212)
Public log D/EBITDA	-0.186***		-0.186***	
	(0.0629)		(0.0593)	
Divisional			-0.584***	
			(0.222)	
Going Private			-0.194	
			(0.181)	
Private Company			-0.317	
			(0.198)	
Secondary Buyout			-0.105	
			(0.162)	
Management Buyout			0.250	
			(0.200)	
LBO EV Quartile 1			0.0765	
			(0.127)	
LBO EV Quartile 2			0.199*	
			(0.116)	
LBO EV Quartile 3			0.222	
			(0.150)	
Public Market/book		0.0251		-0.148
		(0.0454)		(0.0911)
Public Sales/PPE		0.0127		-0.148***
		(0.0279)		(0.0562)
Public R&D/Sales		0.0208		-0.00295
		(0.0393)		(0.0402)
Public ROIC		0.271		-0.611
		(0.306)		(0.423)
Public Earnings Volatility		-0.0552		-1.308***
		(0.317)		(0.470)
Constant	1.872***	1.835***	1.818***	0.420*
	(0.122)	(0.167)	(0.192)	(0.254)
Observations	273	300	273	266
R-squared	0.141	0.117	0.240	0.409

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1