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Master Thesis Financial Economics

Deterrent Effect of Open Market Share Repurchases on Takeovers Attempts

ABSTRACT

This study re-examines and extends the findings of the paper by Billet and Xue (2007), to test whether the takeover deterrent effect of open market share repurchases (OMSR) is a motive for repurchase. The used data set contains 1,980 listed U.S. firms over the period 2012-2018. To examine the research question, a two-stage approach is used to obtain the takeover probability of firms. In the first stage, a Probit regression is executed to generate the takeover probability of a company. This variable is included in the Tobit regression, to test the takeover likelihood and the subsequent share repurchases. This thesis finds comparable results to Billet and Xue (2007) in accordance to the takeover deterrent hypothesis. The deterrent effect of OMSR to thwart takeover attempts is minimal for the takeover probability variable. An additional 2.93% are repurchased when moving from the 5th percentile to the 95th percentile of takeover probability. On the other hand, Billet and Xue (2007) found no effect on OMSR when using a dummy variable. Conversely, this study found an increase of 11.02% repurchased shares with this specific measure. The last part of the analysis includes R&D investments into the Tobit regression and finds this variable to decrease share repurchases.

Keywords: open market share repurchases, motives for share repurchases, takeover prediction, Tobit model, U.S. listed companies

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1. INTRODUCTION

From 2000 until 2018 share repurchases in the US surged from approximately 200 billion USD to 1000 billion USD, which is an increase of 400%. Respectively, dividends increased with 257%[1]. Moreover, since 1998 stock buybacks[2] have surpassed dividends in dollar amounts in the US. In addition, the proportion of dividend-paying firms decreased from 78% in 1980 to 43% in 2018, while the proportion of firms repurchasing shares increased from 28% to 54%. Repurchase programs are used as substitute payout policy to dividends and operate as a method to redistribute cash to shareholders. So why do firms opt for share repurchases? It is mainly driven by some key advantages of this method, such as tax benefits and financial flexibility (Zeng & Luk, 2020). Cutting dividends has major negative effects on share price, and therefore firm value, while not fulfilling a buyback program has minor negative effects. As the exploitation of share repurchases changed over the last decades, the underlying motives for initiating these programs vary.

Motives to conduct share repurchases have been subject to considerable amount of research, but remains an area of controversy (Hsieh & Wang, 2009). There are several key motives which have been examined extensively such as: *undervaluation and market timing* (Brav et al, 1996; Dittmar, 2000; Vermaelen, 1981; Ikenberry et al, 1995); *substitution hypothesis considering dividends* (Brav et al., 2004; Grullon & Michaely, 2002); *optimal capital structure* (Harris, 2015; Harris & Arthur, 1988; Hsieh & Wang, 2009; Bonmaine et al, 2014); *financial flexibility* (Jagannathan et al, 2003; Grullon & Michaely, 2004), *and agency costs of free cash flows* (Dittmar, 2000; Grullon & Michaely, 2004).

Besides the aforementioned reasons for stock buybacks, the takeover deterrence hypothesis is a subject which is rather limitedly examined. This is remarkable, given the fact that Dutch auctions and tender offers have proved to be effective takeover deterrent methods (Vermaelen, 1998; Person, 1994). Dittmar (2000) and Billett and Xue (2007) were the first to conduct empirical research on the detrimental effect of the open market share repurchases (OMSR) on takeover attempts. They found opposing evidence regarding the deterrent hypothesis. Whilst Dittmar (2000) did not find significant estimates for the takeover deterrence hypothesis, Billett and Xue (2007) did find a significant relationship. Some other literature examined the hypothesis, but the estimates vary (Doan et al., 2011; Lin et al, 2014).

Considering the increasing importance of OMSR in combination with the variety of motives for firms to conduct share repurchases, I am convinced this thesis will substantially contribute to the existing literature on motives for OMSR, and especially to the takeover deterrent effect.

[1] Appendix 1: Aggregate amount of share repurchases and dividends from 1980 - 2018 in the US

[2] Share repurchases or repurchasing are used interchangeably with buybacks or stock buyback programs.

The aim of this study is to examine whether firms use OMSR to deter takeover attempts. A newly collected data set of actual monthly U.S. share repurchases will be used to conduct research on the detrimental effect of open market share repurchases on takeover attempts. Consequently, the research question is constructed as follows:

Do firms in the United States, during the period of 2012 – 2018, conduct open market share repurchases to deter takeover attempts?

In order to answer the research question, this study is going to re-examine and extend the results found by the study of Billett & Xue (2007). In this paper I conduct a two-stage approach to test the hypotheses. In the first stage a Probit model estimates the takeover probability of firms. The values derived from the first stage are implemented in the second regression, which is a Tobit model to estimate the ex-ante effect of takeover probability on OMSR-decisions.

My thesis provides several contributions to the existing literature. Firstly, the sample gives an updated perspective of the findings on the deterrent effect of OMSR on takeover attempts. The data set used by Billett & Xue (2007) was generated before 2000, while share repurchases rose to tremendous amounts starting from the early 2000s and onwards. Secondly, from 2011 until 2018, there was an economic expansion with increasing stock prices and low-interest rates. Business school literature and standard economic theories state that in times of low-interest rates, it is relatively cheaper for firms to borrow and obtain cheap debt. These resources will increase firms' investments and boost the economy. However, besides the increased M&A investments during the sample period, there was a significant increase in buybacks of shares (Zeng & Luk, 2020). It is therefore interesting to further examine open market share repurchases and the effect on takeover attempts during this sample period. Thirdly, this thesis examines two additional motives to conduct OMSR. Sales growth and R&D intensity are included in the analysis to examine the effect on repurchases decision. At last, Billet and Xue (2007) generated takeover dummies based on actual takeover data. In this research this data is divided into three different types of takeover dates: rumoured, announced, and completed dates.

Billet and Xue (2007) tested the takeover deterrent hypothesis with a dummy variable and a latent takeover probability variable. Their research did find minor effects for the dummy variable and a significant positive relationship between the takeover probability and OMSR. This thesis finds the takeover deterrent hypothesis to have a much smaller effect than the proposed findings in their research. Firms with a takeover probability in the 95th percentile will repurchase 2.93% more shares on the open market, compared to the firms with a takeover probability in the 5th percentile. It is difficult to determine if the effect of buying an additional 2.93% of shares is economically meaningful, taking in consideration the large amounts repurchased nowadays. However, the takeover dummy proposed by Dittmar (2000) does provide with a sufficient effect. Firms that actually received a takeover bid, repurchases an

additional 11.02% of shares. Buying back 11% of equity value is a feasible amount to thwart against potential buyers.

Another interesting finding in this research is that firms with an above industry leverage ratio seem to buyback more shares on the open market. This may be explained by the period of low interest rate and relatively cheap debt is used to repurchases shares. In addition, sales growth is shown to decrease OMSR. The effect of this variable was not examined in previous literature before. It may indicate that growing firms do not invest in repurchases but hold their funds to invest in other projects.

At last, the effect of Research and Development (R&D) is tested on OMSR activity. R&D data is limited and for many firms the data was missing. Therefore, a Tobit regression was performed which only contained companies with R&D values. The findings of this model provide evidence that increasing R&D reduces the OMSR activity. In this specific sample the leverage ratio decreases the repurchase decision of firms, whilst in the overall sample it increased the activity. Companies might internally fund their R&D investment and obtain less debt.

This thesis is structured in several chapters to effectively address the research question. In Section 2, an extensive literature review on the detrimental effect of open market share repurchases on potential takeover attempts is presented. Secondly, after providing a clear overview of the existing literature, in Section 3 I will construct my hypotheses to answer the research question. Following the literature part, Section 4 describes my data sample and Section 5 will further elaborate on the methods I used in this research. The tests are based on the study of Billet and Xue (2007), who were the first to describe the deterrent effect open market share repurchases have on takeover probability. Section 6 describes the empirical results of the study and provides an answer to the hypotheses. Section 7 discusses the limitations, proposes recommendations for further research, and ends with a brief conclusion.

2. LITERATURE REVIEW

In order to examine the research question, it is important to first understand the factors of share repurchases. Therefore, an extensive literature on share repurchases specifications and the reasons for share repurchases programs will be provided. Motives of share repurchases are well-documented in previous literature, and a variety of papers studied the motives for share repurchases. In the past, most of the papers mainly focused on the substitution effect of share repurchases and dividends. However, over the last decades, other motives were tested to explain the increasing popularity of stock buybacks. Analysing the existing literature, one can conclude that there are multiple reasons for share repurchases, and it is not possible to assign a single motive to firms to initiate stock buyback programs. In this following section, besides the general information on repurchase programs, an extensive literature review will be performed on the detrimental effect of OMSR on takeover probability and the determinants of firm's takeover likelihood.

2.1 INTRODUCTION OF SHARE REPURCHASES

This subsection will provide a brief description to apprehend what a share repurchases programs is and what it entails. The simplest form for share repurchases is that management decides to buy back shares. They repurchase a part of the outstanding equity, which has the purpose of increasing demand and decreasing supply for the firm's shares. Furthermore, by reducing the number of shares outstanding, the earnings per share increase. Through the years, repurchases have become a popular method to redistribute cash to the existing shareholder (Brave et al., 2005). Another pay-out policy is dividends, which was historically the key method to distribute cash to shareholders. A key benefit of buyback programs is the flexibility in comparison with dividends. Cutting dividends or even abandoning dividends has adverse effects on firm value, e.g., firms who announce dividends and fail to pay-out these dividends experience negative market reaction (Dennis et al., 1994), whilst repurchases do not face these commitments and risks (Jagannathan et al., 2000). These reasons may explain why over the last decades the popularity of share repurchases has surged to high levels and resulted in the dollar amount spent on repurchases, to surpass dividend values in the US and other countries (Wesson et al, 2017).

There are four categories of how firms can buy back their stocks: 1) Repurchasing shares on the open market is the most dominant buyback method. Firms are obligated to announce repurchase programs, however it does not restrict them to buy back any number of shares. In addition, the firm includes information about the period and price for which they want to buy back stocks. 2) Fixed-price tender offer is a much less frequently used type of repurchasing shares. The firm sets a fixed amount of value for a specific number of shares. Moreover, in this type the firm is not obligated to conduct the repurchases, but are not as flexible as in an OMSR, considering the fixed amount. 3) Dutch auction programs like the fixed-price offer, provide a fixed price at the announcement. However, in the Dutch auction the company seeks information prior to the announcement of the program and provides a price

range for shareholders to sell their stocks. 4) Privately negotiated is a unique method, because instead of managers the shareholders can initiate to sell share shares. This type is mostly used when a shareholder has a significant share in the company.
For this thesis, the focus will lie on the OMSR. This is particularly due to the significant proportion of this type in the total amount and number of repurchasing programs.

2.2 SHARE REPURCHASES

Appendix 1 shows the growth and volatility of share repurchases over the last decades. Repurchases follow the economic cycle, e.g., they increase in time of economic growth and decrease when the market is down. The increased popularity of multiple types of share repurchases has probably led to the development of numerous possible motives for repurchases programs. Tender offers and Dutch auctions were used with the prevalent motive of takeover deterrence, while OMSR were used to signal undervaluation to the market. Nowadays, there are numerous motives for OMSR. Hsiegh and Wang (2009) conducted a systematic review about the most popular motives to initiate share repurchases. They presented the following motives as the most significant ones. First, signalling and undervaluation are the most frequently mentioned motives in existing literature. Share repurchases are used to signal future prospects of management to the market. Management can use buyback programs to signal a firm's value, the programs tend to have greater information content than dividends. Secondly, there is a difference in tax rate between capital gains and dividends, which favours the use of repurchases. Furthermore, repurchases create more flexibility for investors. They can defer taxes and can create dividends when they intend to sell shares to the firms. Thirdly, it gives management financial flexibility regarding firm's pay-out policy. Cutting or even abandoning dividends has adverse market reactions on the firm's value, whilst cutting or postponing share repurchases has this sort of effect to a much lesser extent. Therefore, management is much more flexible to redistribute value to shareholders. The fourth motive is agency cost theory. Companies use buybacks to decrease free cash flows. Management can use excess cash flows for projects which do not align with the benefits of shareholders, by redistributing these free cash flows conflicts between shareholders and management can be reduced. Fifthly, repurchases can be utilized to get the preferred capital structure. Decreasing the equity and consequently increasing the leverage ratio, gives management the opportunity to quickly adjust to the desired capital structure. Lastly, the takeover deterrent effect of repurchases is mentioned in their article. Buyback programs are used to fend off unwanted bids by signalling real firm value, increasing share prices, changing capital structure, and giving more voting power to the firm.

These motives show that there are multiple reasons for repurchasing programs. However, previous studies mainly focus on describing one or two motives for companies to buy back shares. Dittmar (2000) was the first to conduct research investigating all the motives in one model. She found that companies primarily use buyback programs to signal undervaluation and to distribute excess capital

to shareholders. However, she did not find significant results for the takeover deterrence motive. This was to my knowledge, the first research to investigate the relation between OMSR and takeover deterrence.

2.3 SHARE REPURCHASES AND TAKEOVER DETERRENCE

In 2007 Billet and Xue examined the deterrent effect of OMSR on takeover attempts. They discuss there is absence of empirical findings supporting the takeover deterrent hypothesis. This is a surprise, because especially Dutch auctions and fixed-price tender offers, are often used to counter takeover attempts (Person, 1994). These two methods of share buybacks are cited as an adequate tool to counter takeover attempts. In their research, Billet and Xue (2007) reason that these two methods both have different effects on the takeover process. Tender offers are an effective technique used as a defence in a takeover battle. At the same time, OMSR could serve as a pre-emptive move against unwanted takeover bids and therefore tackle would-be acquirers. In their paper, they test these hypotheses empirically and found a significant and positive relation between OMSR and the takeover probability of a firm. Furthermore, they compare their model to the results of Dittmar (2000). In the study she used a dummy variable to estimate whether a takeover occurs around share repurchases. Billet and Xue (2007) argue that the use of a dummy variable can be problematic for two reasons. Firstly, there is a timing problem when including a dummy variable. The dummy contains information regarding the post repurchase takeover status of a firm, which imparts downward bias in the estimating results. Secondly, a dummy variable to measure the takeover status of a firm, measures the ex-ante takeover probability. Hence, using a dummy as a proxy for ex-ante takeover probability and the subsequent repurchase activity, would lead to measurement error and inconsistent estimates according to Billet and Xue (2007). To prevent these errors, they have adopted a two-stage approach. First, they calculate the takeover probability prior to the year a firm conducts a buyback program and subsequently use this measure to estimate the effect on repurchasing activity. This method is argued to be more adequate to address the ex-ante takeover deterrent hypothesis of OMSR than a dummy variable.

There is a variation of theories supporting why OMSR may have a detrimental effect on possible takeover bids. These motives originate from previous discussed literature on reasons for share repurchases. Billet and Xue (2007) give some reasons, such as reducing agency costs, opportunity to influence the capital structure, and making a firm less attractive takeover target by reducing the possible gains. Harris (2014) found that firms conduct share repurchases to achieve higher levels of financial flexibility. In addition, Jardik et al. (2015) found significant results supporting their hypothesis that companies buy back shares to achieve higher debt levels, which can be used as a takeover defence. Bonmaine et al. (2014) conducted research to test the association between stock performance, share repurchases and capital structure. They found that undervalued and under levered firms could benefit more from share repurchases and to move towards their optimal debt levels. To increase the leverage

ratio, firms could lessen their free cash flows to fund the buyback program. As mentioned in subsection 2.2 with access free cash flow principal-agent problems may arise. Reducing this cash also results in lower agency cost and less risk (Jensen,1986: Hseigh and Wang, 2009).

Bagwell (1991) models that the supply curves of firm's share are upward sloping, hence repurchasing might help a firm to acquire shares available at a lower cost. This leaves the firm with shareholders who have a high valuation of the shares, which consequently increases the takeover cost for potential would-be acquirers. The heterogeneity hypothesis of shareholders demand is shown to exist with Dutch auction tender offers (Bagwell, 1992). Another reason often mentioned for share repurchases is the signalling hypothesis. This theory is derived from information asymmetry between management (insiders) and shareholders (outsiders). Management usually has more complete information on the company's performance than shareholders, which only have access to public information. Therefore, management is able to make better predictions of firm value or future prospects (Vermaelen, 1981). When management believes stock prices are undervalued they may conduct repurchase programs to signal their expectations to the market. The opportunity of firms to signal their prospects and influence stock prices may deter takeover attempts. Furthermore, survey evidence under 384 financial executives by Brave et al.et al. (1996) also confirm undervaluation as the primary reason for share repurchases under executives. Jagannathan & Stephens (2003), Dittmar (2000), Lee et al., (2010) all found significant abnormal returns after the announcement of share buyback programs. The magnitude of the abnormal returns varies from 2% to 11% depending on the period and repurchases method used. In combination the signalling hypothesis and the shareholders heterogeneity theory support the hypothesis that share repurchases might have a deterrent effect on takeover attempts. The last argument to support the hypothesis is examined by Person (1994), he proposes that repurchasing a substantial number of shares increases managerial holdings or manager friendly shareholders which makes it more complicated for potential would be acquirers to complete a takeover attempt.

The arguments and theories above about share repurchases are not mutually exclusive, they rather overlap and when combining them they improve the explanatory power of the takeover deterrent hypothesis.

2.4 SHARE REPURCHASES AND ECONOMIC CONDITIONS

In the previous subsections, existing literature on motives for share repurchases and takeover deterrence were defined. One can derive from the literature that motives for repurchases change over time. Farrugia et al., (2010) examined the motives for OMSR under different economic conditions. They found a significant relationship between economic conditions and the decision to buy back shares. In period of 'high' economic condition share repurchases were 15% and 18% higher than the 'low' and 'medium' states, respectively. Dittmar and Ditmar (2008) stated that firms issue equity in relatively early years of an economic expansion wave and repurchase shares at the end of the same cycle. These findings are

relevant for this research since the sample period (2012-2018) is a time of economic expansion after the Financial Crisis of 2008.

In addition, issuing debt to finance share repurchases has become common practice over the last decades. Before the Financial Crisis, the amount of debt-financed repurchases peaked at 700 billion USD in 2007 (Milken, 2009). After the crisis, this trend continued, with low-interest rates resulting in relatively cheap debt. Bates et al. (2006) proposed that in a period of low interest rates, the same motive holds as the precautionary[3] motive for holding cash for future uncertainties in the capital markets. Firms build cash buffers to undertake future investments and use cheap debt to finance these projects. Conversely, issuing debt may entail information asymmetry problems for external financing. Myers and Majluf (1984) explain that in periods of low information asymmetry, companies should obtain external financing funds. Furthermore, they predicted that debt issues are less sensitive for information asymmetry and thus result in lower issuing costs. The level of information asymmetry in a firm can be a proxy to measure the degree of financial constraints. Unconstrained firms are expected to have low information asymmetry compared to constrained firms. Thus, the cost of debt should be lower for unconstrained firms. Conversely the cost of issuing new debt for internal financed unconstrained firms with excess debt capacity is much lower. Hence, one could expect unconstrained firms with future investment opportunities to conduct debt-financed buyback programs and maintain sufficient cash flows for investment opportunities. Chen and Wang (2012) tested the effect of buyback programs on cash, leverage, and investments. They found that constrained firms experience declines in cash and investments, next to an increase in leverage after repurchasing shares. Similarly, unconstrained firms also experience a decrease in cash and an increase in leverage, but no significant change in investments. The evidence indicates that constrained firms are more likely to issue debt to finance share repurchases, whilst unconstrained firms on the other hand use additional leverage to maintain sufficient cash balance for investment expenditures.

This subsection shows more recent findings in accordance to share repurchases. Motives to initiate programs evolve over time. Therefore, the sample period examined in this thesis may alter the findings of Billet and Xue (2007).

2.5 DETERMINANTS OF TAKEOVER PROBABILITY

Financial or other firm characteristics to predict target firms have been the subject of myriad empirical papers. Firm size, growth opportunities, leverage ratio, performance, undervaluation and clustering effects in industries are several characteristics which have discriminatory ability on firm's takeover likelihood. The difference in firm size between target and acquiring firms is a distinctive characteristic for takeover likelihood of a firm. Levine and Aaronovitch (1981) argued that economies of scale and

[3] Precautionary motive of holding cash as a buffer in "good" periods for periods of economic downturn.

market power make large firms more efficient than smaller firms, which results in large companies acquiring smaller targets. Additionally, Palepu (1986) argued that transaction costs are the reason for acquiring small firms by large counterparts. The article by Palepu (1986) may be the most cited article in the existing literature on target characteristics. Besides firm size, he proposed a model with eight other independent variables to estimate takeover likelihood. Firms with high growth opportunities are more often potential targets (Palepu, 1986; Myers & Majluf, 1984). Year-on-year sales growth rates are used as a proxy for growth opportunities. Firms with high growth but low resources, experience even larger takeover probabilities. Another hypothesis tested by Palepu (1986) is based on the inefficient management argument that the market is used as an external corporate control. If managers fail to maximise the potential market value, new management should replace them. Return on assets is used as a proxy for management efficiency. In the 1990s, vast amount of M&A activity was driven motivated by overvalued stocks of acquirers. Shleifer & Vishny (2003) examined this market timing hypothesis and found evidence that targets tend to have low market-to-book ratios. At last, a vast amount of literature examined the effect of capital structure and targets. Changing the capital structure of under levered firms, may provide them with additional benefits of leverage, such as tax shields[4]. On the other hand, additional leverage entails extra costs of debt, such as cost of financial distress or agency problems. Korteweg (2010) found the costs of debt of over levered firms to be higher than under levered firms. According to Korteweg (2010), reducing the leverage ratios of over levered companies results in much higher costs than issuing equity.

The reviewed literature above provides an overview of the determinants, which may indicate potential target firms. These factors are important to understand the first stage of the analysis. In this part of the research, the takeover probability of firms is generated on the basis of the above discussed factors.

3. HYPOTHESIS DEVELOPMENT

In this thesis, the detrimental effect of OMSR on takeover attempts is tested. I expect to find a positive relationship between OMSR and takeover probability of a company. Therefore, I first have to generate the takeover probability of companies in the sample. To estimate the takeover probability, several control variables will be used. These variables are drawn from previous literature discussed in section 2. On the other hand, I expect to find other motives for share repurchases to have a significant relationship with OMSR. Thus, several explanatory variables to estimate these motives will be included in the model.

[4] Tax shield is an opportunity to deduct certain interest expenses of the taxable income. This reduction allows a company to pay less taxes.

3.1 TAKEOVER PROBABILITY

Section 2.5 discussed the determinants that predict a firm's takeover likelihood. In the first stage of the analysis, the takeover probability is measured to test the determinantal effect of this probability on OMSR activity. The first hypothesis will test several control variables which are expected to have a positive impact on the takeover likelihood of a firm. The first variable tested in the first hypothesis is the sales growth measure, which is used as a proxy for growth opportunities. Firms with growth potential experience high levels of likelihood in the M&A market and are indicated as potential targets (Palepu, 1986; Myers & Majluf, 1984). The last part of the hypothesis is industry takeover wave theory, which states that M&A activity in the same industry cluster within certain periods. Differences in valuation of firms within the same industry might trigger takeovers waves. These differences can arise from economic shocks, technological innovations, and changes in industrial structures (Mitchell & Mulherin, 1996). In accordance with the findings of these empirical articles, I propose the following hypothesis:

H1: *Sales growth, level of tangible assets, and takeover attempts within the industry have a positive effect on takeover likelihood*.

In the second hypothesis, I expect to see a negative effect on the takeover likelihood. The principal of corporate control is a well described theory in the existing literature. The papers of Palepu (1986) and Tunyi et al. (2019), describe that inefficient management should be replaced. Return on assets is used as a proxy for management efficiency and I would expect it to have a negative impact on takeover likelihood. Secondly, undervalued firms are potential targets for overvalued firms according to Shleifer & Vishny (2003), Tobin's Q[5] is used as a proxy to measure overvaluation. Low levels of Q ratio should increase the takeover probability of a firm. The third variable in the hypothesis is the firm size. Levine and Aaronovitch (1981) argued that economies of scale and market power make large firms more efficient than smaller firms, which results in large companies acquiring smaller targets. At last, this thesis uses an industry adjusted leverage ratio to test the capital structure hypothesis. The relevance of this factor is mentioned in the aforementioned literature and is expected to be an important factor. Korteweg (2010) found that the additional costs of leverage to be higher for overlevered firms than underlevered firms. On the other hand, firms with high levels of debt are less likely a takeover target (Palepu, 1986). The reason behind this is that the chance of bankruptcy increases with higher levels of debt. Jensen and Meckling (1976) state that less capable managers are inclined to keep low levels of debt to reduce the risk of bankruptcy. Underleverage could be explained as signal of inefficient management, which increase the takeover probability. Taking into account the period of low interest rates, I expect the benefits of additional leverage to dominate the cost of leverage, and thus a positive

[5] Q ratio is derived as the market value divided by de book value

effect on takeover likelihood. Taking the previous literature into consideration, the second hypothesis is stated as follows:

H2: *Firm size, industry adjusted leverage ratio, firm performance, and Tobin's Q have a negative impact on takeover probability.*

3.2 SHARE REPURCHASES

In addition to takeover deterrence, previous literature examined several motives for firms to conduct share repurchase programs. The main reasons include: signalling and undervaluation hypotheses where management signals future prospects to the market and take advantage of undervalued stock price (Hseigh & Wang, 2009); substitution hypothesis with regard to dividends (Grullon & Michaely, 2004); decrease common equity and change capital structure to take advantage of lower costs of capital (Harris, 2015); distribution of high levels of free cash flow are positively correlated with repurchase activity (Dittmar, 2000). Furthermore, Grullon and Michaely (2004) found that firms which had a reduction in their return on equity, are more likely to distribute the free cash flows by repurchasing shares. Dittmar (2000) was the first to test all these motives in one model on a yearly basis. She found that share repurchase activity is explained by only a few motives. Taking advantage of undervaluation and distribution of free cash flows are the main motives she provided for firms to initiate share repurchases. Hseigh and Wang (2009) proposed in their systematic review, that capital structure also has a dominant influence on share repurchases. In accordance with the literature, I expect that all these motives will have a discriminatory ability for firms to conduct OMSR programs. In addition to these motives, I include two other variables to test the relationship between growth opportunities and OMSR. Literature on growth potential of firms discussed, that most firms use cash flows to invest in NPV projects in order to achieve long-term growth (Abraham et al., 2018). Conversely, firms with high growth potential were identified as attractive takeover targets. In order to thwart takeover attempts, management could repurchase shares to deter potential bids. Nevertheless, Brave et al. (2005) surveyed management decision in regard to pay-out policy. They found that eighty percent of management prefers to invest in NPV project over repurchasing shares. Therefore, I expect the first argument to dominate the second. The first variable I include is sales growth, which I use as a proxy for growth potential of firms. The second variable is R&D intensity. As previously discussed, management prefers to invest in NPV projects. Abraham et al. (2018) found growth firms to invest in R&D to increase earnings per share (EPS) and mention share repurchases as the method to increase EPS. Hence, I construct the following hypothesis:

H3: *Sales growth, Tobin's Q, Firm size and R&D investments have a negative impact on open market share repurchases*.

In aforementioned literature, free cash flows are indicated to have discriminatory ability for firm's decision to initiate share repurchases and take advantage of undervalued stock prices. Return on equity serves as a proxy for management efficiency. The methodology section 5.1 will further specify the importance to vary between these two proxies. At last, section 2.4 elaborates the significance of the sample period. A long period of structural low interest rates may modify the fundamentals of funding methods for share repurchases. Therefore, I propose the fourth hypothesis:

H4: *Free cash flows, return equity and book value of leverage have a positive impact on OMSR activity.*

At last, previous literature on the substitution hypothesis between cash dividends and share repurchases found support for both negative and positive effects. Appendix 1 shows the increase of share repurchases. However, dividends are still a major pay-out policy for firms. This leads to the following hypothesis:

H5: *There is no substitution effect of dividends and share repurchases activity.*

3.3 SHARE REPURCHASES AND TAKEOVER DETERRENT HYPOTHESIS

As described in previous sections, there are several motives for firms to initiate share repurchases. The takeover deterrent hypothesis is not examined as much as the other hypothesis, while it is commonly accepted that Dutch auctions and tender offers are used to thwart potential takeovers (Bagwell, 1992; Person, 1994). The insight of Bagwell (1991) with regard to shareholder heterogeneity is relevant for this subsection. When firms initiate repurchase programs, shareholders with low reservation rates are expected to sell their stocks and consequently increase existing share prices. Thus, a possible effect of a buyback program could be eliminating the shareholders with low reservation prices, as a takeover defence. Even more in periods of high M&A activity, there is a need for more takeover defence (Ruback, 1988).

Billet and Xue (2007) indeed found that share buybacks are an effective defence in a takeover battle. The first studies to examine takeover deterrence and other estimates in one model were conducted by Dittmar (2000) and Billet and Xue (2007). They found opposing evidence, Dittmar did not found a significant effect, whilst Billet and Xue did found a positive significant relationship between takeover probability and OMSR. The adverse results could be explained by the difference in methodology. Section 5 will elaborate on these differences in further detail and both theories will be examined.

The sample period of Billet and Xue (2007) was designed before 2000 and as explained in previous sections, share repurchases surged to much higher amounts. In particular OMSR triggered this growth, since roughly ninety percent of total repurchases volume is related to OMSR (Busch and

Obernberger, 2017). Furthermore, M&A activity surged to high constant levels after the financial crisis of 2008, and even more interesting dry powder[6] in the market is at a record high level[7]. Because of these high levels of share repurchases and M&A activity, I expect the findings of Billet and Xue (2007) to hold. Hence, considering the aforementioned arguments, I hypothesise that:

H6: *The ex-ante (pre-repurchase) takeover probability has a positive significant effect on OMSR.*

Firms initiate buyback programs prior to a materialised takeover. Consequently, the higher a takeover probability of a firm grows, the more share repurchase activity will emerge.

4. DATA

In this part of the research, the data that will be examined is briefly explained. The sample and data regarding the variables in this research will be discussed. Section 4.1.1 presents the sample and the dependent variable, OMSR. Section 4.1.2 presents a description of all the variables used in this research.

4.1 DATA AND SAMPLE

The sample consists of 1,984 U.S.-based listed firms, between 2012 and 2018. The starting date is based on the deterrent effect of OMSR on takeover probability in periods of economic expansion and low interest rate. More specifically, the time span after the economic crisis of 2008 is chosen. Financial firms (those firms have 4-digit SIC between 6000 and 6999) and firms with total assets of less than 5 million USD, are excluded from the sample. Moreover, firms are excluded when there is non-availability of data. This is largely due to missing repurchases data, but also to a certain extent, due to the explanatory variables. The repurchases data is drawn from 2012-2018 and the other variables from 2011 to 2017.
A variety of sources is used to constitute the final dataset. EDGAR of the Securities and Exchange Commission (SEC) is consulted for repurchase data. In addition, the Zephyr database is accessed to retrieve data on tender offers and privately negotiate share repurchases. At last, EIKON DataStream is consulted for the firm's accounting characteristics.

[6] Dry powder is available cash in the M&A market, which is not allocated at the moment.
[7] BCG, "The 2019 M&A Report". September 2019.

4.1.1 REPURCHASE DATA

The repurchase data contains the fillings from all 10-K and 10-Q of the American Stock Exchange (AMEX), New York Stock Exchange (NYSE), and Nasdaq Composite Index (NASDAQ) between 2012 – 2018. PhD Candidate Y. Li at the Erasmus School of Economics provided me with the data. She retrieved the data from database EDGAR of the Securities and Exchange Commission (SEC), and it was extracted by using Python codes. Not all of these codes recognised the actual repurchases data in the 10-K and 10-Q fillings. To account for these missing values, manually obtained data was added to complete the dataset. The sample used in this thesis consists of actual U.S. repurchase data from 2012 through 2018. The data contains the total amount of shares purchased monthly and is aggregated annually with Stata to obtain yearly amounts. However, a problem with this measure is that it includes all types of share repurchases. Since the focus of this thesis is on the effect of OMSR, other types of repurchases need to be extracted from the aggregated amounts. Therefore, the Zephyr database is consulted for announcements on share buyback programs. Manually I adjusted the actual repurchases data by subtracting tender offers and privately negotiated share repurchases to obtain OMSR. In addition to the repurchases data, company-specific codes such as CUSIP (9)[8] and SIC[9] codes are retrieved to match the corresponding accounting characteristics.

The procedure of obtaining the actual repurchase data exposes the dataset to outliers. Therefore, I use the Winsor approach, introduced by Charles P. Winsor in 1946[10]. The repurchase data contains extreme values, which transformed by limiting these outliers to reduce their effect in the regressions. The Winsor approach transforms the outliers in a way that they are close to the other values in the sample (Ghosh & Vogt, 2012). If a level of 5% in both tails is used to winsorize the data, the outliers beyond the 5th and above the 95th percentile are changed in the same values in the 5th and 95th percentile. For the repurchases data, I use a Winsor cut-off of 1%.

Table 1 presents summary statistics of the OMSR in the sample. The decline in the number of observations and means over the sample period, is not in accordance with findings of previous literature (Zeng & Luk, 2020). OMSR reached the highest level in 2018, which is not similarly presented in the results in Table 1. This discrepancy might be explained by the selection and criteria used for creating the data sample. Furthermore, if control variables of certain firms are missing, it is not possible to use these firms in the regression. Given these explanations, the repurchase figures in the sample can deviate from actual S&P repurchases volumes presented in Appendix 1.

The sample consists of 10,214 reported repurchases in a time span of 7 years with a mean of 36.05%. This indicates that on average 36.05% of the market value of equity in this sample, is

[8] CUSIP (Committee on Uniform Security Identification Procedures) is a unique alphanumeric code that identifies North American securities. In This thesis, nine-digit CUSIP codes are used.
[9] SIC (Standard Industrial Classification) codes are four-digit codes that categorize companies into different industries.
[10] First to use this technique to account for outliers in his dataset.

repurchased per year. Besides the declining number and amount of OMSR over the sample period, one can conclude from the results that OMSR is volatile on a year-on-year basis, which can support the flexibility advantage of share repurchases regarding dividends.

Table 1. OMSR by Year

	Obs.	Mean	SD	p50	Min	Max
2012	1,592	0.4520	0.4836	0.0682	0.0000	1.0000
2013	1,496	0.4258	0.4816	0.0499	0.0000	1.0000
2014	1,493	0.3815	0.4694	0.0427	0.0000	1.0000
2015	1,500	0.3254	0.4486	0.0369	0.0000	1.0000
2016	1,400	0.3113	0.4445	0.0298	0.0000	1.0000
2017	1,354	0.3153	0.4497	0.0227	0.0000	1.0000
2018	1,379	0.2942	0.4345	0.0318	0.0000	1.0000
All	10,214	0.3605	0.4635	0.0374	0.0000	1.0000

4.1.2 DATA AND EXPLANATORY VARIABLES

After adjusting the share repurchase data to the annual amount of OMSR, the dependent variable is constructed.

Open market share repurchases (OMSR) = (the annual amount of open market repurchases of a firm / the market value of common equity)

Chapter 2 and 3 define several explanatory firm characteristics, which identify a firm's takeover probability (Billet and Xue, 2007; Levine and Aaronovitch, 1981; Myers & Majluf, 1984; Palepu, 1986; Powell, 1997; Shleifer & Vishny, 2003) and motives for share repurchases (Billet and Xue, 2007; Brav et al., 2005; Dittmar, 2000; Grullon and Michaely, 2004; Harriss, 2015; Hseigh and Wang, 2009; Jagannathan et al., 2000). The explanatory variables are retrieved from EIKON DataStream, with exception of dummy variables TODUM and ITODUM. The dummies are generated into three different types. The data is obtained from the Zephyr database, which provides data on actual M&A activity. In this database one can specify the deal dates into three different types: rumour, announced, and completed dates. In this research, I examine whether different stages of deals, influence the estimation results. It can be noticed that Billet and Xue (2007) specify a single version of TODUM. In my thesis, the dummy variable TO_RUMOR is the equivalence to their dummy. Table 2 provides an overview of the variables and the corresponding data sources. Some of the variables derived from DataStream appeared to be incorrect and prone to spurious outliers. Therefore, all the values with exception of NPPE, R&D

intensity, and the dummy variables are winsorised at the 1st and 99th percentile. The following overview presents the explanatory variables, used to examine the hypotheses:

Table 2. Overview of the Used Data Sources

This table presents the sources of the sahre repurchase data, actual takeover data, and firm-specific accounting variables.

Data Item	Variable	Explanation	Source
Amount of Actual Share Repurchases	OMSR	In USD, Monthly Annual Amount of OMSR / Market Value of Equity	EDGAR
Tender Offers and Privately Negatiated Share Repurchases		In USD, Annually	Zephyr and SDC
Actual Takeover Data	TODUM[11]	Date, Annually Takeover Dummy equals one if a firm is a takeover target in a given year and zero otherwise	Zephyr and SDC
Actual Takeover Data	ITODUM[12]	Date, Annually Industry Takeover Dummy equals one if at least one firm in the same industry (SIC code) is a takeover target in the previous year and zero otherwise	Zephyr and SDC
Cash dividends	CASHDIV	In USD, Annually Dividends / Net Income	EIKON DataStream
Property Plant Equipment	NPPE	In USD, Annually Property, Plant and Equipment / Total Assets	EIKON DataStream
Free Cash Flows	FCF	In USD, Annually (Cash Flows From Operations - Dividends - Capital Expenditure) / Total Assets	EIKON DataStream
Tobin Q	TOBINQ	Percentage, Annually Market Value / Book Value	EIKON DataStream
Sales Growth	SALEGR	Percentage Change Annually Natural Log of Sales Growth Ratio	EIKON DataStream
Return on Assets	ROAIA	Percentage, Annually (Operating Income Before Depreciation / Total Assets) - the median for firms with the same two-digit SIC code	EIKON DataStream
Market Value of Common Equity	SIZEQ	In USD, Annually Natural Log of Market Value of Common Equity	EIKON DataStream
Market Value of Equity		In USD, Annually	EIKON DataStream
Return on Equity	ROE	Percentage, Annually Net Income / Common Shareholders EQuity	EIKON DataStream
Book Value of Debt	LEVBIA	In USD, Annually (Book Value of Debt / Total Assets) - the median for firms with the same two-digit code	EIKON DataStream
Market Value of Debt	LEVIA	In USD, Annually (Book Value of Debt / (Book Value of Debt and the Market Value of Equity)) - the median ratio of firms with the same two-digit SIC code	EIKON DataStream
Total Assets	SIZEA	In USD, Annually Natural Log of Total Assets	EIKON DataStream
R&D Investment	R&D	In USD, Annually R&D investments / Total Assets	EIKON DataStream

[11] This is the general description of the industry takeover dummy. In the regressions the dummy is split in TO_ANNOUNCE and TO_COMPLETE.

[12] This is the general description of the industry takeover dummy. In the regressions the dummy is split in ITO_ANNOUNCE and ITO_COMPLETE.

5. METHODOLOGY

The outline of the methodology is two-fold. In the first part of the analysis, the takeover probability is measured by a Probit model. The variable, takeover probability, generated in the first stage is included in the second part of the analysis. In section 5.2 a censored regression model (Tobit model) is used to examine the ex-ante effect of the takeover probability on the dependent variable OMSR. In the third section, the importance of this two-stage approach is specified.

5.1 DERIVING THE TAKEOVER PROBABILITY WITH A PROBIT MODEL

The Probit model is used to test dichotomous dependent variables which are assumed to be a linear function of a number of explanatory variables (Noreen, 1988). The dependent variable is binary and consequently has a value of 1 when occurring and 0 otherwise. Binary response models tend to exhibit heteroskedasticity in the error terms. Thus, OLS regressions are not applicable to these variables. Conditional probabilities in the Probit model lie between 0 and 1. In OLS regressions these values are more likely to be continuous and lie outside the range of 0-1 (Bartholomew et al., 2011). This would also be an issue in my research since the variables are constrained to lie between 0 and 1. The dependent variable in this research has the value of 1 (takeover bid received by a specific firm) and 0 (no takeover bid received).[13] The Probit model overcomes the issues of the OLS regression and is therefore more suitable to measure the takeover probabilities. Traditionally the Probit model was introduced in econometrics as a model applicable for estimating parameters, when the dichotomous dependent variable has a continuous underlying latent variable, which is unobservable and immeasurable (Bartholomew et al.,2011). In this research, a firm's takeover probability is this variable. Although we know a firm has a certain takeover probability, we cannot observe this probability. What can be observed is the dichotomous value of the latent variable, whether a certain firm receives a takeover bid or not. The Probit model estimates the latent variable by the observed value of the dependent variable. The model uses a maximum likelihood technique to estimate the Betas and standard errors (Noreen, 1988). The Betas in the Probit model indicate the impact of the explanatory variables on the latent variable and not on the dependent variable. Hence, a positive Beta indicates that an increase in the explanatory variable leads to an increase in the predicted probability and a negative Beta vice versa. The next step is to transform the latent variable into a probability estimate for the dependent variable. This is done by a cumulative distribution function of a standard normal distribution (Bartholomew et al.,2011). The technique to generate the latent variable gives a linear model. However, by transforming the latent variable into a probability estimate for the dependent variable the linear relationship disappears (Bartholomew et al.,2011).

[13] With regard to the other types of takeover data; 1 if takeover was announced and 0 otherwise, 1 if takeover was completed and 0 otherwise.

To create the Probit model I start with the modelling of the latent takeover process (TO^*_{it}). In practice, this variable is unobservable and immeasurable. Hence, to measure the latent takeover process I use the linear relation of the Probit model, which is taken as follows:

$$TO^*_{it} = z_{it-1}\beta_1 + u_i, \quad u_i \sim N(O, \sigma_1^2) \quad (1)$$

z represents a constant and the firm characteristics as described by Billet and Xue (2007). There are seven explanatory variables which are used for modelling the latent takeover process. These variables are ITODUM[14], LEVIA, TOBINQ, NPPE, ROAIA, SALEGR. In previous academic literature, these variables have been cited as explanatory variables of target firms (Billet and Xue, 2007; Levine and Aaronovitch, 1981; Myers & Majluf, 1984; Palepu, 1986; Shleifer & Vishny, 2003). Since this model describes the ex-ante takeover probability the explanatory variables need to be measured as of the end of a year ago at *t-1*. This is an important aspect to measure the takeover probability of a firm before the repurchases decision and it describes the relationship between the subsequent repurchases activity following the extent of takeover threat. Therefore, the repurchases data in the sample is of the period 2012 to 2018, the explanatory variables are measured from 2011 to 2017.

In the second equation the assumption is made by the Probit model that dependent variable is defined by an unobservable latent variable. However, we can actually observe the dependent variable and use binary data to measure the variable (Billet and Xue, 2007). This dummy is defined as TODUM[15]:

$$TODUM = \begin{cases} 1 & if\ TO^*_{it} > 0 \\ 0 & otherwise \end{cases} \quad (2)$$

if a firm received a takeover bid the value equals 1 or otherwise 0. In the last step, the binary Probit model generates the ex-ante probability that a company will become a potential target. The TOPROB is modelled as follows:

$$TOPROB = Prob(TODUM_{it} = 1) = \Phi\,(z_{it-1}\beta_1) \quad (3)$$

ϕ (.) is the cumulative distribution function of a standard normal distribution (Billet and Xue, 2007). TOPROB is a probability estimate of the latent variable and will be included in the second model of section 4.2.

[14] The general description of TODUM and ITODUM are used in the methodology for clarity of the explanation. In this chapter rumour data is used to explain the methodology, however announced and completed data follow the same steps.

[15] In this study three different types of the takeover process are measured. Rumour data (TO_RUMOR) is the same data used by Billet and Xue (2007) in order to measure the takeover probability. Announced data (TO_ANNOUNCE), is 1 when a takeover is actually announced to complete in a given year and 0 otherwise. The number of announce data is a smaller than rumoured takeover, since acquirers have the opportunity to withdraw their bid or targets to refuse a bid. The last type is the complete dummy (TO_COMPLETE), which is 1 if a takeover is completed in a given year and 0 otherwise. The number of completed takeovers is much lower than rumour and announced data in the sample. After a takeover is announce it can take years to actually complete the process.

5.2 OPEN MARKET SHARE REPURCHASES AND THE TOBIT MODEL

In the second stage an additional technique is used, the Tobit model. This model estimates the subsequent repurchases activity with regard to the calculated takeover probability of equation 3. In this model, the dependent variable will be OMSR and is defined as the annual amount of open market share repurchases divided by the market value of common equity the year before the repurchases data.

The Tobit model is explained by Forrest (1974) as an econometric technique known as a censored regression model. It aims to estimate the relationship between independent variables and non-negative dependent variables. The model wishes to estimate the parameters of a regression with incomplete data on the dependent variable. The variable is only observed when the value exceeds a certain threshold. The censored dependent observed variable is determined from a latent variable, which depends on the independent variables through a vector (B). The relationship between the latent variable and the independent variables are assumed to be linear. Furthermore, the model contains a normally distributed error term (e), which estimates the random influences on the relationship. Whenever the latent variable has exceeded the threshold (zero in this research) the observable variable is assumed to be equal to the latent variable. When the dependent variable is censored OLS regression may provide biased estimates, the Tobit model overcomes these issues when a large number of observations are zero (Billet and Xue, 2007). The Tobit regression is an appropriate technique to analyse OMSR data with censored dependent variable.

The summary statistics in Table 4 indicate that OMSR has a median of approximately zero. Furthermore, the dependent variable is relatively censored, which is also found in previous literature on OMSR (Billet and Xue, 2007). In order to estimate the subsequent repurchase activity, equation 4 is specified as follows:

$$OMSR_{it}^{*} = \gamma TOPROB_{it} + x_{it-1}\beta + \varepsilon_i, \quad (4)$$

Where

$$OMSR_{it}^{*} = \begin{cases} OMSR_{it}^{*} & if\ OMSR_{it}^{*} > 0 \\ 0 & otherwiser \end{cases}$$

x includes the firm accounting variables, a constant and the time affect a company's repurchase decision (Billet and Xue, 2007). One can see in equation 4 that TOPROB is specified separately from the firm characteristics (x). The objective of separating the takeover probability from the x variables is to explicitly examine the unobservable variable in the OMSR equation. The explanatory variables which are used for the Tobit model are CASHDIV, FCF, LEVBIA, TOBINQ, ROE, SIZEASST, R&D, and TOPROB.

5.3 TWO-STAGE APPROACH

As described by Billet and Xue (2007), a two-stage instrumental variable approach is required to estimate the above system of equations. In the first stage the Probit model, as described in 5.1, is used to obtain the pre repurchases takeover probability. In equation 3 the latent unobservable takeover process is generated. However, from equation 2 the dummy variable TO_RUMOR is obtained, which is an observable event and is 1 if a firm receives a takeover bid and 0 otherwise year *t*. The explanatory variables of equation 1 are measured at t-1 to measure the takeover probability prior to the repurchases decision. In that context, TOPROB presented in equation (3) measures the ex-ante takeover probability observed at the beginning of year *t* and is not influenced by firms repurchase activity during year *t* (Billet and Xue, 2007). In the second stage, equation (4) calculates the subsequent repurchase activity by using the values of TOPROB obtained from the first stage. The explanatory variables of the first stage are documented in previous literature as indicators of target firms but are not identified as motives for share repurchases. Table 3 provides an overview of the variables used and the subsequent stage.

Table 3. Overview of Variables

This table present the variables and the subsequent Model. Furthermore, the hypothesis and the regarding effect on the dependent variable is indicated.

Hypothesis	Variable	Formula	Model	Exp. Sign
Size	SIZEEQ	LN Market Value Equity	Probit	-
	SIZEA	LN Total Assets	Tobit	+
Management Inefficiency	ROAIA	(Operating Income / Total Assets) - Media Same Industry	Probit	-
	ROE	Net Income / Common Shareholders Equity	Tobit	+
Growth Opportunities	SALESGR	LN (Sales *t-1* / Sales *t)*	Probit Tobit	+ -
Capital Structure	LEVIA	(Book Value of Debt/ (book value of debt + the market value of equity)) - Median Same Industry	Probit	-
	LEVBIA	(Book Value of Debt / Total Assets) - Median Same Industry	Tobit	-
Under valuation	TOBINQ	Market Value / Book Value	Probit Tobit	- -
Assets Structure	NNPE	Plant, Property, and Equipment / Total Assets	Probit	+
Substitution Hypothesis	CASHDIV	Cash Dividends / Net Income	Tobit	-/+
Agency Problems	FCF	(Cash Flow from Operations - Preferred Dividends - Capital expenditures) / Total Assets	Tobit	+
R&D Intensity	R&D	Research and Development / Total assets	Tobit	-
Takeover Deterrence	TODUM	1 if Takeover Bid is received, 0 otherwise	Tobit	+
	ITODUM	1 if Takeover Bid occurred in the same industry, 0 otherwise	Tobit	+
	TOPBROB	Calculated takeover probability from Probit model	Tobit	+

6. RESULTS

This chapter provides an overview of the empirical results and findings of this thesis. First, section 6.1 starts with a brief overview of summary statistics of the variables used in this research. This is followed by the findings of the Probit model. In this subsection the takeover probability of firms is measured. Hereafter, the takeover probability measure is used in the Tobit model to estimate the subsequent repurchase activity. Section 6.3 and 6.4 elaborate on the results in accordance with the literature of Dittmar (2000) and Billet and Xue (2007) respectively.

6.1 DESCRIPTIVE STATISTICS

Table 3 presents the descriptive statistics of the dependent variable and the firm characteristics during the sample period. All variables, with exclusion of OMSR, NPPE, R&D, and the dummy variables, are winsorised at the 1_{st} and 99_{th} percentile to avoid the tests to be influenced by outliers in the sample. In order to test the deterrent effect, section 5 explains that the explanatory variables are constructed as *t-1* (2011-2017) and OMSR (2012-2018). The sample period of 2011-2017 contains 13,334 firm-year observations.

Compared to the findings of Billet and Xue (2007), an obvious difference is the type of takeover dummies. In this thesis, an additional value is introduced to test actual takeover target data. The mean of TO_ANNOUNCE indicates that 6.94% of the firms has the threat of a takeover bid in a given year. In addition, I use the dummy variable TO_COMPLETE, which indicates if acquisition is announced and completed in a given year. Hence, the mean is lower than TO_ANNOUNCE, since the takeover process follows several steps and it takes time to complete the actual takeover. Both dummies appear to be censored to the left and have a median of zero.

In addition, the lower range of the variable CASHDIV is negative. Since this variable is defined as the cash dividends scaled by net income, a negative value indicates that a firm pays dividends when net income is negative. Brav et al. (2005) found management to be very reluctant to abandon dividends. They rather forego profitable projects to preserve the announced dividends level. The results in Table 4 support this finding.

Overall, the descriptive statistics are rather similar to the statistics of Billet and Xue (2007), apart from the OMSR variable. A deviating result is found for the dependent variable, which has a mean of 20.20% in the sample. This implies that the companies used in the sample on average repurchase approximately 20% equity value on the open market, which results in surpassing the mean of the dependent variable of the Billet and Xue (2007) sample, which was 0%. The data in their research was collected in the sample period that lasted from 1985-1996. During this period of twelve years, there was a prevalence of 2,544 share repurchase programs in the open market. Conversely, in this research 10,214 share repurchases are executed within a time frame of seven years. Furthermore, the share repurchases

market in the US developed into a mature and important market over the last decades. Appendix 1 can help to clarify the deviation in the numbers of OMSR between the two sample periods. In 1996 approximately 7% of US firms executed a buyback program, whilst in 2018 more than 50% of listed firms repurchased shares. As a consequence of these higher volumes, the dependent variable is censored to a much lesser extent. The median of 0.9% indicates that most of the companies report zero OMSR values, but the overall volume surpasses the values of Billet and Xue (2007). Overall, the dataset enables their study to be re-examined with an appropriate sample. However, the differences of the dependent variable described above may result in different estimates.

Table 4. Summary Statistics

	Obs.	Mean	SD	Median	Min	Max
OMSR	18,219	0.2021	0.3904	0.0009	0.0000	1.0000
TO_ANNOUNCE	18,219	0.0694	0.2541	0.0000	0.0000	1.0000
TO_COMPLETE	18,219	0.0555	0.2290	0.0000	0.0000	1.0000
SIZEA	15,961	20.5901	2.2743	20.7194	11.4076	25.7689
NPPE	16,161	0.2405	0.2454	0.1424	-0.1941	1.3948
ROAIA	16,356	-0.0388	0.3194	0.0011	-4.4632	0.6343
LEVIA	14,794	0.0424	0.1830	0.0000	-0.4361	0.7428
TOBINQ	15,956	3.5749	7.5203	2.4000	-41.2900	54.0800
SALESGR	15,754	0.1753	0.7294	0.0593	-0.9920	11.5171
CASHDIV	16,357	0.1719	0.5977	0.0000	-2.5079	4.5743
FCF	16,243	-0.0561	0.2976	0.0265	-3.5967	0.3057
ROE	14,805	-0.1301	1.0514	0.0775	-15.4638	1.3308
LEVBIA	16,276	0.0392	0.2434	0.0000	-0.4083	2.4464
SIZEA	16,380	13.5611	2.1975	13.6252	5.7807	19.2099
R&D	8,992	0.1550	0.2620	0.0670	0.0000	2.8169

6.2 ESTIMATION RESULTS OF THE PROBIT MODEL

This section describes the findings of the takeover probability. Subsection 6.2.1 provides the estimation results of the Probit model. Table 5 contains six models, of which each type of takeover dummy has three models. The first excludes the industry takeover dummy of the respective type. The second and third model include the industry takeover dummy. In addition, the third model tests for time trend. Subsection 6.2.2 answers the hypotheses 1 and 2 regarding the takeover probability. In 6.2.3 the robustness checks are provided.

6.2.1 ESTIMATION RESULTS

As proposed by Billet and Xue (2007), the first step to estimate the takeover probability is to estimate a Probit model by maximum likelihood. Based on the Zephyr and SDC data on actual takeover data, the Probit model defines a takeover attempt as a company that receives a bid in a given year *t-1*. As discussed in section 4 and 5, I use several explanatory variables for a firm's takeover probability. The following variables (measured at *t-1*) are included in the Probit model: SIZEQ, NPPE, ROAIA, LEVIA, TOBINQ, SALESGR, and ITODUM[16]. The explanatory variables are obtained a year prior to repurchases activity, in order to measure the ex-ante takeover likelihood of firms.

Table 5 presents the estimation results of the Probit model. Significant coefficients are found for all variables excluding TOBINQ, in at least one of the models in Table 5. As illustrated in the table, one can observe takeover likelihood to increase with percentage of tangible assets (NPPE), industry-adjusted market value of debt (LEVIA), industry-adjusted assets (ROAIA), and takeover attempts within the same industry (ITODUM). On the other hand, firm size (SIZEQ) and sales growth (SALESGR), will decrease firm's takeover likelihood.

Most of these results are in line with aforementioned literature on takeover probability. For instance, the coefficient of SIZEQ in model 4 indicates that in an increase in firms size decreases takeover probability which is in line with previous findings. The literature on management inefficiency proposes that management which is underperforming should be replaced by a new management. The variable ROAIA is a proxy for this hypothesis and the coefficient contradicts the previous literature. One could expect well performing firms within the same industry to be less prone to takeover attempts. This is hypothesis is not confirmed in Table 5, a coefficient of 0.5104 for ROAIA in model 3 indicates that an increased return on assets within the industry increases the takeover likelihood of a firm. The following subsection will further elaborate on the results and answering the results.

[16] The industry takeover dummy has two types. The variables are derived from the takeover dummy. The types are: ITO_ANNOUNCE and ITO_COMPLETE.

6.2.2 HYPOTHESES TAKEOVER PROBABILITY

In Section 3 several hypotheses were developed to answer the research question. The first two hypotheses were formulated to examine the takeover probability of firms in the dataset. H1 is defined as follows:

H1: *Sales growth, level of tangible assets, and takeover attempts within the industry have a positive effect on takeover likelihood.*

Following the results in Table 5, H1 is only partly accepted. The significant negative coefficients of sales growth in models 2 and 3 do not confirm the drawn hypothesis. An increase in sales growth will decrease the takeover probability by 0.086, which is the opposite of which is expected. Myers & Maljuf (1984) found that firms with growth potential are attractive target firms. One could argue that these findings were found 35 years ago and are less representative to the used dataset. With regard to the other two variables, the results in Table 5 accept H1. The variable NNPE is used as a proxy for the level of tangible assets of a firm. In the models that include the industry takeover dummy one could see NPPE to increase the takeover likelihood. Ambrose and Megginson (1992) reason that firms with relatively more intangible assets can obtain higher levels of debt. This enables an acquirer to borrow against lower costs, since the targets tangible assets serve as collateral. In addition, industry adjusted leverage ratio shows to increase the takeover probability. One could argue that in a period of record low interest rates it is relatively cheap to obtain leverage and fund firms projects with debt. However, companies with an above industry debt level are argued to have higher chances of financial distress (Palepu, 1986; Ambrose et al., 1992). Furthermore, Korteweg (2010) found that costs of overlevered firms are higher than underlevered firms. The results of the Probit model confirm the previous findings and show that above industry leverage ratios increase firm's takeover probability. At last, the industry takeover dummy is positive and significant for both types of takeover data. Documented in various literature M&A activity appears to cluster by industry (Palepu, 1986, Shleifer & Vishny, 2003). The coefficients in Table 5 have large positive values, which leads to the conclusion that the probability of takeover increases with M&A activity in the same industry. In accordance with the results discussed above, H1 is accepted with exclusion of sales growth. The second hypothesis of the first stage of the analysis is defined as follows:

H2: *Firm size, industry adjusted leverage ratio, firm performance, and Tobin's Q have a negative impact on takeover probability.*

The results of the variables regarding the hypothesis are twofold. H2 is accepted for firm size, but not for firm performance and Q ratio. The mechanism of corporate control describes, if management is underperforming and not optimizing the firm's potential, that the old management should be replaced by a new management (Palepu, 1986, Tunyi et al., 2019). The coefficients of ROAIA, which is used as a proxy for management performance, presents the opposite of what is hypothesized. An increase in the

industry adjusted return on assets increases the probability of a firm to be taken over. The coefficients are positive and significant for all six models at a p-value of 1%. The variable TOBINQ is used to measure if firms are overvalued. Palepu (1986) found that overvalued firms are to a lesser extent targets at the takeover market. Therefore, one would expect the Q ratio to have a negative impact on takeover probability. The results indicate positive and negative effects of TOBINQ in different models. Hasbrouck (1985) used Tobin's Q as a determinant for growth opportunities and found a significant positive relationship with takeover likelihood. If this holds, the positive coefficient could be interpreted in the same matter as sales growth hypothesis. Previously mentioned literature stated that firms with growth potential are more likely to be taken over. However, the results are not significant and therefore H2 cannot be accepted for this variable.

Similar to the Q ratio, for firm size two-sided results are found. In models 2 and 3 the coefficients are positive, which is not in line with the customarily accepted assumption that firm size decreases takeover probability (Palepu, 1986: Billet and Xue, 2007). In the last decade some researchers did find opposing evidence to some extent. Offenberg (2009) proposed that larger firms are more likely a target of disciplinary takeovers than smaller firms. Additionally, Mawson and Brown (2016) examined the acquisitions of small and medium firms in the UK. They found that these firms are acquirers with the purpose to exploit technological complementarities between the acquiring and acquired firms. However, the results are not significant for a p-value of 10%. In model 4 a significant negative effect is found as proposed by previous literature on the effect of firm size on target firms. Therefore, H2 is accepted for firm size.

As discussed above, most of the explanatory variables are in line with previous literature and the hypotheses are accepted for most of the variables. However, some of the coefficients were more challenging and contradicted the hypothesized effects. H1 and H2 are there for both partly accepted.

6.2.3 Robustness check probit model

The first test which is performed to check the robustness of the Probit model, is to run the regression as a logit model. The estimations of the Probit model preserve in the logit model. Moreover, these specific regressions are non-linear functions and the variance of X variables differ. This results in heterogeneity and therefore robust standard errors are used.

In model 3 and 9, I include a dummy for year fixed effects to test for unobserved heterogeneity. This can be caused by unobserved constant factors over time. The coefficients of the variables in these models decrease but are relatively the same compared to the models 2 and 5, without the fixed effects. There is some existence of unobserved time effects, however it does not influence the estimates.

At last, the Chi-squared test holds for a probability of $p<0.01\%$. This indicates that the explanatory value of the model is significant. Therefore, the estimates of the Probit model are accepted.

6.2.4 TAKEOVER PROBABILITY

The next step in the first stage of the analysis is to generate an estimate for the takeover probability. In order to do so, I create the variable TOPROB as an estimate for the ex-ante takeover probability. Figure 1 presents the estimated takeover probability of its associated percentile. The variable has a mean of 3.5%. The plot shows that there is a wide variation in takeover likelihood. That is, moving from the 5th to the 95th percentiles, the probability increases respectively from 1.0% to 12.5%. Appendix 2 provides the plots for estimated takeover probability for the complete takeover data. The variable TOPROB_COMPLETE has a mean of 1.5 %, the 5th percentile a value of 1.0 %, and the 95th percentile 9.5%.

Figure 1. Estimated Takeover Probability Announce

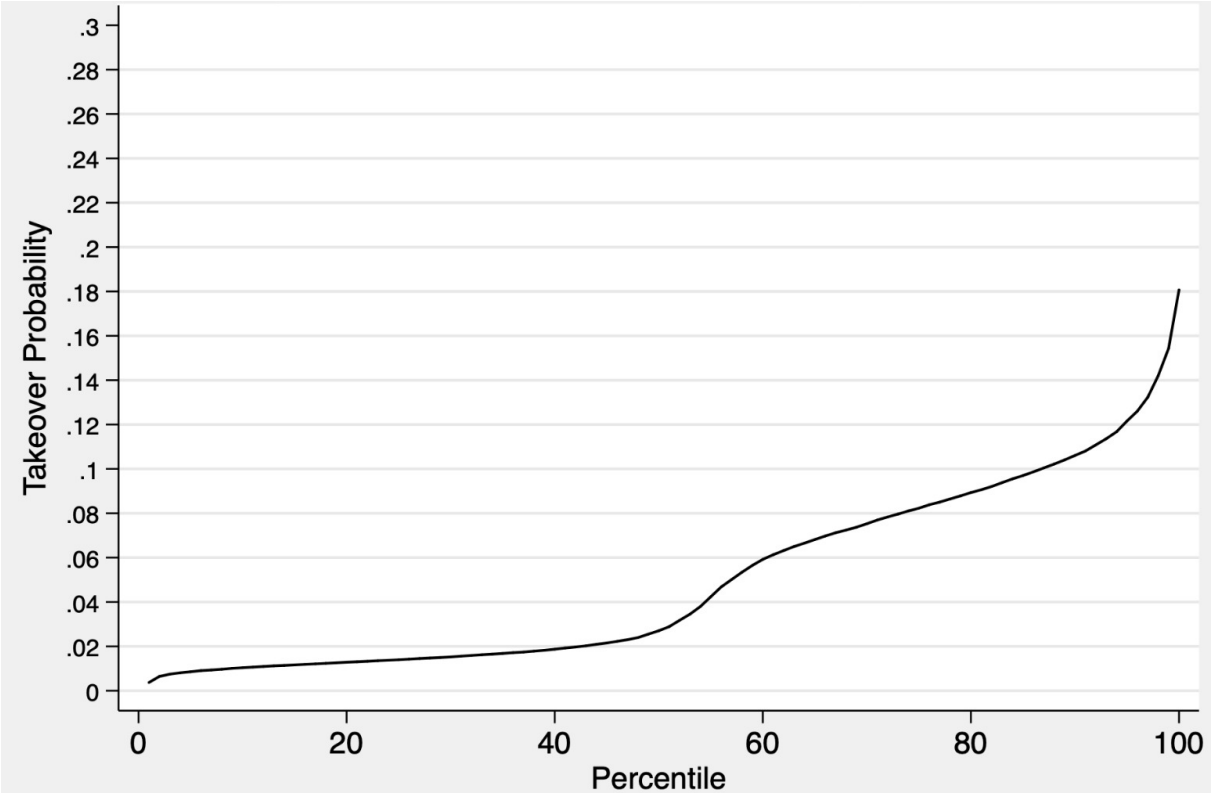

Table 5. Takeover Probability Estimation (Probit)

	TO_ANNOUNCE	TO_ANNOUNCE	TO_ANNOUNCE	TO_COMPLETE	TO_COMPLETE	TO_COMPLETE
	(1)	(2)	(3)	(4)	(5)	(6)
SIZEEQ	-0.0008	0.0067	0.0039	-0.0345***	-0.0142	-0.0174
	(0.0101)	(0.0102)	(0.0103)	(0.0113)	(0.0114)	(0.0115)
NPPE	-0.0284	0.2282***	0.2206***	-0.0947	0.1959**	0.1919**
	(0.0815)	(0.0837)	(0.0833)	(0.0950)	(0.0960)	(0.0956)
ROAIA	0.3693***	0.4865***	0.5104***	0.4193***	0.5422***	0.5657***
	(0.1075)	(0.1034)	(0.1046)	(0.1219)	(0.1106)	(0.1120)
LEVIA	0.4599***	0.5067***	0.4858***	0.1637	0.1840	0.1603
	(0.1070)	(0.1206)	(0.1202)	(0.1244)	(0.1434)	(0.1430)
TOBINQ	0.0032	0.0016	0.0016	0.0026	-0.0007	-0.0006
	(0.0027)	(0.0029)	(0.0028)	(0.0033)	(0.0032)	(0.0032)
SALESGR	-0.0424	-0.0900**	-0.0860**	0.0023	-0.0463	-0.0441
	(0.0334)	(0.0384)	(0.0380)	(0.0270)	(0.0318)	(0.0318)
ITO_ANNOUNCE		0.8282***	0.7979***			
		(0.0474)	(0.0469)			
ITO_COMPLETE					0.8808***	0.8524***
					(0.0532)	(0.0530)
_cons	-1.6858***	-2.4006***	-2.4879***	-1.1497***	-2.0858***	-2.1416***
	(0.2086)	(0.2196)	(0.2302)	(0.2330)	(0.2470)	(0.2591)
Year_FE	No	No	Yes	No	No	Yes
chi2	34.35***	340.76***	342.14***	22.63***	323.76***	332.57***
N	12157	12157	12157	12157	12157	12157

Standard errors in parentheses

* p<.10 ** p<.05 *** p<.01

6.3 TOBIT MODEL

6.3.1 ESTIMATION RESULTS

In order to tackle the research question, the variable TOPROB[17] generated in the Probit model above is added to the second stage of the analysis. Here, the censored regression model of equation 4 is used to estimate the effect on OMSR. Besides the takeover probability, I include both the takeover dummies (as proposed by Dittmar (2000)), and the control variables (CASHDIV, FCF, ROE, SALESGR, LEVBIA, TOBINQ, SIZEA, and R&D) in the Tobit regression. As discussed in Chapter 5, the independent variables in the Tobit model need to be obtained a year prior to the repurchases data, to prevent the estimates to be possibly biased.

In Table 6 the estimates of the Tobit model are provided. Models 1 and 3 follow the methodology proposed by Dittmar (2000). The takeover dummy for both types of takeover data equal one, if an actual bid is received and zero otherwise. On the other hand, model 2 and 4 present the results of the takeover probability variable (TOPROB) derived from the Probit model. This variable is also displayed in two different types of takeover status. In accordance with the previous literature on share repurchases, I also include explanatory variables which are identified as reasons to initiate OMSR.

6.3.2 CONTROL VARIABLES

As described in Section 3 there are three hypotheses defined with regard to share repurchases. Hypothesis 3 is stated as follows:

H3: *Sales growth, Tobin's Q, Firm size and R&D investments have a negative impact on open market share repurchases*.

Table 6 indicates that sales growth has a negative relationship with OMSR for all four models at a p-value of 1%. To the best of my knowledge, there is currently no literature which tested this relationship to OMSR. Corporate life cycle theories state that firms in earlier stages have higher sales growth. Liang et al. (2013) proposed a model to estimate if repurchases motivation differ between life cycle stages. They found that younger firms fund their repurchases with free cash flows. On the other hand, Carreira and Silva (2010) and Guney et al. (2017) mentioned young firms to be more financial constraint and therefore rely less on external financing to invest in R&D projects. They rather use cash for investment opportunity to fulfil their growth opportunity. Therefore, one could expect these firms not to invest in share buyback programs, but instead preserve cash for innovation. In accordance with the results of sales

[17] TOBROB has two types; TOBROB_ANNOUNCE (same as the variable used by Billet and Xue) and TOPROB_COMPLETE.

growth, H3 is accepted. On the other hand, the coefficients of firm size (SIZEA) show the opposite of what is hypothesized. Total assets is used to denote firm size, which is used as a proxy to identify asymmetric information. Previous literature proposes that smaller firms are more opaque and experience increased levels of information asymmetry between firms and shareholders. To tackle the problems arising between shareholders and management, OMSR is used signal prospects to the market. We would therefore expect a negative coefficient of SIZEA. The coefficient of TOBINQ is almost equal to zero for all models and is not significant. It is therefore not possible to fully accept hypothesis 3.

In H4 I hypothesized indicators which have a positive impact on repurchase activity:

H4: *Free cash flows, return equity and book value of leverage have a positive impact on OMSR activity.*

The results in Table 6 indicate positive coefficient for FCF in al 4 models for a p-value of 1%. This is in line with previous findings that management uses excess cash flows to redistribute cash to shareholders. The the industry adjusted leverage ratio (LEVBIA) is contradicting the expect effect on OMSR. As presented in Section 2.4, the effect of leverage ratio is one of the most interesting to further discuss. During the sample period it was relatively cheap to obtain additional leverage. Combining this with the increased levels of debt-financed buyback programs over the last decades, one might expect a positive impact of leverage ratio on OMSR. Gyimah et al. (2019) stated that financial unconstrained firms use leverage finance buyback programs when market conditions are favourable. Since, during the sample period of this study interest rates were extremely low, we could expect firms to use leverage to fund OMSR. Interestingly, their study found that financial constrained firms use debt-financed repurchases programs. Nevertheless, the positive effect of LEVBIA is not found in neither of the models. The results are in line with the research of Billet and Xue (2007) and Dittmar (2000) which both found negative coefficients. Lastly, return on equity has a negative coefficient, but is not significant for any model. Thus, H4 is accepted for FCF but rejected for the other two variables.

Previous findings showed both proponents and opponents' arguments for the substitution hypothesis of share repurchases and dividends. Hypothesis 5 was derived as follows:

H5: *There is no substitution effect of dividends and share repurchases activity.*

The betas in Table 5 represent small negative values for all 4 models. In model 3 the coefficient has a value of 0.9% at a p-value of 0.1. This effect is negligible and in line with the overall picture of Appendix 1, which shows that dividends and share repurchases are both major pay-out instruments. The results led met to accept this hypothesis that both forms of pay-out policies are used interchangeably.

6.3.3 R&D INTENSITY

Unfortunately, R&D data is missing for a large proportion of firms in the dataset. To examine the effect of investments on OMSR activity, the variable R&D intensity is included in the second stage of the analysis. However, the number of observations is reduced by approximately 4400 observations. Moreover, the model only contains firms with available R&D data. This may lead to selection biased estimates, since the sample contains a specific sort of firms. Therefore, I run a separate model with R&D included in the analysis. It is interesting to see that coefficients change in the extra model. Appendix 3 presents the results of the model with all variables included. In hypothesis 3, I assume R&D expenditures to have a negative effect on repurchase activity. Appendix 3 shows a positive coefficient for R&D in all four models. However, they are not significant, which leads to rejection of this part of hypothesis 3. An interesting coefficient found in this regression is much stronger effect of the takeover probability variable. Companies which report R&D investment and experience increased levels of takeover threat, repurchases twice as much shares as the sample without R&D investments. This is a rather interesting finding, since Mawson & Brown (2017) showed that R&D intensive firms tend to hold cash to invest instead of repurchasing shares. It is important to notice to be extremely caution with the interpretation of the results found in this Tobit model. As the firms in this subsample are all listed and relatively large firms (total assets higher than five million) which reported R&D investments. Moving from the 5th percentile to the 95th percentile, a firm will buyback an additional 4.29% of shares[18]. It is hard to explain why the effect is larger in this subsample compared to the overall regression, since it is not in the scope of this research to distinguish between indicators for R&D investing firms.

6.3.4 TAKEOVER DUMMY OF DITTMAR

The takeover dummies in model 1 and 3 do provide significant coefficients. Model 1 contains dummy TO_ANNOUNCE, which is the same proxy as the takeover dummy presented by Dittmar (2000). The coefficient in Table 5 shows a positive effect of takeover bids on repurchases activity. The effect of the takeover dummy is much more evident than the findings of the previous two, which both found minor influence of the takeover dummy on OMSR. The coefficient indicates that firms with actual received announced takeover bids initiate 11% more buyback activity. On the other hand, TO_COMPLETE in model 5 shows a positive coefficient of 0.1802 with and a significance level 1%. This is also the opposite of the findings of Dittmar (2000), she finds very small effect of the takeover dummy, which leads here to conclude that takeover deterrent hypothesis has a minor effect on share repurchases. The coefficient in my study indicates that firms are 18.02% more likely to repurchases stocks, when a takeover is completed in that year. This is an interesting finding, since one might not expect firms to repurchase shares, given that an acquisition is completed in that year.

[18] Calculation: Coefficient of table 5 * (95th – 5th percentile) = 0.4089* (0.115 – 0.01) = 4.29%

6.3.5 TAKEOVER PROBABILITY OF BILLET AND XUE

The last hypothesis that is tested addresses the takeover probability and OMSR and is formulated as follows:

H6: *The ex-ante (pre-repurchase) takeover probability has a positive significant effect on OMSR.*

In models 2 and 4, I include the latent variable TOPROB, derived from the Probit model. This variable estimates the takeover probability of a firm at t-1. TOPROB provides significant result with the announced data. The coefficient 0.2787 is statically significant at p-value <0.01. This indicates that a firm in the 5th percentile of TOPROB_ANNOUNCE (Figure 1) will buyback 0.28% of shares, while a firm in the 95th percentile will repurchase 3.21%. Thus, moving from the 5th to the 95th percentile, a firm will buyback an additional 2.93 %[19] of shares outstanding on the open market. Since the average of OMSR for repurchasing firms is 27.99% (see Table 1), a deviation of 2.93% seems relatively small. In addition, it is not clear from the perspective of the corporate takeover market that buying back an extra 2.93% of shares outstanding, will serve as a deterrent against takeover attempts. The two-stage approach leads to more economically meaningful results compared to the approach Ditmar (2000) used. However, to what extent the OMSR is used as a deterrent against takeover attempts is questionable. Overall, the answer to the hypothesis yes, firms with increased levels of takeover probability repurchases more shares on the open market.

[19] Calculation: Coefficient of table 5 * (95th – 5th percentile) = 0.2787* (0.115 – 0.01) = 2.93%

Table 6. Repurchases Estimation (Tobit, Robust SE)

	OMSR	OMSR	OMSR	OMSR
	(1)	(2)	(3)	(3)
TO_ANNOUNCE	0.1102***			
	(0.0241)			
TOPROB_ANNOUNCE		0.2787***		
		(0.0854)		
TO_COMPLETE			0.1802***	
			(0.0323)	
TOPROB_COMPLETE				0.1440
				(0.1168)
CASHDIV	-0.0087	-0.0078	-0.0091*	-0.0080
	(0.0055)	(0.0063)	(0.0055)	(0.0058)
FCF	0.1194**	0.1251***	0.1166**	0.1261***
	(0.0469)	(0.0391)	(0.0485)	(0.0423)
ROE	-0.0044	-0.0001	-0.0039	-0.0002
	(0.0127)	(0.0093)	(0.0117)	(0.0105)
SALESGR	-0.0260***	-0.0236***	-0.0270***	-0.0238***
	(0.0092)	(0.0087)	(0.0086)	(0.0081)
LEVBIA	-0.0351	-0.0451**	-0.0345*	-0.0339*
	(0.0234)	(0.0212)	(0.0181)	(0.0174)
TOBINQ	0.0006	0.0006	0.0006	0.0007
	(0.0005)	(0.0006)	(0.0007)	(0.0006)
SIZEA	0.0225***	0.0228***	0.0231***	0.0231***
	(0.0018)	(0.0023)	(0.0019)	(0.0020)
_cons	-0.3847***	-0.3934***	-0.3907***	-0.3919***
	(0.0265)	(0.0353)	(0.0267)	(0.0276)
sigma	0.2617***	0.2612***	0.2604***	0.2615***
	(0.0075)	(0.0068)	(0.0083)	(0.0068)
F	20.83***	20.74***	21.52***	20.43***
chi2	368.43***	303.52***	500.97***	331.50***
N	9386	9337	9386	9337

Standard errors in parentheses

* p<.10 ** p<.05 *** p<.01

6.3.6 ROBUSTNESS CHECKS TOBIT MODEL

Billet and Xue (2007) specify that with the presence of heteroskedasticity or non-normality in the error terms, the Tobit model may reproduce inconsistent coefficients. To check for heteroskedasticity, I use the methodology of the paper of Drukker (2002). He proposed to run the Tobit regression with different SE terms. Bootstrapping is a method used to calculate different SE. The next step is to run the Tobit model with the bootstrap SE. Appendix 6 displays the Tobit regression with bootstrap error terms. Compared to Table 5, one can see that the betas and significance of the coefficients do not vary, however the t-stats differ. The significance level does not change in the bootstrap Tobit model. Appendix 4 presents the bootstrap outcomes for robust and bootstrap SE. When the value of the Langrangian Multiplier (LM) is above the critical values (CV) of the significance level, the null hypothesis is rejected for homoskedasticity. Appendix 4 shows that the LM values surpass the critical value for all tests. The Tobit model is heteroskedastic for all three types of SE.

7. CONCLUSION, LIMITATIONS AND FURTHER RESEARCH

The last chapter will start with a brief conclusion of the thesis, in which I will elaborate on the main findings of the research. Section 7.2 provides the limitations of this study and will provide the reader with recommendations for further research in the future.

7.1 CONCLUSION

The aim of this thesis is to examine the ex-ante takeover deterrent effect of OMSR in the period 2012-2018, shortly after the Financial crisis of 2008. The sample period is interesting, since this period was marked by low interest rates, which made it relatively cheap to obtain debt and fund potential share repurchase programs. By re-examining the results of Billet and Xue (2007) two decades after their paper was initially published, I expected that nowadays stronger outcomes would be generated. Firstly, the takeover probability of a firm was measured and this estimate was implemented in the second stage, which examined the deterrent hypothesis of OMSR.

The Probit regression in the first stage examined the takeover probability of the firms in the sample. The results showed that firm's takeover likelihood is positively influenced by higher levels of tangible assets, increased levels of industry adjusted returns on assets, industry adjusted leverage ratio and M&A activity within the same industry. ROA is used as a proxy for management efficiency and it is therefore noteworthy to see that better performing management experience higher levels of takeover likelihood. is contradicting previously found estimates. On the other hand, negative coefficients are found for sales growth, which is the inverse of what was expected. Firms with higher growth opportunities are commonly seen as attractive targets and is therefore interesting to see a negative effect on takeover probability in this research.

After defining the takeover probability, the estimates are used to derive the takeover probability variable. This variable is used to test, whether the ex-ante takeover probability influences the OMSR decision. An increase of 2.93% additional share repurchases is found with regard to firms which experience increased takeover threat and subsequent repurchase activity. The takeover dummy that indicates if firm actually received a takeover bid at t-1 or in the given year shows that firms which are actual targets repurchases 11.02% more shares. This effect is far above the previously found effect of this dummy variable. With regard to other explanatory motives of share repurchases derived from previous literature, this research also found new evidence. In the sample period, sales growth is shown to decrease OMSR activity. The effect of this variable was not yet examined in previous literature. It may indicate that growing firms do not invest in repurchases but preserve their funds to invest in other projects.

To conclude, this study finds evidence for the takeover deterrent hypothesis of OMSR. The explanatory effect of the takeover probability on firm's share buyback value is economically limited. Following the research to test the hypothesis, I can only answer the research question to a certain extent.

The results show there are several motives for firms to buy back shares and it is not possible to allocate one single factor to the repurchase decision.

7.2 LIMITATION AND FURTHER RESEARCH

First of all, the sample data is retrieved from various number of databases which contain a variation of identification numbers. Some of the data was manually adjusted to firms, which made it possibly more prone to make mistakes. Furthermore, as explained in section 4.1.1 the actual repurchases data is obtained from a raw database. Phyton codes were used to retrieve the 10-K and 10 Q fillings from EDGAR database. For some of the fillings, the codes were not able to find the respective repurchases specifications and these fillings needed manual inspections. Most of the variables used in the data set contained spurious outliers. I used the Winsor approach to address the possible problems, arising with these extreme values. Nevertheless, the findings of the Tobit model should be carefully interpreted. This is mainly due to the heteroskedasticity measured in the Tobit model. The robustness checks reject the hypothesis of homoskedasticity for all types of checks. To overcome the specification concerns of the Tobit model, Billet and Xue (2007) use the Censored Quantile Regression. However, after applying this test to my data set, Stata shows an error, which displays: “Convergence not achieved”. This concern makes the test not fully reliable.

It could be particularly interesting to examine if the corporate life cycle has influence on the deterrent effect of OMSR. Dividing firms into different groups to examine the deterrent hypothesis could be an avenue for further research. In this study growing firms and R&D intensive firms executed less buyback programs. However, for large and mature firms the findings could be different.

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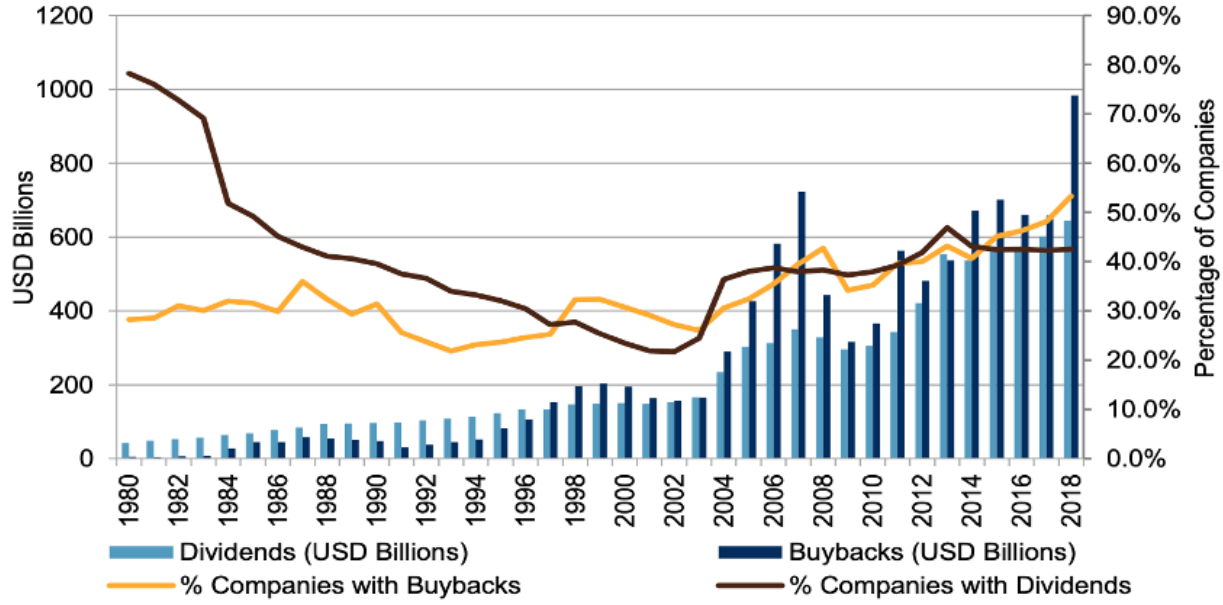
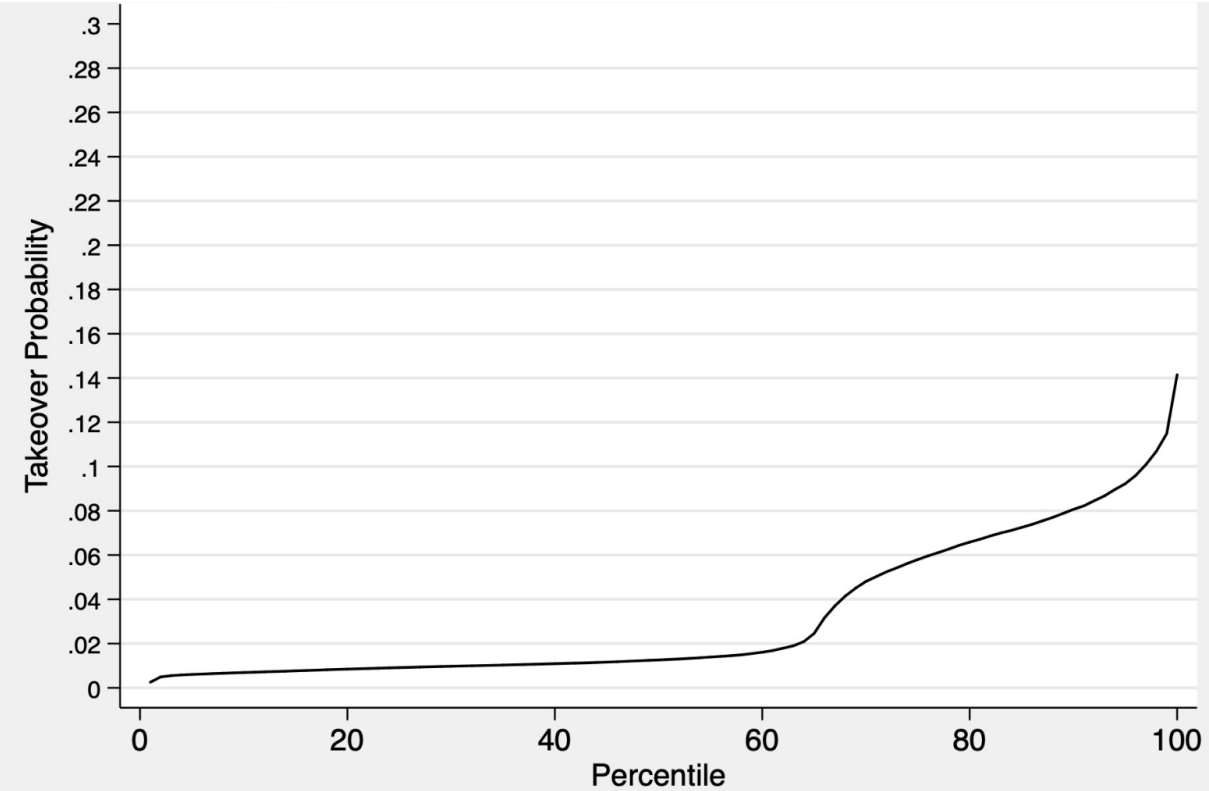
9. APPENDIX

APPENDIX 1. ZENG, L., LUK, P. (2020). EXAMINING SHARE REPURCHASING AND THE S&P BUYBACK INDICES IN THE U.S. MARKET. S&P DOW JONES INDICES LCC



Source: S&P Dow Jones Indices LLC, Compustat. Only listed companies with fundamental data available in Compustat are calculated. Data as of fiscal year-end from 1980 to 2018. Dividend and buyback data may include the amount paid for preferred shares. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

APPENDIX 2. ESTIMATED TAKEOVER PROBABILITY COMPLETE DATA



APPENDIX 3. TOBIT MODEL WITH R&D INTENSITY

Table 7. Repurchases Estimation with R&D (Tobit, Robust SE)

	OMSR	OMSR	OMSR	OMSR
	(1)	(2)	(3)	(4)
TO_ANNOUNCE	0.1115***			
	(0.0340)			
TOPROB_ANNOUNCE		0.4089***		
		(0.1255)		
TO_COMPLETE			0.1950***	
			(0.0452)	
TOPROB_COMPLETE				0.4125**
				(0.1734)
CASHDIV	-0.0138	-0.0141	-0.0140	-0.0140
	(0.0095)	(0.0096)	(0.0094)	(0.0096)
FCF	0.2004***	0.2087***	0.1985***	0.2128***
	(0.0570)	(0.0541)	(0.0570)	(0.0543)
ROE	-0.0005	-0.0008	-0.0001	-0.0010
	(0.0149)	(0.0150)	(0.0151)	(0.0150)
SALESGR	-0.0304***	-0.0295***	-0.0315***	-0.0308***
	(0.0114)	(0.0112)	(0.0115)	(0.0113)
LEVBIA	-0.0310	-0.0547*	-0.0292	-0.0460
	(0.0333)	(0.0311)	(0.0331)	(0.0311)
TOBINQ	0.0010	0.0013	0.0009	0.0013
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
SIZEA	0.0269***	0.0271***	0.0273***	0.0288***
	(0.0032)	(0.0032)	(0.0032)	(0.0031)
RD_TA	0.0297	0.0463	0.0284	0.0502
	(0.0620)	(0.0613)	(0.0619)	(0.0613)
_cons	-0.4473***	-0.4644***	-0.4526***	-0.4799***
	(0.0474)	(0.0466)	(0.0475)	(0.0460)
sigma	0.2700***	0.2692***	0.2683***	0.2695***
	(0.0107)	(0.0108)	(0.0106)	(0.0108)
F	16.37***	17.29***	16.72***	17.11***
chi2	249.27***	357.23***	310.46***	256.32***
N	4924	4910	4924	4910

Standard errors in parentheses

* p<.10 ** p<.05 *** p<.01

APPENDIX 4. ROBUSTNESS CHECK - STANDARD ERRORS

Table 8. Bootstrap values

	LM	CV 10%	CV 5%	CV 1%
ANNOUNCE Bootstrap with First Stage	4456.4	2.503	3.727	5.571
COMPLETE Bootstrap with First Stage	4476.3	2.783	3.902	6.736
ANNOUNCE Bootstrap without First Stage	4452.8	2.591	4.407	8.302
COMPLETE Bootstrap without First Stage	4431.7	2.535	3.814	5.999
ANNOUNCE Robust with First Stage	4456.4	2.877	3.652	6.748
COMPLETE Robust with First Stage	4476.3	2.599	4.350	6.878
ANNOUNCE Robust without First Stage	4452.8	2.925	4.194	6.447
COMPLETE Robust without First Stage	4431.7	3.203	4.164	8.572
ANNOUNCE Bootstrap with RD and First Stage	2158.8	2.766	4.203	6.807
COMPLETE Bootstrap with RD and First Stage	2162.5	2.520	3.754	6.158
ANNOUNCE Bootstrap with RD and No First Stage	2156	3.436	4.302	9.376
COMPLETE Bootstrap with RD and No First Stage	2135.4	2.898	3.888	7.051
ANNOUNCE Robust with RD and First Stage	2158.8	2.486	3.706	6.459
COMPLETE Robust with RD and First Stage	2162.5	2.498	4.077	8.370
ANNOUNCE Robust with RD and No First Stage	2156	2.888	4.606	7.606
COMPLETE Robust with RD and No First Stage	2135.4	2.849	4.277	6.578

*All Bootstraps have 499 replications.

APPENDIX 5. TOBIT REGRESSION WITH BOOTSTRAP ERROR TERMS.

Table 9. Repurchases Estimation (Tobit, Bootstrap SE)

	OMSR	OMSR	OMSR	OMSR
	(1)	(2)	(3)	(4)
TO_ANNOUNCE	0.1102***			
	(0.0241)			
TOPROB_ANNOUNCE		0.2787***		
		(0.0854)		
TO_COMPLETE			0.1802***	
			(0.0323)	
TOPROB_COMPLETE				0.1440
				(0.1168)
CASHDIV	-0.0087	-0.0078	-0.0091*	-0.0080
	(0.0055)	(0.0063)	(0.0055)	(0.0058)
FCF	0.1194**	0.1251***	0.1166**	0.1261***
	(0.0469)	(0.0391)	(0.0485)	(0.0423)
ROE	-0.0044	-0.0001	-0.0039	-0.0002
	(0.0127)	(0.0093)	(0.0117)	(0.0105)
SALESGR	-0.0260***	-0.0236***	-0.0270***	-0.0238***
	(0.0092)	(0.0087)	(0.0086)	(0.0081)
LEVBIA	-0.0351	-0.0451**	-0.0345*	-0.0339*
	(0.0234)	(0.0212)	(0.0181)	(0.0174)
TOBINQ	0.0006	0.0006	0.0006	0.0007
	(0.0005)	(0.0006)	(0.0007)	(0.0006)
SIZEA	0.0225***	0.0228***	0.0231***	0.0231***
	(0.0018)	(0.0023)	(0.0019)	(0.0020)
_cons	-0.3847***	-0.3934***	-0.3907***	-0.3919***
	(0.0265)	(0.0353)	(0.0267)	(0.0276)
sigma	0.2617***	0.2612***	0.2604***	0.2615***
	(0.0075)	(0.0068)	(0.0083)	(0.0068)
F	20.83***	20.74***	21.52***	20.43***
chi2	368.43***	303.52***	500.97***	331.50***
N	9386	9337	9386	9337

Standard errors in parentheses

* p<.10 ** p<.05 *** p<.01