

LBO Determinants & The Financial Crisis

Evidence from Nordic Public to Private Transactions

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ABSTRACT

The determinants of leveraged buyouts (LBOs) have received a lot of attention in past research after the 1980s LBO boom and mid-2000s takeover wave. This thesis aims to examine the effect of the Great Financial Crisis on the explanatory power of LBO determinants, using 62 Nordic public-to-private transactions from the last two decades. Using the crisis year as a structural break, pre-crisis and post-crisis sub-sample regressions are conducted. The study finds that, post-crisis, LBO targets have higher liquidity levels and are relatively undervalued compared to matched controls, confirming the hypotheses and previous literature. Bidders' increased focus on liquidity is intuitive given the stricter credit conditions and the importance of cash-buffers after the financial crash. Value-creation, being the key objective of an LBO, explains why bidders target firms whose managers are deemed to be underperforming by the market. Contradicting traditional theory, post-crisis targets have higher debt levels; the study suggests that this finding can be attributed to the signaling hypothesis, partially supported by higher EBITDA growth rates sustained by LBO targets. Although this study identifies capital raising activities as potential Nordic LBO determinants, it cannot with certainty confirm the economic relationship between pre-transaction debt financing activities and LBO likelihood.

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1. Introduction

1.1 Background

The private equity (PE) industry is today a fundamental part of the world economy. The industry became well known during the 1980s popular for the wave of hostile takeovers. From the 1980s, there have been two additional booms, one before 2007 and one in the last few years with the improvement in financial market conditions accompanied by the revival of the PE industry. The PE market has expanded significantly: there were 6,628 PE firms worldwide in 2015 compared to only 24 firms in 1980 (The Economist, 2016).

From the inception of the PE industry, the market in United States of America has been at the forefront and has accounted for almost all private equity transactions during the 1980s. However, the European market has seen a vast augmentation in the decades that followed. Kaplan and Strömberg (2009) found that between 2000 and 2007 over 30% of all PE transactions were European, which is considerably larger than their 3% share between 1985 to 1989. The main markets driving Europe's LBO activity are United Kingdom, France, and Sweden. LBO activity in Sweden, and other Nordic countries, majorly comprises of public-to-private transactions (SVCA, 2017).

Private equity firms usually use a method called leverage buyout (LBO) when completing a Public-to-Private (PTP) transaction. In a leveraged buyout, a company is acquired by a specialized investment firm, such as a PE fund or an acquisition vehicle formed by/with a financial sponsor. An LBO acquisition is characterized by a relatively large fraction of external debt financing, approximately 40% to 70%, and only a relatively small fraction of equity to finance the purchase. Typically, the funds are borrowed against the assets of the company being acquired and the acquirer usually buys majority control of the firm (Kaplan and Strömberg, 2009). Raising a significant amount of debt to purchase the target allows the bidder to reduce its initial equity requirement and thus amplify returns.

Supporters of PTP transactions have argued that going private leads to better managerial discipline and improved operational performance. Existing literature primarily tends to focus on LBOs during the 1980s and the early-2000s, not considering the years followed by the Global Financial Crisis (GFC). The GFC, characterized by the extreme stress in financial markets during 2008, led to a sharp decline in PTP transactions thus highlighting that financial market conditions are of utmost importance to LBO activity. This is also supported by Strömberg et. al (2013) who argue that the credit market has an influential role in buyout activity, particularly on the amount of leverage involved in a transaction and priced paid by PE

firms. Interestingly, the last few years have recorded similar top levels of LBO activity as before the GFC. Thus, it would be worthwhile to analyze how PE firms have modified their selection criteria after barely surviving the financial crisis 12 years ago (Renneboog and Vansteenkiste, 2017).

Through this study, we intend to augment the empirically investigated universe of LBOs by focusing on recent PTP transactions in the Nordic markets and analyzing changes in shared characteristics of the targets after the financial crisis. There have been very few studies which have examined the years after the Global Financial Crisis in 2008, and there have not been any attempts to compare LBO characteristics of acquisitions in the pre- vs. post-crisis era. The sample used in this paper consists of 62 LBOs, with 32 transactions in the pre-crisis era (2000 to 2007), and 30 transactions in the post-crisis era (2008 to 2020). Additionally, this paper will focus on LBOs in the Nordic region, which includes Sweden, Norway, Finland and Denmark.

1.2 Definition and taxonomy of LBOs

1.2.1 Financial Sponsors

A Private Equity (PE) firm is an investment management company that plays the role of a financial intermediary by providing its limited partners access to the private equity asset class. Often referred to as financial sponsors, PE firms raise funds to invest capital committed by their limited partners. One of the primary investment types of a typical private equity firm is a buyout wherein the PE fund purchases a significant stake in the soon-to-be portfolio company.

1.2.2 Public to Private

A Public-To-Private (PTP) transaction involves an offer for the entire share capital of a listed company by a bidder/acquisition vehicle and the subsequent re-registration of this target as a private company (or as a part of the acquisition company). Thus, a PTP transaction is one in which a free standing publicly traded company is converted to a private firm (Lehn and Poulsen, 1989). As all such deals are financed by a significantly high level of borrowing, these are categorized as leveraged buyouts (Renneboog and Vansteenkiste, 2017). Taking the scope of the thesis into account we have chosen to only focus on public to private transactions, and we will use the term PTPs and LBOs interchangeably. In most empirical US and UK literature, LBOs are usually confined to going-private transactions (Renneboog et al., 2005).

1.2.3 Types of LBOs

There are three major types of LBOs that are generally discussed in academic literature, namely MBOs, MBIs, and IBOs. MBOs represent a noticeable chunk of LBO activity and have played the role of a key instrument of privatization in Europe (Sondof and Stahl, 1992). Management Buyouts (MBOs) are LBOs in which the incumbent management, with the aid of investors, replaces public stockholding in the firm with relatively closely held equity. A Management Buy-In (MBI), on the other hand, takes place when the firm is acquired by an outside management team and privatized. The deviation in the level of private information possessed by outside management and incumbent managers differentiates MBIs from MBOs (Renneboog and Vansteenkiste, 2017). A Buy-In-Management-Buy-Out (BIMBO), essentially a hybrid between an MBI and MBO, is a transaction in which the bidding entity consists of internal as well as external managers. Institutional Buyouts (IBOs), also known as Bought Deals or Finance Purchases, are LBOs in which the new owners of the delisted firms primarily consist of institutional investors such as PE firms, hedge funds or investment banks. Typically, the existing managers are retained, and rewarded with equity stakes in the new private firm using equity ratchets (Wright et al, 1991). As far as equity ownership is concerned, in an MBO the management team has gained its equity interest through being part of the bidding consortium while in an IBO management has gained its equity interest through its remuneration package (Renneboog and Vansteenkiste, 2017). An Institutional Buy-In (IBI) is a transaction in which a financial institution acquires the stake in conjunction with a trade-buyer (MergerMarket, 2020).

Table 1: Distribution of transactions by type

Transaction type	Number of transactions
IBO	44
IBI	7
MBO	9
MBI	1
BIMBO	1
Total LBOs	62

Notes: The table provides a summary of transaction types included in the study. IBOs represent the largest share of Nordic LBOs in the last 20 years.

2. Literature review & Expected contribution

Bharat and Dittmar (2010) is one of the recent papers that uses a long sample period (1980 to 2004) to examine a broad set of factors posited by past research to understand the characteristics of firms going-private. They propose an extensive framework for PTP transaction motives including, among other things, agency considerations, access to capital and value/control issues. This is a modified version of the framework posited by Singh (1990) that considers cash flow, operational and contextual determinants of PTPs. Singh (1990) was amongst the first few papers to analyze PTPs from the 1980s LBO boom. An overview of both frameworks allows us to settle on five key factors: free cash flow, liquidity, debt, tangible assets and undervaluation. In the rest of this section, we discuss the findings from existing literature for these factors.

The relationship between the LBO likelihood and the Free Cash Flow Hypothesis (Jensen, 1986) has been greatly debated. FCF is defined as “cash flow in excess of that required to fund all projects that have positive net present value (NPV) when discounted at a relevant cost of capital” (Jensen, 1986). Jensen posited that the market for corporate control should eradicate the agency costs of FCF. Lehn and Poulsen (1989) studied 263 LBO transactions between 1980 and 1987, concluding that mitigation of agency problems is a large part of the gains of being subject to an LBO. Additionally, they showed that the probability increased in companies with managers who own a relatively small equity stake in the firm, highlighting the principal-agent problem. Support for agency costs of free cash flow and realignment of incentives has been found by several LBO studies like Kaplan (1989), Smith (1990), and Muscarella and Vetsuypens (1990). However, by examining Lehn and Poulsen’s (1989) dataset in more detail and accounting for particular attributes such as potentially incorrectly specified variables and outliers, Kieschnick (1998) reached a contradictory conclusion. Furthermore, a similar study on the UK market by Reeneboog et al. (2007) could not find any support for the free cash flow hypothesis and was thus in line with Kieschnick’s findings.

The free cash flow hypothesis, discussed above by Jensen (1986), is closely related to the financial liquidity of a firm as cash is a function of FCF. Jensen argues that with large amounts of liquidity, agency problems such as wasteful spending and empire building can become an issue. In past LBO studies, liquidity was measured using the current ratio metric. By changing this metric and removing industry-related mechanisms, Hasbrouck (1985) found that the probability of being an LBO target could not be explained by financial liquidity. Singh (1990), however, proves that companies engaged in an MBO experience higher levels of

liquidity compared to industry counterparts remaining public. This phenomenon can be derived from the fact PE firms need to raise a large amount of debt when acquiring new companies, and in order to convenience lenders they have the capacity to service their debt (i.e. meet interest payments) they need cash as a security. This is in line with the later study of Desbrieres and Schatt (2002) and also supported by Le Nadant and Perdreau (2006) who prove that French LBO targets exhibit higher financial liquidity by examining a sample of 175 targets.

Leverage has been an important and well-documented determinant of LBO likelihood. Given that a leveraged buyout uses a considerable amount of debt, conventional theory suggests a negative relationship between the existing debt levels of a firm and LBO likelihood. Jensen (1986), who stipulated that going private transactions mitigate agency costs, highlighted the disciplinary role of debt in constraining “free cash flow problems,” thus supporting the notion that LBO targets firms have lower debt levels. Furthermore, financial distress costs are positively related with leverage. Opler and Titman (1993), using a sample of 180 transactions over 1980 to 1990, provided evidence that financial distress costs deter LBO occurrence. Using 124 transactions from the same time period, Kaplan and Stein (1993), also note that an increase in debt burden and financial distress costs hinder the success of MBOs. This is supported by Le Nedant and Perdreau (2006) who conclude that French LBO targets are less indebted than their controls. *Prima facie*, more debt will reduce the attractiveness of a firm as an LBO target, but some studies suggest otherwise. Kieschnick (1998) does not find any negative relationship between debt levels and PTP transactions. Loh (1992), using a sample of 45 manufacturing LBOs in 1987, finds that LBO targets have higher levels of debt on average. Alluring to Ross (1977) and Myers and Majluf (1984), Loh advocates a positive relationship between debt and LBO likelihood by highlighting its strength as a credible signal and its nature as a preferential form of financing, respectively. The increasingly relevant role played by debt in an LBO coupled with strong yet conflicting evidence regarding its impact on the LBO likelihood makes it an important determinant to include in our study.

Given that a substantial increase in leverage enables tax deductions, Lowenstein (1985) suggested tax-saving incentives as motives for LBOs. However, this is strongly contradicted by Kaplan (1989) who argues that public companies can appropriate predictable tax benefits without going private. Similarly, Newbould et al. (1992) conclude that buyout premiums capture possible tax reductions already rendering their explanatory power insignificant. Furthermore, the rise of tax neutrality laws in the Nordics implies that LBOs are not likely to be motivated by tax arbitrage.

Maupin (1987) notes that a noteworthy risk in an LBO is the inability of the target firm to service the acquisition debt. Analyzing a set of French LBOs, Desbrières and Schatt (2002) conclude that LBO targets tend to have a high ability to remunerate lenders' funds and have a lower risk of incurring financial distress. This reasoning was backed by Opler and Titman (1993) who concluded that higher financial distress costs reduce the probability of an LBO. Le Nadant and Perdreau (2006) find that firms with substantial tangible assets are favored as LBO targets given their capacity to take on more debt. Even though only a handful of studies have researched the explanatory power of a firm's tangible assets, all of them have documented a strong relationship between collateralizable assets and LBO likelihood. Hence it is an interesting aspect to consider in our study on Nordic LBOs.

Agency theory, as initially posited by Jensen (1986), also suggests that one of the key motives for a takeover is managerial inefficiency. Analyzing takeover bids for Fortune 500 firms during the 1980s, Davis and Stout (1992) argue that the market price of the public firm is a reliable indicator for managerial inefficiency and conclude that lower market-to-book ratios reduced the risk of takeover. This supported the findings of Hasbrouck (1985), who used a sample of non-financial firms from the early 1980s, to conclude that buyout targets are undervalued. Even though the undervaluation hypothesis has been fairly supported, its rationales have been different. Past studies including Dann (1981) have documented that insiders, who have a different view of firm value, primarily initiated MBOs. This is similar to the concept that undervalued firms are more likely to repurchase their stock as suggested by Myers and Majluf (1984). However, a few studies such as Lehn and Poulsen (1989) have presented evidence that transactions taking firms private are preceded by competing bids or takeover rumors and thus question the insiders' informational advantage. However, recent studies such as Rath and Rashid (2016) conclude that undervaluation increases buyout probability suggesting that the undervaluation is driven by capital market conditions. Considering the turmoil in capital markets caused by the financial crisis, undervaluation could be a determinant of LBOs during the last decade.

The Global Financial Crisis of 2007-2009 refers to a period of extreme stress in the global financial markets and marks the beginning of a worldwide recession sparked by the bursting of the US housing bubble as well as bankruptcies of "too-big-to-fail" institutions (Reinhart and Rogoff, 2009). Ljungqvist et al. (2007), using a dataset of 207 US funds investing in 1,957 buyout targets over a 30-year period, document that investment flows from buyout funds are accelerated when credit market conditions are loosened. In line with this, Kaplan and Strömberg (2009) observe that the GFC was preceded by a boom in LBO activity triggered by

the relaxed lending environment. Noting that PE investors are majorly financially motivated players in capital markets, Strömberg et al. (2013) using a sample spanning LBOs from 1980 to 2008, conclude that macroeconomic credit conditions significantly impact buyout leverage. This supports findings of Axelson et al (2009) who observe that the capital market is the major constraint for financial sponsors. Evidently, there is abundant research that studies LBO activity in the run-up to the financial crisis. This is not surprising given that PE players contributed to the financial fragility during the crisis, as observed by Bernstein et al (2020).

2.1 Expected contribution to literature

Most of the papers have extensively covered the US markets with the UK market receiving occasional attention. There have been very few studies covering the Nordic market and this paper adds a new geographical dimension to the existing body of literature. As mentioned previously, current literature is focused primarily on two LBO waves. Including more recent deals in the sample allows us to test whether results established from the 1980-2000 data still hold. Additionally, to the best of our knowledge, no study has imposed an instructive split with respect to the GFC to analyze the relationship between LBO target characteristics preferred, before and after the crisis. Following the financial crisis of 2008, European financial sponsors only participated in 524 LBOs worth \$24bn as opposed to 1,046 transactions worth \$179bn in 2007, as shown by the MergerMarket database. Thus, there was a “lull” in LBO activity immediately after the crisis. Interestingly, more recent empirical studies such as Bernstein et al. (2020) document that it picked up eventually with the return of “megadeals” by 2015. This implies that there could have been a shift in bidders’ selection criteria as they adapted to the evolving macroeconomic conditions. As such, our study seeks to add some insight on relevant LBO target characteristics after the GFC.

There have not been many efforts in formally examining the relationship between non-financial characteristics and LBO likelihood. One such characteristic that we identify is the capital raising activity of target firms. Although we do not rigorously investigate the relationship of this variable with LBO likelihood, we seek to provide some preliminary evidence about how capital raising is relevant to LBO likelihood in the Nordic markets. While this study seeks to help understand the rationale for PTP transactions, it could be of particular interest to several stakeholders such as equity analysts, investment banks and private equity investors themselves. Given the impact of buyout announcements on share prices, this study could be of critical importance to virtually all stock market participants.

3. Theory & Hypothesis

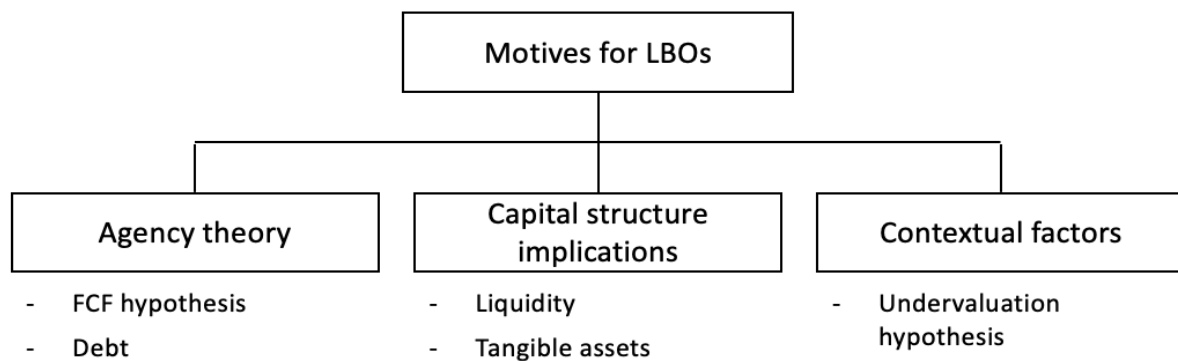


Figure 1: The scope of this study can be divided into three areas: Agency theory, Capital structure implications and Contextual factors. The diagram takes inspiration from the framework suggested by Singh (1990).

Liquidity hypothesis

A number of LBO studies including Singh (1990) and Loh (1992) have identified financial liquidity as determinants of going private transactions. The ability to pay interest in time is a function of the financial liquidity of the firm and is an integral part in an LBO as it improves the bidder's position with respect to the lender. Pre-buyout liquidity can therefore be utilized in paying-down debt, and thus insulating the company from defaulting on its future payment obligations (Singh, 1990).

Liquidity not only prevents future default but also allows bidders to enjoy increased flexibility, post-acquisition. To repay the bridge financing, many financial sponsors tend to liquidate the assets of the target firms. Asset disposals may not necessarily realize their full value (Shleifer and Vishny, 1993) but cash can be used dollar-for-dollar. Therefore, high liquidity levels of a firm make it an attractive target since the LBO deal may finance itself, allowing bidders to focus on their value-creation agendas for the target.

H1: Higher financial liquidity increases the likelihood of being an LBO target

Free cash flow hypothesis

A central theory in corporate finance for value generation and improved efficiency in LBOs is the theory by Jensen (1986) that LBO targets suffer from agency problems of free cash flows. Jensen argues that in the absence of adequate investment opportunities, or managers being reluctant to make investment decisions leads the inefficient use of cash flows. The motives of the firms' managers and shareholders are not always aligned as managers can engage in empire

building by retaining the excess cash flow within the firms. This results in the company growing larger than its optimal size and thus destroying value for its owners. (Jensen, 1986)

Firms with high FCF are attractive to bidders, given that PTP transactions are motivated by an incentive to mitigate such agency problems, and that bidders create value by introducing active monitoring mechanisms (Strömberg et al, 2013).

H2: Higher levels of free cash flows increase the likelihood of being an LBO target

Debt hypothesis

There are several relevant mechanisms when considering the impact of a firm's debt level on the likelihood of being an LBO target. As discussed previously, a key ancillary in the free cash flow hypothesis is the tendency of managers to engage in value-destructive initiatives such as empire building using the excess cash flows. Debt, by enabling managers to "bond their promise" to disburse future cash flows, has an inherent control function and therefore tends to prevent managers from using the firm's free cash flows inefficiently. (Jensen, 1986) Previously, we hypothesized that firms with higher free cash flows have a higher likelihood of being LBO targets. Therefore, given that debt tends to reduce the problems associated with free cash flows, it also tends to reduce the likelihood of the firm being subject to an LBO.

More importantly, traditional theory also highlights its role in increasing costs of financial distress. Singh (1990) documents that highly levered firms would be more susceptible in downturns, indicating that an increase in debt increases the likelihood of incurring financial distress costs. This is because the excessive use of debt will increase the probability of defaulting on coupon payments, therefore increasing the expected direct (and indirect) costs of default. As argued by Opler and Titman (1993), the incidence of financial distress is a major deterrent of LBO likelihood.

H3: Higher debt levels decrease the likelihood of being an LBO target.

Tangible assets hypothesis

As mentioned in the previous hypothesis, a rise in debt levels increases the likelihood of incurring financial distress costs. Firms with substantial tangible assets are favored by bidders since they give creditors better guarantees in the event of distress (Le Nadant and Perdreau, 2006).

Leverage buyouts will, by definition, lead to firms having their debt levels increased. The debt used by financial sponsors in these transactions usually comes from a syndication of third-party lenders (Kaplan and Stein, 1993). Third-party lenders are generally concerned with the “serviceability” of debt (Loh, 1992). Therefore, the borrowers need to convince the lenders that they have ability to service the debt, in this case by being able to fulfill the collateral requirements. This is also highlighted by recent studies such as Bharath and Dittmar (2010) who document the importance of collateralizable assets in going private transactions.

Tangible assets, by definition, have real transactional worth and physical form (Kenton, 2020). Thus, having sufficient tangible assets not only highlights the ability of a firm to secure debt but also indicates its ability to avoid the incurrence of financial distress costs since these assets have high recovery values.

H4: A higher tangible asset base increases the likelihood of being an LBO target.

Undervaluation hypothesis

The roots of the undervaluation hypothesis originate from the rationale that takeovers are motivated by the market's perception of poor management performance. The undervaluation hypothesis has also been backed by Davis and Stout (1992): whose study concluded that the likelihood of being acquired decreased for Fortune 500 industrial companies with higher market-to-book ratios. Undervaluation could be a strong driver in management-led acquisitions because management may have superior information compared to shareholders. Insiders, with superior information, tend to have a better-informed view of firm value than the market, and can thus initiate an MBO if they adjudge the undervaluation to exceed the takeover premium (Dann, 1981).

Additionally, this knowledge could also be exploited by well-informed external investors realizing that a firm has substantial unrealized lock-up value, which motivates them to purchase majority stakes followed by initiation of MBIs or IBIs (Renneboog et al., 2005). An undervalued firm, one with a low market to book ratio, is an attractive takeover target. If the market value of a company is lower than its book value, then in theory a buyer could take control and sell the assets for more than it paid (Frazer, 2019).

H5: A higher market-to-book valuation decreases the likelihood of being an LBO target.

4. Methodology

4.1 Data Collection

This section describes the data and data gathering tools used to conduct our study, with a description of the statistical model. The increasing number of LBO transactions in the last two decades present a valuable source of investigating the potential predictors of such transactions. The sample used in the study consists of 62 LBO targets and 62 matched controls. The usage of control firms is to distinguish target characteristics and thus create a base case to compare the treatment group with. To conduct our study, we construct a treatment group of firms from buyout transactions that have been announced in the Nordics. The list of LBOs was extracted from the MergerMarket database using the following criteria:

1. The transaction type is set to “Buyouts,” and we select “Public-to-Private” in the subset - We specifically select PTP transactions because they form the largest share of Nordic LBO activity, and it is feasible to obtain data for firms which were listed
2. The target firms are from the Nordics - We separately extract the Public to Private transactions by setting the geography to Sweden, Norway, Denmark and Finland respectively
3. The transaction is announced between January 2000 and September 2020

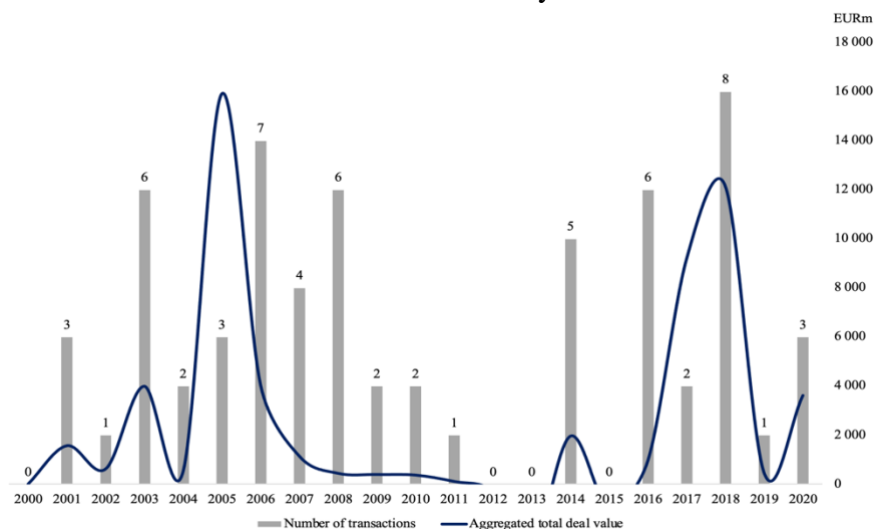
Refinitiv Eikon is our primary source for gathering data on firms. However, the initial sample of 89 transactions from MergerMarket contains noise in the form of duplicates and deals where the bidders are VC funds. In the initial sample, there were 25 firms for which Eikon did not have complete financial data, for the years preceding the LBO transaction. To supplement our data collection procedure, we searched for these firms in FactSet and managed to procure the required information for 7 of these firms. This gave us a complete dataset of 71 transactions. While checking the deal description individually for each transaction, we eliminated 2 duplicate deals and 7 transactions in which the consortium was led by a venture capitalist/angel investor. The final dataset consists of 62 Public-to-Private LBOs (including MBOs, IBOs, MBIs and IBIs) across the Nordic countries. Due to differences in target company names across databases and functional limitations in Eikon, it was not feasible to procure the financial statement data for firms automatically hence the required financial statements were obtained individually for each firm to construct the final dataset.

The fundamental assumption in the sample selection process is that the institutional framework and the LBO environment is essentially uniform across the Nordic countries.

Therefore, nuances in, for example legislation and capital markets, are not specifically accounted for. Further, the year 2000 was chosen as our starting point mainly due to this being the first year in which MergerMarket has a full year history on deals from all four countries.

It is important to note that we consider announced transactions in our treatment group. The reason is that the objective of this study, is to analyze the fundamental characteristics of LBO targets rather than to evaluate the structural drivers of a buyout transaction. There are various reasons for an LBO transaction to fail such as regulatory framework, banking requirements and stakeholder negotiations to name a few. These external factors have no effect on the characteristics of the LBO targets that bidders consider relevant. Since all transactions, completed or not, are included in the sample, it should somewhat mitigate the survivorship bias associated with analyzing completed deals only. For example, including only completed LBOs would skew the results and overlook the bids which failed, i.e. there would have been a form of selection bias. Having said that, in our final sample 95% of the announced transactions are completed deals.

Graph 1: Distribution of transactions used in the study



Notes: The graph shows the distribution of LBO transactions within the Nordic region between 2000 and September 2020. 2018 had the greatest number of transactions, recording a total of eight LBOs, while 2012-2013 recorded no activity.

4.2 Constructing the control group

As this study investigates motives for LBOs, we compare firms in our treatment group, i.e. LBO targets, with similar companies that were not subject to a buyout. For every company that has undergone a public-to-private buyout, one unique public company is selected as a control.

While one to one matching tends to come at cost of higher variance, it allows us to achieve a balanced sample and eliminates the implications of a class bias in the regression.

To be considered a control, the most basic criterion is that the company had to be a publicly traded firm when the transaction was announced and remain on the stock market for at least three years after the LBO. Otherwise, the identified firm would have been an LBO target and would contaminate the control group, defeating its purpose. Apart from being a public firm, three criteria were chosen in order to establish the control group. These are as follows:

1. The target and its peer should be of similar size - We use revenue as a proxy for firm size as we believe this to be a good proxy for company size. This reasoning is in line with previous research such as Gaspar (2012) who also uses revenue to capture firm size. We select the company with the least percentage deviation in revenue compared to the target in the year preceding the transaction announcement.
2. It belongs to the same cluster of industries as the target firm - Companies are matched according to the TRBC sector categories. TRBC is an established market-based classification scheme developed by Reuters and allows us to match controls on the basis of the target's business sector. Industry matching has been used by both Lehn and Poulsen (1989) as well as Le Nadant and Perdreau (2006) when searching for control firms. We use industry matching as it allows us to mitigate industry differences between target and control groups, thus giving us comparable peers.
3. Target and control are from the same geography - We ensure that the control firm is from the Nordic region and preferably incorporated in the same country as the target firm. This maintains comparability with respect to factors idiosyncratic to the target's country at the time of the transaction announcement such as the political scenario, business cycle and trading environment. Further, by being part of the same geographical market, these firms would be exposed to similar investor/shareholder attributes and characteristics.

The control firm was matched to the target firm based on the three criteria above (industry, geography and size) in the year $t-1$, where t represents the year in which the LBO is announced. We gather data up to the transaction announcement year to ensure that the market-based metrics are not affected by the noise/reactions generated after the bid announcement. For example, if in 2006 a Swedish target is announced to be acquired, a Swedish firm which was public during the year 2005, and remained public at least until 2009, had the lowest percentage

deviation in revenue compared with that of the target in 2005 and operated in the same (TRBC) business sector, is the chosen control. To gather all necessary metrics, the required financial data is downloaded from the Refinitiv Eikon database for the years t , $t-1$, $t-2$ and $t-3$ for the selected control firms. In the example mentioned above the three financial statements for 2003, 2004, 2005 and 2006 would have been retrieved.

4.3 Assessing the control group

The objective of identifying matched controls was to eliminate the risk of class bias while conducting the logistic regression. We use a two-sample t-test (assuming unequal variances) in order to ensure that the treatment group and the control group are not significantly different from each other.

Table 2: Overview of t-tests on full sample

Variable	Mean: Target	Mean: Control	t-statistics: difference
Revenue	6,894	6,838	0.0235
Total assets	9,989	12,728	-0.6352
Effective tax rate (%)	19.6	19.8	-0.0234
ROA (%)	3.7	4.1	-0.2522
EPS	4.4	2.4	0.7599

Notes: The table presents results from the t-test for the differences between variable means of the target and control group. None of the t-statistics are significant. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 2 shows that the sample means of revenue, total assets, tax rate, ROA and EPS for firms in the treatment group and those in the control group are not significantly different from each other. Given that the matching was primarily done to obtain firms of similar size within the same geography and the same industry, there is no significant difference between the two groups with respect to the following proxies for size (Revenue and Total assets), geography (Effective tax rate) and industry (ROA and EPS). This implies that we have identified comparable peers for target firms in the treatment group.

The test indicates that the set of control firms is similar to the set of target firms and thus LBO decisions are unlikely to be driven by these variables in our sample. Therefore, the matching procedure has been successful in controlling for the pre-LBO characteristics.

4.4 Choice of Statistical Model

We have reason to believe that the selected variables in our study are related to one another, and therefore a multivariate analysis is our preferred choice of method since it accounts for interactions between the variables. The logistic regressions consist of a binary dependent variable, which takes the value of 0 or 1 depending on the definition of “success” and applies the logistic function to model the event. By construct of the regression, the coefficients show the effect of the regressor on the log-odds ratio¹, rather than on the probability itself.

Another model which could have been employed is the linear probability model (LPM) which uses standard linear regression to estimate the probability of success. Although both the models can be used to model binary events, we use the logistic regression throughout the study. The reason is that logit uses the maximum likelihood estimation (MLE) rather than the Ordinary Least Squares (OLS) method, which is relatively strict, to obtain the parameter estimates. Using the cross-sectional data, we possess, there are likely to be heteroskedastic disturbances which would render the OLS estimates inconsistent. Even though this can be accounted for, a fundamental and unavoidable problem of standard LPM is its tendency to generate probabilities outside the interval [0,1] since the relation between the binary dependent variable and the continuous independent variables is linear. This is discernible by looking at the LPM model equation:

$$Y = E[Y = 1|X] = \beta X$$

The logit model does not assume homoscedasticity and is relatively flexible in terms of the assumptions it imposes. The standard logit model's basic equation can be written as:

$$P[Y = 1 | X] = [1 + e^{-\beta X}]$$

As

$$\lim_{X \rightarrow +\infty} \beta [1 + e^{-\beta X}] \rightarrow 1, \text{ and as } \lim_{X \rightarrow -\infty} \beta [1 + e^{-\beta X}] \rightarrow 0$$

Therefore, the left-hand side of the equation remains within the interval [0,1].

Thus, we deem the logistic model suitable for our study. One could also make the case for the probit regression, which only differs from the logit regression in the fact that it employs the cumulative normal distribution. Although the probit model tends to yield similar results to the logit model for a sufficiently large sample, we prefer the latter because it does not impose the assumption that errors should be normally distributed.

¹ Log-odds ratio is defined as $\log(p/1-p)$ where p is the probability of success (i.e. LBO target, in this case)

5. Empirical Strategy

The aim of our thesis is to understand the effects of the identified firm characteristics on the likelihood of being LBO'd and to study how these effects have been influenced by the financial crisis. We conduct a preliminary logistic regression on the full sample to analyze the results of a basic model in which the parametric estimates are time invariant. Then, we impose a structural break to split the sample and conduct sub-sample regressions, allowing us to analyze the impact of GFC on the parametric estimates. Model specifications are modified, using other potential explanatory variables, to better explain the significance of certain regressors. The sub-sample regressions allow us to examine the effects of the characteristics on LBO likelihood in each time period separately and the z-test uses the coefficients from the sub-sample regressions to quantify the impact of the GFC on each regressor.

5.1 Regression-set up and model specification

As mentioned previously we use the logit regression, a statistical method that is often used to model binary events, to investigate the predictive power of various shared characteristics of firms on the likelihood of undergoing an LBO.

Our illustrative model to identify these characteristics of firms being taken private is:

$$P(\text{LBO}) = F(\text{Liquidity, Free Cash Flow, Debt, Tangible Assets, Undervaluation})$$

The functional form is as follows:

$$P(\text{LBO} = 1) = G(Z), \text{ where } G \text{ is logistic function}$$
$$Z = \beta_0 + \beta_1 X_1 + \dots + \beta_n X_n, \text{ where the } X\text{s represent variables for the characteristics}$$

5.2 Variable selection for hypotheses

The liquidity hypothesis is represented by using a modified version of cash ratio defined as cash and cash equivalents divided by total assets, in line with Opler and Titman (1993) who use a similar measure. This metric is a more robust measure of liquidity than the commonly used, current ratio because the version of the cash ratio used in our study accounts for cash inflows from debt issuances since the denominator is total assets.

The FCF hypothesis is measured by the variable free cash flow upon revenue. In this

thesis, free cash flow is defined as:

$$\text{FCF} = \text{EBIT} - \text{Paid Taxes} + \text{Depreciation and Amortization} - \text{CAPEX} - \Delta \text{NWC}$$

The FCF has been divided by revenue (an aggregate measure of cash inflow) to reduce the estimation bias with respect to firm size, which is coherent with prior studies such as Lehn and Poulsen (1989) and Renneboog et al. (2007). Alternative methods would be to create a ratio using the balance sheet for the denominator, for instance market cap or enterprise value. However, these bases are not chosen due to the risk of the metric becoming a valuation multiple.

A firm's leverage i.e. Debt-to-Equity (D/E) ratio is our chosen metric for measuring a firm's level of indebtedness. Debt is defined as long-term debt of the firm (as we intend to capture the long-term interest-bearing liabilities) and Equity refers to the book value of total shareholders' equity. Following the practice of Le Nadant and Perdreau (2006) as well as Singh (1990), we divide debt by equity to ensure our measure does not contain a size bias, as explained above.

We employ the fraction of plant, property & equipment (PPE) in total assets, as an adequate measure of the firm's tangible assets. This is similar to Le Nadant and Perdreau (2006) who use the company's total tangible assets (i.e., fixed assets + current assets) as a proxy. We refrain from using the current assets component of tangible assets because current assets could be a measure of short-term liquidity and cannot be posted as collateral while taking on debt. The relative size of tangible, fixed assets is relevant because, in LBOs, funds are usually borrowed against assets on the target's balance sheets (Gilhully, 1999). Since these assets usually have high recovery values in bankruptcy proceedings, having a higher fraction of PPE assets also tends to mitigate the loss of value during situations of financial distress.

A simple measure of how the market evaluates a company is the ratio of the market price per share to the book value per share. The presence of a strong positive correlation between managerial efficiency and the market price for shares serves as the fundamental premise underlying the market for corporate control, therefore implying that the share price serves as an objective indicator of management performance (Manne, 1965). In line with Davis and Stout (1992) as well as Rath and Rashid (2016), we use the price-to-book (P/B) ratio as the metric to test the undervaluation hypothesis. We do not use Tobin's q, an alternative valuation measure, since it requires the estimation of the replacement cost of the firm's total assets which is not feasible.

Table 3: Hypothesis overview

Concept	Expected sign	Metric	Formula
Liquidity	+	Cash ratio	Cash & Equivalents / Total assets
Free cash flow	+	FCF ²	FCF / Revenue
Debt	-	Leverage	Long term debt / Shareholder's equity
Tangible assets	+	PPE ratio	Fixed assets / Total assets
Undervaluation	-	P/B ratio	Price per share / Book value per share

Notes: Summary of hypothesis stated previously and the expected sign of each metric's coefficient. A detailed version of this table is given in the Appendix A.1.

5.3 Pooled sample analysis

The first set of regressions that we run is essentially for the full sample that consists of 124 observations i.e. 62 targets firms and 62 controls. This allows us to see the impact of the select firm characteristics on the likelihood of an LBO for the pooled sample that consists of transactions from the last two decades. Table 4 presents the results of the full regression. Liquidity, tangible assets and undervaluation exhibit the correct sign in accordance with our hypothesis but fail to exhibit significance. Contrary to our expectations, free cash flow is negatively related to LBO likelihood and is not statistically significant across models (1) & (2) in Table 4, which is in accordance with Kieschnick (1998).

For leverage we observe significance at 10%. However, the coefficient is positive. This contradicts earlier studies such as Davis and Stout (1992). Instead of buying companies with lower debt levels, where bidders have more headroom to raise a large amount of debt post acquisition, our results show that they are buying companies with higher debt levels. This is in line with Loh (1992) who suggests that high debt levels could be explained by market signaling.

The signaling theory posits that managers of high-quality firms can use a credible signal (such as debt) to distinguish themselves from low quality firms (Ross, 1977). Loh (1992) argues that bidders are rather attracted to firms that signal better prospects suggesting that post-acquisition, value creation could be driven by realization of the targets' growth potential. Managers' tendency to take on higher levels of debt as a mode of funding can be construed as an effort to signal their optimistic expectations for the firm.

² Although the calculation refers to FCF margin, we refer to it as FCF in the regression tables

In an effort to test the signaling hypothesis and explain the significance of leverage, we add EBITDA growth as a variable in model (2) expecting it to be positively related to LBO likelihood. EBITDA growth is known to be one of the barometers of a company's growth prospects (StockEdge, 2018). Although not abundant in LBO literature, growth variables have been tested by Lehn and Poulsen (1989), Muscarella and Vetsuypens (1990), and Singh (1990). We add EBITDA growth as a regressor to supplement the debt signaling hypothesis: high EBITDA growth tends to justify high debt levels and signals optimistic prospects. As expected, EBITDA growth does have a positive sign, but it is insignificant and as such we cannot draw any major conclusions regarding the debt signaling hypothesis from model (2).

Table 4: Summary of pooled regression

Full regression	LBOs and control groups	
Variable	(1)	(2)
Cash ratio	1.391 (0.656)	1.400 (0.658)
FCF	-0.245 (-0.423)	-0.245 (-0.424)
Leverage	0.661 (1.734) *	0.659 (1.722) *
PPE ratio	0.579 (0.718)	0.580 (0.719)
P/B ratio	-0.105 (-0.864)	-0.106 (-0.864)
EBITDA growth		0.002 (0.056)
N	124	124
Log likelihood	-81.218	-81.217

Notes: The dependent variable is the Probability of being an LBO target. Reported z-stats are in the parentheses. This table presents the effect of the following determinants on LBO likelihood, using data from years 2000 to 2020. None of the intercepts are significant and not reported in any tables further.
*** p< 0.01; **p< 0.05; *p< 0.1

It is important to note that the full sample regression assumes that the parameters are time invariant. However, given the long time period considered they are not constant throughout the period and we therefore impose a structural break.

5.5 Imposition of a structural break

Structural break refers to an unexpected change over time in the parameters of regression models that can cause forecasting errors and render the model unreliable, if not accounted for. With the benefit of hindsight and knowledge of the wide-ranging impact of the economic event across the financial sector, we identify the Global Financial Crisis (GFC) to be the source of the structural break. Pertaining to the scope of the thesis, we focus on the impact of the financial crisis on the relationship between the identified characteristics and LBO likelihood.

To test the importance of the structural break, we conduct a likelihood ratio test where we compare the restricted full sample regression model (1), with an unrestricted full sample regression which uses a crisis dummy to allow the covariates to vary before-and-after the financial crisis. The increase in likelihood, after allowing for periodic flexibility, is statistically significant at 1%, and therefore splitting the sample allows us to run a pre-crisis and a post-crisis regression (observed in Appendix A.2).

In order to ensure that our choice of the split year (2008) is not particularly arbitrary, we conduct the likelihood ratio test by imposing “fake” structural breaks in different years to assess the change in likelihood (see results in Appendix A.2). The improvement in likelihood was not significant for any of these years.

The choice of 2008 as the split year also considers economic reasoning rather than pure statistical incidence. Strömberg et al. (2013) document the importance of market-wide conditions for LBO activity and in line with this paper, we use the Euro High-Yield Index Option-adjusted spread to proxy for the credit market status. As discernible from the graph (in Appendix A.3), the credit spread peaks in 2008 showing the ultimate brink of the financial crisis. Therefore, transactions announced before 2008 are used in the pre-crisis regression and the ones announced since 2008 are used in the post-crisis regression.

To analyze what drives the factors in more detail and how these have changed over time we split the transactions into two time periods: pre- and post-the financial crisis.

5.6 Impact of the Global Financial Crisis

The onset of the Global Financial Crisis had a major impact on financial markets across the world. The financial crisis started in the US in December 2007 (Reinhart and Rogoff, 2009) causing the nationwide banking system to collapse. The crisis rapidly spread to Europe given its strong exposure to the US markets, and several European countries faced marked economic setbacks. The strong trade interdependence of economies across the world facilitated the contagion causing the Great Recession.

One of the observable features of LBO markets is the cyclicity evidenced by the high correlation between economic conditions and the volume of PE transactions, first documented by Kaplan and Stein (1993). More recent work, on the relationship between LBOs and market conditions, such as Strömberg et al. (2013) show that the economy-wide credit environment majorly influences the use of leverage in buyouts. Drawing upon this work, we study the impact of the financial crisis on the relationship between the identified characteristics and LBO likelihood.

We believe that the impact of the financial crisis on bidders' ability to take on leverage and on macroeconomic conditions will primarily affect the relationship of the following factors with LBO likelihood: liquidity, tangible assets and undervaluation. During a time period when it's riskier and more difficult to take on debt (Murfin, 2012), liquidity particularly attracts bidders as it allows them to focus on implementing their vision and strategy rather than having financial distress looming over their decisions. Another reason for acquiring liquid targets is the flexibility to use the firms' cash-holdings for executing "buy-and-build" strategies, especially when external funding is costly. Similarly, targets with higher tangible assets are attractive as they enable bidders to secure better debt terms in such conditions. Our hypothesis for an increase in the effect of factors associated with liquidity and debt security is supported by Wollaston and Witte (2020) who observe that financial sponsors increase focus on factors, which insure survival of their portfolio companies in the event of a crisis. Post-crisis, the effect of undervaluation should increase i.e., bidders will seek firms with significantly lower price-to-book ratios. This could partially be expected due to bidders' increased focus on value creation potential and the urge to buy at "reasonable" prices to boost IRRs in difficult times. Rath and Rashid (2016) show that market undervaluation is a dominant factor in private equity takeovers in tense market conditions.

For the remaining factors, we do not hypothesize a significant change as we believe that they remain fairly important both, before and after the financial crisis. Post-crisis, leverage is still expected to be negatively related with LBO likelihood given the increase in corporate default rates (Giesecke et al, 2014) and the increase in investors' risk aversion right after the

crash (Hoffmann et al, 2012). Similarly, we believe that there won't be a significant increase in the effect of FCF on LBO likelihood, owing to the rise in corporate governance regulation (Anthony et al, 2014).

Table 5: Impact of GFC on variables

Variables	Expected sign	Impact of GFC on variable sign
Cash ratio	+	Stronger
FCF	+	No significant change
Leverage	-	No significant change
PPE ratio	+	Stronger
P/B ratio	-	Stronger ³

Notes: Snapshot of identified variables for each hypothesis and how we expect the financial crisis to affect their explanatory power on log-odds ratio.

5.7 Quantifying the impact of the crisis

To study the effect of the financial crisis on the relationship between the identified variables and LBO likelihood, we conduct two sub-sample regressions after imposing an instructive split.

From our discussion in the previous section, it is evident that we expect the coefficients of the identified variables to change significantly. Even though the sub-sample regressions already allow us to observe the effect of these determinants on LBO likelihood during both the periods, the *impact* of the crisis on the coefficients cannot be adjudged by merely comparing the coefficients in the pre- and post-crisis models.⁴

In order to test the severity of change in regression coefficients, we compute the z-statistic for the difference in regression coefficients. Drawing upon the work of Paternoster et al. (1998), we use the corrected formula for the statistical test:

$$Z = \frac{\beta_{post,i} - \beta_{pre,i}}{\sqrt{SE_{post,i}^2 + SE_{pre,i}^2}}$$

³ Stronger in this case represents more negative

⁴ For example, if cash ratio has a coefficient of 6.5 in the pre-crisis regression and 8.5 in the post-crisis regression both significant at 5%, it only indicates that liquidity is an important determinant of LBOs in both time periods. However, we cannot conclude that the importance of liquidity significantly increased post-crisis simply because 8.5>6.5; this can only be concluded iff the increase from 6.5 to 8.5 is significant.

Here, the β s are the coefficients for the same regressor from both time periods and SEs are their respective standard errors.

This corrected formula uses an unbiased estimate of the standard deviation for the sampling distribution of the difference. The formula is applicable for regression-type problems that yield maximum likelihood estimates and is thus valid for the logit model which we use. We compare the z-statistic with the relevant critical value (e.g. 1.645 for 5%) using the pre-crisis and post-crisis models which have the same set of regressors to maintain consistency. The computation of the test statistic assumes that there is negligible covariance between the estimates, as the coefficients stem from independent sub-samples.

This test allows us to quantify and evaluate the impact of the financial crisis on the strength of the slope coefficients. Thus, a significant z-stat demonstrates that there is a significant increase in the explanatory power of a regressor on the log-odds ratio, due to the financial crisis.

5.8 Robustness checks and validity of model assumptions

We modify models across Table 8 by inclusion, exclusion and replacement of other potential explanatory variables. The stability of the coefficients, across the various model specifications, indicates robustness. To ensure that the sub-sample results are not driven by the matching criteria used while constructing the full sample, we conduct control assessment tests for the sub-samples and confirm that there are no significant differences between the target and control groups after the instructive split, as observed in Table 6 and Table 7.

Although we use industry matching to obtain matched controls, the regressions do not explicitly control for industry effects across sub-samples. For example, the significance of liquidity in the post-crisis era could be driven by PE firms' shift towards cash-rich industries. We include intercept-dummies for industries (based on TRBC sector classification) in both sub-sample regressions (table can be found in Appendix B.1). The variables deemed significant initially in Table 8, retain significance after accounting for underlying industry effects, ensuring robust estimates.

We also compute the average marginal effects (AME) for the regressors in each of the models. The AMEs shows the partial effect of each regressor on the actual *probability* of an LBO, as opposed to the coefficients which show effects on the log-odds ratio of an LBO. The AMEs (Appendix B.2) exhibit the same sign as coefficients and retain significance for the

regressors which are significant in the original regression models observed in Table 8. Although this does not prove that the regressions are free of unobserved heterogeneity, it gives assurance that the parameter estimates are not materially affected by extreme observations and are therefore meaningful.

More importantly, we need to ensure that the models adhere to other structural assumptions for the logistic regression (Appendix B.3 and B.4). Logit assumes a linear relationship between each regressor and the log-odds ratio, which we confirm by observing the linear trend evident in the smoothened scatter plots. Secondly, multicollinearity renders logit estimates inconsistent. We compute the variance inflation factor (VIF) for the original model specifications and all the values are well below the critical limit of five (Appendix B.6).

Table 6: Overview of t-tests on pre financial crisis sample

Variable	Mean: Target	Mean: Control	t-statistics
Revenue	8,480	8,808	-0.0795
Total assets	9,543	12,414	-0.4016
Effective tax rate (%)	36.7	24.8	1.1292
ROA (%)	4.0	5.8	-0.8645
EPS	7.3	2.2	1.1501

Notes: The table presents results from the t-test for the differences between variable means of the target and control group. None of the t-statistics are significant. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 7: Overview of t-tests on post financial crisis sample

Variable	Mean: Target	Mean: Control	t-statistics
Revenue	5,201	4,737	0.2181
Total assets	10,464	13,062	-0.5474
Effective tax rate (%)	15.6	14.2	0.1435
ROA (%)	3.3	2.3	0.4511
EPS	1.3	2.7	-0.5861

Notes: The table presents results from the t-test for the differences between variable means of the target and control group. None of the t-statistics are significant. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

6. Results & Discussion

6.1 Interpretation of results

The evolution of the models across the post-crisis regression panel is driven by the effort to explain the significance of debt in the post-crisis period. We add similar variables in the pre-crisis regression in order to maintain comparability of coefficients across the two regression periods. Furthermore, the post-crisis regression panel has an extra model which consists of a variable added as a robustness check for the liquidity hypothesis. We have only included this robustness test in the post-crisis regression as liquidity is insignificant in the pre-crisis regression.

Pre-crisis, liquidity is insignificant and negatively related to LBO likelihood. Although in line with Hasbrouck (1985), this contradicts our hypothesis. Targets with lower liquidity could be justified given bidders' ease of infusing cash in the pre-crisis era given the benign capital markets. Post-crisis, liquidity increases LBO likelihood, and cross models (6) to (9) in Table 8, the cash ratio is positive and statistically significant at 10%. This finding is consistent with Desbri eres and Schatts (2002) and Le Nadant and Perdreau (2006). Furthermore, this result is evidence that bidders seek targets with higher liquidity in the post-crisis period. Alves and Morais (2018) advocate an increase in importance of corporate cash holdings in the post-crisis period as a buffer against future uncertainties. Thus, firms with higher cash ratios are subject to an LBO given bidders' precautionary motives.

Pre-crisis, FCF coefficient is positive and post-crisis the FCF coefficient is negative, although insignificant throughout the panels. The statistical insignificance of FCF can be explained by the decrease in agency costs associated with free cash flows over the last two decades given the developments in corporate governance (Chen et al., 2011).

The significance of liquidity, in post-crisis regressions, could have been driven by its net income. A firm's cash holdings are directly related to its profitability (Ali and Yousaf, 2013). Thus, we add the profit margin in the regression as a robustness check for the liquidity hypothesis. Profitability turns out to be statistically insignificant with a negative coefficient in line with Loh (1992). Model (7) shows that the inclusion of the profit margin leaves the cash ratio's significance unaffected. We drop it in further regressions as it is insignificant and does not lead to a significant increase in fit. Since liquidity of targets is not driven by profitability, there could be other factors contributing to high cash ratios of LBO targets in the post-crisis era. We speculate that the higher liquidity of target firms is also driven endogenously i.e., their

decision to incrementally build their cash reserves over time and maintain liquidity levels could have helped them survive the crisis making them more attractive buyout targets.

In the pre-crisis era leverage, although negatively linked to LBO likelihood, is statistically insignificant. This is probably because pre-acquisition capital structure is not extremely important for bidders as they can, post-acquisition, set almost any new financial structure by taking advantage of the relatively benign, liquid capital markets preceding the financial crisis. In the post-crisis era, counterintuitively, leverage is positive and statistically significant at 1% across models (6) to (8). Although this result contradicts conventional theory (Jensen, 1986) and past studies such as Davis and Stout (1992), it is line with findings of Loh (1992). Also, in retrospective, the strong positive coefficient for leverage is in line with the strong, positive coefficient for liquidity and positive coefficient for PPE ratios - high leverage needs to be backed by higher ability to service debt.

To test the signaling theory, we add the EBITDA growth variable in models (4), (5), (8) and (9). As can be seen in Table 8, there are no changes in signs and significance of other coefficients indicating that the inclusion of this explanatory had no confounding effect on other variable interactions, hence indicating robustness. In both time periods, the inclusion of the EBITDA growth variable marginally reduces the effect of leverage on the log odds ratio, although it is insignificant in the pre-crisis era. In the post-crisis era, EBITDA growth is significant at 10% in models (8) and (9). The results provide partial support for the debt signaling hypothesis. More importantly, for the last two models tested in both the pre- and post-crisis eras, the growth and debt variables have the same sign i.e., when debt is negatively related to LBO probability, so is growth and vice versa when debt is positively related to LBO probability. The fact that the direction of relationship of these variables with respect to LBO probability always goes hand-in-hand shows support for the signaling hypothesis.

The significance of liquidity and the significance of the growth variable, in our result, could also refer to a profound aspect of the targets' attractiveness. The pecking order theory, posited by Myers and Majluf (1984), essentially states that high-quality firms will prefer to finance their needs internally rather than externally. For example, if a company meets its financing needs using its own cash reserves, it sends a signal of strength to the capital markets. The fact that the EBITDA growth variable is significantly positive indicates augmentation in operational profits which could translate to future growth. This coupled with the strong, positive result for liquidity implies that the target firms have the capability to finance sustained growth with existing funds, indicating that they could be viewed as "high-quality" firms. A

firm's ability to fund growth could be a particularly valuable trait for financial sponsors who implement a "buy-and-build" strategy.

Observing the strong significance retained by leverage after the instructive split, we replace leverage ratio with gearing as seen in the last model of each panel. Gearing is long term debt divided by total assets. Gearing, unlike leverage, accounts for debt issuances as its denominator increases with capital raisings. As, it is still a measure of debt, we expect gearing to have a negative coefficient. Models (5) and (9) show that the inclusion of gearing leaves other coefficient signs unaffected. Furthermore, the variable for gearing does show a negative sign and retains significance. Post crisis, using the adjusted measure of debt, gearing is significant at 5% in the presence of EBITDA growth.

In line with our hypothesis, tangible assets are positively related to LBO likelihood across the panel, although insignificant. In the pre-crisis era leverage coefficient is negative but the PPE ratio coefficient is positive: though targets are not heavily indebted, bidders still seek firms with a strong, fixed-asset base. This implies that regardless of the economy-wide conditions, bidders are more comfortable acquiring firms with assets which can be pledged as collateral.

Financial sponsors have easier access to capital when credit markets are good and thus in the pre-crisis era P/B ratio has a positive coefficient, although not significant. In the post-crisis era, the P/B ratio is a key predictor of LBO likelihood. It is statistically significant at 10% across models (6) to (9) and is negatively related to the likelihood of an LBO. This provides strong support for the undervaluation hypothesis and is in line with findings from Rath and Rashid (2016) as well as Davis and Stout (1992). The result tends to indicate bidders' focus on intrinsic valuations after the crash and their tendency to acquire firms deemed to be underperforming by market.

The support for the signaling hypothesis could cast doubt on the significance of the undervaluation hypothesis: Firms that signal optimistic prospects should have share prices that incorporate these expectations and thus should not be undervalued, assuming perfect capital markets. However, the undervaluation hypothesis might not indeed be contradicted since our variable for the signaling hypothesis (EBITDA growth) may not be a good proxy for capturing growth prospects of the firm. Moreover, low P/B ratios could have been caused by other reasons implying that signaling and undervaluation do not necessarily contradict each other. An alternative explanation could be PE firms' ability to identify the 'right' LBO targets i.e., the 'signals' of high debt firms were not adequately valued by the stock market and were therefore bargain acquisitions.

Table 8: Pre-financial crisis and Post-financial crisis regressions

Variable	Pre-Crisis panel			Post-Crisis panel			
	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cash ratio	-2.924 (-0.937)	-3.073 (-0.973)	-3.658 (-1.150)	7.201 (1.861) *	6.932 (1.743) *	7.471 (1.885) *	6.857 (1.834) *
FCF	0.630 (0.458)	0.661 (0.479)	0.898 (0.630)	-0.499 (-0.553)	-0.380 (-0.375)	-1.029 (-1.034)	-1.050 (-1.026)
Leverage	-0.086 (-0.257)	-0.086 (-0.251)		2.047 (2.517) **	2.066 (2.529) **	1.736 (2.026) **	
Gearing			-2.081 (-0.989)				5.376 (1.822) *
PPE ratio	0.348 (0.305)	0.321 (0.281)	0.682 (0.563)	2.213 (1.195)	2.168 (1.192)	1.614 (0.849)	1.148 (0.632)
P/B ratio	0.228 (1.270)	0.234 (1.291)	0.202 (1.254)	-0.477 (-1.804) *	-0.467 (-1.765) *	-0.592 (-1.989) *	-0.482 (-1.791) *
Profit margin					-0.290 (-0.257)		
EBITDA growth		-0.010 (-0.366)	-0.006 (-0.210)			0.655 (1.718) *	0.695 (1.659) *
N	64	64	64	60	60	60	60
Log likelihood	-42.813	-42.746	-42.269	-31.076	-31.042	-29.094	-30.537

Notes: The dependent variable is the Probability of being an LBO target. Reported z-stats are in the parentheses. This table presents the effect of the above determinants on LBO likelihood for the pre-crisis sub-sample and the post-crisis sub-sample. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 9: Overall result summary

Hypothesis	Expected sign	Pre GFC	Post GFC
Liquidity	+	Not supporting	Supporting *
Free cash flow	+	Supporting	Not supporting
Debt	-	Supporting	Not supporting *
Tangible assets	+	Supporting	Supporting
Undervaluation	-	Not supporting	Supporting *

Notes: This table presents whether the empirical findings support the previously formulated hypotheses.

*Represents significance in result.

6.1.1 Assessing the impact of the crisis

The results of the regressions in Table 8 allow us to observe the effects of the identified variables on LBO likelihood separately for each sub-sample. In order to draw inferences on the impact of the crisis on the regressors' explanatory power, we check for the *increase* in the coefficients of these variables for the same model specification in the pre- and post-financial crisis era. We assess the impact of the crisis on the identified variables by using Paternoster's (1998) z-test for comparing the coefficients between the two regressions.

As we can see across Table 10, the variables for liquidity, debt, undervaluation and growth are significantly different after the crisis. The signs of the z-scores further convey that the effect of cash ratio, leverage and EBITDA growth on LBO likelihood significantly increased in the post-crisis era. For example, a z-score of 2.037 indicates that the effect of cash ratio on the log-odds ratio is significantly higher in the post-crisis regression. The statistical significance of this increase is 5% (as $2.037 > 1.645$)⁵.

Table 10: Quantifying impact of GFC

Variable	A: (6) vs (3)	B: (8) vs (4)	C: (9) vs (5)
Cash ratio	2.037 **	2.080 **	2.142 **
FCF	-0.686	-0.993	-1.109
Leverage	2.426 ***	1.974 **	
Gearing			2.057 **
PPE ratio	0.858	0.583	0.213
P/B ratio	-2.206 **	-2.370 ***	-2.181 **
EBITDA growth		1.740 **	1.670 **

Notes: The above table presents the GFC's impact on explanatory power. Thus, column A shows the z-scores for the increase in regressor coefficients between model (6) and model (3). Although EBITDA growth was not a part of initial hypotheses, we include it in further tests because it leads to a significant improvement in model fit and provides partial support for the debt signaling hypothesis.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

⁵ Z-score is compared with critical value for one-tailed test

As mentioned before, bidders' preference for higher leverage in LBO targets can be partially explained by the signaling hypothesis, given the significant z-scores of the EBITDA growth coefficient accompanied with the significant z-scores of the coefficients for debt in columns (B) and (C). Additionally, we believe that the significance of debt could also be driven by financial sponsors' motivation to create value through debt renegotiations e.g., refinancing at lower rates after the crisis (Bernstein et al., 2020).

The increase in the effect of liquidity on LBO likelihood is significant at 5% as we hypothesized. This can be attributed to the increase in bidders' precautionary motives and their tendency to increase the resilience of their portfolio companies after the crisis (Bernstein et al, 2020). It is also important to note that the increased focus on target firms' liquidity is not only an incidence of bidder preference but also an endogenous function of the firm's characteristics: increased target liquidity is also explained by target growth rates, evident from higher z-score for cash ratio in presence of EBITDA growth, in column (B) of Table 10. This line of argument is supported by Opler et al. (1999) who observe that firms with higher growth rates are more likely to have higher cash holdings than their peers. Similarly, Song and Lee (2012) explain that cash flow volatility increases firms' tendency to build cash holdings through the post crisis era. The imperative role of cash as a buffer and its ease to pay off debt during volatile times, explains why the z-score of the cash ratio is high in presence of EBITDA growth.

The change in the effect of FCF on LBO likelihood is insignificant and negative which can be attributed to the increase in corporate governance regulation. To re-align incentives of managers and shareholders, governance structures have increased focus towards long-term company performance, resulting in the mitigation of problems associated with agency costs of free cash flow (Anthony et al, 2014).

The increase in the effect of PPE ratio is positive but not significant. This is not necessarily caused by a decrease in the relevance of tangible assets in determining LBO likelihood. Rather it is because a firm's level of tangible assets remains relevant, both before and after the crisis therefore causing the z-score to be insignificant.

A particularly interesting result is the increase in the effect of undervaluation after the crisis. The z-score for P/B ratio was significantly negative highlighting that the explanatory power of undervaluation increased after the crisis. We expected this result to be purely driven by bidders' quest for undervalued targets in the post crisis era. Interestingly, the magnitude of the z-score is also attributable to bidders opting for relatively overvalued firms in the pre-crisis era. This could be explained by the fact that the financial crisis was preceded by a bull-run and PE firms had a plenty of "dry powder" to invest during the "heated" market conditions

(Bernstein et al, 2020). Support for this argument can also be found in Strömberg et al. (2013), showing that PE firms are more prone during lenient credit conditions, to be overpaying as their investment criteria applied are less stringent.

6.2 Additional discussion

Given that signaling only partially explains targets' high debt levels in the post-crisis era, we believe it would be interesting to see the impact of raising capital, ahead of the transaction announcement, on LBO likelihood.

As we highlight in our previous discussion, our initial measure of debt i.e., leverage is inflated if the firm has raised capital (in the year preceding the transaction date) and does not account for capital raising. Hence, we replaced it with gearing. However, gearing also accounts for capital raisings only partially: an increase in debt will increase the numerator more than the denominator, and for larger debt issuances, the inflationary effect on the numerator could be particularly severe. In order to explicitly control for capital raising, we introduce an intercept dummy in our regression: this dummy takes value 1 if the firm has issued debt in the calendar year preceding the recording year ($t-1$), and 0 otherwise. In Table 11, we include the last regression from the post-crisis regression panel and then add the capital raising dummy to it. This yields a particularly interesting set of results.

The variables that we had identified to be significant in the post regression are robust: liquidity, undervaluation and growth retain significance in model (10) in Table 11. Furthermore, after inclusion of the capital raising dummy, gearing is not significant anymore although it is still positively related to LBO probability. Likewise, the capital raising dummy is positively related to the likelihood of an LBO and has a relatively high z-statistic. We are aware that this cannot be an explanatory variable when we apply economic reasoning - a company cannot be an attractive LBO target simply because it raises capital. However, the activity of raising capital sheds light on other relevant factors which could not be adequately captured by the metrics in the regression even though they affect LBO likelihood.

Table 11: Effect of Capital raising

Post crisis sub-sample	LBOs and control groups	
Variable	(9)	(10)
Cash ratio	6.857 (1.834) *	6.838 (1.758) *
FCF	-1.050 (-1.026)	-1.146 (-1.142)
Gearing	5.376 (1.822) *	4.661 (1.561)
PPE ratio	1.148 (0.632)	0.897 (0.481)
P/B ratio	-0.482 (-1.791) *	-0.497 (-1.760) *
EBITDA growth	0.695 (1.659) *	0.749 (1.766) *
Capital raising		0.820 (1.251)
N	60	60
Log likelihood	-30.537	-29.746

Notes: The dependent variable is the Probability of being an LBO target. Reported z-stats are in the parentheses. This table presents the effect of the determinants and the capital raising dummy on LBO likelihood for the post-crisis sub-sample. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

6.2.1 Credit market environment

The tightening of credit conditions accompanied with the strengthening of regulations amplified the difficulties faced by firms to raise capital after the financial crisis. Murfin (2012) found evidence that banks wrote tighter loan contract covenants following the financial crisis. The rise in credit screening mechanisms and loan restrictions ex-ante implies refined borrower quality. Further, Nini et al. (2012) provide evidence that imposition of credit covenants has an active role in governance of corporations and can lead to improved operating performance. Thus, we suggest that raising capital in the post crisis era not only signals optimistic prospects but also indicates firms' commitment to managerial discipline. Therefore, the onset of higher debt could potentially make target firms attractive to bidders, rather than

being a deterrent. However, this could be in contradiction of past studies such as Renneboog et al. (2007) which suggest that buyouts are driven by PE firms' motivation to create value through disciplinary improvements.

Also, Pickens (1987) argues that financially constrained firms would prefer to remain public. This is in line with our findings as we observe that the PTP targets, post crisis, are not financially constrained given the strong, positive result for liquidity and their ability to raise capital in difficult times.

6.2.2 Equity capital market visibility

Recently, studies such as Bharath and Dittmar (2010) and Mehran and Peristiani (2010) have documented the effects of market visibility on the firms' delisting decisions. They conclude that the decrease in analyst coverage tends to increase the likelihood of going private.

We posit that the target firm's decreased equity market visibility could be a peripheral factor in their decision to raise capital through debt issuance. This argument is backed by Chang et al. (2006) who observe that firms with less analyst coverage are more likely to seek debt financing, when raising cash. This effect could be more pronounced in the post-crisis era due to the increased fund-raising barriers in equity capital markets. Therefore, the identification of a positive relationship between capital raising and likelihood of being bought out is perhaps driven by decreased firm visibility in the equity markets. This essentially contributes some clarification as to why debt is positive in likelihood of being acquired in our post-crisis regression.

6.2.3 Nordic debt markets

There has been a paradigm shift in the Nordic private equity markets with regards to their engagement in direct lending. Vandeveld (2018) reports that by setting up huge lending arms, private equity companies have transformed from heavy dealmakers to principal debt providers, during the post-crisis era. By pivoting from private equity to private debt, financial sponsors have filled the void for firms seeking capital. Teten and Farmer (2010) observe that the involvement of PE players along with other intermediaries such as investment banks in credit markets has been a channel of deal flow, although not a major one.

Thus, PE firms with significant activity in debt capital markets, gain relevant information about capital-seeking firms through their roadshows and fund-raising presentations. This could potentially be a reason for financial sponsors to initiate the due diligence for LBOs if they deem

the firms to be attractive. Therefore, target firms' capital raising activities could be the reason they appear on a bidder's radar who subsequently acquires them.

6.3 Wider implications of result

An analysis of our result tables indicates that debt, be it leverage or gearing, has an important role in increasing LBO likelihood. Our result is in contrast to traditional theory and empirical evidence from the 1980s. Jensen (1986) suggests that desirable targets have lower debt levels as this gives bidders the flexibility to take-on further debt, after the takeover. Taking further debt after the acquisition improves management behavior by "creating pressure" to not waste money and thus reduces agency problems. This is backed by Kaplan and Strömberg (2009) who conclude that financial engineering is a key channel of value creation in LBOs. In our post-crisis regression, we observe that targets have a significantly higher leverage than controls and lower FCF, indicating lesser scope for value creation driven by financial engineering or incentive realignment. Furthermore, targets have a higher growth rate than their controls, and assuming that this is indicative of strong prospects, the above results indicate that bidders' value creation agenda evolved from "gains through financial engineering" to "realization of long-term potential." Rather than simply creating pressure on management to reduce wastefulness, bidders are also interested in working with the management to support long-term value realization (see Appendix C.1).

The above suggestion of PE firms' mission of working with the management is also supported by the higher financial liquidity of target firms prior to the LBO. Given that our study focuses on PTPs, financial sponsors primarily initiated the LBO by making a tender offer for the target's shares. If the bid was deemed to be *hostile*, the target firm could have easily used its cash holdings to repurchase shares and preempt the takeover attempt. The fact that the takeover did occur (in 95% of the deals)⁶ allows us to reasonably speculate that most of the Nordic LBOs in the post-crisis era have been "friendly" driven by consensus between bidders and management about the "future of the company." The arguments put forth above suggest that Nordic LBO activity in the post-crisis era possibly differed from that of the U.S in 1980s in two ways - an evolution in the value creation agenda of the bidders and a change in the perceived nature of the takeover bids.

⁶ The failure of the rest 5% of the deals was mainly due to regulatory issues and antitrust laws.

7. Limitations & Further research

7.1 Limitations

We identify a couple of limitations with this study. Firstly, we have only used the three financial statements of a firm while constructing variables for the regression. There are other characteristics which could be considered when building our regression variables to better explain the probability of being an LBO target. For example, the firms' market share, efficiency ratios and dividend payouts are all variables which could have explanatory power, especially since we have limited understanding of what was driving LBOs in the pre-crisis era. However, we had to maintain parsimony in model construction making it virtually impossible to include all possible variables that affect a firm's likelihood of going private. Another limitation in this regard, is the lack of data availability on the pre-transaction dynamics. Even if we have access to a comprehensive financial history of the target, we are unable to consider actions/dealings of managers and current owners. PE firms can discuss and get an indication of whether large shareholders are inclined towards selling their stake if there were to receive an offer, hence informing their likelihood of making a bid. Furthermore, the metrics we used are from the year preceding the transaction announcement and thus we are not able to accurately capture management's rhetoric concerning future growth rate/opportunities. These factors could have explanatory power regarding LBO likelihood.

There are also limitations inherent in the variables used to test the hypotheses. For example, the metric used for a firm's tangible assets - the PPE ratio - represents ability to avoid future distress and the asset capacity that can be posted as a collateral for debt. However, we do not know how much of this "capacity" is already used as collateral for the current debt outstanding. As such, even if a firm has a substantial amount of tangible assets, they might have already borrowed funds against them, limiting firms' ability to use these assets as collateral to secure new debt. Similarly, the P/B ratio may not completely capture undervaluation because it is a relative metric, and it could also be proxying for the growth hypothesis.

A potential limitation in our dataset is the geographical distribution of LBO transactions in the Nordic market, which includes Denmark, Norway, Sweden and Finland. For example, 43.5% of all LBOs are from the Swedish market. This can bias the results from the regression to reflect more the characteristics in Sweden, rather than general Nordic conditions. Even though the capital markets and investor bases in the Nordics are similar, the countries have different fiscal policies and ownership rules, which may affect our results.

Lastly the dataset that has been used for the regressions is very limited. As mentioned before, only 62 LBO transactions fulfill our criteria, and as such the transactions could be capturing extraordinary market events. The implications would be that our result is stained and thus not reflect true market conditions for the entire time period. One could account for this by extending the time intervals in order to include more transactions in the sample, and hence reducing the impact of any potential outliers. Additionally, all transaction data is derived from MergerMarket. Even though MergerMarket is considered the gold standard on data on mergers and acquisitions, it is possible they have missed transactions during these 20 years. The risk is especially larger for our data set as the demand for Nordic transactions in the early 2000s is quite limited, implying lesser scope for improvements driven by error scrutiny by users/clients.

7.2 Further research

Our study includes certain delimitations which can be addressed to improve the design and conduct of further studies in this domain. Additionally, we also suggest areas of further research by highlighting extensions to the topical framework

7.2.1 Improvements to empirical strategy

The results from the logit regression are valuable as they show the effects of the intrinsic firm characteristics on LBO likelihood. However, it is not just the initial characteristics at one point in time, before the buyout announcement, that determine if a firm will undergo an LBO but also the changes in these characteristics over time. The evolution of characteristics could be examined by tracking targets' and controls' financials from the time of their initial public offering in order to generate further data points required for estimating Cox's proportional hazard model. We choose to not include this model because it requires extensive data collection, given the timeframe. Another key delimitation of the research design is the construction of the control group, which follows a one-for-one matching procedure. Identifying only one control per target can make the results contingent on the matching procedure due to extreme control observations. We check for these using the control assessment tests and the AMEs from regression. However, the method can be further improved by using a group of control firms for each target. Secondly, using a more objective method for selecting the control group such as propensity score matching (PSM) could further increase the reliability of the results. However, the use of PSM for achieving balanced samples has been criticized for doing

exactly the opposite and increasing model bias (King and Nielsen, 2018). An alternative solution could be to use randomized industry matching such as Singh (1990).

Throughout our study, we treat all the LBOs uniformly without making a distinction between the investment case for an LBO. LBOs could be classified into Growth LBOs and Turnaround buyouts (SVCA, 2017) allowing the researcher to distinguish between target characteristics for each classification and would help justify the high-debt levels in the post-crisis era. This could be done by looking at the LBO prospectus or by interviewing the financial sponsors/bidding consortium.

7.2.2 Recommendations for future studies

There are a few interesting areas, which further research could focus on. An exciting area to examine would be the signaling hypothesis. Upon adding the EBITDA growth variable to the regression, there was a decrease in effect of leverage on the log-odds ratio of an LBO. An issue with our variable is that we use historical EBITDA growth as an indication of prospective growth. One could incorporate equity analysts' projections as reliable proxies for the company's growth prospects. Capital raising is also an unexplored area where future research is needed. The link between potential participants in a target firms' debt capital market activities and the LBO transaction's bidder consortium could be intriguing to investigate.

Another interesting aspect would be to extend the scope of the control group. Our study as well as most of the existing literature only uses non-LBO'd comparable peers as a control group thereby violating the 'exclusion of relevant alternative assumptions' axiom in research. It would be worth examining differences in characteristics of target firms when it comes to strategic acquisitions compared to financial. An acquisition is said to be financial when a sponsor such as a PE firm leads the buyout, and it is considered strategic when the buyer is generally in the same industry allowing synergies to be captured. Hence, one would argue that the strategic buyouts are motivated by other characteristics warranting their inclusion in control groups for future research.

Lastly, another area of future research would be to include non-accounting ratios. For example, one could look at further contextual variables such as prior takeover threats and institutional ownership. Currently there are no variables significant in the pre-crisis period, and thus it is reasonable to argue that PE firms during this time period were not solely analyzing financial characteristics while selecting LBO targets.

8. Conclusion

Through our thesis, we identify determinants of LBOs and aim to examine the effect of the GFC on their explanatory power. In the study, we use public-to-private transactions, backed by financial sponsors, in the Nordics between the years 2000 and 2020.

Regression of the shared target characteristics on LBO likelihood for the pooled sample did not yield significant supporting results for our hypothesis. We identify the GFC as the natural source of a structural break allowing us to conduct pre-crisis and post-crisis sub-sample regressions. We identify two significant determinants in the post-crisis regression, supporting our hypothesis for liquidity and undervaluation. Interestingly, our results contradict the debt hypothesis since we observe that LBO targets have significantly higher leverage than matched controls. We partially attribute this to the signaling hypothesis, supported by the significance of the EBITDA growth variable which we use as a proxy for the firm's optimistic prospects and ability to sustain high debt levels. Unlike the 1980s, the importance of agency costs of free cash flow in explaining LBO likelihood has decreased as indicated by the insignificance of the FCF variable, given the strong improvements in corporate governance.

Bidders' ease of infusing cash in targets, by taking advantage of the benign capital markets, could explain the insignificance of liquidity in the pre-crisis era. The GFC was followed by a liquidity crunch which led to an increase in the importance of corporate cash holdings and an increase in credit covenants. Our results allow us to conclude that after the financial crisis, LBO bidders have a stronger inclination towards targets with higher liquidity. This can be attributed to the importance of having a cash-buffer in the post-crisis era and the ability to pay-back the LBO debt, following tense market conditions. Undervaluation was not a significant determinant in the pre-crisis era since the GFC was preceded by a strong bull-run and lenient credit market conditions, causing bidders to overpay. Findings from the post-crisis regression indicate that bidders seek targets that are relatively undervalued by the market highlighting their tendency to acquire firms, whose managers are, deemed to be underperforming and their penchant to capture upside potential. The significance of liquidity and undervaluation in the post-crisis era is intuitive given that both factors are related to market conditions (such as access to credit and the share prices), which were strongly affected by the GFC and are economic drivers of LBO activity.

9. References

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Appendix

A. Sub-sample control assessment tests

Table A.1: Overview of applied metrics

Concept	Variable	Formula
Liquidity	Cash ratio	Cash & Equivalents _{t-1} / Total assets _{t-1}
Free cash flow	FCF ⁷	FCF _{t-1} / Revenue _{t-1}
Debt	Leverage	Long term debt _{t-1} / Shareholder's equity _{t-1}
Tangible assets	PPE ratio	Fixed assets _{t-1} / Total assets _{t-1}
Undervaluation	P/B ratio	Price per share _{t-1} / Book value per share _{t-1}
Profitability	Profit margin	Net income _{t-1} / Revenue _{t-1}
Growth	EBITDA growth ⁸	(EBITDA _{t-3} / EBITDA _{t-1}) - 1
Debt	Gearing	Long term debt _{t-1} / Total assets _{t-1}

Notes: Extended table including all regression variables applied in this study.

Table A.2: Likelihood ratio test on structural breaks

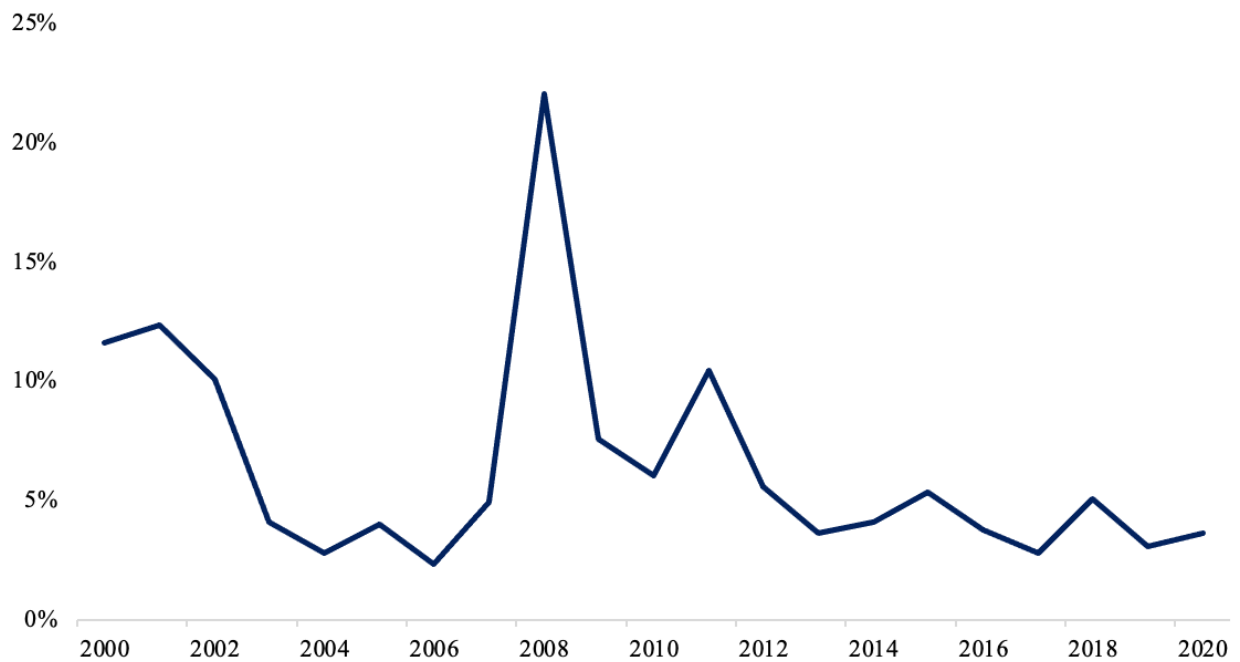
Structural break	2008	2005	2016
Variable	Full regression	Unrestricted full regression	Unrestricted full regression
Log likelihood	-83.893	-75.053	-79.747
Chisq		17.683	8.295
Pr (>chisq)		0.007 ***	0.217

Notes: The crisis dummy takes value 0 up-to and including the structural break year and 1 after that year. For example, it takes the value 0 for the years 2000 to 2007, and the value 1 for the years 2008 to 2020. In the table below we identify the year 2008 as the crisis year. It is used as an intercept dummy, and an interaction dummy to allow covariates to vary. ***p< 0.01; **p< 0.05; *p< 0.1

⁷ Although the calculation refers to FCF margin, we refer to it as FCF in the regression tables

⁸ We use the simple 2-year EBITDA growth measure as it gives a picture of sustained operating growth, with adjustments to avoid invalid values. E.g. for targets in which EBITDA_{t-3} is negative and EBITDA_{t-1} is positive, the measure is negative indicating a false degrowth, since EBITDA actually increased. For such values we have put the EBITDA growth to 0% for the target, and its matched control to ensure that there is no class bias, while we still retain the observation.

Graph A.3: ICE BofA Euro High Yield Index Option-Adjusted Spread, Percent, Annual, Not Seasonally Adjusted.



Notes: It can be observed that in 2008 the spread in the Euro High Yield Index Option was at its peak. We can therefore use the year 2008 as our structural break for breaking our data sample into two sub samples.

B. Robustness tests

Table B.1: Robustness test for industry effects

Variable	LBOs and control groups	
	Pre	Post
Cash ratio	-3.309 (-1.003)	8.204 (1.694) *
FCF	0.976 (0.604)	-1.439 (-1.044)
Leverage	-0.075 (-0.194)	2.421 (2.196) **
PPE ratio	0.289 (0.209)	1.639 (0.727)
P/B ratio	0.245 (1.288)	-0.689 (-2.160) **
EBITDA growth	-0.012 (-0.424)	0.685 (1.655) *
Consumer non-cyclical	-0.398 (-0.184)	1.797 (0.818)
Industrials	-0.413 (-0.227)	1.072 (0.610)
Real Estate	-0.658 (-0.336)	0.453 (0.216)
Consumer cyclicals	-0.587 (-0.313)	0.874 (0.517)
Healthcare	-0.810 (-0.354)	0.605 (0.357)
Technology	-0.300 (-0.159)	2.613 (1.403)
Basic materials	-0.403 (-0.217)	0.766 (0.386)
Financials	Na Na	Na Na

Energy	Na	Na
	Na	Na
N	64	60
Log likelihood	-26.974	-42.609

Notes: The table above presents the increase in explanation. Reported z-stats are in the parentheses. The variables deemed significant in Table 6 maintains their significance, when accounting for underlying industry effects. ***p< 0.01; **p< 0.05; *p< 0.1

Table B.2: Average marginal effect of regressors

Model	Liquidity	FCF	Leverage	Tangible assets	Undervaluation	EBITDA growth	Gearing
(1)	0.324 (0.660)	-0.057 (-0.424)	0.154 (1.815) *	0.135 (0.724)	-0.025 (-0.874)		
(2)	0.326 (0.662)	-0.057 (-0.425)	0.154 (1.801) *	0.135 (0.724)	-0.025 (-0.874)	0.000 (0.056)	
(3)	-0.698 (-0.962)	0.150 (0.461)	-0.021 (-0.257)	0.083 (0.306)	0.054 (1.334)		
(4)	-0.732 (-1.001)	0.158 (0.482)	-0.020 (-0.251)	0.077 (0.282)	0.056 (1.357)	-0.002 (-0.367)	
(5)	-0.858 (-1.197)	0.211 (0.638)		0.160 (0.568)	0.047 (1.310)	-0.001 (-0.209)	-0.488 (-1.020)
(6)	1.275 (2.095) **	-0.088 (-0.558)	0.362 (3.231) ***	0.392 (1.249)	-0.085 (-1.994) **		
(8)	1.216 (2.122) **	-0.168 (-1.067)	0.283 (2.329) **	0.263 (0.867)	-0.096 (2.329) **	0.107 (1.908) *	
(9)	1.169 (2.042) **	-0.179 (-1.055)		0.196 (0.639)	-0.082 (-1.970) **	0.119 (1.800) *	0.917 (2.045) **

Notes: ***p< 0.01; **p< 0.05; *p< 0.1

Table B.3: Linearity assumption on pre financial crisis variables observed in model (4) and gearing from model (5). There is linearity observed in the graphs.

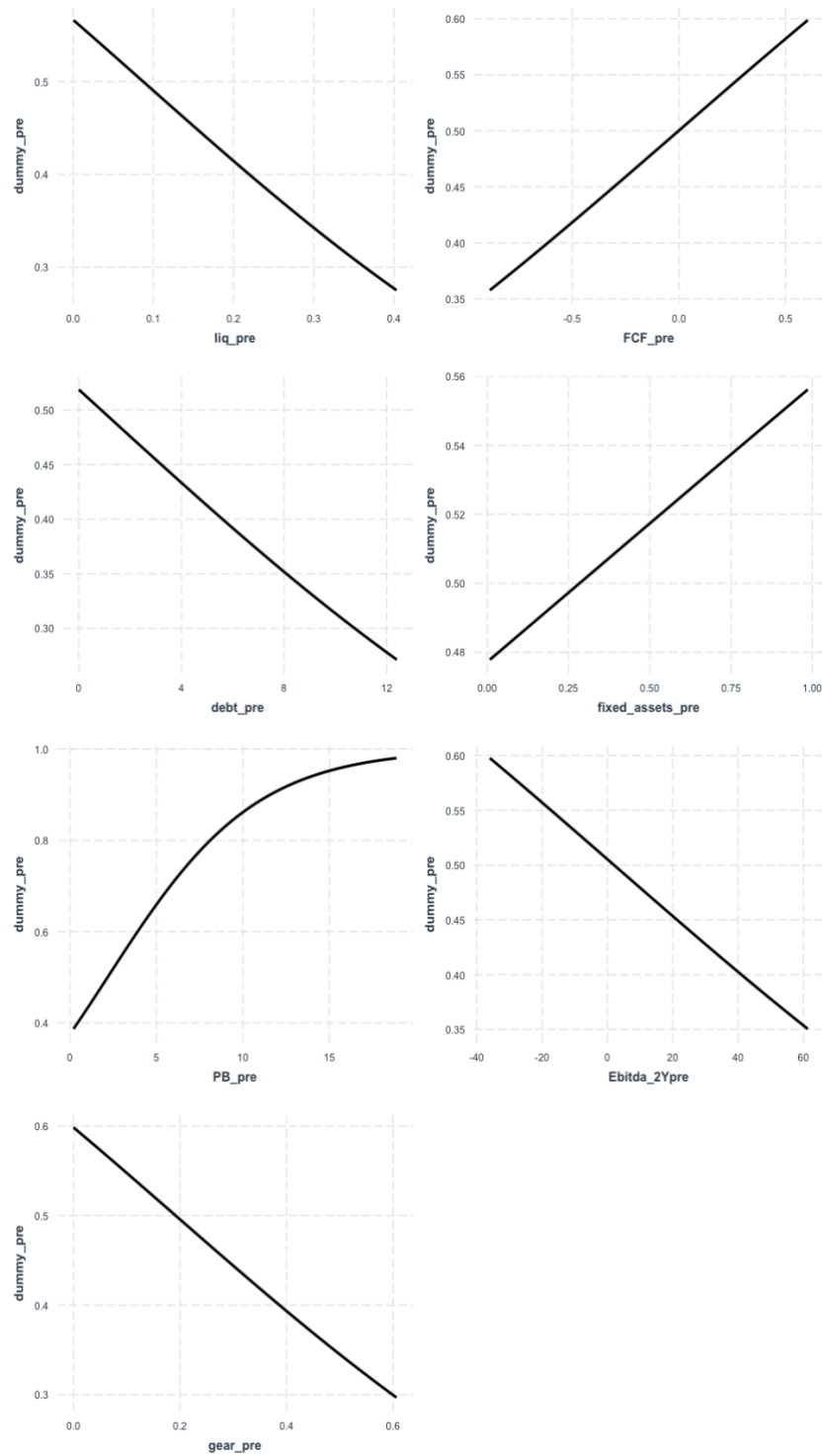


Table B.4: Linearity assumption on post financial crisis variables observed in model (8) and gearing from model (9). There is linearity observed in the graphs.

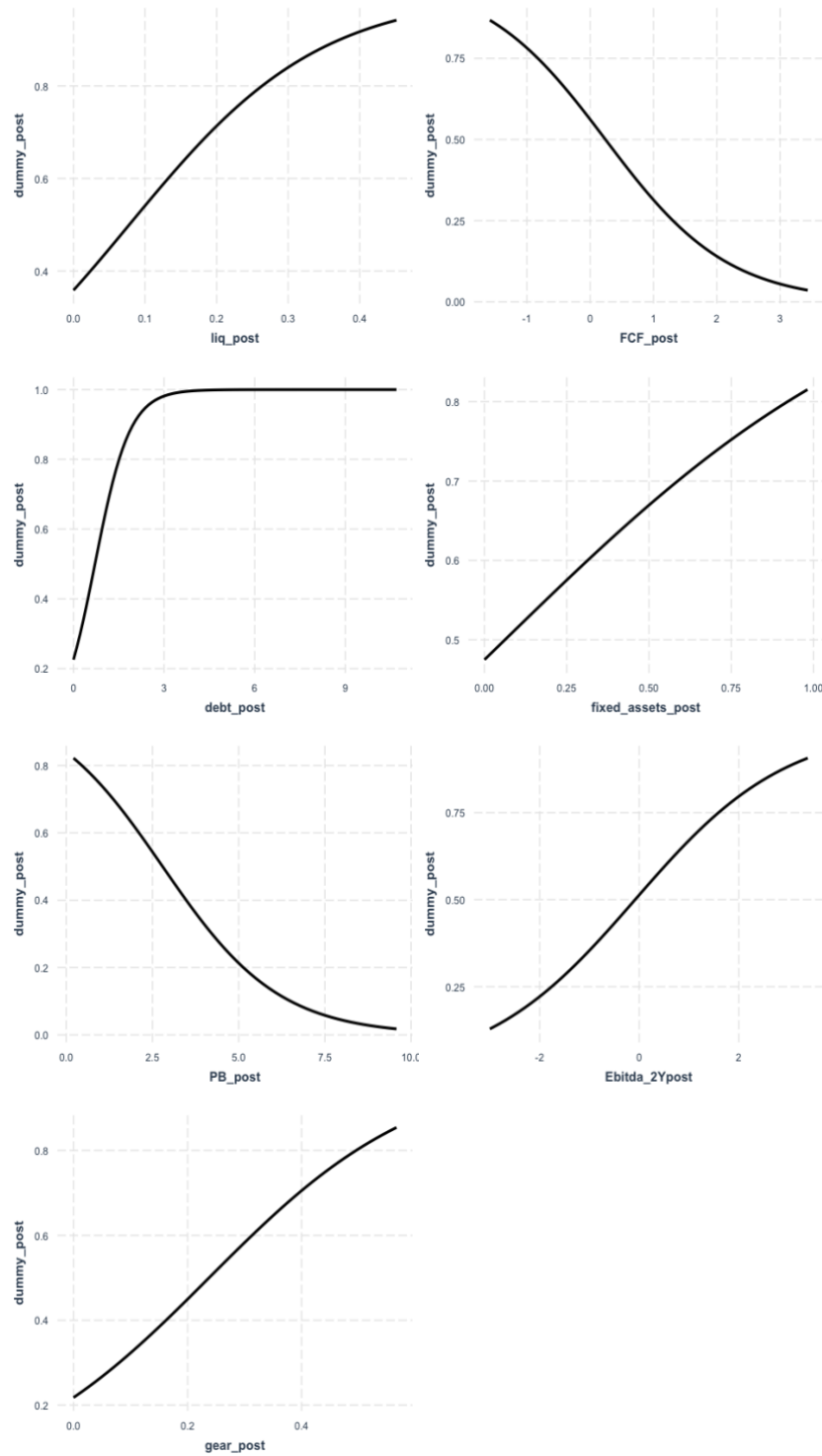


Table B.5: Correlation between variables

Variable	Liquidity	FCF	Leverage	Tangible assets	Undervaluation
Liquidity	1.000	-0.020	-0.087	-0.295	0.267
FCF	-0.020	1.000	0.115	-0.105	0.227
Leverage	-0.087	0.115	1.000	0.014	0.409
Tangible assets	-0.295	-0.105	0.014	1.000	-0.260
Undervaluation	0.267	0.227	0.409	-0.260	1.000

Notes: Correlation test between variables on full sample regression. Largest correlation between Leverage and undervaluation, however their value is far below the critical level of 0.8 and is not seen as an issue.

Table B.6: VIF Test for multicollinearity

Model	Liquidity	FCF	Leverage	Tangible assets	Undervaluation	EBITDA growth	Gearing
(1)	1.252	1.033	1.141	1.159	1.232		
(2)	1.261	1.033	1.152	1.160	1.248	1.028	
(3)	1.350	1.079	1.423	1.346	1.595		
(4)	1.375	1.084	1.388	1.352	1.568	1.031	
(5)	1.360	1.123		1.484	1.209	1.056	1.540
(6)	1.597	1.072	1.159	1.084	1.379		
(8)	1.634	1.208	1.195	1.112	1.502	1.235	
(9)	1.498	1.397		1.107	1.480	1.472	1.552

Notes: Multicollinearity test on variables on all three sample regressions. As can be observed in the table below, no variable in any time period shows any signs of multicollinearity as the critical values are larger than 5.0 or less than 0.2. We do not show multicollinearity for model (7) as this model is only an additional robustness check in the post-crisis panel.

C. Deal excerpts from post-crisis sub-sample

Figure C.1: From CVC's press release in connection to their public bid of Ahlsell

"...Our experience and history with the company provides us with the ability to **help it grow further** across its core segments and industries, delivering top quality services and value for all stakeholders. **We look forward to continuing to work with the existing management team at Ahlsell and develop the company further under private ownership.** We believe that the offer price represents a full and fair valuation for Ahlsell."

(<https://www.cvc.com/media/press-releases/2018/quimper-announces-cash-offer-sek-55-per-share-shareholders-ahlsell>)

Figure C.2: From Altor's press release in connection to their public bid of Gunnebo

"We see great potential in the Company ... we have extensive experience from working side by side with companies under transformational processes **and we look forward to collaborating long-term with Stena Adactum and Gunnebo's management.** We are also encouraged by the support for the offer from the board of directors and major shareholders."

(<https://news.cision.com/gb-holdco/r/altor-and-stena-adactum-announce-a-recommended-cash-offer-of-sek-25-per-share-to-the-shareholders-of,c3203814>)

Figure C.3: From Apax's press release in connection to their bid of EVRY

"EVRY is a leading Norwegian provider of IT Services with a well-established customer base, broad service offering and leading technical expertise. **We fully support the vision and strategy outlined by EVRY's management** to further develop its leading competitive position..."

"**We are impressed by the leading position of EVRY in Norway and Sweden and look forward to working with the management team** and the employees to position EVRY to deliver accelerated growth and increased competitiveness..."

(<https://www.apax.com/news/press-releases/2014/december/recommended-cash-offer-by-funds-advised-by-apax-to-acquire-100-of-the-shares-of-evry/>)