LBO effects on industry peers' capital structure: Evidence from short sellers

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Abstract

This paper investigates the effect of leveraged buyouts on the capital structure of target firms' industry peers. Using the short interest ratio of peer firms as an instrument for buyout activity to overcome the endogeneity problem of the selection channel, I find that industry peers significantly increase their leverage ratios after leveraged buyout announcements in their industry. The analysis reveals that industry peers use these adjusted leverage ratios primarily to prevent potential future takeovers and to a lesser extent to mitigate agency problems. Furthermore, I show that changes at the competition level made by leveraged buyouts might offset the positive effect on peer firms' leverage ratios. These findings have implications for the study on LBOs, considering that specific implications of the decision made by industry peers on capital structure has been addressed by only a few studies which do not analyze these implications in detail.

Keywords: leveraged buyouts, peer effects, capital structure, signaling, short sellers
JEL Classification: G32; G34

1 Introduction

Over the last four decades, private equity (PE) investments have extensively increased in value and number of deals in the US. Considerable empirical evidence shows that these investments co-occur with an improvement in the value of target firms (e.g., Boucly et al. (2011); Guo et al. (2011); Acharya et al. (2013)). This development might have substantial implications for industry peers of target firms. A newer strand in the literature shows spillover effects of PE investments on whole industries (e.g., Bernstein et al. (2017); Aldatmaz and Brown (2020)), and on industry peers (e.g., Harford et al. (2016); Feng and Rao (2022)). In this regard, managers use and act on the information on other firms when they determine their own corporate policies (e.g., Foucault and Frésard (2014); Cao et al. (2019); Grennan (2019); Bustamante and Frésard (2021)). These peer effects are also observable in the decisions of firms on the capital structure (Leary and Roberts (2014)). In this respect, firms tend to follow industry peers more closely when those firms or their managers are perceived as an expert in the industry (Bikhchandani et al. (1998)), as PE investors are typically considered to be (Kaplan and Strömberg (2009)). Thus, peer firms could be motivated to adopt similar strategies as PE investors apply in their portfolio firms. These investors particularly use leverage as the key ingredient to improving the efficiency of target firms (e.g., Kaplan and Strömberg (2009)).

This paper aimed to show that industry peers of target firms increase their leverage ratios after announcing a leveraged buyout (LBO) in their industry. My results, formed by looking at the different channels of this effect, primarily support higher leverage ratios as a defense tool to reduce the increased takeover threat. I have found weaker evidence for peer firms' use of more leverage to solve industry-wide agency problems. In terms of the competition effect, I illustrate through a quasi-natural experiment that an exogenous increase in competition reduces the LBO effect on the leverage ratio of industry peers. However, further analysis reveals that an increase in LBO activity decreases competition within the industry. From this decrease, firms in more competitive industries benefit and respond with an increase in their leverage ratios when they experience an LBO announcement. My findings do not provide evidence for an increase in industry peers' leverage ratios as a result of positive industry prospects (e.g., Slovin et al. (1991)) or industry undervaluation (e.g., Harford et al. (2019)) that also drives PE investors to certain industries.

Investigating the impact of LBOs on the capital structure of industry peers is important for several reasons. First, LBOs signal relevant information to market participants, especially the managers of industry peers, which they consider in their decision-making process. Moreover, the results show different importance for the potential channels of the LBO signal. Second, previous work looks into the spillover effects of LBOs on industry peers on several dimensions such as corporate governance (e.g., Oxman and Yildirim (2008); Harford et al. (2016)), operating performance (e.g., Aldatmaz and Brown (2020)) or valuation (e.g., Slovin et al. (1991); Hsu et al. (2011)), but the specific implications for the decision of industry peers on the capital structure have not yet been addressed. Third, it enhances our understanding of the determinants of firms for their capital structure by including the actions of other firms in the decision-making process on their objective function.

Slovin et al. (1991) argue that an LBO announcement signals industry-related information about follow-on acquisitions, future prospects, and agency problems within the industry or changes to the competitive environment (Harford et al. (2016)). More specifically, PE investors possess private information (Dittmar et al. (2012)), which they gather during their due diligence process. Part of this information becomes public when they make investments and might influence the decision of other market participants. As for the decision on a firm's capital structure, these signals are empirically and theoretically relevant in determining the leverage ratio. For example, if an LBO signal indicates a positive industry outlook, the trade-off theory and pecking order theory illustrate changes to the capital structure of firms (e.g., Frank and Goyal (2009)).

However, to study the effects of LBO activity on the process of making the decision on the capital structure of industry peers, one has to overcome the endogeneity problem of the selection channel. In more detail, PE funds can, perhaps, quickly select industries that are about to change (Harford et al. (2016)). If they respond to developments in some industries, whether firm *i* responds to the LBO announcement or to the same stimulus is uncertain. To make a causal inference, I used the short interest ratio of the peer firms of firm *i*. I showed that PE investors and short sellers share a similar interest in target firms, since these firms may not run at the optimal efficiency level. Thus, on the one hand, short sellers are present more in these firms. On the other hand, these firms are also interesting for PE investors because of the upside potential, which results in a strong correlation between both concepts. I do not find the same link in case of strategic bidders. I argue with evidence that short sellers follow a target-oriented approach, which does not support their trading owing to the common shock of the whole industry. Using my instrument, I showed that a one-standard deviation increase in LBO activity within the industry is associated with a 0.8049 standard deviation increase in firm *i's* leverage ratio. My results are robust to alternative explanations such as an increase in the supply of debt (Axelson et al. (2013)) or deterioration in the corporate governance of industry peers after LBO announcements (Harford et al. (2016)). I also ran a placebo test and applied my empirical strategy in case of M&A deals. Both are insignificant and support the findings in this study.

My paper contributes to the literature in several ways. To the best of my knowledge, this is the first paper that links LBO activity with the short interest ratio of industry peers to test the causal impact of LBO announcements on firm *i's* leverage ratio. Thus, it contributes to a growing body of studies that examine the real effects of PE investments on industry peers (Harford et al. (2016); Aldatmaz and Brown (2020); Feng and Rao (2022)). Second, this study complements the papers that examine peer effects in corporate finance (e.g., Foucault and Frésard (2014); Leary and Roberts (2014); Cao et al. (2019); Grennan (2019); Bustamante and Frésard (2021)). Third, it contributes to the literature on the capital structure (e.g., Rajan and Zingales (1995); Fama and French (2002); Frank and Goyal (2009)) by showing that LBO activity is a determinant of the financial policy of firm *i*.

The rest of the paper is organized as follows. In Section 2, I develop the hypotheses of this study. Section 3 describes the data and the empirical model. In Section 4, I provide detailed arguments for my identification strategy. Section 5 illustrates and discusses the results. Section 6 looks into alternative mechanisms, which could drive the results and Section 7 provides supporting analyses. In Section 8, I provide a general discussion of my findings and relate them to other papers. Finally, I summarize the arguments in Section 9.

2 Hypotheses development

In this section, I outline the hypotheses addressed in this paper. A newer strand in the literature argues that industry peers play a vital role in the decision-making process of firms. For example, peer effects have been located in dividend policies (Grennan (2019)), corporate social responsibility practices (Cao et al. (2019)), and investment decisions (Bustamante and Frésard (2021)). In terms of making decisions on the capital structure and interest as outlined in this paper, Leary and Roberts (2014) show that firms incorporate the actions and partly the characteristics of peer firms into their decisions on leverage ratios. Furthermore, survey evidence underlines this notion and states that CFOs use the information on the financing policy of other firms (Graham and Harvey (2001)). Capital structure studies also outline a positive relationship between industry average and firm leverage ratios (e.g., Welch (2004); Frank and Goyal (2009)).

With regard to leveraged buyouts, target firms experience an increase in their leverage ratios post-buyout up to 60–90% (e.g., Kaplan and Strömberg (2009); Cohn et al. (2014)). Leverage is an important element of PE fund strategy to improve their portfolio firms (e.g., Kaplan and Strömberg (2009)). The benefits associated with an increase in the target firm's leverage ratio are manifold. For instance, from a financial-channel perspective, a higher leverage ratio boosts tax shields and decreases tax payments (Kaplan (1989b); Guo et al. (2011); Cohn et al. (2014)). Further, from a governance-channel perspective, an increase in the leverage ratio hinders the management from inefficiently using free cash flows owing to interest and principal payments (Jensen (1986, 1989); Kaplan (1989a)). The literature on peer firms postulates that firms, which are industry peers for those target firms, might respond in a similar way because they learn from the actions or the conveyed signal of PE funds and mimic their behavior.

Theoretical framework on herd behavior may explain this, specifically the one on informational cascade in which following the observed actions of preceding firms, even in the presence of private information, is optimal (e.g., Bikhchandani et al. (1992)). For making decisions on the capital structure, this might come from the free-riding of firms in information acquisition or principal agents' concerns (Zeckhauser et al. (1991)). The free-riding occurs when firms have superior information and other firms mimic their actions (Zeckhauser et al. (1991)). Agents' concerns mean that managers tend to mimic the actions of other managers despite having private information because performance evaluation is relative and herding prevents managers with low managerial ability to be exposed (Devenow and Welch (1996)). These effects are stronger when a firm or manager appears to be an expert in the industry (Bikhchandani et al. (1998)), as in the case of PE investors (Kaplan and Strömberg (2009)).

Importantly, these agents possess private information (Dittmar et al. (2012)), which they gather during their due diligence process. Thus, managers of industry peers may rely more on the actions and the conveyed signal of these financial bidders because acquiring such (private) information is costly and time-consuming, which reduces the incentive to collect them (Bikhchandani et al. (1998)) and may be optimal from the perspective of a peer firm. Therefore, managers of industry peers incorporate this information into their objective function, which leads to the first hypothesis.

> **Hypothesis 1** *(Mimicking and learning channel): LBO announcements convey (private) information to industry peers about the imminent changes in LBO targets. Managers of peer firms incorporate this into their objective function and apply similar behavior to capital structure decisions by increasing their leverage ratios.*

Besides learning from, and mimicking, a PE-backed firm, industry peers receive a more specific signal which an LBO announcement might convey. Slovin et al. (1991) argue that these bids contain information on follow-on acquisitions, future prospects, and agency problems within an industry. Harford et al. (2016) investigate these potential signals in more detail and find that LBOs predict follow-on acquisitions within an industry and peer firms undertake governance changes. If the managers of industry peers do not only respond in a herding manner to these bids but rather act more specifically on the perceived information, I should be able to channel more precisely changes to the capital structure and indentify the relevant drivers of industry peers' behavior.

Starting with follow-on acquisitions, PE investors possess industry expertise (e.g., Kaplan and Strömberg (2009)) and special knowledge in selecting high-quality targets (e.g., Cressy et al. (2007)) and detecting potential undervalued industries (Harford et al. (2019)). Thus, an LBO announcement could contain information on not only certain target firms but also the whole industries, making them relevant for other market participants. Gorbenko and Malenko (2014) show that the number of bidders increases after financial bidders successfully make acquisitions and Dittmar et al. (2012) prove that strategic bidders earn higher cumulative abnormal returns if they compete with financial bidders for the same target. Overall, Harford et al. (2016) find that LBOs may be the first mover in a merger sequence predicting an increase in M&A activity within an industry.

Evidently, a stronger acquisition activity also has implications for the management of future target firms. When firms are being acquired, CEOs of target firms usually lose their positions (Hartzell et al. (2004)). Therefore, they have incentives to prevent these transactions. As a result, the managers of industry peers take anti-takeover actions. In this regard, leverage can serve as a defense tool. Theoretical models indicate that higher leverage ratios decrease the probability of takeovers for at least three reasons. First, an increase in debt increases the value of a firm and decreases the benefit for potential bidders. Second, debt usually contains covenants, which prevent bidders from using assets in their interest. Third, a higher leverage ratio limits the possibility to issue further debt for potential acquirers (e.g., Harris and Raviv (1988); Stulz (1988)). Garvey and Hanka (1999) as well as Safieddine and Titman (1999) provide empirical evidence for the theoretical background for debt as a takeover defense tool and confirm the negative relationship between leverage ratios and takeover probability. Therefore, if managers of industry peers interpret the announcement of an LBO as the start of a merger sequence, they could increase the leverage ratio to reduce the likelihood of being acquired. This argument leads to the second hypothesis.

> **Hypothesis 2a** *(Signalling channel I: Follow-on acquisitions): LBOs signal follow-on acquisitions within an industry. Managers of peer firms increase their leverage ratios to decrease the likelihood of the firms being taken over by financial or strategic bidders.*

LBO signals may also contain industry-wide governance problems (Slovin et al. (1991)). These problems arise from the separation of ownership and control, which causes agency costs (Jensen and Meckling (1976)). They could be mitigated by adopting more leverage. Under the agency cost hypothesis, higher leverage reduces these costs because of lenders' monitoring activities (Ang et al. (2000)) and the borrower's obligation to pay the interest and principal

(Jensen (1986)). Furthermore, debt contracts normally include covenants, which restrict the actions of management and can mitigate agency problems (Garleanu and Zwiebel (2008)). This rationale shows that the relationship between agency costs and leverage ratios is negative. For example, Ang et al. (2000) illustrate that low-efficiency firms with higher agency costs have lower debt ratios than firms that are operating more efficiently. If LBO bids contain information related to overall governance problems within the industry of the target firm, the signal will be more valuable to firms with higher agency costs. Thus, the following hypothesis is formed.

> **Hypothesis 2b** *(Signalling channel II: Agency problems): Industry peers with higher agency problems react to LBO announcements more strongly by increasing their leverage ratios more distinctly than peers facing fewer manager-shareholder conflicts.*

Contrary to the above arguments, LBO announcements could provide information on changes in the competitive environment within the industry. PE funds substantially impact their portfolio firms regarding financial, operational, and strategical changes, which influence competition in the industries of these firms (e.g., Chevalier (1995a,b); Kovenock and Phillips (1997); Bharath et al. (2014)). On average, literature states that PE funds improve efficiency and create value for their target firms (e.g., Boucly et al. (2011); Guo et al. (2011); Acharya et al. (2013)). Further, PE investors provide access to debt at lower costs (Demiroglu and James (2010); Ivashina and Kovner (2011)) and expertise in restructuring poorly performing firms (Gorbenko and Malenko (2014)). Consequently, industry peers face stronger target firms. Furthermore, PE-backed firms gain more bargaining power toward their suppliers after LBO transactions (Brown et al. (2009)) leaving peer firms at a relative competitive disadvantage. To improve their competitiveness, industry peers may adapt their business to the new competitive environment (Aldatmaz and Brown (2020)). One possibility is to use a higher leverage ratio similarly to PE-backed firms. This argument follows from the apparent conservative use of debt in public firms. Strebulaev and Yang (2013) show that many firms hardly use leverage and are mostly equity-financed. From a tax perspective, Graham (2000) illustrates that firms leave a significant amount of money on the table. Thus, efficiency gains could yield from adopting more debt. However, Valta (2012) argues that firms facing stronger competition bear a higher cost of debt and experience higher default risks. Additionally, firms in more intensified industries are exposed to higher cash-flow uncertainty and more idiosyncratic risk (e.g., Abdoh and Varela (2017)). Overall, an increase in the competition level significantly decreases the leverage ratio and impacts the financial decision of firms, since they issue more equity (Xu (2012)).

This leads to a situation in which managers of industry peers receive an ambiguous signal. On the one hand, firms would be able to increase efficiency and keep up with their PE-backed competitors; on the other, intensified competition yields a higher cost of debt. In short, as for the effect of LBO announcements on competition in the light of the negative relationship between leverage and competition, LBO has a reduced effect on leverage compared to industry peers exposed to a smaller increase in competition. Thus, the next hypothesis is as follows.

> **Hypothesis 3** *(Competition channel): Industry peers experiencing higher changes in the competition via LBO announcements have a smaller capital structure effect than industry peers exposed to a smaller increase.*

Finally, the literature underlines that PE investors are industry experts (e.g., Kaplan and Strömberg (2009)), which allows them to select undervalued industries (Harford et al. (2019)) and those with positive future prospects (Slovin et al. (1991)). In case of industry undervaluation, the implication on the leverage ratio is twofold. Baker and Wurgler (2002) argue from a market timing perspective that the leverage ratio is highly negatively related to firms' market valuations. If valuations are low, firms either issue debt or repurchase equity. However, empirical studies (e.g., Hovakimian (2006); Alti (2006)) find a stronger tendency of raising debt in case of undervaluation, whereas the effect of repurchasing equity is rather weak (Hovakimian (2006); Kayhan and Titman (2007)). Thus, the undervaluation channel should positively affect the leverage ratio of industry peers as supported by the traditional capital structure theory such as the trade-off theory (Frank and Goyal (2004)).

In terms of the positive future industry prospects, the theoretical implications of the capital structure are ambiguous as before. The trade-off theory predicts that if firms become more profitable, an increase in the leverage ratios caused by the decrease in the expected bankruptcy cost and increase in the expected tax shields (e.g., Bradley et al. (1984); Fama and French (2002)). The pecking order theory illustrates a decrease because firms rely more on internal funds (e.g., Frank and Goyal (2009)). On the contrary, the trade-off theory predicts a negative relationship contrary to the positive one in the pecking order theory, if the positive outlook in the industry is measured by growth opportunities (e.g., Frank and Goyal (2009)). The trade-off theory highlights larger costs of financial distress whereas the pecking order theory suggests that firms with more investment opportunities should use more debt (e.g., Frank and Goyal (2009)).

Nevertheless, empirical literature states that firms with more profitability and higher growth opportunities will have a decrease in the leverage ratio (e.g., Frank and Goyal (2009); Leary and Roberts (2014)). Therefore, the positive future industry prospects channel is supposed to be negative. From these arguments, I draw two sub-hypotheses.

Hypothesis 4a *(Selection Channel I: Undervaluation): PE investors select undervalued industries, in which industry peers rely more on debt financing owing to undervaluation, which results in higher leverage ratios.*

Hypothesis 4b *(Selection channel II: Positive future industry prospects): Positive future industry prospects): PE investors select industries with positive prospects, in which industry peers become more profitable and rely more on internal funds, which results in lower leverage ratios.*

These hypotheses are not mutually exclusive. However, I will try to provide different empirical setups in the following sections to take a closer look at the channels and their implications for the leverage ratios of industry peers.

3 Sample construction and empirical model

3.1 Data and sample construction

The starting point for the sample construction is all leveraged buyout transactions of Thomson Mergers & Acquisitions, targeting US public firms in the period from 1989 to 2019. These transactions are retrieved from Refinitiv Eikon. To ensure that PE funds can implement changes in the target firms, they were required to have a majority interest (>50%) in the firm. Moreover, target firms belonging to the utility (SIC code 4900-4999) or financial industries (SIC code 6000-6999) were excluded (e.g., Leary and Roberts (2014); Grennan (2019)). Applying these filters, the sample contained 1,021 LBO deals.

For the classification of industry peers, I defined peers according to the text-based industry classification (TNIC) (Hoberg et al. (2014); Hoberg and Phillips (2016)). The notion of TNIC lies in the similarity of their product descriptions. The more similar the descriptions of the two firms are, the more likely these firms are competitors to each other. For this, TNIC provides a pairwise score measure between 0 and 1. The higher the score value is, the more similar the products of the two firms are. The benefit of this industry classification is that it dynamically links with one another in the product market space in terms of product market vocabulary used in 10-K business descriptions (Hoberg et al. (2014); Hoberg and Phillips (2016)). In contrast, classical industry classifications such as SIC or NAICS codes are based on production processes and are rather static. They may also suffer from inaccurate reporting of data providers.[1] Also, industry peers were required to have common shares outstanding (CRSP share code 10 or 11)

[1] Compustat reports the current, not historical, SIC codes of firms (MacKay and Phillips (2005)) and CRSP reports the last digit of 4-digit SIC codes as zero for NASDAQ listed firms (https://www.crsp.org/products/documentation/data-definitions-s).

and are listed on the NYSE, NASDAQ or Amex (e.g., Grennan (2019)). The final and merged sample with industry peers included 836 leveraged buyouts.

Fundamental data and stock prices of industry peers were retrieved from the merged (CRSP)-Compustat database. In case of missing values, I used Datastream to reduce these numbers. To mitigate the effect of outliers, all continuous variables are winsorized at the 0.5 and 99.5 percentiles. There are three categories of variables in this study—firm-specific, industry, and peer firm averages. Foucault and Frésard (2014) and Leary and Roberts (2014), state that peer firm averages are constructed by calculating the average of all firms within an industry-year, excluding firm *i's* observation.[2] Variables related to the industry classification (TNIC) were taken from Hoberg-Phillips Data Library.[3]

Table 1 reports summary statistics of the used variables throughout this paper for targets and industry peers. Values of target firms were the last reported values, i.e. generally one year before the LBO transaction, in Compustat or Datastream because the majority of these firms were going private. Therefore, comparisons among the samples of industry peers may be difficult. When the peers were focused, the sample covered 12,216 unique firms in a dynamic setup, which allowed them to be in different industries in the same year. Contrary to other industry classifications, the median of the number of peer firms within an industry-year is generally larger (e.g., Leary and Roberts (2014); Harford et al. (2016)). However, the values for the variables in the column "All peers" shows similarities with those in other studies on capital structure (e.g., Frank and Goyal (2009); Strebulaev and Yang (2013); Leary and Roberts (2014)). To get further insights into the possible differences of the sample firms in the context of LBO activity, the peer firms were split into two groups—“LBO peers" and "Non-LBO peers"—and in the last column of Table 1, whether the mean values of the groups differ from each other was assessed. The first group covered the industry-years, for which peer firms experienced an LBO and the second group covered the industry-years of peers without any LBO involvement.

In terms of leverage ratios (e.g., *Market leverage*) industry peers having an LBO announcement tended to have significantly lower ratios than those firms without any LBO involvement. Further, a larger proportion of firms had *Zero leverage* or *Almost zero leverage* ratios. Furthermore, firms in the first group are significantly larger than their counterparts as shown in the variable *Firm size*. However, the mean profitability (*EBITDA-to-assets*) is significantly lower for industry peers affected by an LBO announcement, whereas the *M/B-ratio* of this group is larger than that of the second group. This could be an indication that peer firms in an industry in a

[2] To calculate peer firm averages, at least 50% of the data points of the competitors within an industry-year were required. On average, data availability was over 90% for the constructed variables.

[3] https://hobergphillips.tuck.dartmouth.edu/industryclass.htm

specific year with LBO involvement might be overvalued compared to their current profitability.

Regarding peer firm averages, the direction of the differences in the variables is similar to those of the above described firm-specific characteristics. Industry controls showed significantly stronger competition in case of the "LBO peers" for the variables *Herfindahl index* and *Product market fluidity*. Overall, the median number of peers is more than three times larger for the industry-years with LBO involvement.

[Table 1 about here]

At this point, I note that firms differ on several dimensions when they face LBO announcements in their industry from those firms which do not.

3.2 Empirical model

To investigate the impact of LBO activity on the capital structure decision of firm *i*, the following empirical model was employed:[4]

$$y_{i,j,t} = \alpha + \beta_1 \mu_{j,t} + \beta_2 \bar{y}_{-i,j,t} + \beta_3 \bar{X}_{-i,j,t} + \beta_4 X_{i,j,t} + \beta_5 I_{j,t} + \eta_i + \delta_t + \varepsilon_{i,j,t} \quad (1)$$

where *i* indexes firm; *j* indexes industry; *t* indexes the time (year). On the left-hand side of equation (1), $y_{i,j,t}$ is the outcome variable that reflects different forms of leverage ratios. On the right-hand side, $\mu_{j,t}$ indicates leveraged buyout announcements proxied differently as LBO activity within the industry of firm *i* over a year.

The literature generally uses a binary variable to measure the effect of PE involvement on industry peers and on industry dynamics (e.g., Hsu et al. (2011); Bernstein and Sheen (2016); Harford et al. (2016); Bernstein et al. (2017)). However, this approach may fail to include all relevant information on the bids of PE funds. As derived in Section 2, several dimensions in the possible information content are relevant to the decision on the capital structure of a firm. A binary variable probably captures this information insufficiently. Therefore, the deal volume, the number of LBOs, and the industry size matter in this context. For example, several LBOs within an industry in a specific year could indicate an increased likelihood of takeovers. Larger deals could more distinctly change the competitive environment in an industry. Combined with these ideas, the signal could be differently interpreted when industries differ in the number of peer firms. In smaller industries, the effects are assumed to be more distinct than in industries with many competitors. To account for these distinctions, I use three different proxies. First, the number of LBOs was divided by the number of firms within an industry-year (*B-Activity*). This considered the intensity of LBO activity scaled by the size of the industry. The notion of this

[4] This is an extension of the used model in Leary and Roberts (2014).

definition is that firm *i* receives a stronger signal with higher intensity, though it also considers its industry circumstances. Second, the log of total deal value over an industry-year was employed (*V-Activity*) (Haddad et al. (2017)), which illustrates the volume and value component of LBO announcements. The larger the deal value is, the more implication it has for peer firms. Lastly, I combined both approaches and proxy LBO activity as the log of total deal value divided by the number of firms within an industry-year (*VB-Activity*).

To consider the potential influence of other peer firms of firm i on its leverage ratio, I used the same techniques and control variables as in other peer effect studies (e.g., Leary and Roberts (2014); Grennan (2019)). As to that, I wanted to emphasize that these studies used the properties of idiosyncratic risk (equity shocks)[5] (e.g., Leary and Roberts (2014)) to overcome the reflection problem that arises when one tries to infer whether the average behavior of a group or industry influences the individual behavior of firms, which belong to this group or industry (Manski (1993)). $\bar{y}_{-i,j,t}$ and $\bar{X}_{-i,j,t}$ controls for the influence of other firms through their actions or characteristics[6] on firm *i's* leverage ratio. I included firm-fixed effects (η_i) to control for time-invariant differences across firms and year-fixed effects (δ_t) to consider common trends and market conditions. $\varepsilon_{i,j,t}$ represents the firm-specific error term which is adjusted for within firm-year error clustering and heteroskedasticity (Petersen (2009)). Overall, the model used contemporaneous variables to reduce the influence of other events relevant to the capital structure.

4 Identification strategy

The main challenge to this study is to address whether firm *i* reacts to an LBO announcement or to some developments in the industry and both, PE fund and firm *i* respond to the same stimulus. These concerns arise from the selection channel. In Section 2, I discuss the sub-channels undervaluation and positive future industry prospects, both of which can explain LBO activity within an industry and changes to firm *i's* leverage ratio. In the following, I argue that short interest ratios of industry peers of firm *i* can be used as an instrument to overcome the endogeneity issue.

The central idea of this approach is that PE investors are interested in firms where they can apply their value-creating strategies. Arguably, these firms offering upside potential and are not run at their optimum. Since short sellers trade on such inefficiencies, potential target firms might show relatively higher short sale interest ratios (e.g., Desai et al. (2002)) than comparable firms

[5] In Online appendix D, I show the formal derivation of the equity shocks used in this paper

[6] The paper extended the reduced-form model of Leary and Roberts (2014) to control for the presence of peer effects, indicated by one coefficient being unequal to zero. However, it does not allow to assess whether peer effects come through actions or characteristics (Leary and Roberts (2014)).

in their industry, resulting in a positive correlation between both concepts. From the perspective of firm *i*, if its peer firms show relatively higher short sale interest ratios, its likelihood of being exposed to a higher LBO activity increases. Consequently, the LBO signal in the industry of firm *i* is more distinct. Concerns about a spurious correlation caused by a common shock in the whole industry are mitigated, since short sellers follow a firm-oriented approach because of the limited upside but unlimited downside potential in their trading strategy.

In more detail, PE investors possess a special skill set in detecting promising targets (e.g., Cressy et al. (2007)). As Gorbenko and Malenko (2014) argue, PE investors base their investment decisions predominantly on target characteristics and economy-wide conditions differently from the way other players in the corporate control market such as strategic bidders do. Similarly, short sellers rely on observable accounting and market variables (Dechow et al. (2001); Drake et al. (2011)). The literature shows both parties' information advantages over other market participants. Thus, these informed agents may show a common foundation in their use of fundamental information, which differentiates them from other market participants. To examine these similarities, I examined differences between the target firms and industry peers in the short interest ratio and other dimensions before PE investors' announcement of a takeover. The short interest ratio is calculated as the number of shares short of a firm divided by the average trading volume over a month.[7] This ratio represents the number of days to cover a short position and provides information about the sentiment of a stock. Panel A, Table 2, shows in columns (1) and (2), the average of two years of monthly data for different variables with regard to LBO targets and their industry peers before LBO announcements. In column (3), the difference for significance is tested. The results illustrate significantly higher *Short interest ratios* for target firms than their industry peers. Generally, a ratio below 4 indicates a positive sentiment, whereas a ratio of 10 expresses extreme pessimism about a stock.[8] Moreover, the *M/B ratio*, which is often used as a proxy for under- or overvaluation, is significantly lower for LBO targets which tend also to be smaller (*Log(MCAP)*) than peer firms. The variable *Illiquidity*, which measures inversely the supply side of short selling (Amihud (2002); Hirshleifer et al. (2011)), is significantly larger for LBO targets.

To differentiate these results from other market players, the analysis for M&A deals[9] in Panel B was repeated. In contrast to the results of LBO announcements, no significant difference

[7] Short sales data are taken from Compustat. Since exchanges do not report firms without short interest, in this case, I assumed zero short interest as Chen and Singal (2003). Compustat covers only stocks listed at the NYSE, NASDAQ, and Amex.

[8] https://www.powercycletrading.com/what-is-a-high-short-interest-ratio/

[9] In online appendix B, I describe the sample construction and show in Table B.1 summary statistics of of M&A deals.

is shown in the short interest ratio. M&A targets are significantly larger and show higher valuations than their industry peers. They also tend to provide a higher supply for short sellers. This analysis illustrates differences of LBO targets from industry peers as well as common factors with short sellers that are not present for M&A deals.

[Table 2 about here]

Analysis in Table 2 ignores the timing dimension and objective of short sellers and PE investors in their trading and investment behaviors. Akbas et al. (2017) argue that the level of short interest provides value-relevant information about firms several months before new information arrives in the market. For example, short sellers take higher short positions in firms with poor earnings quality (Desai et al. (2006)) or in response to financial misconduct (Karpoff and Lou (2010)) long before the information becomes public. The literature refers to bad news, whereas takeovers have typically positive implications for the stock prices of targets. However, PE investors are interested in firms that can be improved through financial, governance, and operational engineering (Jensen (1989); Kaplan and Strömberg (2009)). Therefore, I argue that short sellers tend to be more present in these firms. This argument becomes stronger in case of poorly performing firms. For a subsample in their analysis, Gorbenko and Malenko (2014) point out that financial bidders show particular interest in those firms because they have special skills in restructuring and can provide access to debt on favorable terms (e.g., Ivashina and Kovner (2011)). The above arguments show that a higher short sale interest ratio can be interpreted as a bearish signal about these firms and indicates operational problems (Desai et al. (2002)). Thus, the correlation between LBOs and short sale interest ratio should be more present.

To test the timing dimension, the predictive power of the short interest ratio on LBO announcements was examined as shown in Table 3. I used *CVSI*, the coefficient of variation of the short interest ratio, by using the monthly short interest ratio *(SI)* data to calculate the means and standard deviations for each firm over a year. Equation (2) formally illustrates the calculation, where *i* indexes firm; *s* indexes month; *t* indexes year.

$$CVSI_{i,t} = \frac{\sqrt{\frac{1}{S}\sum_{s=1}^{S}(SI_{i,s,t} - \overline{SI_{i,t}})^2}}{\frac{1}{S}\sum_{s=1}^{S} SI_{i,s,t}}, \qquad \text{with } S = 12 \quad (2)$$

The data presented in Table 3 display a significant positive relationship with the binary variable *Target LBO*. This variable equals one for firms becoming targets in the next year by a financial bidder. Importantly, I do not find this predictive link in case of strategic bidders and notice differences in the significance of other variables such as the *M/B ratio*. This corresponds to the arguments in the literature about the differences between financial and strategic bidders (e.g., Gorbenko and Malenko (2014)). These findings support the above-mentioned notion about a positive link between these informed agents.

[Table 3 about here]

Using the information from above, I constructed my instrument as *Peer CVSI* for each firm *i* in the sense of a peer variable (e.g., Foucault and Frésard (2014); Leary and Roberts (2014)). That means, I calculated the average *CVSI* of all firms within an industry in a year, excluding firm *i's* observation. In Table 2, Panel C, I test my instrument in light of the different definitions of LBO activity. The first-stage regressions of two-stage least square estimations show a statistically significant positive relationship with all proxies in LBO activity. *Peer CVSI* easily passes the weak instrument test (Stock and Yogo (2005)) and illustrates a strong relevance in this context. Importantly, I did not derive the same finding in case of M&A activity (see Appendix, Table A.2, column (1))

The derivation of peer variables as an instrument is criticized in the literature. Gormley and Matsa (2013) show that a potentially endogenous regressor using its peer variable as an instrumental variable violates the exclusion restriction whenever the unobserved heterogeneity is correlated with the endogenous regressor. Contrary to this critique, I included as regressors the firm-specific variables and my instrument accounts for LBO activity instead of the firm-specific variable. More specifically, the inclusion of *CVSI* mitigates these concerns. Firm- and year-fixed effects as well as control variables leave the identifying variation to within-firm time-series variation. Thus, the issue of the exclusion restriction in this paper is reduced to the remaining omitted variables, such as industry developments, or measurement errors, because it might be a better measure of the capital structure determinants of firm *i* than the characteristics of the firm included in my model.

To address the first concern, my instrument was constructed as a peer variable and the use of the coefficient of variation provided certain benefits. First, it was unlikely that firm *i* used the short interest ratio of other firms to determine its own leverage ratio, which I considered by using the peer variable. Second, the coefficient of variation helped mitigate the concerns of symmetric industry shocks. That means, if a shock influences all firms in the same manner—the means and standard deviations increase equally in the industry—the instrument remains unchanged. Unfortunately, these construction benefits do not explain common shocks with asymmetric influences across firms. To mitigate these concerns, I investigated the short interest ratio around the LBO announcement in the first step. Figure 1 displays the development of target firms[10] (red line) and industry peers (blue line). The x-axis represents the months relative to the LBO announcement. Figure 1 shows that target firms have larger *SIs* before the event. Short sellers of these firms respond strongly to the LBO announcement. However, *SI* remains quite stable in case of industry peers. If LBO activity is the result of PEs selecting industries owing to industry developments or shocks, I would expect that short sellers respond accordingly. Consequently, Figure 1 should show larger movements for industry peers. However, only target firms show strong fluctuations around LBO announcements and contribute to the variation in *Peer CVSI*. From the perspective of firm *i*, if the instrument reacts more strongly, more peers of firm *i* will have an LBO event.

[Figure 1 about here]

As a further test, I employed the variable *Industry shock* and defined it as the first principal component of the median absolute changes in the used variables[11] in Harford (2005) for each industry-year. This variable captures differences in the impact of a shock across firms. In Panel A, Table 4, there is not any relationship between my instrument and the variable *Industry shock* for the whole sample (column (1)), as well as for a subsample around the LBO events (column (2)). Though, I cannot completely rule out unobserved factors. However, these two analyses provide strong evidence that *Peer CVSI* is not driven by common shocks.

[Table 4 about here]

To reinforce my arguments, I also checked whether major events (the Dotcom bubble and Financial crisis) made short sellers shift their focus on other industries. Table C.1 (see Online appendix C) shows that this idea cannot be supported. For example, I did not locate the move of short sellers from low-tech into high-tech industries in case of the Dotcom bubble. Thus, less severe and specific events are unlikely to be related to industry rotations of short sellers. It seems more likely that short sellers are target-orientated. Since borrowing a stock includes a rebate rate (interest rate for the collateral, (cash) - fee rate (for borrowing the stock)), and if the lender is a US broker-dealer it requires an additional 50% in margin. Further, for some stocks, it is more difficult to short them, which results in higher rebate rates. For instance, it is easier and cheaper to short firms with higher institutional ownership (D'Avolio (2002)). Additionally, any approach to naively short all stocks in an industry because of a common shock is highly risky because of the asymmetric payoff structure and the different rebate rates.

[10] The number of observations is smaller after the announcement since some LBOs become effective and typically, those firms are going private.

[11] Net income/sales, asset turnover, R&D, capital expenditures, employee growth, ROA, and sales growth.

The second concern in my instrument relates to the better measure of the determinants of firm *i's* capital structure. I address this potential problem in Panel B of Table 4. The dependent variable is *Peer CVSI*. The independent variables are either contemporaneous (column (1)) or one-period-lead (column (2)) firm-specific characteristics for the years surrounding LBO events. In both cases, I do not find any relationship with my instrument. Thus, *Peer CVSI* does not contain information on the determinants of firm *i's* capital structure in the current or next year. Overall, these findings provide support for the validity of the derived instrument in this section.

5 Results: The effect of LBO activity on the capital structure of industry peers

In this section, I empirically investigate the relationship between LBO activity within an industry and firm *i's* capital structure. I also analyze different possible channels for the LBO signal.

5.1 Main results

To estimate equation (1) and examine whether firm *i* responds to LBO announcements in its industry, in the first step, I test this equation with proxies I introduced and in the second I instrument those with *Peer CVSI* as derived in the previous section. Table 5 presents the results of the first analysis. As dependent variables, I used different measures for the leverage ratios (e.g., Frank and Goyal (2009); Axelson et al. (2013)), which are indicated at the top of the columns. The table shows coefficient estimates and the values in parentheses are t-statistics. The variable of interest is *LBO*. In columns (1)–(3), it is defined as *VB-activity*, whereas in columns (4)–(6), I use *B-Activity* and *V-Activity* for columns (7)–(9), respectively.

Table 5 shows a highly positive, statistically significant relationship between firm *i's* leverage ratios and LBO within its industry in all specifications. In other words, when a firm experiences an increase in LBO activity, it responds by changing its capital structure. As for its control variables, the firm-specific characteristics as shown in the table are in line with previous findings in the literature on capital structure (e.g., Rajan and Zingales (1995); Frank and Goyal (2009)). Peer firm averages are in most cases significant, which supports the notion that firms respond to the actions and characteristics of other peer firms (Leary and Roberts (2014)).[12] Finally, the industry controls provide a mixed picture of the relationship between the competition and leverage ratio of firm *i*. In case of the *Herfindahl index*, competition is positive and significant as it indicates an increase in the leverage ratios when competition decreases, which

[12] The findings of peer firm averages are stronger in terms of significance than those of Leary and Roberts (2014). Besides the differences in the sample period, Leary and Roberts (2014) used three-digit SIC codes as industry classification. This might be less precise in determining the right competitors than TNIC used for industry classification.

supports previous findings (e.g., Xu (2012)). However, *Product market fluidity*, which captures competition threats within an industry (Hoberg et al. (2014)), and *Total similarity*, which measures the similarity among the firms within an industry, show an opposite relationship with the dependent variables. As argued in Section 2, PE activity may change the competitive environment within an industry (Harford et al. (2016)) and the managers of industry peers might face a trade-off in their decisions on the capital structure. I will elaborate on this issue and provide a more detailed analysis in Section 5.4.

[Table 5 about here]

Hitherto, the results encourage hypothesis 1 that industry peers increase their leverage ratios and thus mimic the actions of PE investors. However, these findings might be spurious. One potential concern is the selection channel described in Sections 2 and 4, and the associated endogeneity problem. Thus, in the second step, I used the derived instrument to show the causal effect of LBO activity on the decision on the capital structure of firm *i*.

Table 6 presents two-stage least square regressions (2SLS), in which *Peer CVSI* is used as an instrument for the endogenous variable *LBO*. As before, the results show a positive and statistically significant association with the leverage ratio of firm *i*. For *VB-Activity* and *V-Activity*, the effect is highly significant, whereas for *B-Activity* it shows a statistically weaker relationship. To facilitate the interpretation of the magnitude of the effects, I scaled the variables by their sample standard deviation in all further tables in this paper. As an example, I will discuss the effect in column (1). A one-standard deviation increase in LBO activity leads to 0.8049 standard deviation increase in the leverage ratio of firm *i* measured as market leverage. This effect is also economically significant. Other models show some variations in the effects on dependent variables and 0.4–0.7 standard deviations increase. This illustrates that the magnitude of the effect differs in the definitions of LBO activity. I also show the firm-specific *CVSI*, which is insignificant in all regressions. Overall, these findings reinforce the notion that industry peers respond to LBO announcements in their industry with an increase in their leverage ratios and confirm hypothesis 1.

[Table 6 about here]

To examine whether this behavior of industry peers is only of mimicking nature or whether LBOs provide more specific (industry-related) information, on which industry peers respond, I will investigate in the next subsection follow-on acquisitions as potential signal of LBO activity.

5.2 Follow-on acquisitions

Harford et al. (2016) argue that LBO activity predicts follow-on acquisitions within an industry and that LBOs tend to be the first-mover in a merger sequence. Consequently, the bids of PE investors contain relevant information on an increased takeover activity within an industry. In Section 2, I argue that firms can use leverage as a defense tool to prevent potential takeovers.

In Panel A, Table 7, I empirically investigate this idea and analyze the percentage change in the leverage ratios of peer firms that have received a signal through an LBO announcement contrary to industry peers which have not received any signal over delta (Δt) years. The notion of this analysis incorporates two objectives. First, if LBOs predict follow-on acquisitions, industries should develop differently depending on LBO activity. Second, if leverage can reduce the likelihood of a takeover, firms with a signal should respond differently from those without the signal. For this, I construct two binary variables, *Target signal LBO* and *Target no signal*. The first one is equal to one if firm *i* receives a LBO signal in its industry and becomes a target of financial or strategic bidders in Δt years. Otherwise, this variable is zero for those firms with a signal but without becoming a target in the future. Therefore, this variable is forward-looking. The second binary variable, *Target no signal*, is one for firms that become a target without having an LBO or M&A before in their industry and zero for firms that are not targeted and do not have any signal. Therefore, this measure is backward-looking. That means, if firm *i* becomes a target, I compare its leverage ratio to the one Δt years before the announcement. I ensure that there is no signal in between the two time points and, importantly, take for all LBO announcements the leverage ratio of one quarter before the announcement date. I used the log percentage change of the leverage ratio of firm *i* over Δt as a dependent variable.

Panel A of Table 7 displays the results of the main variables of interest. In columns (1)–(2), I look at the change in the leverage ratios and follow-on acquisitions over the next year after receiving an LBO signal. Columns (3)–(4) and (5)–(6) represent the analysis over three and five years, respectively. In the case of *Target signal LBO*, I find that firms that become targets increase their leverage ratios to a lesser extent than the firms that do not become targets in Δt years provided that both received a signal. This distinction becomes stronger and highly significant if the period after an LBO event is longer. In untabulated results, I note that both groups increase their leverage ratios after receiving an LBO signal. With regard to *Target no signal*, the results reveal no significant differences between firms that become the target of a financial or strategic bidder and those that are not being taken over provided that both groups have not received a signal over Δt years before the transaction. These results provide evidence for the hypothesis 2a[13]—managers of industry peers respond to the additional takeover threat signaled by LBOs with an increase in their leverage ratios.

[Table 7 about here]

In Panel B of Table 7, I also test the first-mover argument of Harford et al. (2016). *Target LBO* (*Target M&A*) is a binary variable, which is one for firms that are announced to be the target of financial bidders (strategic bidders) over Δt years and zero, otherwise. As the table illustrates, LBO activity significantly predicts M&A acquisitions but not LBO ones. Contrarily, I do not find that M&A activity has this predictive power regarding future M&A acquisitions (see Online appendix B, Table B.3, Panel B). These findings support the notion that LBO announcements convey information about follow-on acquisitions and potentially the start of a merger sequence within an industry and that industry peers respond to this increased takeover threat by changing their capital structure.

5.3 Corporate governance

Another potential signal of LBO announcements may be industry-wide agency problems (Slovin et al. (1991)). If the managers of industry peers interpret PE involvement in an industry as a manager-shareholder conflict resulting in higher agency costs, the signal is particularly valuable for firms with relatively higher corporate governance problems. Thus, these firms should have a higher incentive to mitigate these problems to be more closely aligned with shareholders' value.

To analyze the interaction between firms' decisions on their capital structure, agency costs, and LBO signals, I used the turnover ratio and expense ratio as proxies for the agency costs of firm *i*. A higher turnover ratio is associated with more efficient use of the assets of a firm and suggests an inverse relationship with agency costs. An increase in the expense ratio shows higher operating costs, including also all non-efficient investments, and indicates higher agency costs (Ang et al. (2000); Chhaochharia et al. (2017)). To measure firms with high agency costs, I calculated the difference between the turnover ratio (expense ratio) of firm *i* and its industry median and constructed a binary variable *TR-low* (*ER-high*) that equaled one if the difference of firm *i* is smaller (larger) than the value of the prespecified thresholds indicated in Panel A of Table 8 (column (1) <10%; column (2) <25%; column (3) >90%; column (4) >75%). Otherwise, this variable is zero. Further, to test the influence of LBO announcements on those firms, I made

[13] In untabulated results, I include the alternative measures of takeover defense such as poison pill and golden parachute as binary variables in the regression model. The results become weaker, and they are significant for Δt equal to 3 and 5. Data for those variables are taken from Institutional Shareholder Services (ISS) and only available for S&P 1500 companies, which significantly reduce the sample.

the binary variables interact with LBO activity. In all specifications of this table, the dependent variable is *Market leverage*. I used *VB-activity* as a proxy for *LBO* and instrumented it with *Peer CVSI*. In case of the interaction terms, I included the interaction between *Peer CVSI* and *TR-low*, or *ER-high*, as the second instrument. This instrument fulfilled the relevance and exclusion conditions through the same arguments as for the first instrument.

The results show that the variable *LBO* is statistically significant in all regressions. The variables of interest are *LBOxTR-low* and *LBOxER-high*. In columns (1) and (2), Table 8 indicates that firms that belong to the lowest 10% or 25% in their industry and experience LBO activity significantly increase their leverage ratios compared to those firms which do not possess both conditions. This effect on the expense ratio is only found in column (3), not in column (4). The results suggest that industry peers that bear higher agency costs respond to a higher LBO activity in their industry. Thus, parts of the information conveyed through LBO announcements could reflect industry-related agency problems. Moreover, Table 1 illustrates lower leverage ratios, a higher proportion of zero leverage, and almost zero leverage for these peer firms (column "LBO peers"). In untabulated results, I find significantly lower leverage ratios and a higher proportion of zero or almost zero leverage for "*TR-low*"- and "*ER-high*"-firms than for firms with lower agency costs. From this perspective, managers of industry peers use this new information and adjust their capital structure accordingly. However, the findings are rather weak in significance and depend strongly on the classification of the thresholds. Furthermore, there might also be measurement errors of the proxies caused by differences in accounting methods (Ang et al. (2000)). Another issue might arise from the negative relationship between profitability measures and the leverage ratio of firms (see Table 5). For example, the turnover ratio is also a profitability measure and could reflect the dependence on external financing for "*TR-low*" firms.

Panel B of Table 8, shows different corporate governance proxies[14] which I used to test whether differences in these variables can explain the relationship between the market leverage of firm *i* and LBO activity accounting for the potential insufficiency of the variables used in Panel A. In columns (1)–(3), I included *Log(board size)* and the fraction of independent directors *(Frac. ind. directors)*, and *CEO stock ownership* that are related to the leverage ratio of a firm (e.g., Strebulaev and Yang (2013)). *E-Index*, in column (4) accounts for the overall corporate governance level within a firm. A lower level indicates better governance and better protection of takeovers, which should yield lower leverage ratios. First, in all regressions, the variable *LBO* remains significant. Second, the corporate governance variables are insignificant in this setting.

[14] Data are taken from Compustat Execucomp and Institutional Shareholder Services (ISS).

Overall, Panel B shows that the relationship between LBO activity and market leverage is also present in case of using other proxies.

[Table 8 about here]

To sum up, this subsection illustrates that parts of the information conveyed by LBO announcements might come from industry-wide agency problems, which confirms hypothesis 2b. However, the evidence for this claim is rather weak and depends on the definition of high agency cost firms. Importantly, the results— the relationship between LBO activity and firm *i's* market leverage— would be robust if other corporate governance measures are used.

5.4 Competition

The literature states that PE funds improve efficiency and create value for their portfolio firms (e.g., Boucly et al. (2011); Guo et al. (2011); Acharya et al. (2013)). As a result, industry peers of target firms could experience a change in the competition environment. So far, the interpretation of the signal has not accounted for information related to this specific part. As derived in Section 2, there is a potential trade-off between increasing efficiency through more leverage and the negative link between leverage and competition (e.g., Xu (2012)).

To establish a suitable empirical framework, I employed a quasi-natural experiment with multiple exogenous shocks to the competition level through import tariff cuts (Frésard (2010); Frésard and Valta (2015)). The notion of this experiment follows from the change in relative prices of foreign and home products. If tariff rates decrease, the prices of foreign products become relatively cheaper than the prices of home products. This increases competition or at least the threat of foreign competitors entering the market. This paper considers that this framework allows examining several dimensions of making decisions on the capital structure of firms. First, it enables the analysis of the role of competition from a causal point of view. Second, it simulates the trade-off for firms that experience an LBO and an increase in competition within their industry. In a sense, one can interpret this artificial scenario as a large influential and impactful PE-backed firm in an industry.

Following Frésard (2010) and Frésard and Valta (2015), I calculated tariff rates as duties collected (ad-valorem tariff) over the value of imports (free-on board value). I determine tariff cut within an industry-year,[15] if a change in the negative tariff rate is twice (or three-times) larger than the change in the industry average and is not followed by an equivalent increase in the subsequent two years. The tariff cut should also be larger than 1%. In this case, the binary variable (*TC*) takes the value of one in the next year and that of zero the year before the tariff

[15] I use the concordance by Pierce and Schott (2012) to transfer HS codes into SIC codes. This procedure is not perfectly in line with the text-based industry classification used in this paper.

cut. The control group contains never-treated firms and treated firms when they are not exposed to an event of tariff cut. Importantly, both groups should have an LBO announcement when the tariff cut happens. The merged sample contains 77 tariff cuts.[16]

Figure 2 shows the development of leverage ratios (y-axis) for the treated and the control groups regarding tariff cuts provided that both groups have an LBO event in their industry. The x-axis presents the relative time in years to the event (tariff cut). The graph illustrates similar development for the treated and control groups before the tariff cut that fulfills the parallel trend assumption. They diverge afterward. In case of the control group, I observe an increase in the leverage ratio provided that these firms have an LBO announcement at t=0. For the treated group, the reaction regarding their leverage ratio is negative. These firms face both conditions. From this graphical illustration, it is applicable that an increase in competition can offset or reverse the positive effects of LBO activity on the leverage ratio of the firms.

[Figure 2 about here]

In Panel A of Table 9, these insights are empirically tested. The dependent variable is *Market leverage*. Columns (1) and (2) (as well as (3) and (4)) show the results when the negative change in tariff rates within an industry is twice (or three times) as large as the change in the industry average indicated by "TC-2" ("TC-3") in the table. *Treat* is a binary variable that equals one for the treated firms and zero otherwise.[17] The variable of interest is *TC-LBO*, which is conditioned on the fact that both groups experience an LBO announcement at t=0. As expected from the graphical illustration, firms that face both events have significantly lower leverage ratios than firms that experience only LBO activity in their industry. This analysis reinforces the negative relationship between firm *i's* leverage choice and competition. This confirms hypothesis 3—the firms that experience a higher change in the competition through LBO announcements show a weaker capital structure effect.

To analyze the competition effect, in Panel B, the firms are split at the median of the *Herfindahl index* into two groups. In column (1), the subsample of industry peers is considered to belong to low competition industry (HC=0, above the median). Column (2) considers peer firms as part of the high competition industry (HC=1, below the median). For the endogenous variable *LBO*, which is proxied with *VB-Activity*, I have used my instrument. This subsample analysis reveals that an LBO effect is present in the high-competition (HC=1) group, which means industry peers face more competition in response to LBO activity. In column (3), the

[16] Data on tariff rates were obtained from Schott (2008) (https://faculty.som.yale.edu/peterschott/international-trade-data/) and covers the years from 1989 to 2018.

[17] Since firms can be part of the treated and control group owing to multiple treatments, this variable is not multicollinear with the firm-fixed effects.

interaction *LBOxHC* is tested. For this term, the interaction of *Peer CVSI* and *HC* is included as the second instrument. It follows the same logic in terms of exclusion and relevance conditions as that of the first instrument. The results reveal the same findings as those of the subsample analysis. Industry peers tend to increase their leverage ratios more when they experience an LBO activity and are in more competitive industries.

I consider these results counterintuitive to some extent in the light of this paper and considering the negative relationship between leverage and competition (e.g., Xu (2012)). Thus, column (4) examines how LBO activity affects the competition level of industry (*Herfindahl index*). There, I find a positive link indicating a decrease in competition, which explains a specific increase for industry peers in more competitive industries. The literature also offers support for this positive effect on the competition (e.g., Chevalier (1995a,b); Kovenock and Phillips (1997)), who argue that PE-backed firms encounter reduced financial flexibility through their high-leverage burdens and interact less aggressive in the product market. Moreover, Table 1 illustrates higher competition among industry peers that face LBO activity in their industry. This might have two implications related to the findings in Panel B. First, PE funds may select more competitive industries and only peer firms in these industries experience an LBO effect. This explains the differences between low- and high- competition industries. Second, the benefit of this study is that it uses a dynamic industry classification, which considers strategic changes of firms regarding their products. Thus, the increase in the Herfindahl index might be a consequence of these potential changes in which firms leave an industry. Altogether, this could explain how the results of Panel B fit together.

[Table 9 about here]

Based on the findings of this subsection, I show that an exogenous shock to the competition level offsets, or reverses, the positive LBO effect on the leverage ratio of firm *i*. This confirms the hypothesis outlined in this section. However, the positive leverage effect is centered on more competitive industries, for which a decrease in the competition level through strategic changes in industry peers or reduced financial flexibility of target firms appear to be more likely explanations.

5.5 Undervaluation and industry prospects

Under the selection channel, PE funds can detect undervalued industries (Harford et al. (2019)) and those with positive future industry prospects (Slovin et al. (1991)). As addressed in Section 4, this channel causes the endogeneity problem within the framework used in this paper, which I overcome through the instrument I have derived. However, if the selection channel is valid, understanding how it influences the decision on the capital structure of firm *i* is relevant. From the theoretical point of view, the effect of the selection channel is ambiguous (see Section 2).

To tackle the different facets of the selection effect, the M/B decomposition of Rhodes–Kropf et al. (2005) was employed by which the M/B ratio is decomposed into three components.[18] *Firm-specific error (FSE)* measures the firm-specific deviations from the fundamental value implied by the industry multiples. *Time-series industry error (TSIE)* captures short-term industry-level deviations from their long-run values. *Long-run to book value (LRtB)* is part of the M/B ratio that is not attributable to firm *i's* misvaluation. It reflects long-run average growth rates for an average firm within an industry (Rhodes–Kropf et al. (2005)). In Table 10, these components, instead of the M/B ratio, are included and interact with LBO activity. As in previous analyses, my instrument is included for the endogenous variable *LBO*. For the endogenous interaction terms, I used *Peer CVSI* and the components of the M/B decomposition. The results show that the variable *LBO* is in all specifications positive and significant. In column (1), I included the three components and ascertain that their coefficients are all negative and highly statistically significant. In case of the two misvaluation terms, an increase is associated with lower misvaluation, which supports hypothesis 4a. That means, a higher firm or industry misvaluation leads to an increase in the leverage ratio. In terms of *LRtB*, which represents the growth opportunities of a firm, the relationship is negative with *Market leverage* and would confirm hypothesis 4b. However, columns (2)–(4) cast doubt on the results in column (1)—with regard to the explanation for the hypotheses since all interaction terms are insignificant. Therefore, the three components have no effect on the leverage ratio of firm *i* when LBO activity is present within its industry. A feature of the selection channel from the perspective of positive industry prospects is an improvement in profitability (Harford et al. (2016)). In column (5), I test whether LBO activity is positively related to the *EBITDA-to-assets ratio*. The results do not support this relationship and provide evidence against hypothesis 4b and the selection channel.

As for industry undervaluation, there is no supporting link in column (6) between *TSIE* and LBO activity, which does not support hypothesis 4a. These findings provide evidence against the selection channel.

[Table 10 about here]

Column (7) examines the valuation arguments about dependent variable *Market leverage*. In my empirical analysis, it is possible that firms do not actively counteract their leverage ratios, but rather they are exposed to fluctuations in the stock price (Welch (2004)). Hsu et al. (2011)

[18] In Online appendix D, I show the formal derivation of the M/B decomposition used in this paper.

and Kathan and Tykvová (2021) provide evidence for negative abnormal returns for industry peers after an LBO announcement. Consequently, the change in market leverage is the result of a decrease in market capitalization. The results in column (7) do not support this argument. Since, the dependent variable *Log(MCAP)* is significantly and positively related to an LBO activity.

6 Alternative mechanism

In the following, I consider two alternative explanations for the results derived in this paper. The first one pertains to changes in the corporate governance of firms. Harford et al. (2016) have found that industry peers that experience LBO announcements show weaker measures for corporate governance afterward. However, they argue that these firms strengthen their defense strategy to reduce the likelihood of a takeover. As for short sellers, there is evidence of higher short sale activity for firms with larger manager-shareholder conflicts in case of earnings manipulation (e.g., Hirshleifer et al. (2011)) or financial misconduct (Karpoff and Lou (2010)).

These findings show that if LBO activity weakens the corporate governance of industry peers, a higher short interest ratio could be observed in these firms. To reduce the takeover threat from the declining prices, managers could use higher leverage ratios as a defense tool. The observed effect would be caused by the changes in corporate governance of firm *i*. In Panel A, Table 11, this concern is tested. The dependent variables are proxies for corporate governance used in Section 5.3. For the endogenous variable *LBO*, my instrument is used. The results show a positive significant relationship with board size as well as the independence of the boards (columns (1) and (2)) and the variable *LBO*. In case of *CEO stock ownership* and *E-Index*, LBO activity is insignificant. These findings provide evidence for an improvement in the corporate governance proxies of firm *i* and contradict the findings of Harford et al. (2016). However, it confirms to some extent the analysis of Oxman and Yildirim (2008) that shows positive changes in the corporate governance of industry peers. Thus, deterioration in the corporate governance of industry peers does not explain my results.

[Table 11 about here]

The second explanation for the results is an increase in the supply of debt. LBO activity is particularly strong when debt market conditions are favorable (Axelson et al. (2013)). Thus, firms could increase their leverage ratios as predicted by the market timing theory (e.g., Frank and Goyal (2009)). To test the supply effect, I relied on the credit rating of firms since it provides information whether investors, such as banks or pension funds, can invest in those firms. They also provide information about the quality of a firm (e.g., Kisgen (2006)). Thus, firms with a rating should benefit more from favorable debt market conditions.

Further, firms with almost zero leverage should be more inclined to increase their debt. They face low bankruptcy costs and benefit from tax shields. In Panel B of Table 11, I investigate both approaches. For the endogenous variables related to *LBO*, my instrument is used. In all regressions, the variable *LBO* is statistically significant and positively related to *Market leverage*. Column (1) shows the results of the inclusion of the binary variable *Rating*. Firms with rating have significantly higher leverage ratios than those without. In column (2), *Rating* is interacted with *LBO*. The findings for the interaction term and *Rating* are insignificant. For the second case, the variable *AZL* is included. This binary variable is equal to one for firms with market leverage below 5%; otherwise, it is zero. Columns (3) and (4) report a negative and statistically significant relationship with the dependent variable, but the interaction term *LBOxAZL* is insignificant. Overall, the results of Table 11 do not support the alternative mechanism that can explain the findings in this paper.

7 Additional support and robustness

As shown in Section 4 in Table 2, M&A targets do not differ from their industry peers in the short interest ratio. I also illustrate differences in other variables, which are not present in case of LBO deals. In other words, the link between *Peer CVSI* and M&A activity within an industry should not exist. In Table A.2 (see Appendix), I check the validity of my instrument for M&A deals. In the first column, I show the first stage regression, which indicates a low F-Value. The variable *M&A* represents *M&A-Activity* and is defined in the same manner as *VB-Activity*. The relationship between *Peer CVSI* and *M&A* is insignificant. In columns (2)–(4), I show two-stage least square regressions in this context, which are insignificant with the different proxies for the leverage ratio of firm *i*. These findings underline that the short interest ratio of other firms is only valid in case of LBO activity.

In previous sections, I have extensively argued the importance of LBO announcements to the decision on the capital structure of firm *i*. In Table B.2 (see Online appendix B), I illustrate the almost non-existent importance of M&A activity to the financial decision of other firms. In this regression, my instrument is not used. In light of these results, industry peers respond primarily to LBO signals whereas the information content of M&A deals is not present. However, following the arguments of Section 5.2 and those of Harford et al. (2016) about the likelihood of LBOs being the first mover in a merger sequence, M&A activity still may contain relevant information about follow-on acquisitions. Table B.3 (see Online appendix B) uses the same framework as in Table 7. In Panel A, similar but weaker results as in the context of LBOs can be noticed. For example, in case of Δt equal to one, industry peers becoming targets do not significantly change their leverage ratios compared to those that do not become targets, provided that both groups had an M&A announcement in their industry. Admittedly, the analysis does not provide a clear setting for the signals, since LBO and M&A activities overlap within industries to some extent. But, the timing argument about LBOs states that the differences for the first year might result from the predictive power of merger sequences. It means that if industry peers observe an M&A announcement in their industry, they do not respond by changing their leverage ratios because the likelihood of a merger sequence is considerably lower. In Panel B, I have illustrated this explanation and shown that M&A activity does not predict follow-on M&A acquisitions. There is only a weak link in case of Δt being equal to three, which could be an indication for firms being in the ongoing merger sequence. Altogether, my results support significant differences between LBO and M&A deals. These findings prove that the managers of industry peers tend to use LBO-related information for their capital structure decisions.

To reinforce my findings, I performed a placebo test by changing the current announcement date of LBOs to the same date two years ago. In Table C.2 (see Online appendix C), the relationship between LBO and different proxies for firm *i's* leverage ratios is shown to be insignificant. In untabulated results, I repeat the analysis without my instrument and find insignificant results as well. These results support the notion that industry peers respond to LBO activity.

8 General discussion

Hitherto, only a few papers have been shown to look at the implications of LBO activity for the capital structure of industry peers. However, these studies do not analyze this relationship in detail but provide in their empirical framework a sub-analysis to consider its potential effects on the capital structure of peer firms. Therefore, it is not surprising that empirical evidence is sparse and mixed. Harford et al. (2016) and Aldatmaz and Brown (2020) do not find an increase in the leverage ratios of industry peers after LBO announcements, whereas Hsu et al. (2011) and Kathan and Tykvová (2021) show the opposite. Beyond different sample periods, there are fundamental distinctions in the empirical setups, such as the use of industry classification, and the definition of PE activity that could explain differences in the findings. For example, Harford et al. (2016) define LBO activity as a binary variable in which industry peers made an LBO announcement in the past three years. In untabulated results, I used the same definition and did not find an effect on the leverage ratio of firm *i*. Arguably, if the effect is contemporaneous, definitions allowing longer periods do not catch information relevant to the capital structure of industry peers. Moreover, during these periods firms repay debt and use it for other means. In Table A.3 (see Appendix), I investigate how other variables of industry peers change through an LBO activity. In columns (1) and (2), *Equity issuance* is significantly negative and *Share* *repurchase* is significantly positive related to *LBO*. Therefore, industry peers may use parts of the issuance of debt to repurchase equity. This adds more evidence to hypothesis 2a, since share repurchases help decrease the threat of takeovers (e.g., Dittmar (2000)).

In general, studies find positive spillover effects of PE investments on industries, or industry peers, resulting from increased competitive pressure (e.g., Harford et al. (2016); Aldatmaz and Brown (2020); Feng and Rao (2022)). From a capital structure perspective, leverage is negatively associated with an increase in competition. I have discussed the potential decrease in competitive pressure for industry peers in Section 5.4. Further, as shown in columns (5) and (7) of Table 10, for the selection channel, there are inconclusive findings regarding an increase in the efficiency of firm *i*. Similarly, Table A.3 (see Appendix) illustrates a significant increase in *Intangible-to-assets*, whereas *CAPEX-to-assets* significantly decreases. On the one hand, industry peers arguably increase the R&D expense to become more innovative; on the other, they decrease the investments that impact the former ratio. I also notice a statistically significant increase in *Dividends-to-assets* and insignificant results related to *Log (employees)*. Thus, these results provide scant evidence for an improvement in industry peers through an increase in competitive pressure caused by LBO activity. This is probably because of the use of contemporaneous variables and the definition of LBO activity. Further, studies typically rely on classical industry classifications, which may insufficiently represent the industry peers of firm *i*. Therefore, using a dynamic industry classification allows firms to change industries. This is particularly relevant since industry peers have undergone strategic changes (e.g., Harford et al. (2016); Feng and Rao (2022)) that influence the products of these firms. Further, these studies do not consider the peer effects of other firms that could drive the results.

The limitation of my study is its focus on public targets owing to my instrument and industry classification. Like the authors of other studies (e.g., Harford et al. (2016); Feng and Rao (2022)), I faced the issue that the implications for private deals could significantly differ. In this respect, literature on stock performance shows significant positive results for public deals (Slovin et al. (1991); Chevalier (1995b); Feng and Rao (2022)). However, if the majority of deals are private, their effect on industry peers is significantly negative (Hsu et al. (2011); Kathan and Tykvová (2021)). Consequently, peer firms face differences in the LBO signals depending on the target status. However, Cohn et al. (2022) show that the increase in the leverage after private firm buyouts is considerably lower for public firm buyouts. Therefore, considering only public deals might be less crucial in light of this study.

9 Conclusion

This paper sheds new light on the relationship between LBO activity and the choice of industry peers for their capital structure. By using a novel instrument to overcome the endogeneity problems of the selection channel, I have found a highly positive and significant causal effect of LBO activity on firm *i's* leverage ratio. Analyzing different channels used in the literature elucidates differences in the importance of the overall effect. The study provides strong evidence that managers of industry peers use higher leverage ratios to reduce the likelihood of takeover. In terms of LBOs signaling industry-wide governance problems, my findings attribute a less important role to leverage in reducing these problems. I do not provide support for the selection channel. Applying a quasi-natural experiment to investigate the competition effect, the findings suggest that an exogenous increase in competition reduces the LBO effect. However, I also show that LBO activity decreases competition within an industry, which explains why peer firms in more competitive industries respond in particular with higher leverage ratios to LBO announcements. To strengthen my results, I have considered alternative mechanisms and provided further support. Most importantly, my instrument does not work in the context of M&A deals. A limitation of the paper is that the setting does not allow the investigation of the LBO signal for private deals. Future research is needed to fully understand the information content of LBO signals for industry peers. Since my study focuses on the effects of LBO activity on the decisions of industry peers on their capital structure with reference to the US firms, I suggest that research analyze these effects on other countries at a deeper level.

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Figure 1: Short sale interest ratio of LBO targets and industry peers

This figure displays the development of LBO targets and industry peers in their average short sale interest ratios over 24 months prior and after an LBO announcement. The x-axis represents the months relative to the LBO announcement (Event time).

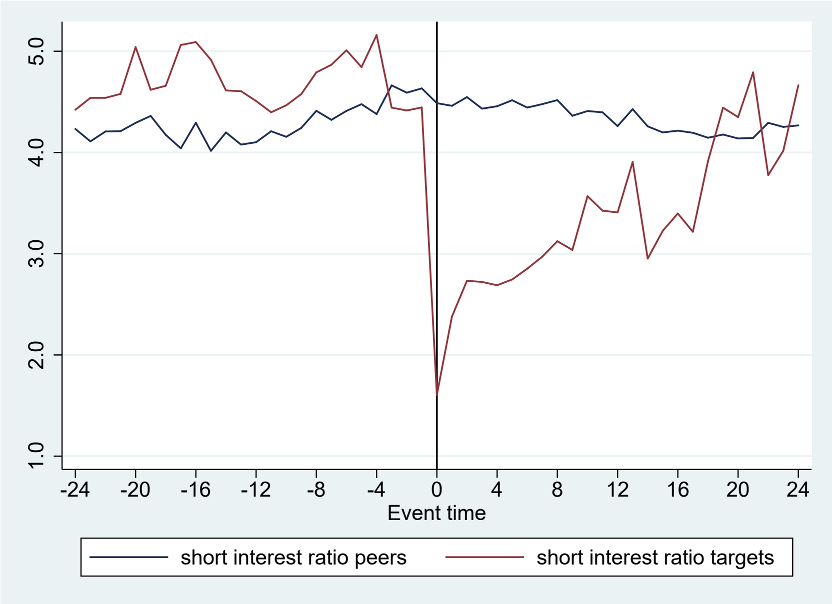

Figure 2: Competition and leverage

This figure displays the development of industry peers in their leverage ratios around a tariff cut event. The y-axis represents the average market leverage (MLEV) and the x-axis shows the years relative to the tariff cut event (Event time). Treated firms (treated) are exposed to both conditions, tariff cut and LBO announcement at t=0. Control firms (control) are only exposed to an LBO announcement at t=0.

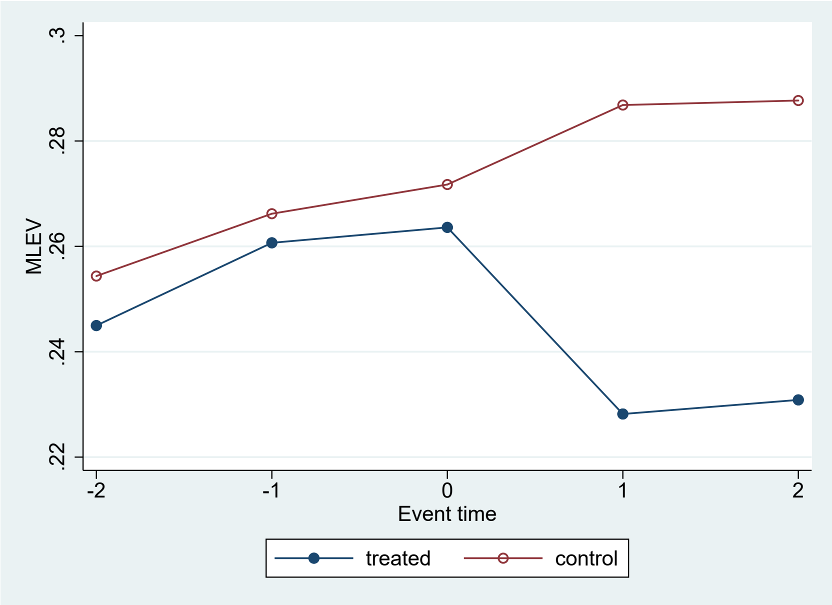

Table 1: Summary statistics of industry peers and LBO target firms

This table displays summary statistics of industry peers and LBO target firms over the sample period from 1989 to 2019. Target firms of the financial and utility industries are excluded. The values for "Target firms" are the last reported values in Compustat or Datastream before the LBO event. "LBO peers" indicates industry-years in which peer firms had an LBO announcement in their industry. "Non-LBO peers" represents industry-years in which peer firms did not have an LBO announcement. Differences are calculated between "LBO peers" and "Non-LBO peers". ***, **, and * indicate statistical significance of a two-sided t-test at the 1%, 5%, and 10% levels, respectively. All variables are winsorized at the 0.5% level. Detailed information about these and other variables are provided in Table A.1.

Target firms and industry peers characteristics

	Target firms			All peers			LBO peers			Non-LBO peers			LBO vs. Non-LBO
Variable	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Diff. mean
Market leverage	0.284	0.228	0.264	0.238	0.162	0.246	0.204	0.106	0.244	0.245	0.174	0.246	−0.041***
Debt/EV	0.321	0.247	0.362	0.272	0.181	0.341	0.235	0.121	0.327	0.280	0.194	0.343	−0.045***
Book leverage	0.300	0.236	0.302	0.230	0.175	0.276	0.225	0.148	0.302	0.232	0.180	0.270	−0.007***
Zero leverage	0.140	0.000	-	0.146	0.000	-	0.207	0.000	0.405	0.133	0.000	-	0.074***
Almost zero leverage	0.267	0.000	-	0.324	0.000	-	0.405	0.000	0.491	0.306	0.000	-	0.099***
Firm size (log sales)	5.528	5.527	1.642	5.230	5.200	2.256	5.497	5.487	2.131	5.172	5.128	2.278	0.325***
M/B ratio	2.651	1.600	6.749	2.886	1.842	5.595	3.192	2.042	6.284	2.819	1.808	5.430	0.373***
EBITDA-to-assets	0.063	0.115	0.653	0.023	0.092	0.387	0.003	0.092	0.450	0.027	0.092	0.372	−0.024***
Net PPE-to-assets	0.272	0.193	0.241	0.253	0.169	0.241	0.249	0.144	0.251	0.254	0.175	0.239	−0.005**
Peer firm averages													
Peer firm size	-	-	-	5.298	5.256	1.562	5.314	5.401	1.305	5.295	5.218	1.613	0.019*
Peer M/B-ratio	-	-	-	2.986	2.509	2.191	3.401	2.975	2.108	2.895	2.385	2.198	0.506***
Peer EBITDA-to-assets	-	-	-	0.013	0.069	0.180	−0.021	0.044	0.203	0.021	0.075	0.173	−0.042***
Peer net PPE-to-assets	-	-	-	0.250	0.183	0.197	0.237	0.154	0.194	0.253	0.190	0.197	−0.016***
Industry controls													
Herfindahl index	0.323	0.226	0.283	0.238	0.152	0.221	0.144	0.100	0.131	0.259	0.174	0.231	−0.115***
Product market fluidity	6.118	5.594	2.828	7.371	6.683	3.737	8.377	7.769	3.723	7.150	6.450	3.704	1.227***
Total similarity	2.830	1.609	3.199	8.262	2.032	17.454	7.819	3.994	12.429	8.359	1.717	18.369	−0.540***
Obs. (& unique firms)	836 (801)			102,422 (12,216)			18,388 (6,001)			84,034 (12,037)			
Median no. peers	27			40			96			28			

Table 2: Short-interest ratio and first-stage regressions

In Panel A, this table displays the average of the *Short interest ratio*, *M/B ratio*, *Log(MCAP)* and *Illiquditiy* for the period over 24 months before an LBO announcement within an industry. Column (1) represents the values for LBO targets, whereas column (2) presents the averages for industry peers. Column (3) tests the differences for significance (two-sided t-test) between LBO targets and industry peers. Panel B illustrates the analysis in case of M&A deals. Panel C shows the first stage regressions of two-stage least square (2SLS) estimations. The top of this panel illustrates different proxies of the variable *LBO* as dependent variable. In column (1), *LBO* is proxied as the log of total deal value divided by the number of firm *i's* industry peers within an industry-year (*VB-Activity*). *B-Activity*, the number of LBOs divided by the number of firm *i's* industry peers, is used as proxy in column (2). In column (3), *V-Activity* is calculated as the log of total deal value over firm *i's* industry-year (Haddad et al. (2017)) and represents *LBO*. The instrument is *Peer CVSI*. This variable is constructed as the average of *CVSI* over all firms within an industry-year, excluding firm *i's* observation. Firm *i's CVSI* is constructed as the standard deviation over the mean of monthly short interest data over a year. All continuous variables are scaled by their sample standard deviation in Panel C. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. F-values (first stage) are shown in the last row of Panel C. *** indicates statistical significance at the 1% level. All variables are winsorized at the 0.5% level. Detailed information about these and other variables are provided in Table A.1.

Panel A - LBO	LBO Targets	Industry peers	Difference
	(1)	(2)	(3)
Short interest ratio	4.692	4.285	0.407***
M/B ratio	2.093	2.453	−0.360***
Log(MCAP)	12.002	12.053	−0.051***
Illiquidity	0.271	0.201	0.070***

Panel B - M&A	M&A Targets	Industry peers	Difference
	(1)	(2)	(3)
Short interest ratio	4.450	4.436	0.014
M/B ratio	2.885	2.367	0.518***
Log(MCAP)	12.535	11.680	0.855***
Illiquidity	0.184	0.298	−0.114***

Panel C - First stage	LBO VB-Activity	LBO B-Activity	LBO V-Activity
	(1)	(2)	(3)
Peer CVSI	0.0310***	0.031****	0.0451***
	(3.40)	(2.97)	(2.97)
Industry & Peer firm variables	Yes	Yes	Yes
Firm-specific cont. & CVSI	Yes	Yes	Yes
Firm FE & Year FE	No	No	No
Observations	92,757	92,757	92,757
F-Value (first stage)	34.07	36.73	95.79

Table 3: Target firms and CVSI

This table displays the results from fixed effects regressions. The dependent variable is *Target LBO* (*Target M&A*), which is a binary variable and equals one for firms that become targets of a financial (strategic) bidder in Δt years. It is zero, otherwise. Firm *i's CVSI* is constructed as the standard deviation over the mean of monthly short interest data over a year. Firm-specific characteristics denote variables corresponding to firm *i's* value in year t. Industry controls are from Hoberg et al. (2014) and Hoberg and Phillips (2016). Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level. All regressions include a constant. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. *** and ** indicate statistical significance at the 1% and 5% levels, respectively.

	Target LBO	Target M&A
Δt: 1 Year	(1)	(2)
CVSI	0.0011**	0.0009
	(2.64)	(1.58)
Firm size (log sales)	0.0005	0.0024***
	(1.48)	(3.72)
M/B-ratio	-0.0000**	-0.0000
	(-2.29)	(-0.60)
EBITDA-to-assets	-0.0002	-0.0008
	(-0.43)	(-1.07)
Net PPE-to-assets	0.0010	-0.0045
	(0.43)	(-1.23)
Herfindahl index	0.0008	-0.0037**
	(0.54)	(-2.51)
Product market fluidity	-0.0000	-0.0007***
	(-0.16)	(-3.45)
Total similarity	-0.0000	0.0002***
	(-0.61)	(3.68)
Firm FE	Yes	Yes
Year FE	Yes	Yes
N	102,320	102,320
Adj. R^2	0.003	0.051

Table 4: Industry shock and Peer CVSI properties

This table displays the results from fixed-effects regressions. The dependent variable is *Peer CVSI*. In Panel A, the variable of interest is *Industry shock* calculated as the first principal component of the median absolute change of the variables used in Harford (2005) for each industry-year. Column (1) covers the whole sample, whereas column (2) considers the years (-2 to +2) around an LBO announcement. In Panel B column (1), firm-specific variables correspond to the value of firm *i* in year *t*. In column (2), they correspond to the value of firm *i* in year *t + 1*. Both columns consider the years (-2 to +2) around an LBO announcement. Detailed information on these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level and scaled by their sample standard deviation. All regressions include a constant. Heteroscedasticity and within firm-year clustered t-values are reported.

Panel A	Peer CVSI	
	(1)	(2)
Industry shock	0.0009	-0.0108
	(0.13)	(-1.03)
Industry controls	Yes	Yes
Peer firm averages	Yes	Yes
Firm-specific controls	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	43,567	14,696
Adj. R^2	0.653	0.820

Panel B	Peer CVSI	
	(1) contemporaneous Ind. Var.	(2) one-period-lead Ind. Var.
Firm size (log sales)	0.0038	-0.0164
	(0.23)	(-0.85)
M/B-ratio	-0.0049	-0.0023
	(-1.45)	(-1.23)
EBITDA-to-assets	-0.0009	-0.0036
	(-0.29)	(-1.09)
Net PPE-to-assets	-0.0047	-0.0065
	(-0.41)	(-0.46)
Industry controls	Yes	Yes
Peer firm averages	Yes	Yes
Firm CVSI / Equity shock	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	29,963	27,799
Adj. R^2	0.753	0.753

Table 5: LBO activity and firms' capital structure

This table displays the results from fixed effects regressions. The dependent variables are *Market leverage*, *Debt/EV* and *Book leverage* as indicated at the top of this table. In columns (1)–(3), *LBO* is proxied as the log of total deal value divided by the number of firm *i's* industry peers within an industry-year (*VB-Activity*). *B-Activity*, the number of LBOs divided by the number of firm *i's* industry peers, is used as proxy in columns (4)–(6). In columns (7)–(9), *V-Activity* is calculated as the log of total deal value over firm *i's* industry-year (Haddad et al. (2017)) and represents *LBO*. Firm-specific characteristics denote variables corresponding to firm *i's* value in year t. Peer firm averages are constructed as the average of all firms within an industry-year, excluding firm *i's* observation. Industry controls are from Hoberg et al. (2014) and Hoberg and Phillips (2016)). Detailed information on these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level. All regressions include a constant. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Market leverage	Debt/ EV	Book leverage	Market leverage	Debt/ EV	Book leverage	Market leverage	Debt/ EV	Book leverage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	VB-Activity			B-Activity			V-Activity		
LBO	0.0336***	0.0335***	0.0230***	0.1461***	0.1555***	0.0874**	0.0021***	0.0023***	0.0017***
	(4.18)	(3.18)	(3.17)	(3.48)	(2.84)	(2.49)	(3.77)	(3.28)	(4.16)
Firm-specific characteristics									
Equity shock	-0.0009	-0.0025	0.0011	-0.0009	-0.0025	0.0011	-0.0010	-0.0026	0.0010
	(-0.49)	(-1.03)	(0.75)	(-0.49)	(-1.03)	(0.76)	(-0.54)	(-1.08)	(0.68)
Firm size (log sales)	0.0295***	0.0269***	0.0321***	0.0295***	0.0268***	0.0321***	0.0292***	0.0265***	0.0318***
	(12.09)	(8.34)	(8.54)	(12.08)	(8.33)	(8.53)	(12.10)	(8.31)	(8.45)
M/B-ratio	-0.0013***	-0.0017***	-0.0010***	-0.0013***	-0.0017***	-0.0010***	-0.0013***	-0.0017***	-0.0010***
	(-12.16)	(-12.24)	(-7.69)	(-12.18)	(-12.26)	(-7.69)	(-12.26)	(-12.32)	(-7.66)
EBITDA-to-assets	-0.0563***	-0.0615***	-0.2080***	-0.0563***	-0.0615***	-0.2080***	-0.0561***	-0.0612***	-0.2078***
	(-5.97)	(-5.13)	(-6.36)	(-5.97)	(-5.13)	(-6.36)	(-5.97)	(-5.13)	(-6.36)
Net PPE-to-assets	0.1980***	0.1701***	0.1834***	0.1978***	0.1699***	0.1833***	0.1976***	0.1697***	0.1831***
	(12.50)	(8.96)	(8.78)	(12.48)	(8.96)	(8.78)	(12.46)	(8.94)	(8.75)

(continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Peer firm averages									
Equity shock	-0.0094**	-0.0094*	-0.0043	-0.0094**	-0.0095*	-0.0043	-0.0096**	-0.0096*	-0.0044
	(-2.21)	(-1.74)	(-1.28)	(-2.22)	(-1.74)	(-1.28)	(-2.25)	(-1.77)	(-1.32)
Firm size	0.0033*	0.0049**	0.0022	0.0033*	0.0049**	0.0022	0.0033*	0.0049**	0.0022
(log sales)	(1.97)	(2.64)	(1.41)	(1.97)	(2.64)	(1.42)	(1.94)	(2.61)	(1.40)
M/B-ratio	-0.0046***	-0.0061***	-0.0013**	-0.0046***	-0.0061***	-0.0013**	-0.0046***	-0.0061***	-0.0013**
	(-5.18)	(-5.57)	(-2.32)	(-5.21)	(-5.59)	(-2.33)	(-5.17)	(-5.55)	(-2.36)
EBITDA-to-	-0.0389***	-0.0681***	-0.0249	-0.0388***	-0.0681***	-0.0248	-0.0360***	-0.0650***	-0.0225
assets	(-3.10)	(-4.65)	(-1.13)	(-3.08)	(-4.65)	(-1.12)	(-2.85)	(-4.50)	(-1.04)
Net PPE-to-	0.0214	0.0319*	-0.0055	0.0209	0.0314	-0.0057	0.0205	0.0308	-0.0063
assets	(1.44)	(1.70)	(-0.38)	(1.41)	(1.67)	(-0.40)	(1.38)	(1.65)	(-0.44)
Industry controls									
Herfindahl index	0.0179***	0.0195**	0.0130**	0.0181***	0.0197**	0.0131**	0.0192***	0.0209***	0.0140**
	(3.15)	(2.59)	(2.39)	(3.18)	(2.61)	(2.41)	(3.41)	(2.82)	(2.59)
Product market	0.0015***	0.0010	-0.0002	0.0015***	0.0010	-0.0002	0.0014**	0.0008	-0.0003
fluidity	(2.77)	(1.32)	(-0.32)	(2.77)	(1.32)	(-0.33)	(2.52)	(1.11)	(-0.49)
Total similarity	0.0006**	0.0011**	0.0008***	0.0006**	0.0011**	0.0008***	0.0006*	0.0011**	0.0008**
	(2.10)	(2.53)	(2.76)	(2.10)	(2.53)	(2.76)	(2.03)	(2.45)	(2.69)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	102,422	102,419	102,422	102,422	102,419	102,422	102,422	102,419	102,422
Adj. R^2	0.677	0.493	0.558	0.677	0.493	0.558	0.677	0.493	0.558

Table 6: Instrumental variable, LBO activity and firms' capital structure

This table displays the results from two-stage least squares (2SLS) regressions. The dependent variables are *Market leverage*, *Debt/EV* and *Book leverage* as indicated at the top of this table. The endogenous variable *LBO* is proxied as the log of total deal value divided by the number of firm *i's* industry peers within an industry-year (*VB-Activity*) in columns (1)–(3). *B-Activity*, the number of LBOs divided by the number of firm *i's* industry peers, is used as proxy in columns (4)–(6). In columns (7)–(9), *V-Activity* is calculated as the log of total deal value over firm *i's* industry-year (Haddad et al. (2017)) and represents *LBO*. *Peer CVSI* is used to instrument the endogenous variable *LBO*. This variable is calculated as the average of *CVSI* over all firms within an industry-year, excluding firm *i's* observation. Firm *i's CVSI* is constructed as the standard deviation over the mean of monthly short interest data over a year. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level and scaled by their sample standard deviation. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Market leverage	Debt/ EV	Book leverage	Market leverage	Debt/ EV	Book leverage	Market leverage	Debt/ EV	Book leverage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	VB-Activity			B-Activity			V-Activity		
LBO	0.8049**	0.5840**	0.7731***	0.7829*	0.5680*	0.7519**	0.5531***	0.4013**	0.5313***
	(2.36)	(2.28)	(2.77)	(1.98)	(1.93)	(2.30)	(2.86)	(2.71)	(3.02)
CVSI	0.0045	0.0048	0.0033	0.0058	0.0057	0.0045	0.0053	0.0053	0.0040
	(0.86)	(1.05)	(0.81)	(1.02)	(1.16)	(0.97)	(0.81)	(1.01)	(0.71)
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peer firm averages	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	92,757	92,756	92,757	92,757	92,756	92,757	92,757	92,756	92,757

Table 7: Follow-on acquisitions

Panel A of the table displays results from fixed-effects regressions. The dependent variable is Δ*t (%) Market leverage*, which is the percentage change in the market leverage of firm *i* over Δt. In columns (1)–(2), Δt is equal to one year. It presents three years (five years) in columns (3)–(4) (columns (5)–(6)). The variable *Target signal LBO* is a binary variable and equals one when firm *i* receives a signal through an LBO announcement in its industry and becomes a target by a strategic or financial bidder in Δt years. It is zero for those firms that have a signal but do not become a target. *Target no signal* is a binary variable and is equal to one for firms that become a target without having a prior an LBO or M&A in their industry and zero for firms that are not targeted and do not have any signal over Δt years. All regressions in Panel A include a constant. Panel B shows the results from two-stage least squares (2SLS) regressions. The dependent variable is *Target LBO (Target M&A)*, which is a binary variable and equals one for firms that become targets of a financial (strategic) bidder in Δt years. It is zero, otherwise. The endogenous variable is *LBO* and is defined as *VB-Activity*. The instrument is *Peer CVSI*. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A	Δt (%) Market leverage					
Δt	1 Year		3 Years		5 Years	
	(1)	(2)	(3)	(4)	(5)	(6)
Target signal LBO	-0.0137*		-0.0343***		-0.0469***	
	(-1.76)		(-3.68)		(-4.39)	
Target no signal		0.0034		0.0143		0.0153
		(0.48)		(0.87)		(0.72)
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes
Peer firm averages	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific controls & CVSI	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,537	39,906	10,754	21,892	8,770	12,745
Adj. R^2	0.330	0.096	0.339	0.275	0.431	0.400

(continued)

Panel B	Target LBO	Target M&A	Target LBO	Target M&A	Target LBO	Target M&A
Δt	1 Year		3 Years		5 Years	
	(1)	(2)	(3)	(4)	(5)	(6)
LBO (VB-Activity)	-0.0010	0.0378**	0.0220	0.1125***	0.0370	0.1541***
	(-0.08)	(2.16)	(1.11)	(3.57)	(1.52)	(3.73)
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes
Peer firm averages	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm CVSI	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	90,925	90,925	86,788	86,788	82,342	82,342

Table 8: Corporate governance

This table displays the results from two-stage least squares (2SLS) regressions. In Panel A, the dependent variable is *Market leverage*. The endogenous variable *LBO* is proxied as *VB-Activity* and instrumented with *Peer CVSI*. Columns (1)–(2) include the binary variable *TR-low*. This variable is equal to one if the difference in the turnover ratio of firm *i* from its industry median belongs to the lowest 10% (column 1) or 25% (column 2) within an industry-year. The endogenous interaction term *LBOxTR-low* is instrumented with *Peer CVSIxTR-low*. Columns (3)–(4) include the binary variable *ER-high*. This variable is equal to one if the difference in the expense ratio of firm *i* with its industry median is above the highest 90% (column 3) or 75% (column 4) within an industry-year. The endogenous interaction term *LBOxER-high* is instrumented with *Peer CVSIxER-high*. Panel B includes different proxies for corporate governance. The dependent variable is *Market leverage*. The endogenous variable *LBO* is proxied as *VB-Activity* and instrumented with *Peer CVSI*. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level and scaled by their sample standard deviation. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A	Market leverage			
	(1)	(2)	(3)	(4)
	<10%	<25%	>90%	>75%
	VB-Activity			
LBO	0.6649*	0.6162*	0.6706*	0.7179*
	(1.95)	(1.75)	(1.92)	(1.85)
TR-low	-0.1017	-0.0627		
	(-1.02)	(-0.76)		
LBOxTR-low	0.6965*	0.5749**		
	(1.84)	(2.08)		
ER-high			-0.1448	0.0377
			(-1.41)	(0.50)
LBOxER-high			1.1299*	0.3423
			(1.83)	(1.06)
Industry controls	Yes	Yes	Yes	Yes
Peer firm averages	Yes	Yes	Yes	Yes
Firm-specific controls	Yes	Yes	Yes	Yes
Firm CVSI	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	92,702	92,702	89,671	89,671

(continued)

Panel B	Market leverage			
	(1)	(2)	(3)	(4)
	VB-Activity			
LBO	0.4136***	0.4259***	0.6839**	0.3521*
	(2.93)	(2.91)	(2.39)	(1.95)
Log(board size)	0.0152			
	(1.13)			
Frac. Ind. Directors		-0.0120		
		(-0.84)		
CEO stock ownership			0.0248	
			(1.35)	
E-Index				0.0058
				(0.66)
Industry controls	Yes	Yes	Yes	Yes
Peer firm averages	Yes	Yes	Yes	Yes
Firm-specific controls	Yes	Yes	Yes	Yes
Firm CVSI	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	19,800	19,800	21,533	20,749

Table 9: Competition

This table displays the results from fixed-effects regressions in Panel A. The dependent variable is *Market leverage*. Columns (1) and (2) (or (3) and (4)) show the results of tariff cuts if a change in the negative tariff rate is twice (or three times) as large as the change in the industry average indicated by "TC-2" ("TC-3") in the table. Conditioned by an LBO announcement and a tariff cut event, the binary variable *TC-LBO* is equal to one in the year after the tariff cut event and zero the year before. The tariff cut year is excluded. This variable is zero for the control group, which includes the never-treated firms that, however, encounter an LBO announcement. It is also zero for the treated firms, when they are not exposed to a tariff cut event but face an LBO announcement in their industry. *Treat* is a binary variable that equals one for the treated firms and zero, otherwise. Panel B shows the results from two-stage least squares (2SLS) regressions. The dependent variables are either *Market leverage* or the *Herfindahl index* as indicated at the top of this panel. The endogenous variable *LBO* is proxied as *VB-Activity* and instrumented with *Peer CVSI*. In columns (1) and (2), the sample is split at the median value of the herfindahl index. The binary variable *HC* represents this split and is zero for industry peers above the median indicating low competition. It is equal to one for industry peers below the median, indicating more competitive industries. The endogenous interaction term *LBOxHC* is instrumented with *Peer CVSIxHC*. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level and scaled by their sample standard deviation. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A	Market leverage			
	TC 2		TC 3	
	(1)	(2)	(3)	(4)
TC-LBO	-0.0257***	-0.0345***	-0.0271***	-0.0341***
	(-2.71)	(-3.81)	(-2.77)	(-3.68)
Treat dummy	Yes	Yes	Yes	Yes
Industry & Peer firm variables	No	Yes	No	Yes
Firm-specific controls & CVSI	No	Yes	No	Yes
Firm FE & Year FE	Yes	Yes	Yes	Yes
Observations	13,913	9,925	13,717	9,778

Panel B	Market leverage	Market leverage	Market leverage	Herfindahl index
	(1) HC=0	(2) HC=1	(3)	(4)
LBO (VB-Activity)	0.4266	1.6387**	0.6647*	0.5645**
	(1.36)	(2.26)	(1.86)	(2.06)
LBOxHC			0.5217**	
			(2.06)	
HC dummy	No	No	Yes	No
Industry & Peer firm variables	Yes	Yes	Yes	Yes
Firm-specific controls & CVSI	Yes	Yes	Yes	Yes
Firm FE & Year FE	Yes	Yes	Yes	Yes
Observations	51,221	39,246	92,757	92,757

Table 10: Undervaluation and industry prospects

This table displays the results from two-stage least squares (2SLS) regressions. The dependent variables are *Market leverage*, *EBITDA-to-assets*, *TSIE* and *Log(MCAP)* as indicated at the top of this table. The endogenous variable *LBO* is proxied as *VB-Activity* and instrumented with *Peer CVSI*. Instead of the *M/B ratio*, the regressions include the decomposition of it (Rhodes–Kropf et al. (2005)). *Firm-specific error (FSE)* measures the firm specific deviations from the fundamental value implied by the industry multiples. *Time-series industry error (TSIE)* captures short-term industry-level deviations from their long-run values. *Long-run to book value (LRtB)* reflects long-run average growth rates for the average form within the industry. In columns (2)–(4), these components are interacted with *LBO*. The endogenous interaction terms are instrumented with *Peer CVSI* and the respective component. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level and scaled by their sample standard deviation. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Market leverage	Market leverage	Market leverage	Market leverage	EBITDA-to-assets	TSIE	Log(MCAP)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				VB-Activity			
LBO	0.9322*	0.8599*	0.9313*	0.9442*	0.0922	-0.0059	1.2640**
	(1.94)	(1.85)	(1.93)	(1.97)	(0.84)	(-0.12)	(2.07)
FSE	-0.1317***	-0.0708*	-0.1317***	-0.1317***	0.0236***	-0.0165***	0.0504***
	(-12.91)	(-1.74)	(-12.90)	(-12.94)	(5.87)	(-8.91)	(5.17)
TSIE	-0.6753***	-0.6946***	-0.6957***	-0.6695***	0.0591**		0.3532***
	(-10.38)	(-10.79)	(-9.47)	(-8.39)	(2.10)		(5.59)
LRtB	-0.6939***	-0.7142***	-0.7105***	-0.6869***	0.0584**	-0.9866***	0.3559***
	(-10.83)	(-11.17)	(-10.19)	(-8.34)	(2.05)	(-51.50)	(5.63)
LBOxFSE		-0.3097					
		(-1.48)					
LBOxTSIE			0.0998				
			(0.93)				
LBOxLRtB				-0.0282			
				(-0.21)			
Industry & Peer firm variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific contr. & CVSI	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	72,321	72,321	72,321	72,321	72,369	72,369	72,321

Table 11: Alternative mechanism

This table displays the results from two-stage least squares (2SLS) regressions. In Panel A, the dependent variables are *Log(board size)*, *Fraction independent directors*, *CEO stock ownership* and *E-Index*. The endogenous variable *LBO* is proxied as *VB-Activity* and instrumented with *Peer CVSI*. In Panel B, the dependent variable is *Market leverage*. The endogenous variable *LBO* is defined and instrumented as before. Columns (1) and (2) include the binary variable *Rating*. It is equal to one if firm *i* has a S&P domestic long-term issuer credit rating of investment or speculative grade ("AAA" - "CC"). Otherwise, it is zero. The endogenous interaction term *LBOxRating* is instrumented with *Peer CVSIxRating* in column (2). Columns (3) and (4) include the binary variable *AZL*. It is equal to one if firm *i's* market leverage is below 5%. Otherwise, it is zero. The endogenous interaction term *LBOxAZL* is instrumented with *Peer CVSIxAZL* in column (4). All variables are scaled by their sample standard deviation. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level and scaled by their sample standard deviation. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. *** and ** indicate statistical significance at the 1% and 5% levels, respectively.

Panel A - Corporate governance	Log (board size)	Frac. Ind. Directors	CEO stock ownership	E-Index
	(1)	(2)	(3)	(4)
	VB-Activity			
LBO	0.5113***	0.3969**	-0.0419	-0.1532
	(2.89)	(2.45)	(-0.17)	(-0.54)
Industry & Peer firm variables	Yes	Yes	Yes	Yes
Firm-specific controls & CVSI	Yes	Yes	Yes	Yes
Firm FE & Year FE	Yes	Yes	Yes	Yes
Observations	19,800	19,800	21,533	20,749

Panel B - supply effect	Market leverage			
	(1)	(2)	(3)	(4)
	VB-Activity			
LBO	0.8174**	0.8119**	0.6351**	0.7283**
	(2.48)	(2.31)	(2.31)	(2.15)
Rating	0.3073***	0.2284		
	(9.33)	(0.54)		
LBOxRating		0.2370		
		(0.18)		
AZL			-0.7102***	-0.6585***
			(-37.90)	(-6.94)
LBOxAZL				-0.1757
				(-0.52)
Industry & Peer firm variables	Yes	Yes	Yes	Yes
Firm-specific controls & CVSI	Yes	Yes	Yes	Yes
Firm FE & Year FE	Yes	Yes	Yes	Yes
Observations	92,757	92,757	92,757	92,757

Appendix

Table A.1: Definition of Variables

Variable	Description
	LBO (M&A) variables
LBO - B-Activity	LBO - B-Activity is calculated as the number of LBO announcements within firm *i's* industry-year divided by the number of firm *i's* industry peers.
LBO - V-Activity	LBO - V-Activity is calculated as the log of deal volume of LBOs over firm *i's* industry-year.
LBO (M&A) - VB (M&A)-Activity	LBO (M&A) - VB (M&A)-Activity is calculated as the log of deal volume of LBOs (M&As) over firm *i's* industry-year divided by the number of firm *i's* industry peers.
Target LBO (M&A)	Target LBO (M&A) is constructed as binary variable and is equal to one for firms becoming targets in the next year by a financial (strategic) bidder. Otherwise, it is zero.
Target signal LBO (M&A)	Target signal LBO (M&A) is constructed as binary variable and is equal to one if firm *i* receives an LBO (M&A) signal in its industry and becomes a target of financial or strategic bidders in Δt years. Otherwise, this variable is zero for those firms with an LBO (M&A) signal but without becoming a target in the future.
	Firm-specific characteristics
Almost zero leverage (AZL)	Almost zero leverage is constructed as binary variable and is equal to one if firm *i's* market leverage is below 5%. Otherwise, it is zero.
Book leverage	Book leverage is calculated as the ratio of total debt to total assets.
CAPEX-to-assets	CAPEX-to-assets is calculated as the ratio of capital expenditure to total assets.
CEO stock ownership	CEO stock ownership is calculated as the ratio of CEO holdings of the firm's stock to total shares outstanding.
CVSI	CVSI is calculated as standard deviation over the mean of the firm's monthly short interest data over a year.
Debt/EV	Debt/EV is calculated as the ratio of total debt to enterprise value. Enterprise value is defined as stock price x shares outstanding at the end of the fiscal year) $+$ total debt $-$ cash and cash equivalents.
Dividends-to-assets	Dividends-to-assets is calculated as the ratio of cash dividends (common and preferred stocks) to total assets.
EBITDA-to-assets	EBITDA-to-assets is calculated as operating income over total assets.
E-Index	E-Index constructed as score between zero and six based on the number of governance provisions firm *i* has in place. Governance provisions are used as in Bebchuk et al. (2008).
Equity shock	Equity shock is calculated from an augmented market model by subtracting estimated returns from actual returns (see online appendix D - Augmented market model).
ER-high	ER-high is constructed as binary variable and is equal to one if the difference of firm *i's* expense ratio with its industry median is above the highest 90% or 75% within an industry-year. Otherwise, it is zero.

Variable	Description
Equity issuance	Equity issuance is calculated as the difference between the sales of common/preferred stocks and purchase of common/preferred stock over last years total assets.
Firm size (log sales)	Firm size is calculated as the log of sales.
Firm-specific error (FSE)	Firm-specific error is calculated from the M/B decomposition of Rhodes–Kropf et al. (2005) (see Online appendix D - M/B decomposition)
Fraction of independent directors	Fraction of independent directors is calculated as the fraction of independent (noinsider and non-affiliated) directors in the board.
Illiquidity	Illiquidity is calculated as the average ratio of the daily absolute return to the dollar trading volume on the same day over a one-year window ending one month prior to the reported short interest position in this month (Amihud (2002); Hirshleifer et al. (2011)).
Intangible-to-assets	Intangible-to-assets is calculated as the ratio of intangible assets to total assets
Log(board size)	Log(board size) is calculated as logarithm of the number of directors in the board.
Log(employees)	Log(employees) is calculated as logarithm of the number of employees in a firm.
Log(MCAP)	Market capitalization (MCAP) is calculated as stock price x shares outstanding at the end of the fiscal year. Log(MCAP) is the logarithm of MCAP.
Long-run to book value (LRtB)	Long-run to book value is calculated from the M/B decomposition of Rhodes–Kropf et al. (2005) (see Online appendix D - M/B decomposition).
Market leverage	Market leverage is calculated as the ratio of total debt to market value of assets. Market value of assets is defined as (stock price x shares outstanding at the end of the fiscal year) + total debt.
M/B ratio	M/B ratio is calculated as the ratio of market capitalization over book equity.
Net PPE-to-assets	Net PPE-to-assets is calculated as net property, plant and equipment (PPE) over total assets.
Rating	Rating is constructed as binary variable and is equal to one if firm *i* has a S&P domestic long-term issuer credit rating of investment grade or speculative ("AAA" - "CC"). Otherwise, it is zero.
Share repurchase	Share repurchase is calculated as the difference of purchase of common/preferred stock and changes in preferred stock divided by the market capitalization at the beginning of the year (Banyi et al. (2008)).
TR-low	TR-low is constructed as binary variable and is equal to one if the difference of firm *i's* turnover ratio with its industry median belongs to the lowest 10% or 25% within an industry-year. Otherwise, it is zero.
Zero leverage (ZL)	Zero leverage is constructed as binary variable and is equal to one if firm *i* does not have any debt outstanding. Otherwise, it is zero.
	Peer firm averages
Peer CVSI	Peer CVSI is calculated as the average of the CVSI over all firms within an industry-year, excluding firm *i's* observation.
Peer EBITDA-to-assets	Peer EBITDA-to-assets is calculated as the average of EBITDA-to-assets over all firms within an industry-year, excluding firm *i's* observation.

Variable	Description
Peer equity shock	Peer equity shock is calculated from an augmented market model by subtracting estimated returns from actual returns and averaging over all firms within an industry-year, excluding firm *i's* observation.
Peer firm size (log sales)	Peer firm size is calculated as the average of firm size (log(sales)) over all firms within an industry-year, excluding firm *i's* observation.
Peer M/B-ratio	Peer M/B-ratio is calculated as the average of M/B-ratio over all firms within an industry-year, excluding firm *i's* observation.
Peer net PPE-to-assets	Peer net PPE-to-assets is calculated as the average of net PPE-to-assets over all firms within an industry-year, excluding firm *i's* observation.
	Industry variables
High competition (HC)	High competition is constructed as binary variable and is equal to one if firm *i* belongs to an industry below the median level of the herfindahl index. Otherwise, it is zero.
Herfindahl index (HHI)	Herfindahl index is a measure of Hoberg and Phillips (2016).
Industry shock	Industry shock is calculated as the first principal component of the median absolute change for each industry-year of the variables net income/sales, asset turnover, R&D, capital expenditures, employee growth, ROA, and sales growth (Harford (2005)).
Product market fluidity	Product market fluidity is a measure of Hoberg et al. (2014).
Time-series industry error (TSIE)	Time-series industry error is calculated from the M/B decomposition of Rhodes–Kropf et al. (2005) (see Online appendix D - M/B decomposition)
Total similarity	Total similarity is a measure of Hoberg and Phillips (2016).
Target no signal	Target no signal is constructed as binary variable. It is equal to one for firms that become a target of a financial or strategic bidder without having an LBO or M&A announcement before in their industry over Δt years. It is zero for for firms that are not targeted and do not have any signal over Δt years.
Tariff cut (TC)	Tariff cut is constructed as binary variable. It is one for firms in the next year following a tariff cut in a three-digit SIC industry and zero in the preceding year. The tariff cut year is excluded. This variable is zero for never-treated firms and treated firms when they are not exposed to an event of tariff cut. A tariff cut is determined within an industry-year, when a change in the negative tariff rate is twice (or three-times) larger than the change in the industry average and is not followed by an equivalent increase in the subsequent two years. The tariff cut should also be larger than 1% (Frésard (2010); Frésard and Valta (2015)).
TC-LBO	TC-LBO follows the same definition as TC, but it is conditioned on the fact that treated and control groups experience an LBO announcement at t=0.
Treat	Treat is constructed as binary variable that equals one for firms experience a tariff cut and zero otherwise.

Table A.2: Instrumental variable, M&A activity and firms capital structure

This table displays the results from two-stage least squares (2SLS) regressions. Column (1) presents the first stage regression. In columns (2)–(4), the dependent variables are *Market leverage*, *Debt/EV* and *Book leverage* indicated at the top of the table. The endogenous variable *M&A* is proxied as the log of total M&A deal value divided by the number of firm *i's* industry peers within an industry-year (*M&A-Activity*). *Peer CVSI* is used to instrument the endogenous variable *M&A*. This variable is calculated as the average of *CVSI* over all firms within an industry-year, excluding firm *i's* observation. Firm *i's CVSI* is constructed as the standard deviation over the mean of monthly short interest data over a year. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level and scaled by their sample standard deviation. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses.

	M&A Activity	Market leverage	Debt/ EV	Book leverage
	(1)	(2)	(3)	(4)
M&A (M&A-Activity)		20.2750	14.7097	19.4737
		(0.14)	(0.14)	(0.14)
First-Stage instrument				
Peer CVSI	0.0012			
	(0.14)			
Industry & Peer firm variables	Yes	Yes	Yes	Yes
Firm-specific controls & CVSI	Yes	Yes	Yes	Yes
Firm & Year FE	No	Yes	Yes	Yes
Observations	92,757	92,757	92,756	92,757
F-Value (first stage)	0.0558			

Table A.3: Usage of debt

This table displays the results from two-stage least squares (2SLS) regressions. The dependent variables are *Equity issuance*, *Share repurchase*, *Intangible-to-assets*, *CAPEX-to-assets*, *Dividends-to-assets* and *Log(employees)*. The endogenous variable *LBO* is proxied as *VB-Activity* and instrumented with *Peer CVSI*. All variables are scaled by their sample standard deviation. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Equity issuance	Share repurchase	Intangible-to-assets	CAPEX-to-assets	Dividends-to-assets	Log (employees)
	(1)	(2)	(3)	(4)	(5)	(6)
	VB-Activity					
LBO	-0.6899*	0.3440*	0.3581*	-0.6238***	0.0254**	0.0186
	(-2.03)	(2.04)	(1.89)	(-3.07)	(2.16)	(0.27)
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes
Peer firm averages	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm CVSI	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	78,383	86,385	83,621	92,458	92,690	91,438

Data Availability Statement

The data underlying this article were provided by Compustat, CRSP, Refinitiv Eikon and Refinitiv Datastream under licence. Data will be shared on request to the corresponding author with permission of the respective companies.

Online appendix B

M&A deals

M&A transactions were obtained from Eikon with the same restrictions as those for the sample of LBO deals. Additionally, I excluded deals labeled as leveraged buyouts, spin-offs, recapitalization, self-tender offers, exchanges offers, repurchases, partial equity stake purchases, acquisitions of remaining interest, privatizations, buybacks, and non-controlling acquisitions (Derrien et al. (2021)). I also excluded deals with a transaction value smaller than $10 millions (Cai et al. (2011)). I define horizontal deals if the target and acquirer firms have the same four-digit SIC code (Derrien et al. (2021)). The final and merged sample consists of 1,208 M&A transactions. Table B.1 reports summary statistics of the M&A targets in my sample.

Table B.1: Summary statistics of M&A targets

This table displays summary statistics of M&A targets over the sample period from 1989 to 2019. Firms of the financial and utility industries are excluded. The values for "M&A targets" are the last reported values in Compustat or Datastream before the M&A event. All variables are winsorized at the 0.5% level. Detailed information about these and other variables are provided in Table A.1.

	M&A targets		
Variable	Mean	Median	SD
Firm-specific characteristics			
Market leverage	0.216	0.133	0.243
Debt/EV	0.245	0.148	0.325
Book leverage	0.246	0.172	0.343
Zero leverage	0.205	0.000	-
Almost zero leverage	0.385	0.000	-
Firm size (log sales)	5.221	5.229	2.12
M/B ratio	2.903	1.961	6.566
EBITDA-to-assets	−0.021	0.086	0.532
Net PPE-to-assets	0.265	0.149	0.266
Industry controls			
Herfindahl index	0.213	0.127	0.218
Product market fluidity	7.849	7.143	3.723
Total similarity	6.646	3.091	10.124
Observations	1,208		
Unique firms	1,161		
Median no. peers	59		

Table B.2: M&A activity and firms' capital structure

This table displays the results from fixed effects regressions. The dependent variables are *Market leverage*, *Debt/EV* and *Book leverage* indicated at the top of the columns. The independent variable *M&A* is proxied as the log of total M&A deal value divided by the number of firm *i's* industry peers within an industry-year (*M&A-Activity*). Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level. All regressions include a constant. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. * indicates statistical significance at the 10% level.

	Market leverage	Debt/EV	Book leverage
	(1)	(2)	(3)
M&A (M&A-Activity)	0.0048	0.0129*	0.0058
	(1.04)	(1.93)	(1.05)
Industry & Peer firm variables	Yes	Yes	Yes
Firm-specific controls & CVSI	Yes	Yes	Yes
Firm & Year FE	Yes	Yes	Yes
Observations	102,422	102,419	102,422
Adj. R^2	0.679	0.495	0.555

Table B.3: Follow-on acquisitions - M&A

Panel A of the table displays results from fixed-effects regressions. The dependent variable is Δt *(%) Market leverage*, which is the percentage change in the market leverage of firm *i* over Δt. In columns (1)–(2), Δt is equal to one year. It presents three years (five years) in columns (3)–(4) (columns (5)–(6)). The variable *Target signal M&A* is a binary variable and equals one when firm *i* receives a signal through an M&A announcement in its industry and becomes a target by a strategic or financial bidder in Δt years. It is zero for those firms that have a signal but do not become a target. Panel B shows the results from fixed effects regressions. The dependent variable is *Target M&A*, which is a binary variable and equals one for firms becoming targets in Δt years by a strategic bidder. It is zero otherwise. *M&A-Activity* is proxied as the log of total M&A deal value divided by the number of firm *i's* industry peers within an industry-year. In Panel B, all continues variables are scaled by their sample standard deviation. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level. All regressions include a constant. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses. *** and * indicate statistical significance at the 1% and 10% levels, respectively.

Panel A	Δt (%) Market leverage		
Δt	1 Year	3 Years	5 Years
	(1)	(2)	(3)
Target signal M&A	-0.0077	-0.0337***	-0.0383***
	(-1.21)	(-5.13)	(-4.34)
Industry & Peer firm variables	Yes	Yes	Yes
Firm-specific controls & CVSI	Yes	Yes	Yes
Firm FE & Year FE	Yes	Yes	Yes
Observations	27,496	22,001	17,631
Adj. R^2	0.134	0.270	0.356

Panel B	Target M&A		
Δt	1 Year	3 Years	5 Years
	(1)	(2)	(3)
M&A-Activity	0.0001	0.0009*	0.0005
	(0.34)	(1.83)	(0.65)
Industry & Peer firm variables	Yes	Yes	Yes
Firm-specific controls & CVSI	Yes	Yes	Yes
Firm FE & Year FE	Yes	Yes	Yes
Observations	92,127	87,901	83,355
Adj. R^2	0.055	0.260	0.397

Online appendix C

Table C.1: Short sales interest ratio - industry rotation

This table shows the industry average *Short interest ratio* for the period of 12 months before and after a major event. The month of the event is excluded. The industries "High-tech" and "Low-tech" are defined as in Hall and Vopel (1997). Firms belong to the manufacturing industry if they have a SIC code between 2000–3999 and they belong to the finance industry if their SIC codes are between 6000–6999. Column (1) shows the average of the short interest ratio before the event, whereas column (2) represents the average value after the event. Column (3) tests the difference for significance (two-sided t-test) between the two values. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. In Panel A, the analysis covers the Dotcom bubble (March 2000). Panel B analyzes the Financial crisis (August 2007).

Panel A - Dotcom bubble	Short interest ratio		
	Before	After	Difference
Industry	(1)	(2)	(3)
High-tech	5.662	5.865	−0.203**
Low-tech	8.570	8.470	0.100
Manufacturing	6.466	6.549	−0.083
Finance	5.087	4.900	0.187**

Panel B - Financial crisis	Short interest ratio		
	Before	After	Difference
Industry	(1)	(2)	(3)
High-tech	6.343	6.800	−0.457***
Low-tech	11.255	11.083	0.172
Manufacturing	7.014	7.349	−0.335*
Finance	4.550	4.762	−0.212

Table C.2: Placebo test

This table displays the results from two-stage least squares (2SLS) regressions in which the current LBO announcement date is changed to the date two years ago. Column (1) presents the first stage regression. In columns (2)–(4), the dependent variables are *Market leverage*, *Debt/EV* and *Book leverage* indicated at the top of the table. The endogenous variable *LBO* is proxied as the log of total deal value divided by the number of firm *i's* industry peers within an industry-year (*VB-Activity*). *Peer CVSI* is used to instrument the endogenous variable *LBO*. This variable is calculated as the average of *CVSI* over all firms within an industry-year, excluding firm *i's* observation. Firm *i's CVSI* is constructed as the standard deviation over the mean of monthly short interest data over a year. All variables are scaled by their sample standard deviation. Detailed information about these and other variables are provided in Table A.1. Financial and utility target firms are excluded. All continuous variables are winsorized at the 0.5% level. Heteroscedasticity and within firm-year clustered t-values are reported in parentheses.

	LBO VB-Activity	Market leverage	Debt/ EV	Book leverage
	(1)	(2)	(3)	(4)
		VB-Activity		
LBO		2.0770	1.4820	2.1379
		(0.76)	(0.77)	(0.73)
First-Stage instrument				
Peer CVSI	0.0115			
	(0.69)			
Industry controls	Yes	Yes	Yes	Yes
Peer firm averages	Yes	Yes	Yes	Yes
Firm-specific controls	Yes	Yes	Yes	Yes
Firm CVSI	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Observations	88,777	88,777	88,776	88,777
F-Value first stage	4.420			

Online appendix D

Augmented market model

Closely following Leary and Roberts (2014), I estimated an augmented market model to calculate stock returns of firm *i*. Equation (3) illustrates the approach:

$$r_{i,j,t} = \alpha_{i,j,t} + \beta^{M}_{i,j,t}(rm_t - rf_t) + \beta^{IND}_{i,j,t}(\bar{r}_{-i,j,t} - rf_t) + \varepsilon_{i,j,t} \tag{3}$$

where *i* indexes firm; *j* indexes industry; *t* indexes time (month). $r_{i,j,t}$ represents the total return, $(rm_t - rf_t)$ is the market excess return and $(\bar{r}_{-i,j,t} - rf_t)$ is the excess return of an equal-weighted industry portfolio excluding observation of firm *i*.

Equation (3) is estimated with a rolling regression on a yearly basis with monthly returns. At least 6 months of data were required and data up to 60 months could be used. I used the coefficients of the rolling regression to calculate the expected returns and idiosyncratic returns as follow:

$$\hat{r}_{i,j,t} = \hat{\alpha}_{i,j,t} + \hat{\beta}^{M}_{i,j,t}(rm_t - rf_t) + \hat{\beta}^{IND}_{i,j,t}(\bar{r}_{-i,j,t} - rf_t)$$

$$\hat{\varepsilon}_{i,j,t} = r_{i,j,t} - \hat{r}_{i,j,t}$$

Since the analysis is on an annual basis, the monthly returns are compounded to yearly measures. Therefore, the parameters are firm-specific and time-varying but constant within a calendar year. To compare it with the results of Leary and Roberts (2014), I have tabulated the regression results in Table D.1 and show that they have similar properties.

Table D.1: Regression results of stock returns

	mean	median	std
α_{it}	0.004	0.004	0.031
β^{M}_{it}	0.345	0.355	1.370
β^{IND}_{it}	0.654	0.534	1.048
Obs. per regression	50	60	16
R^2	0.231	0.198	0.170
Adj. R^2	0.192	0.160	0.179
Average monthly return	0.010	0.000	0.192
Expected monthly return	0.011	0.011	0.089
Idiosyncratic monthly return	−0.001	−0.008	0.168

M/B decomposition

I closely followed Rhodes–Kropf et al. (2005) to decompose the M/B ratio into three components. I ran equation (4) to obtain the *Firm-specific error*, the *Time-series industry error*, and the *Long-run to book value*. Firms are grouped according to TNIC industry classification.

$$m_{i,t} = \alpha_{0,j,t} + \alpha_{1,j,t} b_{i,t} + \alpha_{2,j,t} \ln{(NI)}^{+}_{i,t} + \alpha_{3,j,t} I_{(<0)} \ln{(NI)}^{+}_{i,t} + \varepsilon_{i,t} \tag{4}$$

$m_{i,t}$ is the logarithm of market equity, $b_{i,t}$ is the logarithm of book equity, $I_{(<0)} \ln{(NI)}^{+}_{i,t}$ is the logarithm of the absolute net income, where $I_{(<0)}$ is an indicator function for negative net income. *i* indexes firm; *j* indexes industry; *t* indexes year.

To obtain the fundamental value of the firm, I used the fitted values of equation (4).

$$\begin{aligned} &v(b_{i,t}, NI_{i,t}; \hat{\alpha}_{0,j,t}, \hat{\alpha}_{1,j,t}, \hat{\alpha}_{2,j,t}, \hat{\alpha}_{3,j,t}) \\ &= \hat{\alpha}_{0,j,t} + \hat{\alpha}_{1,j,t} \beta_{i,t} + \hat{\alpha}_{2,j,t} \ln{(NI)}^{+}_{i,t} + \hat{\alpha}_{3,j,t} I_{(<0)} \ln{(NI)}^{+}_{i,t} \end{aligned} \tag{5}$$

Therefore, this value represents the fundamental value of the firm by applying annual, sector-average regression multiples to firm-level accounting values.
Thereafter, I averaged the alphas over time to get $\bar{\alpha}_j = \frac{1}{T} \sum \alpha_{j,t}$, and then calculated:

$$\begin{aligned} &v(b_{i,t}, NI_{i,t}; \bar{\alpha}_{0,j,t}, \bar{\alpha}_{1,j,t}, \bar{\alpha}_{2,j,t}, \bar{\alpha}_{3,j,t}) \\ &= \bar{\alpha}_{0,j,t} + \bar{\alpha}_{1,j,t} \beta_{i,t} + \bar{\alpha}_{2,j,t} \ln{(NI)}^{+}_{i,t} + \bar{\alpha}_{3,j,t} I_{(<0)} \ln{(NI)}^{+}_{i,t} \end{aligned} \tag{6}$$

This value represents the fundamental value of the firm by applying long-run industry average multiples to firm-level accounting levels.

From these two values, I constructed the three components:

Firm-specific error is defined as $m_{i,t} - v(b_{i,t}, NI_{i,t}; \hat{\alpha}_{0,j,t}, \hat{\alpha}_{1,j,t}, \hat{\alpha}_{2,j,t}, \hat{\alpha}_{3,j,t})$. It measures the firm specific deviations from the fundamental value implied by industry multiplies.

Time-series industry error is defined as $v(b_{i,t}, NI_{i,t}; \hat{\alpha}_{0,j,t}, \hat{\alpha}_{1,j,t}, \hat{\alpha}_{2,j,t}, \hat{\alpha}_{3,j,t}) -$ $v(b_{i,t}, NI_{i,t}; \bar{\alpha}_{0,j,t}, \bar{\alpha}_{1,j,t}, \bar{\alpha}_{2,j,t}, \bar{\alpha}_{3,j,t})$. It captures short-term industry-level deviations from their long-run values.

Long-run to book value is defined as $v(b_{i,t}, NI_{i,t}; \bar{\alpha}_{0,j,t}, \bar{\alpha}_{1,j,t}, \bar{\alpha}_{2,j,t}, \bar{\alpha}_{3,j,t}) - b_{i,t}$. It reflects long-run average growth rates for the average form within the industry.