ERASMUS UNIVERSITY ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS
MSc Economics & Business
Master Specialisation Financial Economics

Effects of share repurchases as a tool to deter takeovers

Master Thesis

Author: N. IJsselstein
Student number: 481441
Thesis supervisor: Y. Li
Second assessor: Dr. Jan Lemmen
Finish date: December 2021

Abstract

This research focuses on the effects of using share repurchases as a takeover deterrence by target companies. The goal is to determine if targets make share repurchases to deter a takeover and study the impact on acquirer profitability, acquisition price and acquisition size. This paper examines this for a sample of 7,273 NYSE, AMEX, and NASDAQ listed companies in the United States with observations from 2004 to 2019. The data of this sample is collected from Compustat, Thomson One and a proprietary database on actual monthly share repurchases. With panel regressions it is found that targets in the United States buy back shares to deter takeovers at an economically significant level. It is found that this behaviour lowers the acquisition price and increases acquirer profitability, however the latter effect is cancelled out by regular buybacks. Possible consequences of these findings are targets using different subsequent takeover defences and acquirers selecting targets with this defence. Non-parametric tests show a strong relationship between acquisition size and takeover deterring behaviour with suggestive evidence of the importance of toeholds.

JEL Codes: **G00** (General Financial Economics), **G34** (Mergers, Acquisitions, Restructuring, Corporate Governance), **G35** (Pay-out Policy)

Preface and acknowledgements

After months of hard work, I am proud to say I have finished my Master's programme with this thesis. This marks an end to my studies at the Erasmus University in Rotterdam. I am grateful for all the great teachers and students I met during my years at the university. I want to thank my family and friends for their continuous support during my Bachelor's and Master's degrees. I also want to thank my supervisor, Amy, for her valuable feedback on the thesis.

Table of contents

List of Tables and Figures

Tables

Figures

1 Introduction

Limited partners continue to inject additional capital into the mergers and acquisitions (M&A) industry, more than the general partners can find a use for (Bain & Company private equity report 2021). Global capital devoted to private equity that is not spent, dry powder, keeps seeing record levels with a total of nearly $3 trillion in 2020. So far, there seems to be limited evidence that this increasing dry powder pressures funds into doing more deals. We do however see increasing deal multiples for leveraged buyouts over the last couple of years. This results in a larger need to find growth opportunities for investments. Both the expanding search for growth and record levels of dry powder can increase the likelihood of being part of M&A activity, especially in innovative industries. These developments underline the rising importance of private equity for all businesses and make research in this area valuable.

It is well documented that a lot of M&A activity results in poor returns because of CEO overconfidence (see Ben-David, Graham and Harvey (2013) and Malmendier and Tate (2005)). Managers either have too optimistic expectations or have too much confidence in their own forecasts, both producing low returns. Next to that, there are several other reasons for negative performance in mergers and acquisitions. For example, Weber and Camerer (2003) find in an experimental setting that differences in the culture of companies involved in a merger negatively impacts performance. Given these negative effects, some target companies may employ takeover defences to become less attractive for M&A activity. Field and Karpoff (2002) explain that the main reason for using these defences for initial public offerings is related to managerial compensation. They empirically find for US incorporated firms with takeover defences that managers want to keep their control benefits and the defences are not associated with higher premiums. This agency problem shifts the costs of the takeover defence towards the regular shareholders. This is corroborated by Subramanian (2003), takeover defences do not result in higher premiums. Subramanian also notes that management with company control accepts lower premiums in return for individual benefits, this confirms the aforementioned agency problem.

Agency problems in combination with a potentially higher likelihood of being part of M&A activity results in a setting where takeover defences need comprehensive research. One example of a simple takeover defence is a share repurchase, a company buying back shares can be a credible signal by management that the share price is too low. Energy giant BP saying that it will do everything to get investors back on board after a tough year and initiating a share repurchase program is a recent example of this (Financial Times, 2021). Cases such as Unitrin Inc. versus American General Corp. and Unocal Corp. versus Mesa Petroleum Co. demonstrate the legal grounds of stock repurchases as a takeover defence which illustrates the potential as a takeover deterrent.

How share repurchases can be used as a takeover defence is explained in Dittmar (2000). Her paper identifies that with stock repurchases the price of the target company is raised because a stock repurchase is a credible signal that increases the average reservation value of the stock. The reservation value of a stock is the lowest price an investor would sell his shares for. With stock repurchases, this value increases because the company buys back stocks with the lowest reservation value. Dittmar also states that in a period with a lot of M&A activity, firms are more likely to make more share repurchases. Ever since the research of Dittmar, merger waves are still present as we can see in Figure 1.

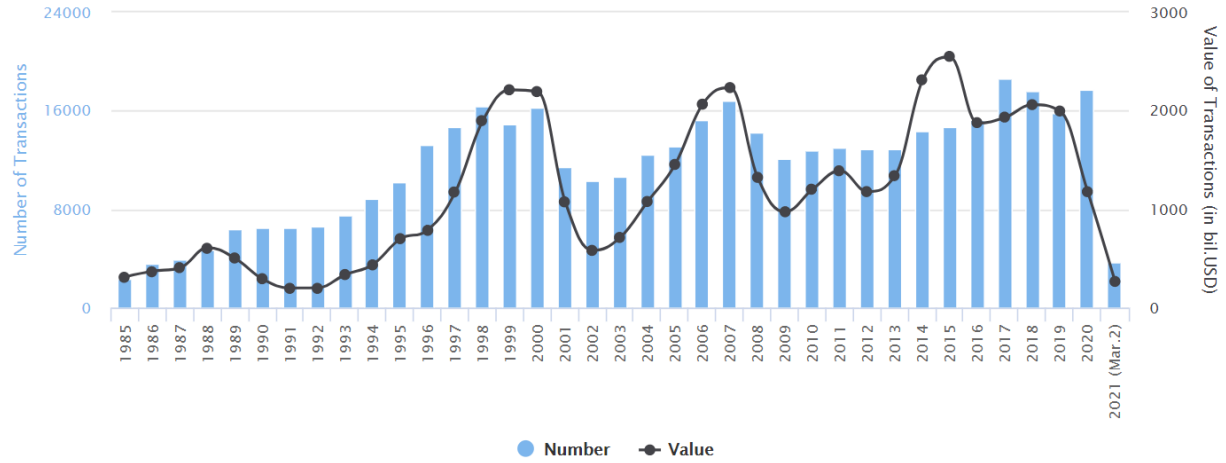

Figure 1: Number and value of mergers and acquisitions in North America from 1985 onwards.

Source: IMAA institute

Dittmar found that firms between 1977 and 1996 indeed repurchase stocks to avoid takeovers and this relation depends on the activity of the takeover market. It is interesting to see whether these findings are still relevant decades later because of high merger activity and even record levels in recent years. This research will analyse how share repurchases are used as a tool to deter takeovers by a target company. If share repurchases are indeed found to be a takeover deterring tool, it is interesting to consider the consequences for parties on the other side of the transaction, the acquirers. Next to profitability, both transaction price and acquisition size will be analysed to study the impact of the takeover deterrent effect of share repurchases.

While mergers and acquisitions are executed to improve the firm through synergies, it is not typically profitable to acquire another company. As mentioned earlier, elements such as overconfidence and different company cultures are at play causing a possible decline in profitability. Increased reservation values can result in higher transaction prices or a smaller acquisition size. Humphery-Jenner and Powell (2011) find that Australian acquirers increase their profitability with acquisitions and are not affected by takeover defences in the form of larger firms. This indicates that both acquisition size and price might be

unrelated to takeover defences, but it can still result in higher profitability. Humphery-Jenner and Powell also note that US firms have effective takeover defences, therefore it is interesting to study the impact on profitability in this study that is focussed on companies listed on exchanges in the United States.

Both the relationship between share repurchases and takeovers of target companies and acquirer consequences will be researched for listed companies on NYSE, AMEX, or NASDAQ from 2004 to 2019. This results in the following research question:

What are the effects of using share repurchases as a takeover deterrence for target companies and acquirers between 2004-2019?

To answer this question, multiple quantitative hypotheses will be tested. Firstly, they will research if target companies indeed try to deter takeovers by repurchasing their own shares before the takeover. Secondly, they will study the consequences for the acquirers through profitability, acquisition price and the size of the acquisition. These hypotheses will be discussed in more detail in the following chapters. All hypotheses will be answered with data from Compustat, Thomson One and a proprietary database on share repurchases. Using this data, panel regression models and non-parametric tests will be used to study the effect of M&A activity on share repurchases. The exact models and tests are described in the methodology.

This research question is relevant in the light of recent record levels of M&A activity as can be seen in Figure 1. With managers suffering from traits like overconfidence, firm value is likely being destroyed with all these activities. Therefore, it is important to see if some companies are actively trying to deter these takeovers and prevent possible value destruction. At the same time, if managers are actively increasing share repurchases to deter takeovers, it can reveal an agency problem. This is the case when managers want to keep personal compensations and are not acting in the principal's best interest. As noted earlier, takeover defences seem unrelated to higher takeover premiums which would be their best interest. This way, the costs of the defence can be shifted towards the regular shareholders reducing their return. However, share repurchases themselves have a positive impact on shareholders. A share repurchase contains favourable information for the shareholders and leads to positive announcement returns (Van der Sar, 2018). It conveys positive developments on future earnings and decreases risk for the shareholder. Share repurchases also decrease agency costs by constraining management and forcing higher operating performance. It is interesting to see how these conflicting dynamics work when share repurchases are used as a takeover defence. This research can help to better understand the relationship between these takeover deterrents and share repurchases. Next to that, this research contributes to

discovering the consequences for acquirers. All these aspects affect shareholder value making this research relevant for all shareholders.

The phenomenon of share repurchases as a takeover defence has been studied in several papers before. Dittmar (2000) studies the reasons why firms make stock repurchases and analyses all available reasons together to see how the motives correlate and which ones are important. This research will continue this work by looking at the importance of the merger deterrence hypothesis while still controlling for other explanations. Next to that, this research uses more recent data and a different methodology, so it is useful to see if the same relations still hold. Bagwell (1991) showed with a mathematical model under what conditions share repurchases effectively increase costs for the acquirer. This research uses quantitative methods that empirically test the outcomes of Bagwell's model which adds to the literature. Billett and Xue (2007) took a different approach in studying this relationship by modelling the takeover probability as a latent variable. It is discussed that there are some problems with model selection. There are unreliable estimates of the Tobit model and there are contradicting results with another model. Therefore, this research can contribute to finding the right direction of the relationship between share repurchases and takeover defences.

Separate academic literature discusses the consequences of mergers and acquisitions for acquiring firms. In general, it is found that bidders do not profit from buying listed companies (Mantecon, 2008). According to Bhagat et al. (2005), traditional measures indicate overpayment by bidders, but improved methods present an insignificant relationship. This study adds to the literature by checking this relationship within the environment of takeover defences. Firms that use a takeover defence in the form of share repurchases can have more value than others since management wants to protect the company. There is little research on the use of share repurchases as a takeover defence and the impact on transaction price, this paper adds to this and the overall literature of takeover defences. To the best of my knowledge, no research has been done on studying the implications of a takeover defence in the form of share repurchases on the acquisition size, adding to the overall M&A literature.

This paper will continue as follows. Chapter 2 discusses the main findings of relevant literature; this provides testable hypotheses to answer the research question. Chapter 3 presents the data to answer these hypotheses and the research question. Chapter 4 explains the different methodologies to analyse the data. Chapter 5 presents the results of the analyses. Finally, chapter 6 concludes these findings and includes room for discussion.

2 Literature

The introduction points out the possible takeover deterrent effect of share repurchases from previous research and theories. Multiple hypotheses will be empirically tested and will collectively provide an answer to this question. Firstly, the definition of share repurchases, and a takeover defence will be discussed since these are crucial concepts for this research. After the definitions are clear, several hypotheses are presented backed by academic literature.

2.1 Definitions

2.1.1 Share repurchase

With plenty of previous research on share repurchases, different definitions of share repurchases have been used within the context of being a possible takeover deterrence. Billett and Xue (2007) define the repurchase variable as "the annual amount of actual open market repurchases divided by the market value of common equity". The number of open market shares was retrieved from Compustat from data item 'purchases of common and preferred stock' which are then corrected for other repurchases. Lin, Stephens, and Wu (2014) look at open market share repurchase announcements from the SDC Mergers and Acquisitions database and use percentage shares repurchased as their independent variable. Dittmar (2000) also uses altered data from Compustat but defines the repurchase variable somewhat different as a dollar volume. For this research, the latter definition is the best suited given that regression models are used instead of Tobit models, and it matches the available data the best.

2.1.2 Takeover and takeover defence

A takeover defence can be defined as all actions in place on either a firm-level or regulatory level to prevent a takeover. Takeover defences come in many forms and can be arrangements, provisions, clauses, or requirements that are put into place. Field and Karpoff (2002) identify 10 types of defences where a blank check preferred stock is the most popular method. This form is about unissued preferred stock that can be issued to friendly parties. To identify if this defence was successful, Dittmar (2000) identifies a takeover with a dummy variable that equals one if the firm is a target of a takeover attempt or is involved in a takeover rumour in the same year of the repurchase or one year earlier. Billett and Xue (2007) also identify dummy variables including the definition of Dittmar, but they also look at an industry takeover dummy and a takeover dummy used for measuring takeover probabilities. Given the nature of this research, the definition and measurement of Dittmar will be used to measure takeovers. This definition relates to the definition of share repurchases since these can be used as a defence which is the key element of this paper.

2.2 Alternative explanations for a share repurchase

There are many reasons besides a takeover deterrence why a company might buy back shares. It is important to control for the other explanations, so the estimated effect of a takeover defence is unbiased. At the same time this can reveal other important effects and allows for comparison between studies.

2.2.1 Excess capital

Successful companies generate yearly free cash flows that can be spent by management. Free cash flows are part of the capital above the necessary funds to achieve optimal growth for the firm (Jensen, 1986). Management can choose to store this capital within the firm as reserves or provisions to cover unfavourable and unexpected future events. Next to that, management can also distribute this capital to shareholders with share repurchases or additional dividends. The higher the free cash flows and resources under control by management, the larger the agency conflict between shareholders and management, increasing related costs (Jensen, 1986). Reducing free cash flows and agency costs with share repurchases is preferred given the additional flexibility for the firm (Jagannathan, Stephens & Weisbach, 2000). To control for firms making repurchases to reduce their agency costs, the model considers the cash flow and cash levels of the firm. Firms are increasingly making more share repurchases instead of giving out dividends indicates some interchangeability (Grullon & Michaely, 2002). To control for this, the dividend pay-out ratio is also added to the model.

2.2.2 Undervaluation

According to the market timing hypothesis, firms will increase their share repurchases following poor returns (Bozanic, 2010). These poor returns cause managers to believe their stock is undervalued when compared to the intrinsic firm value, this leads to an increase in share repurchases. Bozanic (2010) finds that perceived undervaluation is important for explaining the timing of share repurchases. Management anticipates that the firm value will approach the intrinsic value because of this credible signal. Additionally, increasing the average reservation value, share repurchases are followed by abnormal stock returns (Chan, Ikenberry & Lee, 2007). This confirms the anticipation of management and proves that managers can time the market. Smaller firms are more likely to be undervalued because of less investor scrutiny. Investment opportunities, as measured by the market-to-book ratio, can correlate to undervaluation. This follows from the abnormal returns of value stocks as described in the Fama and French three-factor model. With the control variables size and market-to-book ratio, the model incorporates this alternative explanation.

2.2.3 Optimal leverage ratio

Managing the excess capital of a company also adjusts the leverage ratio. With share repurchases, equity levels are lowered, driving up the leverage ratio. The value of a firm with an optimal leverage ratio is 5,5% higher than the same firm without leverage (Korteweg, 2010). This indicates the importance of managing the capital structure. Given that the leverage ratio can be altered with share repurchases, some managers might use them as a tool to achieve their optimal leverage ratio. This strategy is only useful for firms that have a too low leverage ratio at the time of the repurchase. To control for this strategy, the model incorporates the total leverage ratio of the firm.

2.2.4 Management incentive

Employee stock options (ESOs) are often offered to key employees and management to align interests and reduce agency costs. When management holds stock options, they will act in favour of the firm and are disincentivised to make personal gains. With stock options in play, the share price of the firm becomes important for management since a significant part of their compensation stems from these options. If the firm needs to distribute excess cash to its shareholders, managers with options will prefer share repurchases. This is because share repurchases do not dilute the share price while dividend pay-outs do dilute the share price. Bens, Nagar, Skinner & Wong (2003) find that this diluting effect explains the choice for a repurchase. Therefore, the model should control for options held by management by including the percentage of stock options over the total number of shares outstanding as a control variable.

2.3 Hypotheses

2.3.1 Hypothesis 1

From previous parts, it becomes clear that the paper of Dittmar in 2000 is influential within this line of research. For the first hypothesis, the direction of the relationship between share repurchases and M&A activity is central. Dittmar (2000) finds for all unregulated listed firms between 1977 and 1996 that firms indeed make more stock repurchases to avert takeovers. In further analysis, it was found that the marginal effect of preventing takeovers is significant but has little consequences for stock repurchases. From this, we can infer that the relationship between share repurchases and being a target of M&A activity will be positive. However, it is important to note that the data for this paper is more recent and can therefore possibly reveal different results so, other reference papers are discussed.

Billett and Xue (2007) study this relationship for all firms listed on either NYSE, AMEX, or NASDAQ between 1985 and 1996 for firms with relevant data available and excluding the financial industry, utilities, low share prices and low total assets. They find that if there is a high takeover probability, share repurchases

increase and the impact of the perceived threat of a takeover and share repurchases is large, indicating a positive relationship and confirming the study of Dittmar.

Next to empirical studies, other papers describe a theoretical model where share repurchases can be used as a takeover deterrence. Bagwell (1991) demonstrates that it is possible to use repurchases as a defensive strategy in answer to a possible takeover which reassures the positive relationship that was found earlier. Similarly, Bagnoli, Gordon and Lipman (1989) prove with a model that by signalling private information using share repurchases, it can act as a takeover defence.

Taking all the findings of these papers together results in the following hypothesis indicating that firms use share repurchases as a tool to deter takeovers:
H1: *Firms increase their share repurchases when they are the target of M&A activity.*

2.3.2 Hypothesis 2

The second hypothesis considers the consequences for the acquirers if target companies indeed deter takeovers with share repurchases. Humphery-Jenner and Powell (2011) analyse the Australian market where takeover defences are not allowed. As mentioned in the introduction, the paper finds that acquirers increase their profitability when making M&A deals. In the United States, the relevant region for this research, there are takeover defences in place which have downward pressure on the acquirer's profitability since some efficiency in the takeover market is lost. Singh and Mogla (2010) describe that less than one-third of the acquirers enhanced their profitability with a merger. This result is mainly driven by inadequate handling of the additional assets. For the most part, acquirers with a lot of M&A activity underperform, but if successful, the impact on profitability is substantial (Hogarty, 1970). Overall, these findings indicate a negative relationship between profitability and making M&A deals especially with takeover deterring behaviour.

However, there is some additional literature weakening this statement. Kallunki, Pyykkö & Laamanen (2009) explain that acquirers that are oriented in the technology sector increase profitability. This demonstrates that the industry of the acquirer can be critical for the direction of the relationship. More recent research by Liu, Sono & Zhang (2019) reveal that firms with higher initial profitability experience better stock returns after acquiring another company. They also mention that the more profitable firms are less likely to buy targets, this demonstrates that doing more acquisitions typically is not superior.

These papers imply an overall negative relationship between profitability and the acquirer making deals, especially after controlling for industry. With firms actively using takeover defences such as share repurchases, the relationship would be even stronger given the reduction in market efficiency, so the relation depends on the use of share repurchases. Although Kallunki et al (2009) and Liu (2019) find positive effects in some cases the hypothesis is as follows:

H2: *Share repurchases made to deter takeovers decrease acquirer profitability.*

2.3.3 Hypothesis 3

As stated in Dittmar (2000), the reservation value of the stock increases with share repurchases. We would expect that higher reservation values result in higher transaction prices and deal values because the average reservation value of a share has been increased. This hypothesis will study the impact of share repurchases as a takeover defence on the acquisition price paid by the acquirer.

Heron and Lie (2006) describe that poison pills increase the bargaining power of the target. Poison pills are takeover defence strategies where a firm tries to hinder acquirers by diluting the shares or by giving more rights to management. The additional bargaining power that comes with these poison pills predicts that a target can achieve a higher deal value than normal. On the other hand, defensive share repurchases do not come with a higher premium (Heron and Lie, 2006). Proposed arguments for this include the change in capital structure from the repurchase increasing firm value or targets use defensive share repurchases in reply to intrinsically low premium offers. To summarize Heron and Lie, there is an insignificant relationship between acquisition price and the use of takeover defences by targets in the case of defensive repurchases.

Field and Karpoff (2002) study the impact of takeover defences for firms going public with an IPO. They find no relation between the premiums paid and the existence of defences. However, it was found that management creates takeover defences to protect themselves and their gains, igniting the agency problem. All in all, this confirms the findings of Heron and Lie (2006) with an insignificant relationship.

From all the above findings, it is expected that there is an insignificant relationship between takeover defences through share repurchases and transaction price. The third hypothesis that will be tested is as follows:

H3: *Deterring takeovers with share repurchases has no effect on the acquisition price.*

2.3.4 Hypothesis 4

The previous hypothesis argues that there is no significant relationship between having a takeover defence as a target and the price paid for the target. This means that acquirers do not systematically increase their bids in response to certain takeover defences. They might not assign any value to these defences and therefore choose not to increase their premium and favour defenceless targets. Takeover defences could also influence the perception of the takeover probability, Heron and Lie (2006) found a small decrease in takeover probability in response to defensive share repurchases. Even the threat of takeover defences impacts acquirers and targets (Berkovitch and Khanna, 1990). This points towards acquirers being cautious when takeover defences are in place. As a result, some might resort to acquiring a toehold of the target company instead of a full acquisition. A toehold is defined as the purchase of a small portion of the target with the intention of expanding this holding in the future. Acquiring a toehold is mainly popular for strategic reasons in the bidding process. This hypothesis studies if share repurchases as a takeover defence are related to the size of the acquisition.

Goktan and Kieschnick (2012) report that successful toehold bids have a smaller average percentage of ownership than unsuccessful ones. This indicates that smaller toeholds could be more successful and are used as a viable option, maybe in the light of takeover defences. Most toeholds in the study by Goktan and Kieschnick are defined as successful bids with a similar but reverse ratio when compared to other deal variables such as size, emphasizing the practicality of toeholds.

Strickland, Martin & Cotter (2010) point out that some takeover defences only activate when a firm buys more than a certain percentage of the outstanding shares. This limits the usage of toeholds which can reduce the chance of a successful bid. Acquirers could manage and manoeuvre around these takeover defences and gain the strategic advantage of the toehold without the interference of the defence. This could point towards a positive relationship between toeholds and takeover defences. Share repurchases to deter takeovers and increasing reservation values are possible examples of the phenomenon studied in this hypothesis.

With inadequate empirical findings regarding toeholds and share repurchases as a takeover defence, the relation is difficult to determine. The above literature confirms that acquirers are cautious when it comes to takeover defences, inducing the use of toeholds. Therefore, the last hypothesis is as follows:
H4: *Acquisition size depends on takeover deterrence through share repurchases.*

3 Data

3.1 Data description

The data that is necessary to conduct this research comes from different sources. First, a unique dataset of actual monthly share repurchases in the United States is used for information on share repurchases from NYSE, AMEX, and NASDAQ-listed companies. This data contains information on the number of shares repurchased together with the repurchase date. To determine if share repurchases can act as a takeover defence tool, data from Thomson One is used to receive insights into the mergers and acquisitions from companies at the relevant exchanges. This data is collected with several search criteria: from the entire database on mergers and acquisitions, select only the deals between 2004 and 2019, where the target has a public status and where the target is listed at one of the relevant exchanges.

The information of this M&A activity will be combined with the information of share repurchases of the same companies by merging the two separate datasets. Merging is done based on month, year, and CUSIP-code keeping only the correctly matched observations and observations from the repurchase dataset that could not be matched. CUSIP-codes are company identifiers which can be used to track a company throughout time. Merging is done by month because the share repurchases are based on monthly data as well. A drawback of merging the data is the loss of some merger and acquisition observations, this is the case where there are multiple deals in the same month and year for the same company. In these instances, the observations are treated like duplicates without unique identifiers and the most relevant observations are kept. This is done by manually analysing the observation based on missing information and size of the deal. Finally, with a dummy-variable *Takeover* we can indicate if there was a takeover and if share repurchases are related to this M&A activity.

Given the alternative explanations for share repurchases, additional data is needed to generate control variables. This data is collected from Wharton Research Data Services' Compustat and includes industry codes, performance measures, cash, investment opportunities, stock options where available and all other accounting data needed to complete the models. Compustat also provides information for other control variables used in separate models. Some of this information will be on a yearly basis so their values will remain constant over 12 months. This third dataset is then merged with the other combined dataset based on month, year and CUSIP-number keeping only the correctly matched observations.

3.2 Descriptive statistics

The result of merging these datasets is one large dataset that can be used to answer the research question and supporting hypothesis. This raw dataset has been adjusted for any extreme value. These extreme values and outliers could impact and bias the results, so they are removed before the analysis. The descriptive statistics for some key variables of this amended dataset are documented in Table 1.

Table 1: Descriptive statistics of US listed companies

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Takeover	765,139	0.019	0.14	0	1
Repurchase	559,219	2913.30	305,810.2	-405,919	140,000,000
Cashflow	752,728	-0.054	1.31	-91.64	8.83
Cash	765,139	0.21	0.24	0	1
Dividend pay-out	763,803	0.18	3.84	-217.29	300.48
Size	765,139	6.27	2.31	-6.91	15.07
Market-to-book	610,196	2.38	14.19	-770.76	716
Leverage	650,394	0.0024	1.68	-1	340

Table 1 illustrates that there are a total of 765,139 observations, this number originates from 7,273 different companies spread out over 16 years of monthly data. This table demonstrates that on average one in 50 observations of target companies has been in a takeover in the year of the share repurchase or the year before that. The average number of share repurchases (divided by total equity in millions) is 2913.30, the average share repurchase itself is 156,439.8. From the variable size it becomes clear that there are large companies in the sample with a value of 15.07 for the logarithmic assets. Some firms in the sample appear to be small when measured by their assets. We also see extreme values for the market-to-book ratio, this can also be explained by low asset values or large debt accounts. The number of observations clearly differ a lot for different variables, this is due to the data availability on the companies concerned. The missing values for certain companies could limit the scope of the research findings.

How these variables relate to each other is illustrated in Table 2. We see that a lot of the correlations are highly significant, and the effects are mostly small. The highest correlation is between size and cash with a value of -0.41, this is as expected. Larger companies have better access to capital markets and therefore have a lower cash/asset ratio (Opler et al, 1999). There appears to be no correlation between a company's dividend pay-out and the level of share repurchases (divided by equity).

Table 2: Correlation matrix for listed US companies

	Variable	1	2	3	4	5	6	7	8
1	Takeover	1							
2	Repurchase	0.01***	1						
3	Cashflow	0.018***	0.0015	1					
4	Cash	-0.037***	-0.0023*	-0.13***	1				
5	Dividend pay-out	0.0028**	-0.00	0.0074***	-0.015***	1			
6	Size	0.12***	0.0053***	0.26***	-0.41***	0.021***	1		
7	Market-to-book	-0.007***	0.0017	-0.26***	0.083***	-0.0005	-0.10***	1	
8	Leverage	0.0043***	0.0008	-0.28***	-0.18***	0.0032**	0.030***	-0.022***	1

*p<0.1, **p<0.05, ***p<0.01

As mentioned in the introduction, mergers and acquisitions often come in waves as a reaction to the dynamics of the economy and opportunities in the market. Figure 1 reveals how M&A activity dropped after the financial crisis of 2007-2008 and picked up again around 2014. The distribution of M&A activity throughout time for the sample is illustrated in Figure 2. There is a peak around 2008 after which it illustrates a negative trend in the number of deals completed. On the left side in Figure 2 we see a zoomed-in scatterplot of share repurchases over time. This scatterplot reveals how share repurchases seem to be constant over time. From this figure, there does not seem to be a correlation between the share repurchases of a target and the corresponding M&A activity on an aggregate level.

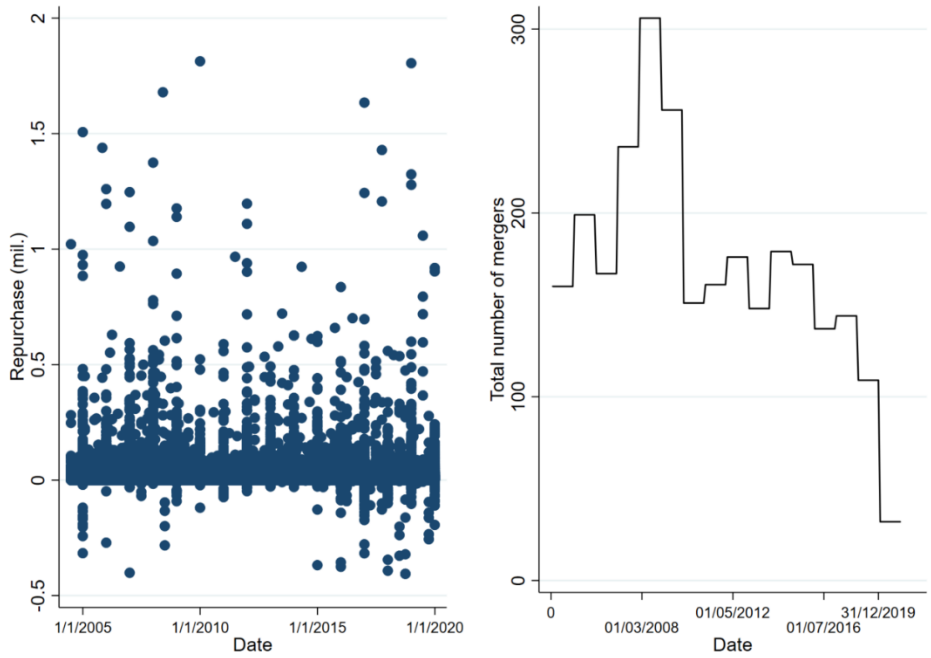

Figure 2: Zoomed-in scatterplot of share repurchases against time and Total number of mergers over time

Hypothesis 4 covers the relation between acquisition size and takeover defences through share repurchases. It is expected that the size of the transaction is related to the takeover itself because smaller deals present a lower risk profile for the acquirer. Figure 3 illustrates the histograms of the percentage of shares acquired and the transaction value. In this sample there seems to be a peak for both small deals and full mergers and acquisitions. We also see a peak at the low end of the value of a transaction which could indicate the importance of toeholds in the sample.

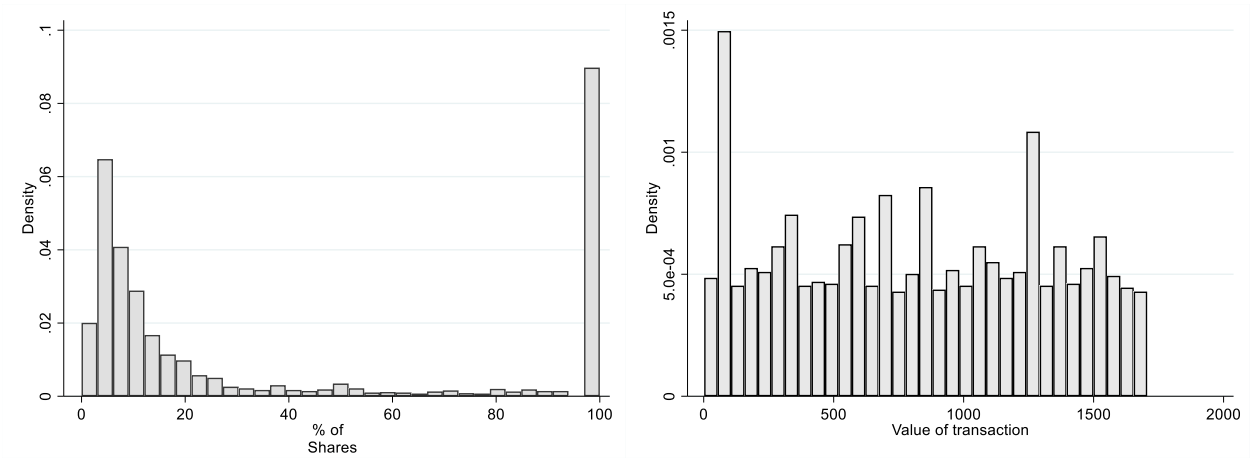

Figure 3: Histograms of the percentage of shares acquired and transaction value

3.3 Main assumptions of the models

Before using any regression model, the variables need to meet certain assumptions for the best unbiased estimators. The Gauss-Markov theorem provides the assumptions that are used to achieve these best unbiased estimators. The assumptions are: the absence of endogeneity, uncorrelated error terms and a zero conditional mean of the error term. Next to that we need to delete outliers in the data and be cautious of multicollinearity.

3.3.1 Endogeneity

Issues regarding endogeneity usually exist when not all relevant variables have been added to the model. If there are variables that correlate with the residual, the estimates will be biased. To solve endogeneity issues, additional variables need to be added so the correlation between the variables in the model and the residual disappears. This research uses the same control variables as other studies, therefore endogeneity due to missing variables is unlikely and all relevant variables are included in the models. Other causes of endogeneity such as simultaneity are also implausible, the takeover decision is a

comprehensive choice and acquirers will not make offers on each firm that does share repurchases since this is a common activity within a listed firm.

3.3.2 Correlation error terms

The second assumption of the Gauss-Markov theorem that needs to be met is the absence of correlation in the error terms. When there is correlation in the error terms one observation can predict the other, however independent observations are desired as this allows for accurate estimates of the models. This requirement is controlled for by using adjusted standard errors. The Wooldridge test for autocorrelation in panel data has a test value of F (1, 6161) = 0.811 and p-value of p = 0.3679. The null hypothesis of no first-order autocorrelation between Repurchase and Takeover cannot be rejected. However, there could still be some correlation left between observations that we need to correct for.

Firstly, the standard errors have been adjusted for the company-invariant effects. Because the same companies are observed over multiple years, it is also possible that there is explanatory power between observations. A Hausman test was conducted to determine if either random effects or fixed effects are suited best for all models. The Hausman test for Model 1 has a test value of $\chi 2(22) = 7.81$ with a p-value of p = 0.9976. The null hypothesis that the difference in coefficients under both effects are not systematic can therefore not be rejected and accordingly random effects are preferred.

Secondly, the standard errors have been adjusted for heteroscedasticity to make the correct inference from the coefficients. Robust standard errors are preferred since the standard errors change significantly when applying this modification, this hints towards heteroscedasticity. Plotting the predicted values against the residuals also reveals non-constant variance proving the presence of heteroscedasticity (see Figure 4 in 'Appendix').

Adjusting the standard errors for both heteroscedasticity and random effects makes correlated error terms improbable. Another measure to make sure there is no correlation in the error terms is adding variables to the model, this is not applicable because comprehensive models are used.

3.3.3 Zero conditional mean

Another requirement in the Gauss-Markov theorem is having a zero conditional mean error term. The regression commands of Stata automatically apply this assumption for their models. The histogram of the residuals visually illustrate that the average error term is indeed zero (see Figure 5 in 'Appendix'). This

finding is confirmed when analysing the residuals, summarizing this variable provides a mean of 0.0000105.

3.3.4 Outliers

Next to the requirements of the Gauss-Markov theorem, it also important to remove outliers from the data. These outliers can have a sizeable impact on the results, so some extreme values have been removed to achieve the correct estimates of the models.

3.3.5 Multicollinearity

Table 2 demonstrates the correlations between all relevant variables for companies listed on the major USA exchanges. This table reveals that most of the variables have a highly significant correlation with each other, this shows that the variables indicate to be related. From the correlation matrix it becomes clear that multicollinearity is not present in this dataset, all correlations are well off the maximum value of 1 and -1. The biggest correlation is between size and cash with a value of -0.41. Having correlations unequal to one is important to receive the correct coefficients in the regression models.

All assumptions from the Gauss-Markov theorem and additional tests have been checked for the other models as well.

4 Methodology

The data described in the previous chapter is used in several panel regression models to find answers to the hypotheses. In this paper, panel regressions are essential to finding proof for these hypotheses since one can use the fact that the firms in the sample have been observed over multiple years. In each panel model, both fixed firm and fixed time effects and their impact on the model will be examined. This way one can control for the differences between firms and a possible trend over time.

4.1 Hypothesis 1

The first hypothesis addresses the relationship between being a target firm of M&A activity and share repurchases. The number of share repurchases will be the dependent variable since we hypothesize that takeovers induce takeover deterring behaviour by buying back shares. Model 1 is the panel regression model for this hypothesis and has the following form:

$$\begin{aligned} Repurchase_{i,t} = {} & \alpha_{i,t} + \beta_1 * Takeover_{i,(t-1)} + \beta_2 * Cash_{i,(t-1)} + \beta_3 * Cashflow_{i,(t-1)} + \beta_4 \\ & * Dividend\ payout_{i,(t-1)} + \beta_5 * Size_{i,(t-1)} + \beta_6 * Market - to - book_{i,t} + \beta_7 \\ & * Leverage_{i,t} + \beta_8 * Stock\ options_{i,t} + \mu_{i,t}\ or\ \epsilon_{i,t} + \lambda_t + v_{i,t} \end{aligned}$$

The first variable is $Repurchase$, the targets total dollar volume of monthly share repurchases divided by total equity in millions. Where $Takeover$ is a dummy variable that equals one if the target company has been in a takeover in the year of the share repurchase or the year before. This variable is key for the first hypothesis since the direction of the coefficient and significance provides the answer. All other variables are included to control for an alternative hypothesis as explained in the literature review and follow the description given by Dittmar (2000). $Cash$ is the ratio of cash and cash equivalents in millions to the total value of assets in millions in the same year. The variable $Cashflow$ represents the cash available in the firm next to investments and is calculated as a ratio between the cash flow of the firm and the total value of assets in the same year. The cashflow is calculated as follows (all in millions):

$$Cashflow = EBIT + depreciation\ \&\ amortization + \Delta deferred\ items$$

The next variable, $Dividend\ payout$, is the ratio of cash dividends in millions given out by the firm to the net income also in millions in the same year. The variable $Size$ represents the size of the firm, this is measured by the natural logarithm of the yearly assets in millions. To control for possible undervaluation $Market - to - book$ is included, this variable depicts the market to book ratio of the firm. The market

value is derived from the Compustat data-item fiscal market value and the book value of the firm is the difference between the total assets and liabilities, all in millions. $Leverage$ is the leverage ratio of the firm as calculated by the ratio of a firm's net debt in millions to total assets in millions. Dittmar (2000) uses the difference between the current leverage ratio and the target leverage ratio of the firm to control for the optimal leverage hypothesis. Since this study uses regression analysis with fixed effects, we already control for the target leverage ratio of a firm. This is because the average firm in the industry approximates an optimal leverage ratio. This assumption is plausible because, on average, firms are using slightly less debt than they should (Korteweg, 2010). With market frictions it is conceivable that the average firm in an industry approximately has an optimal leverage ratio.

Information on management compensation for the variable $Stock\ options$ was unavailable in the data sources that were used. Therefore, this variable will be left out of any analysis, this also removes management incentive as an alternative hypothesis for share repurchases.

All models include fixed effects to control for otherwise unobservable or uncontrollable effects. Fixed firm effects are represented by either $\mu_{i,t}$ or $\epsilon_{i,t}$. If fixed effects are preferred, $\mu_{i,t}$ contains all the variables that affect $Repurchase$ cross-sectionally but are time invariant (Brooks, 2014). When random effects are preferred, $\epsilon_{i,t}$ is a random variable that varies cross-sectionally and does not vary over time. The models also include fixed time effects, denoted by λ_t. This is a time-varying intercept that combines all time-variant variables that affect $Repurchase$ but remain fixed cross-sectionally. These variables use an important characteristic of the data, multiple companies are observed over time. Controlling for both fixed firm and fixed time effects provides robust and unbiased estimates. No underlying trends in the data between companies or trends over the years can bias the models by including these effects. In all models $v_{i,t}$ is the remainder of the error term not explained by individual fixed or random errors.

4.2 Hypothesis 2

The second hypothesis studies the impact of M&A activity, and the use of share repurchases as a takeover defence on acquirer profitability. To study this effect, we use an extended model from Abor (2005). Abor finds that the leverage ratio, size, and sales growth are important determinants for the profitability of a firm. This model is extended by incorporating both information on M&A activity and share repurchases. The specification of Model 2 is as follows:

$$Profitability_{i,t} = \alpha_{i,t} + \beta_1 * Leverage\ ratio_{i,t} + \beta_2 * Size_{i,(t-1)} + \beta_3 * Sales\ growth_{i,t} + \beta_4 * Takeover_{i,(t-1)} * Repurchase_{i,(t-1)} + \beta_5 * Takeover_{i,(t-1)} + \beta_6 * Repurchase_{i,(t-1)} + \mu_{i,t}\ or\ \epsilon_{i,t} + \lambda_t + v_{i,t}$$

In this model, $Profitability$ is the acquirers return on equity and is calculated by dividing the earnings before interest and taxes (EBIT) in millions by the total value of equity in millions. $Leverage\ ratio$ is the total debt in millions of the acquiring firm divided by the sum of equity and total debt in millions. The variable $Size$ is the natural logarithmic of all assets, like the previous models. $Sales\ growth$ indicates the percentage change in sales when compared to the previous year. The other variables are also used in the other two models. They can reveal the impact of M&A activity on acquirers' profitability and how the effect depends on target takeover defences through share repurchases.

4.3 Hypothesis 3

The third hypothesis further studies the consequences for acquirers of share repurchases as a takeover defence; the transaction price. This hypothesis uses a model from Aharon, Gavious and Yosef (2010) who studied how M&A activity is affected by stock market bubbles. Model 3 is used to analyse important determinants of pricing in the M&A industry, it is altered to study the impact of share repurchases as a takeover defence by the target. The applied model is:

$$Price_{i,t} = \alpha_{i,t} + \beta_1 * Equity_{i,t} + \beta_2 * EBIT_{i,t} + \beta_3 * Negative_{i,t} + \beta_4 * R\&D\ expense_{i,t} + \beta_5 * Sales\ growth_{i,t} + \beta_6 * Takeover_{i,(t-1)} * Repurchase_{i,(t-1)} + \beta_7 * Takeover_{i,(t-1)} + \beta_8 * Repurchase_{i,(t-1)} + \mu_{i,t}\ or\ \epsilon_{i,t} + \lambda_t + v_{i,t}$$

For this model, it holds that $Price$ is the sale price of the target's equity in millions. $Equity$ is the total book value of equity in millions for the firm. The variable $EBIT$ depicts the earnings before interest and taxes in millions, the dummy variable $Negative$ is equal to one if there is a negative EBIT. $R\&D\ expense$ is the amount of research and development expenses in millions. Other variables are like previous models and are described earlier in this chapter. Lastly, all variables are deflated with the book value of equity like Aharon, Gavious and Yosef (2010), this means that the variable $Equity$ is equal to one. The dummy $Takeover$ in this model is always equal to one since there is only a relation between acquisition price and share takeover defences if there is M&A activity. The interaction term with $Repurchase$ then reveals how share repurchases as a takeover defence impact the acquirer's price.

4.4 Hypothesis 4

The final hypothesis looks at the use of toeholds when share repurchases are used as a takeover defence. It expects that toeholds are used when target firms are deterring takeovers with share repurchases. This hypothesis is tested with a categorical analysis, the Pearsons Chi-square test for independence can demonstrate it both variables are related. The two categorical variables are $Takeover$ and $Percentage\ acquired$. The variable $Takeover$ is the same dummy variable that can be seen in the other hypotheses and equals one if the target company has been in a takeover in the year of the share repurchase or the year before. $Percentage\ acquired$ is the second categorical variable which is the percentage of the total shares acquired by the acquirer with 10 categories, this implies steps of 10%. The smallest size group only has acquisitions where 10% or less of the total shares are acquired. An alternative of this variable is also used for robustness checks, here we use the percentiles at 10-point increments as thresholds. The smallest size group here is not based on individual percentages but has the 10% smallest acquisitions of the entire sample. The null hypothesis of the Pearsons Chi-square test for independence reads: there is no relationship between $Takeover$ and $Percentage\ acquired$. The alternative hypothesis reads: there is a relationship between $Takeover$ and $Percentage\ acquired$. After performing the test, the strength of the relationship can be tested with Cramér's V. A value larger than $|0.25|$ indicates a strong relationship. With these tests, it becomes clear if the value of one category depends on the value of the other category.

The Pearsons Chi-square test for independence is complemented with a Kruskal-Wallis H test. This test can reveal if there are any significant differences between the different size categories and the use of takeover defences. This way the results of the Pearsons Chi-square test for independence can be verified.

5 Results

This chapter presents the main findings of the paper. The statistical tests and panel regression models that are mentioned in the methodology are applied to the described data so they can be interpreted. The results from the models and tests provides evidence for hypothesis testing and ultimately leads to answering the research question.

5.1 Hypothesis 1

Table 3 illustrates the estimated coefficients of the model for the first hypothesis, Model 1. This is a panel regression model without and with a time-effect to examine the importance of observing the companies over time. The results indicate that target firms are actively repurchasing shares in the two years before the mergers announcement date to deter it.

As described in chapter 4.3.3 'Correlation error terms', Model 1 uses random effects to describe the company-specific effects from the sample. With the Breusch and Pagan Lagrangian multiplier test for random effects we can test if random effects are preferred to regular OLS. The test value of the Breusch and Pagan Lagrangian multiplier test is $\chi2(1) = 2028.16$ with a p-value of $p = 0.00$. We reject the null hypothesis of regular OLS and use random effects to describe Model 1. The standard errors determining the significance of the coefficients are robust because of heteroskedasticity. From the 532,232 observations there are a total of 6,115 companies studied over 16 years with an average of 87 observations per firm. This means the average firm is studied for a little over 7 years in this model.

Table 3 present the results of Model 1 where most of the variables are statistically significant at some level. The effect of $Takeover$ is positive and significant at the 10% level. Following the standard two-sided one-sample t-test we can reject the null hypothesis of no effect. If a company was the target of M&A activity, it made 22,764.69 more monthly share repurchases in dollars (over the total amount of equity). This finding holds for the two years before said takeover and therefore the effect on the target company is also economically significant. There is not enough evidence to reject hypothesis 1 as we found that firms do increase their share repurchases when they are a target.

It becomes clear that the time-effect does not have substantial impact on the results. All coefficients of the independent variables keep the same direction. Only $Cashflow$ changes in significance level, from 1% to 10%. Observing all years as dummies reveals that all of them are insignificant, however it is still important to control for this effect given the change in significance of $Cashflow$.

As described in chapter 3.2 there are alternative explanations for share repurchases. Table 3 reveals a positive significant effect for $Cashflow$, this supports the excess capital hypothesis confirming the finding of Dittmar (2000). Management seems to distribute free cashflows to the shareholders through share repurchases and thereby reducing agency costs. On the other hand, $Cash$ was found to be negative contradicting this statement. However, this variable is insignificant therefore the effect cannot be interpreted as it is not statistically different from zero. Another similarity between Dittmar (2000) is the confirmation of the undervaluation hypothesis. Both $Size$ and $Market - to - book$ are positive and significant at the 1% level. This finding indicates that managers seem to try and time the market by repurchasing based on the undervaluation of the firm. $Dividend\ payout$ is insignificant in Model 1, this does not indicate that companies are making a share repurchase instead of dividends. There also was no evidence of companies altering their leverage ratio towards an optimal level by repurchasing shares, $Leverage$ is insignificant.

Lastly, the value of R^2 is low for both models. Logically this number is higher when including the time-effect since this adds variables to the model. Because of the heterogeneity of the firms in the sample the value of R^2 is low. This value is not crucial for this research since it has an explanatory nature.

Table 3: Panel regression results of Model 1 for the relationship between share repurchases and M&A activity

	Model 1	
	No time-effect	**With time-effect**
Repurchase		
Takeover	22,746.69*	22,785.84*
	(13,938.47)	*(13,959.91)*
Cashflow	189.16***	134.73*
	(72.13)	*(81.06)*
Cash	-1188.31	-932.52
	(1108.57)	*(993.66)*
Dividend pay-out	-9.86	-9.21
	(8.05)	*(8.64)*
Size	577.29***	689.08***
	(148.59)	*(217.04)*
Market-to-book	55.69***	56.62***
	(18.64)	*(18.92)*
Leverage	141.09	152.95
	(93.09)	*(107.06)*
Constant	-801.29***	-513.48
	(300.19)	*(1977.9)*
Observations	532,232	532,232
R^2	0.0037	0.0040

Note. Standard errors between brackets; *p<0.1, **p<0.05, ***p<0.01

5.2 Hypothesis 2

The previous hypothesis showed there is evidence of takeover deterring behaviour influencing share repurchases of the target. We now move to the impact of this behaviour on the profitability of acquirers with Model 2.

Table 4 displays the estimated coefficients of Model 2. This model is a panel regression model as well where time-effects are added to study their impact and importance. The table reveals that takeover

deterrence by targets positively impacts acquirers' profitability. However, this relation is balanced out by the effect of share repurchases overall.

Model 2 uses random effects to describe the company-specific effects from the sample, like Model 1. The Hausman test for the second model provides a test value of $\chi2(1) = 23.12$ with a p-value of $p = 0.2320$. The null hypothesis that the difference in coefficients under both effects are not systematic can therefore not be rejected and accordingly random effects are preferred. Here the Breusch and Pagan Lagrangian multiplier test for random effects provides a test value of $\chi2(1) = 51{,}126.59$ with a p-value of $p = 0.00$. We reject the null hypothesis of regular OLS and therefore random effects are best to describe Model 2. This models also applies robust standard errors for heteroskedasticity reasons, see Figure 6 in 'Appendix'. Here we see that the plot of the predicted values against the residuals presents a funnel-shaped pattern indicating heteroskedasticity. This panel regression observes 919 acquiring firms and contains a total of 109,514 observations. The average firm is being studied for a little under 10 years, somewhat longer than Model 1.

The effect of $Takeover$ in Model 2 is positive but insignificant as demonstrated in Table 4. $Repurchase$ on the other hand, presents a significantly negative effect at the 1% level. If the target makes share repurchases, this negatively impacts the profitability of the acquirer. From the interaction term we learn that if the target makes their share repurchases in the two years before the merger, it has a positive impact on acquirer profitability and depends on the level of share repurchases. This interaction term is especially important because it shows the effect of takeover deterrence, which in this case is positive for the profitability of the acquirer. From these findings we have enough evidence to reject hypothesis 2. We find a positive effect on profitability when a target repurchases shares to deter a takeover. This could be explained by low takeover deterrents, in that case the acquirer can still receive a high return and boost profitability. This also shows that the targets that actively try to deter the takeover have real value as it increases profitability. Nevertheless, this effect is offset by the impact of $Repurchase$ on acquirer profitability making the findings not economically significant.

Again, time-effects seem to have little impact on the results as the coefficients and their standard error barely change. Without time-effects $Size$ is significant at the 10% level, adding time-effects it turns insignificant.

The control variables of Model 2 are central in Gill et al (2011) for companies in the United States and Abor (2005) for Ghanian companies. In Table 4 we see that $Leverage\ ratio$ has a positive effect on profitability but it is insignificant. Gill et al (2011) finds a positive relationship as well but exclusively for

the service industry, the relationship is the reverse for manufacturing companies explaining the insignificant result in Model 2 when all industries are pooled. Another interesting result is that sales growth has a significant negative impact on profitability. Usually sales growth rises along with profitability (Ramezani et al, 2002) indicating a positive relationship. However, Ramezani et al (2002) also illustrates that growth in sales beyond a certain point destroys value, therefore it needs to accompany profitability. This does not hold for this sample since the firms have high sales growth which is destroying firm value as it is not matched with profitable operations.

Table 4: Panel regression results of Model 2 for the relationship between acquirer profitability and takeover deterring behaviour by targets

	Model 2	
	No time-effect	**With time-effect**
Profitability		
Leverage ratio	0.063	0.064
	(0.11)	*(0.11)*
Size	0.17*	0.15
	(0.095)	*(0.094)*
Sales growth	-0.0012***	-0.0012***
	(0.000079)	*(0.000089)*
Takeover	0.11	0.10
	(0.25)	*(0.24)*
Repurchase	-0.0000027***	-0.0000027***
	(0.00000073)	*(0.00000069)*
Takeover*Repurchase	0.0000026***	0.0000026***
	(0.00000073)	*(0.0000007)*
Constant	-1.06	-0.89
	(0.70)	*(0.66)*
Observations	109,514	109,514
R^2	0.0028	0.0026

Note. Standard errors between brackets; *p<0.1, **p<0.05, ***p<0.01

5.3 Hypothesis 3

The results so far show that target firms try to deter takeovers with share repurchases as they are buying back their shares before M&A activity. This leads to an increase in profitability for acquirers which might

be a surprising finding. In this hypothesis we study the impact of takeover deterring behaviour on the price paid by the acquirers, this is tested with Model 3.

Table 5 illustrates the estimation results of Model 3, a panel regression model with and without time-effects. The coefficients indicate that acquirers pay a lower price for their target when the target deters the takeover with share repurchases.

To control for company-specific effects, Model 3 incorporates fixed effects. The Hausman test for Model 3 provides a test value of $\chi 2(21) = 219.87$ with a p-value of $p = 0.00$. Therefore, we reject the null hypothesis that the difference in coefficients under both effects are not systematic and fixed effects are preferred. Like the other models, robust standard errors are added because of heteroskedasticity. When the predicted values are plotted against the residuals we see a funnel shape, see Figure 7 in 'Appendix'. There are a total of 504 observations for this model stemming from 349 companies. This number is significantly lower than the other models, because acquisition price is unique to the announcement date.

Table 5 presents the main result of the third hypothesis. The variable $Takeover$ is negative and significant at the 10% level, only when the time-effect is included. If the target makes a share repurchase to deter a takeover, the acquisition price drops. This effect also depends on the dollar level of share repurchases made by the target because the interaction term is highly significant at the 1% level. The main effect of deterring a takeover is lowering the acquisition price by 185.84, this effect is reinforced with 0.19 per dollar volume of target share repurchases (all in millions over the level of equity). This means the third hypothesis is rejected. Considering the size of the effect, this finding is also economically significant. This confirms the findings in Field and Karpoff (2002), takeover defences seem unrelated to higher takeover premia creating an agency problem. In theory the stock repurchase should increase the average reservation value and the price, but this is not the case in this sample. Nevertheless, targets still deter takeovers with share repurchases as found in hypothesis 1.

The time-effect are important for Model 3. The variable $Takeover$ becomes significant at the 10% level when time-effects are added. This is one variable of interest, so adding time-effects is important when inferring the results. All directions and significance of the other variables remained the same.

Next to studying the effect of takeover deterrence on acquisition price paid by the acquirer, we also control for other factors impacting this price. Table 5 reveals that the inverse of equity is positive and highly significant similar to Aharon, Gavious and Yosef (2010). This can show that book levels of equity see continuous relevance while earnings do not have the same expected persistence since $EBIT$ is

insignificant in this model. This persistence might only be present when these earnings are negative given that $Negative$ is positive and significant at the 5% level. The price paid by the acquirer therefore rises with negative earnings, possibly indicating the high-risk high rewards nature of an acquisition with negative earnings.

Table 5: Panel regression results of Model 3 for the relationship between acquisition price and takeover deterring behaviour by targets

	Model 3	
	No time-effect	**With time-effect**
Price		
1/Equity	570.43***	564.64***
	(20.49)	*(18.47)*
EBIT	0.79	0.77
	(0.62)	*(0.55)*
Negative	478.29**	443.85**
	(199.61)	*(176.87)*
R&D expense	-9.35	-4.66
	(10.18)	*(9.65)*
Sales growth	147.13	176.53
	(153.46)	*(124.60)*
Takeover	-156.64	-185.84*
	(18.64)	*(98.20)*
Repurchase	0.0013	0.00097
	(93.09)	*(0.0011)*
Takeover*Repurchase	-0.20***	-0.19***
	(0.057)	*(0.050)*
Constant	0.83	1.64
	(1.1)	*(1.36)*
Observations	504	504
R^2	0.037	0.030

Note. Standard errors between brackets; *p<0.1, **p<0.05, ***p<0.01

5.4 Hypothesis 4

To further investigate the effect of using share repurchases as a takeover defence we study the impact on acquisition size. Unlike the other hypotheses, this is not tested with a panel regression model. Instead, non-parametric tests are used to answer the hypothesis. Two versions of $Percentage\ acquired$ are tested to avoid misspecification of the variable and can act as a robustness check.

Table 6 illustrates the distribution of the acquisition size across the sample. For example, a total of 965 observations are in the smallest size group, this is 42.2% of the entire sample for mergers and acquisitions. Within this group, 59.07% of the targets have not made share repurchases in the two years before the announcement date of the takeover. The group with acquisitions of 10% of total shares or lower accounts for 66.05% of the total firms that made share repurchases to deter their takeover. This is by far the largest contribution to the total number of takeover deterring firms. It indicates that the smallest group is crucial for the takeover deterring effect found with share repurchases. This is some evidence that acquisition size depends on takeover deterring behaviour through share repurchases so we cannot reject the fourth hypothesis. Toeholds seem to be significantly more popular when targets use share repurchases as a takeover defence.

The second largest size group are the biggest acquisitions, from 90 to 100% of total shares. In this group 90.28% of the targets have not made share repurchases in the two years before the merger. Only 10.37% of all targets that deter takeovers with share repurchases are in this group while it has the largest contribution for the total observations of $Takeover$ = 0. Other size groups also show that many observations have a value of 0 for $Takeover$ and confirm Figure 3 where we see that mostly small and large acquisitions are prevalent in the sample.

The Pearsons Chi squared test on these variables reveals there is a relationship between $Takeover$ and $Percentage\ acquired$. The test statistic for this test is $\chi2(9) = 227.51$ with a p-value of $p = 0.00$. Therefore, we reject the null hypothesis of no relationship between the categorical variables. The post estimation measure Cramér's V is used to quantify the relationship, for these variables it has a value of 0.3154. This tells us there is a strong relationship between the two variables confirming the importance of acquisition size, therefore we cannot reject hypothesis four.

The other specification where $Percentage\ acquired$ is based on percentiles demonstrates similar findings. The overview of this variable against $Takeover$ is shown in Table 7 in 'Appendix'. Here we only have 8 size groups because lots of acquisitions are 100% of the available shares. For this specification we

find a test statistic for the Pearsons Chi squared test $\chi 2(7) = 260.29$ with a p-value of $p = 0.00$ and a Cramér's V value of 0.3374 confirming previous results.

Table 6: Overview of size groups split by Takeover

		Takeover		
		0	**1**	**Total**
Size group				
1	Count	570	395	**965**
	% within Takeover	59.07	40.93	100
	% of Total	33.75	66.05	42.2
2	Count	256	91	**347**
	% within Takeover	73.78	26.22	100
	% of Total	15.16	15.22	15.17
3	Count	87	25	**112**
	% within Takeover	77.68	22.32	100
	% of Total	5.15	4.18	4.90
4	Count	47	7	**54**
	% within Takeover	87.04	12.96	100
	% of Total	2.78	1.17	2.36
5	Count	40	4	**44**
	% within Takeover	90.91	9.09	100
	% of Total	2.37	0.67	1.92
6	Count	33	7	**40**
	% within Takeover	82.50	17.50	100
	% of Total	1.95	1.17	1.75
7	Count	23	1	**24**
	% within Takeover	95.83	4.17	100
	% of Total	1.36	0.17	1.05
8	Count	21	3	**24**
	% within Takeover	87.50	12.50	100
	% of Total	1.24	0.50	1.05
9	Count	36	3	**39**
	% within Takeover	92.31	7.69	100
	% of Total	2.13	0.50	1.71
10	Count	576	62	**638**
	% within Takeover	90.28	9.72	100
	% of Total	34.10	10.37	27.90
Total	Count	**1,689**	**598**	**2,287**
	% within Takeover	73.85	26.15	100
	% of Total	100	100	100

Note. The first row of each size group is the number of observations within that group, this number is split by the variable $Takeover$. The second row of each size group presents the percentage of the total observations within this group as split by $Takeover$.The third row of each size group displays the percentage of observations that are inside that group out of all observations with the same value for $Takeover$.

Additionally, a Kruskal-Wallis H test was conducted to test for significant differences in takeover deterring behaviour for the size groups. This test found statistically significant differences in $Takeover$ among the different size groups. The test statistic has a value of $\chi 2(9) = 131.74$ and a p-value of $p = 0.00$, we can reject the null hypothesis of the same population median of $Takeover$ for each size group. This confirms the findings of the Pearsons Chi squared test. Again, this test does not specify which size group is crucial for takeover deterrence with share repurchases, but it does show there are differences and point out acquisition size is relevant. Tests for specific groups are not available because there is heterogeneity in the variances of the different size groups. This difference in means of population variance for the size groups only allows for non-parametric test like the Pearsons Chi squared test and Kruskal-Wallis H test.

6 Conclusion and discussion

This paper presents evidence of share repurchases as a tool to deter takeovers. There is a significant increase in share repurchases by targets in the years before the announcement date of the takeover. Furthermore, this behaviour of target firms increases acquirer profitability and decreases acquisition prices. Lastly, takeover deterrence also affects the acquisition size.

Model 1 presents robust evidence of targets actively repurchasing shares in the two years before the announcement date with significance at the 10% level. This was expected from papers like Dittmar (2000), we find the same relationship with panel regressions instead of yearly censored regression models. The results of this model are also economically significant whereas Dittmar's findings only showed little consequences. This can point out the growing application of share repurchases as a takeover defence or a correlation with increasing dry powder and deal multiples. The estimates also illustrate empirical evidence of Bagwell (1991) as this paper confirms the use of share repurchases as a defensive strategy for takeovers in American companies.

No evidence was found of takeover defences decreasing acquirer profitability. The results of the second model document that targets deterring takeovers with share repurchases increase acquirer profitability with a significance at the 1% level. On the other hand, this effect is cancelled out by the regular effect of share repurchases on acquirer profitability at the same significance level. Nevertheless, this reveals that takeover defences can increase profitability. This result complements the finding that successful M&A activity has a considerable impact on profitability despite takeover defences (Hogarty, 1970).

Model 3 provides robust evidence of a negative relationship between a firm buying back shares before the merger and the acquisition price. This relation is significant at the 10% level and highly depends on the dollar level of share repurchases. The larger the takeover defence, the bigger the reduction in acquisition price. This confirms the literature that suggested no significant increase in premiums paid. However, the negative relationship is surprising since the target is expected to increase in value with a higher leverage ratio after the share repurchase (Heron and Lie, 2006). The findings also show the presence of the agency problem, without an increase in transaction price of the target the costs of the takeover defence are likely paid by the regular shareholders. Future research can study the role of management compensation when they use stock repurchases as a takeover defence.

Additionally, the evidence suggests that acquirers seem cautious when a target has a takeover defence with share repurchases. Hypothesis four documents a strong relationship between acquisition size and

the use of takeover defences. This indicates that the percentage of shares bought depends on takeover deterring behaviour. Although there was no robust evidence of takeover defences inducing the use of toeholds, the smallest acquisitions were the prevalent group contributing to deterring takeovers with share repurchases.

The conclusion of this paper is that share repurchases as takeover defences matter. It is common for listed companies in the United States to deter takeovers with share repurchases as it explains buy backs at an economically relevant scale. Considering the impact on acquisition price, targets might want to employ different takeover defences as the lower prices can attract more interested parties and therefore have an inverted effect on takeover deterrence. On the other hand, acquirers might focus on these companies for the same reason along with an increase in profitability. Another implication of the findings is that acquisition size is relevant and impacts the use of takeover defences. Targets appear to use more takeover defences with toehold acquisitions as the chance of deterring these might be the largest.

There are also several limitations of this research. Firstly, Model 1 does not control for the management incentive hypothesis as an alternative explanation for share repurchases. The data items regarding this hypothesis were missing for this sample. The exclusion of a control variable can impact the results of the estimation since Dittmar (2000) found a significant positive relationship for stock options in several years. Furthermore, the models have a large dispersion in number of observations. Some models use variables with a great number of missing observations resulting in a low number of total observations. This can impact the results, especially when the missing observations are not random. Lastly, only non-parametric tests could be used to analyse the acquisition size. This limits the results to a general relationship instead of documenting what group is crucial for takeover defences.

Future research in this area could try to extend the analysis on acquisition size. This research is only suggestive of using takeover defences with toehold strategies so more research is needed. One could study if and why toeholds see more takeover deterrence as this is useful for acquirers. Additionally, one can research the effect of share repurchases as a tool to deter takeovers on premiums paid by acquirers and the success rate of an offer on a target with these defences. Finally, it would be interesting to study why targets with share repurchases as a takeover defence have lower acquisition prices as this seems counterintuitive.

7 References

Abor, J. (2005). The effect of capital structure on profitability: an empirical analysis of listed firms in Ghana. *The journal of risk finance*.

Aharon, D. Y., Gavious, I., & Yosef, R. (2010). Stock market bubble effects on mergers and acquisitions. *The Quarterly Review of Economics and Finance*, *50*(4), 456-470.

Bagnoli, M., Gordon, R., & Lipman, B. L. (1989). Stock repurchase as a takeover defense. *The Review of Financial Studies*, *2*(3), 423-443.

Bagwell, L. S. (1991). Share repurchase and takeover deterrence. *The Rand journal of economics*, 72-88.

Bain & Company. (2021). GLOBAL PRIVATE EQUITY REPORT 2021. https://www.bain.com/globalassets/noindex/2021/bain_report_2021-global-private-equity-report.pdf

Ben-David, I., Graham, J. R., & Harvey, C. R. (2013). Managerial miscalibration. *The Quarterly Journal of Economics*, *128*(4), 1547-1584.

Bens, D. A., Nagar, V., Skinner, D. J., & Wong, M. F. (2003). Employee stock options, EPS dilution, and stock repurchases. *Journal of Accounting and Economics*, *36*(1-3), 51-90.

Berkovitch, E., & Khanna, N. (1990). How target shareholders benefit from value-reducing defensive strategies in takeovers. *The Journal of Finance*, *45*(1), 137-156.

Bhagat, S., Dong, M., Hirshleifer, D., & Noah, R. (2005). Do tender offers create value? New methods and evidence. *Journal of Financial Economics*, *76*(1), 3-60.

Billett, M. T., & Xue, H. (2007). The takeover deterrent effect of open market share repurchases. *The Journal of finance*, *62*(4), 1827-1850.

Brooks, C. (2014). *Introductory Econometrics for Finance* (3rd edition). Cambridge University Press.

Bozanic, Z. (2010). Managerial motivation and timing of open market share repurchases. *Review of Quantitative Finance and Accounting*, *34*(4), 517-531.

Chan, K., Ikenberry, D. L., & Lee, I. (2007). Do managers time the market? Evidence from open-market share repurchases. *Journal of Banking & Finance*, *31*(9), 2673-2694.

Dittmar, A. K. (2000). Why do firms repurchase stock. *The Journal of Business*, *73*(3), 331-355.

Dittmar, A. K., & Dittmar, R. F. (2008). The timing of financing decisions: An examination of the correlation in financing waves. *Journal of Financial Economics*, *90*(1), 59-83.

Field, L. C., & Karpoff, J. M. (2002). Takeover defenses of IPO firms. *The Journal of Finance*, *57*(5), 1857-1889.

Gill, A., Biger, N., & Mathur, N. (2011). The effect of capital structure on profitability: Evidence from the United States. *International Journal of Management*, *28*(4), 3-15.

Goktan, M. S., & Kieschnick, R. (2012). A target's perspective on the effects of ATPs in takeovers after recognizing its choice in the process. *Journal of Corporate Finance*, *18*(5), 1088-1103.

Grullon, G., & Michaely, R. (2002). Dividends, share repurchases, and the substitution hypothesis. *The Journal of Finance*, *57*(4), 1649-1684.

Heron, R. A., & Lie, E. (2006). On the use of poison pills and defensive payouts by takeover targets. *The Journal of Business*, *79*(4), 1783-1807.

Hogarty, T. F. (1970). The profitability of corporate mergers. *The Journal of Business*, *43*(3), 317-327.

Humphery-Jenner, M. L., & Powell, R. G. (2011). Firm size, takeover profitability, and the effectiveness of the market for corporate control: Does the absence of anti-takeover provisions make a difference? *Journal of Corporate Finance*, *17*(3), 418-437.

IMAA analysis. (2021). *Number & Value of M&A North America* [Figure 1]. https://imaa-institute.org/mergers-and-acquisitions-statistics/

Jagannathan, M., Stephens, C. P., & Weisbach, M. S. (2000). Financial flexibility and the choice between dividends and stock repurchases. *Journal of financial Economics*, *57*(3), 355-384.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American economic review*, *76*(2), 323-329.

Kallunki, J. P., Pyykkö, E., & Laamanen, T. (2009). Stock market valuation, profitability and R&D spending of the firm: the effect of technology mergers and acquisitions. *Journal of Business Finance & Accounting*, *36*(7-8), 838-862.

Komlenovic, S., Mamun, A., & Mishra, D. (2011). Business cycle and aggregate industry mergers. *Journal of Economics and Finance*, *35*(3), 239-259.

Korteweg, A. (2010). The net benefits to leverage. *The Journal of Finance*, *65*(6), 2137-2170.

Lin, J. C., Stephens, C. P., & Wu, Y. (2014). Limited attention, share repurchases, and takeover risk. *Journal of Banking & Finance*, *42*, 283-301.

Liu, Q., Sono, H., & Zhang, W. (2019). Management quality and acquisition performance: New evidence based on firm profitability. *Journal of Corporate Accounting & Finance*, *30*(3), 44-63.

Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. *The journal of finance*, *60*(6), 2661-2700.

Mantecon, T. (2008). An analysis of the implications of uncertainty and agency problems on the wealth effects to acquirers of private firms. *Journal of Banking & Finance*, *32*(5), 892-905.

Opler, T., Pinkowitz, L., Stulz, R., & Williamson, R. (1999). The determinants and implications of corporate cash holdings. *Journal of financial economics. 52*(1), 3-46.

Ramezani, C. A., Soenen, L., & Jung, A. (2002). Growth, corporate profitability, and value creation. *Financial Analysts Journal*, *58*(6), 56-67.

Raval, A. (2021, 27 april). *BP commits to share buybacks after first-quarter earnings triple*. Financial Times. https://www.ft.com/content/07aefbb0-b4c9-43b3-823a-944408fd294b

Singh, F., & Mogla, M. (2010). Profitability Analysis of Acquiring Companies. *IUP Journal of Applied Finance*, *16*(5).

Strickland, D., Martin, D. R., & Cotter, J. F. (2010). Toeholds as an M&A Strategy? *Journal of Corporate Accounting & Finance*, *21*(5), 57-61.

Subramanian, G. (2003). Bargaining in the shadow of takeover defenses. *The Yale Law Journal*, *113*(3), 621-686.

Van der Sar, N. L. (2018). *Stock pricing and corporate events* (4th edition).

Weber, R. A., & Camerer, C. F. (2003). Cultural conflict and merger failure: An experimental approach. *Management science*, *49*(4), 400-415.

8 Appendix

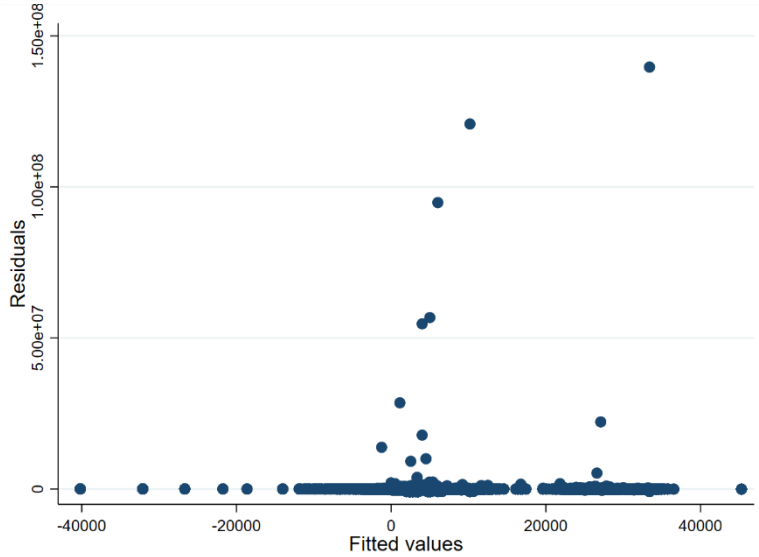

Figure 4: Scatterplot of the predicted values against the residuals for Model 1

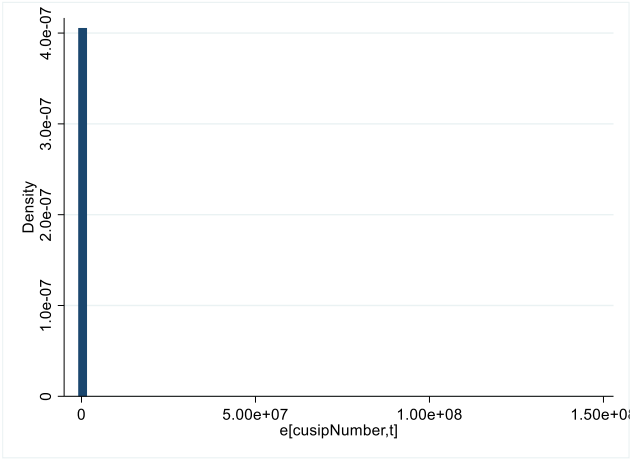

Figure 5: Histogram of the residuals for Model 1

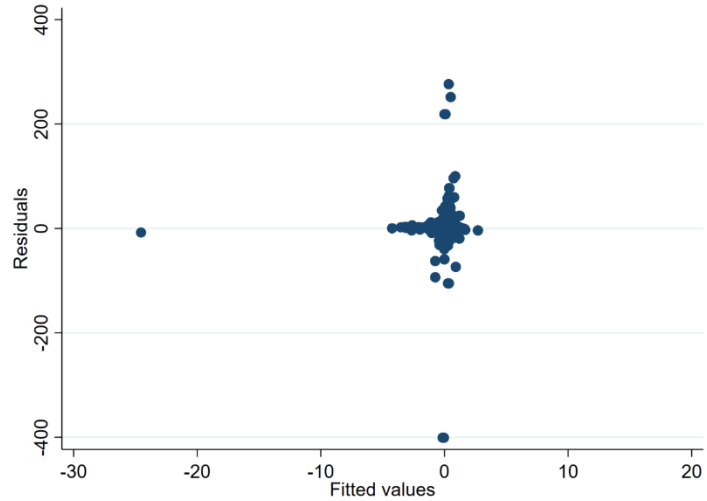

Figure 6: Scatterplot of the predicted values against the residuals for Model 2 (without extremes)

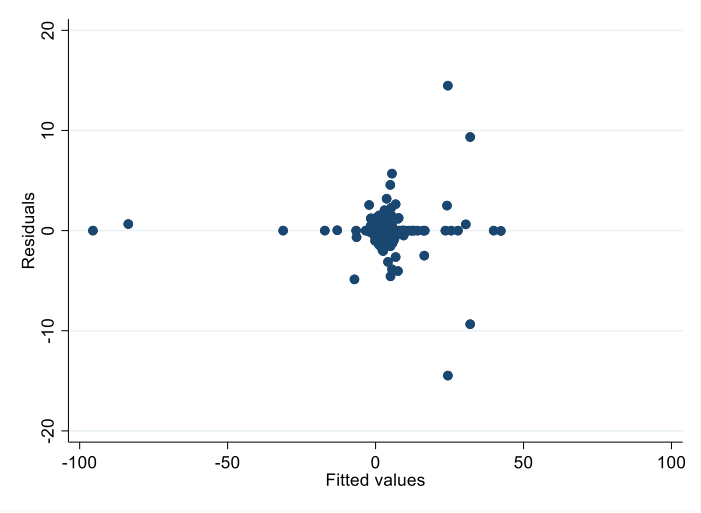

Figure 7: Scatterplot of the predicted values against the residuals for Model 3 (without extremes)

Table 7: Overview of size groups based on percentiles split by Takeover

		Takeover		
		0	**1**	**Total**
Size group				
1	Count	110	119	**229**
	% within Takeover	48.03	51.97	100
	% of Total	6.51	19.90	10.01
2	Count	123	106	**229**
	% within Takeover	53.71	46.29	100
	% of Total	7.28	17.73	10.01
3	Count	149	80	**229**
	% within Takeover	65.07	34.93	100
	% of Total	8.82	13.38	10.01
4	Count	149	79	**228**
	% within Takeover	65.35	34.65	100
	% of Total	8.82	13.21	10.01
5	Count	163	66	**229**
	% within Takeover	71.18	28.82	100
	% of Total	9.65	11.04	10.01
6	Count	181	48	**229**
	% within Takeover	79.04	20.96	100
	% of Total	10.72	8.03	10.01
7	Count	195	33	**228**
	% within Takeover	85.53	14.47	100
	% of Total	11.55	5.52	9.97
8	Count	619	67	**686**
	% within Takeover	90.23	9.77	100
	% of Total	36.65	11.20	30
Total	Count	**1,689**	**598**	**2,287**
	% within Takeover	73.85	26.15	100
	% of Total	100	100	100

Note. The first row of each size group is the number of observations within that group, this number is split by the variable $Takeover$. The second row of each size group presents the percentage of the total observations within this group as split by $Takeover$.The third row of each size group displays the percentage of observations that are inside that group out of all observations with the same value for $Takeover$.