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<u>Share Repurchases as a Takeover Defense</u>

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Abstract:

This paper contains research on share repurchases used as a defensive strategy for takeovers. Based on two samples of 6,798 and 7,095 firms respectively over a timeframe of 20 years, correlations, regressions, probit models and hazard rate models have been created to observe the effect of share repurchases on firm value and takeover probability. This research finds that share repurchase programs can effectively be used to decrease the probability of a takeover announcement. If a takeover were to be announced, share buybacks also help to decrease the probability of said takeover to succeed. This paper also finds that share repurchases affect a firms' capital structure by decreasing its cash balances which indicates an increase in firm value. This increase in firm value is however not confirmed by an analysis on excess returns. These show that excess returns decrease after a buyback announcement followed by the completion of a share repurchase program.

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1 Introduction

Share repurchases are a controversial method to extract value from companies and deliver it to shareholders. A company can buy its own stock from the marketplace but can also directly offer its shareholders a fixed price to regain control of the shares. A share repurchase reduces the shares outstanding of a firm but increases the earnings per share. The latter phenomenon increases the market value of the remaining shares (Banton, 2020).

There are multiple reasons for a company to engage in a share repurchase program. First of all, a buyback reduces the total assets so that the return on assets improve when compared to the pre-repurchase situation. A buyback may hide a slightly declining net income. If the repurchase causes the number of shares outstanding to decrease by a big enough amount, the earnings per share will still rise regardless of the firms' financial situation. An advantage of share repurchases is that they show that the company itself believes its shares are undervalued. In addition, a share repurchase shows investors that the firm has enough cash set aside for emergencies and has a low probability of financial stress (Banton, 2020).

On the contrary, share repurchases are often badly timed. As mentioned before, a company buys its own shares when it has enough excess cash. When there is enough cash on hand, the company is supposedly in a state of prosperity which means its stock price should be high. When the buybacks lead to an increase, the stock will rise but then might drop quickly again after the repurchase indicating that the company is not healthy at all. Further, repurchases can indicate that there are no other opportunities for growth. This is an issue for investors looking for healthy companies with a lot of growth potential (Banton,2020).

An article written by Laura Schneider (2017) for the Harvard Business Review offers two opposing views. The first argues that stock repurchases boost prices in the short term but that the natural way to increase value is to invest in positive NPV projects. On the other hand, firms allocate money to invest in the future based on current opportunities. After these investments are performed, surplus capital is used to repurchase shares. So, a firm only repurchases shares after it invests in the future (Schneider, 2017).

Share buybacks are often used by firm management as a strategy to protect the firm against a takeover. For instance, in 2017 when Kraft Heinz wanted to merge with Unilever, Unilever used a five-billion-dollar share buyback in order to make it impossible for Kraft Heinz to acquire Unilever. Much research exists on general takeover defenses. Examples of these papers are from Bagnoli, Gordan and Lipman in 1981, Bagwell in 1991, Billet and Xue in 2007, Bradley and Rosenzweig in 1986, DePamphilis in 2019, Kang in 2009, and Sinha in

1991. However, for the most part, these papers are not (or only partly) taking into consideration share repurchases. Because of the controversiality around share repurchases, the scarcity of previous research into the usage of share repurchases as a takeover defense, and the age of the papers written about this subject, this research will answer the following two questions:

Can share repurchases be used by firm management to defend themselves against takeovers, and what are the consequences of share repurchases in terms of the likelihood of being taken over and for firm value?

In this research, firm value means the excess returns that a firm generates with respect to a certain benchmark. This is further elaborated on in the methodology section of this paper.

Busch and Obernberger (2017) find empirical evidence that share repurchases make prices more efficient and reduce idiosyncratic risk and that repurchases in down markets primarily drive these effects. They do not find any evidence that shows that managers use share repurchases to manipulate stock prices when selling their equity holdings or exercising stock options.

The undervaluation hypothesis is mentioned in three papers by Dann (1980), Ofer and Thakor (1987), and Constantinides and Grundy (1989) . Dann (1980) finds evidence that firm values significantly increase within one day of the stock repurchase announcement. Dann (1980) adds that these increases are permanent in that share prices do not return to their pre-announcement date levels following the expiration of stockholders' opportunity to tender shares. Ofer and Thakor (1987) and Constantinides and Grundy (1989) find that managers can indeed signal a firms' actual value by either using a dividend or both a share repurchase and dividend.

When a firm is evaluated for a takeover, usually enterprise value is used to determine the theoretical takeover price. The research discussed above and the way a takeover price is determined led to the first two hypotheses that will help to answer the research question:

> **Hypothesis 1:** Share repurchases increase firm value by decreasing cash and changing the capital structure.

> **Hypothesis 2:** Share repurchases add more value to a company in the long run than investments.

Bagnoli, Gordon, and Lipman (1989) state that a typical defensive response to a takeover bid is a stock repurchase. Share repurchases often lead to an increase in the stock price, raising the cost of a takeover. In their paper, they use a signaling model of repurchases with precisely this effect. Since the firm's value decreases more in relation to the amount it

overpays to repurchase shares, a manager of a company with low value will be unwilling to offer a high purchase bid. Therefore, a share repurchase is a positive signal to stockholders about the firm's value under the current management, convincing them not to sell their shares.

The research by Bagnoli, Gordon, and Lipman is backed up by Bagwell (1991) in his paper on how firms can repurchase shares and use this to deter a takeover. He states that a repurchase increases the cost to potential acquirers as it alters the distribution of shareholder reservation values. One of this paper's crucial insights is that repurchases eliminate shareholders with the lowest reservation values, leaving the acquirer facing those with a relatively higher valuation.

Another paper that focuses on share repurchases used as a defensive strategy to takeovers is written by Bradley and Rosenzweig (1986). Their focus is more on the legal side of this subject. They show that defensive self-tenders should be permitted so that managers of targeted companies can compete with hostile bidders for control of the target's resources. Furthermore, in this paper, it is proven that defensive self-tender offers help prevent corporate raiding. Corporate raiding implies buying a significant stake in a corporation and using the shareholder rights to force a company to invest in projects designed to increase the share value (Bradley and Rosenzweig, 1986).

Stulz (1987) analyzes the importance of the fraction α of the voting rights controlled by management. He finds that an increase in α has an ambiguous effect on the value of a potential target. On the one hand, a higher fraction of the management's voting rights negatively affects the target's value, as it decreases the probability of a hostile takeover attempt. However, the premium offered if such an attempt is made increases with α. Suppose these managers control a sufficiently large fraction of the votes and always oppose hostile takeover attempts. In such case, the value of outside shares is the lowest because no tender offers are ever made (Stulz, 1988).

Billet and Xue (2007) model pre-repurchase takeover probability as a latent variable and examine the impact on the firm's decision to repurchase shares. They find a significantly positive relation between open market share repurchases and takeover probability. Thus, a firm may use share repurchases to defend the firm against takeovers. When used as a takeover defense, share repurchases reduce the number of shares that a potential buyer could purchase. In this case, shares held by those who are less likely to sell (individual investors) remain, and the premium offered by the acquirer should be higher, discouraging some prospective bidders (DePamphillis, 2018). Furthermore, as Kang (2009) wrote, a hostile takeover can have both

positive and negative effects. On the one hand, hostile takeovers can reduce the agency problem and enhance management efficiency and increase social and economic wealth. However, a hostile takeover can transfer or reduce current shareholders' wealth and lead to a myopic attitude to operational planning (Kang, 2009).

Harris and Raviv (1988) take on a slightly different approach in their research of takeover defense techniques. They perform research on how capital structure changes can be used as an antitakeover device because they affect the ownership distribution. The authors find that targets of takeover activity have more debt than firms that are non-targets. In an article by Sinha (1991), debt-financed share repurchases used by managers of firms to bond themselves to reduce perquisite consumption and increase investment in the firm are analyzed. He states that these value increases make the firm a less attractive target and finds that there must be a trade-off between the benefit of a reduced probability of a takeover and the cost of an increased likelihood of bankruptcy. The papers written by Harris and Raviv (1988) and Sinha (1991) raise the question whether capital structures do indeed impact the probability of a successful acquisition of a takeover target. Besides, if debt is used for share repurchases, are firms still an attractive target? This led to the last two hypotheses of this research:

Hypothesis 3: There is a positive correlation between share repurchases and takeover announcements.

Hypothesis 4: The probability of a takeover succeeding decreases after a share repurchase.

This research is relevant as share repurchases are a controversial topic within the world of finance. Many people opine that share repurchases need to be regulated more as inequalities can arise following stock repurchases, and it can result in executives that make short-term based decisions around buybacks that allow them to maximize personal gain. Others think share repurchases are just another way of returning cash to shareholders and might even add more value to firms than, for instance, dividends or investments.

Besides, most of the previous research on share repurchases used as a takeover defense was conducted over fifteen years ago. This research aims to close that gap. Analysis of the link between share repurchases and takeover defenses as a whole is quite scarce. Though many papers analyse takeover defenses, share repurchases are not their focus.

Finally, this research will cover two crises, the global financial crisis in 2008 and the COVID-19 crisis. Both situations are economically very different. Where the global financial crisis (GFC) in 2008 led to a significant downturn in the financial markets, the COVID-19

crisis seems to have no impact on the stock markets. As Brian Salsberg (2020) noted in the Harvard Business Review, evidence from the global financial crisis from late 2007 through early 2009 shows that companies that made significant acquisitions during an economic downturn outperform those that did not. Therefore, by comparing data before, during, and after these crises, it should be clear whether share repurchase behavior is different or not. Since the COVID-19 crisis is not yet finished at the time of writhing this paper, only data before and during the pandemic will be considered.

This research has led to some interesting results. First of all, firm value decreases with the announcement of a share repurchases but it increases whenever a buyback is completed. Even though the increase after completion does not offset the decrease caused by the announcement, it can still be concluded that share buybacks do have an impact on firm value. In addition, analysis shows that the cash balance of a firm decreases significantly after a share repurchase whereas investments have no significant effect on firm value when compared to buyback programs. Finally, the takeover announcement probability for a potential takeover target decreases whenever it performs a share buyback. If a takeover is announced, its chances of succeeding decrease with the announcement of a buyback.

The rest of this paper is structured as follows: Section 2 will discuss the data used in this paper. Section 3 describes what methods are applied to perform the analysis; section 4 shows the results of these methods. In section 5, the aforementioned hypotheses are validated, and the research question is answered. Section 6 discusses relevance of the results in this area of research and gives advice on future research. Section 7 and 8 contain the bibliography and appendix.

2 Data

2.1 Sample construction

Two different time intervals were used for this analysis: a daily and a quarterly interval. The quarterly interval is added to increase the robustness of the findings in this paper. Both datasets start on January 3rd, 2000, and end on December 31st, 2020. This data comes from two main data sources: Compustat – Capital IQ and the Thomson One M&A database. The general dataset, from Compustat, contains all companies listed on the following stock exchanges:

- Toronto Stock Exchange
- Montreal Stock Exchange
- New York Stock Exchange
- NYSE Chicago
- Nasdaq

This data is obtained from Compustat – Capital IQ. The daily dataset contains all companies with shares outstanding over the past 20 years. The quarterly dataset is used to accompany the analysis on the daily dataset and it contains company fundamentals that are used as control variables. Repurchase and takeover data was obtained from the Thomson One M&A database. The same stock exchanges were selected and all companies that have announced, completed or withdrawn share repurchases were included.

After obtaining all the necessary data, the Thomson One and Compustat datasets are combined based on the six numbered CUSIP identifier and the date of the share repurchase or takeover announcement. A CUSIP identifies stocks of all registered US and Canadian companies. The first six characters of a CUSIP identify the unique name of a company and can therefore be used together with the announcement date to merge with the Compustat – Capital IQ datasets.

All groups of companies in the dataset with neither a buyback nor a takeover announcement are dropped after the merging process. In addition, all CUSIP – date pairs that have duplicate observations in the dataset are dropped to ensure unique observations in the panel data. With respect to the daily data, this process leaves 18,006,374 observations in total, consisting of 6,798 firms that have either announced a share repurchase or were the target in a takeover announcement. In total, this dataset consists of 11,624 buyback announcements and 4,224 takeover announcements. Regarding the quarterly data, after cleaning up the data, 7,095 firms remain, announcing 6,283 buybacks and 34 of these firms are targets in takeover announcements.

In order to perform the analysis described in the methodology section, some variables were created. First of all, for the announcement of buybacks and takeovers a dummy variable is generated that is zero (0), if there is no share repurchase or takeover announcement and one (1) if an announcement was made. The same is done for completions and withdrawals. Here the dummy variable equals one (1) if a takeover is completed or withdrawn. The time-to-takeover used for survival analysis is calculated by calculating the number of days between the takeover announcement date and the date of takeover completion. One other important variable that is created for the analysis in this paper, is excess returns. To calculate the excess returns of a company, the S&P 500 index (GSPC) is used as a benchmark. This index can be used because first of all, all companies in the dataset are listed on North American exchanges. The S&P 500 index provides a broad view of the economic health of the United States because of its wide market breath. This index contains large-cap companies, representing about three-quarters of the US stock markets in terms of market-cap. The excess returns are calculated by

taking the daily (and quarterly) returns of the firms in the sample and subtractingx these from the daily (and quarterly) returns of the S&P 500 index.

For the regression analysis, probit models, and hazard rate models control variables are used. These control variables are total shares outstanding, and transaction value of the takeover or buyback to control for deal specifics. In addition, net sales over the last twelve months (LTM) and total assets are included as firm specific control variables to control for firm size. Within the quarterly dataset non-operating income is added. This is the portion of an organization's income that is derived from activities not related to standard business operations such as dividend income, profits or losses from investments and asset write-downs. For this reason, non-operating profit can be used as a proxy for investment activity potential.

2.2 Descriptive Statistics

2.2.1 Daily data

In this section, some important descriptive statistics of the dataset will be discussed. First of all, the number of yearly buyback and takeover announcements, completions and withdrawals. Table 1 on the next page summarizes this.

So, within this sample, 14% of the announced repurchases are completed and 5% are withdrawn. From the announced takeovers, 84% is completed and 11% is withdrawn. The proportions not accounted for are intended buybacks, withdrawn intents, pending buybacks and buybacks announcements of which the status is unknown. For takeovers the group that is not covered consists of takeover rumors, discontinued rumors, intended takeovers, withdrawn intents, pending takeovers, and takeover announcements of which the status is unknown. These events are not used for the analysis in this paper but are kept in the sample. In total, the ratio between takeover announcements and buyback announcements is 36.35%, between buyback announcements and takeover withdrawals 4.06% and between buyback completions and takeover withdrawals 28.18%. In table 2 on the next page, one can find all descriptive statistics with respect to the daily dataset.

Table 1: yearly buyback and takeover announcements and takeover completions and withdrawals (daily)

The percentages indicate the ratio between buyback announcements or completions and takeover announcements or completions and takeover announcements or withdrawals, BB = Buyback, TO = Takeover.

Year	Buyback Announced	Buyback Complete		Buyback Withdrawn		Takeover Announced	Takeover Completed		Takeover Withdrawn		BB vs TO announcements	BB vs TO withdrawn	BB announcements vs TO completions	BB completions vs TO withdrawn
2000	661	176	26.63%	96	14.52%	577	479	83.02%	69	11.96%	87.29%	10.44%		39.20%
2001	551	102	18.51%	25	4.54%	377	320	84.88%	51	13.53%	68.42%	9.26%		50.00%
2002	394	62	15.74%	12	3.05%	210	182	86.67%	21	10.00%	53.30%	5.33%		33.87%
2003	416	71	17.07%	15	3.61%	236	210	88.98%	18	7.63%	56.73%	4.33%		25.35%
2004	492	77	15.65%	10	2.03%	222	194	87.39%	23	10.36%	45.12%	4.67%		29.87%
2005	580	77	13.28%	13	2.24%	209	187	89.47%	16	7.66%	36.03%	2.76%		20.78%
2006	560	66	11.79%	7	1.25%	229	189	82.53%	30	13.10%	40.89%	5.36%		45.45%
2007	887	122	13.75%	16	1.80%	241	208	86.31%	27	11.20%	27.17%	3.04%		22.13%
2008	922	96	10.41%	9	0.98%	191	146	76.44%	33	17.28%	20.72%	3.58%		34.38%
2009	381	46	12.07%	7	1.84%	176	138	78.41%	20	11.36%	46.19%	5.25%		43.48%
2010	525	55	10.48%	20	3.81%	151	122	80.79%	21	13.91%	28.76%	4.00%		38.18%
2011	770	99	12.86%	31	4.03%	112	88	78.57%	21	18.75%	14.55%	2.73%		21.21%
2012	554	107	19.31%	41	7.40%	131	121	92.37%	6	4.58%	23.65%	1.08%		5.61%
2013	513	97	18.91%	38	7.41%	129	110	85.27%	12	9.30%	25.15%	2.34%		12.37%
2014	663	112	16.89%	74	11.16%	149	126	84.56%	22	14.77%	22.47%	3.32%		19.64%
2015	721	95	13.18%	57	7.91%	188	156	82.98%	25	13.30%	26.07%	3.47%		26.32%
2016	490	60	12.24%	39	7.96%	157	136	86.62%	12	7.64%	32.04%	2.45%		20.00%
2017	482	66	13.69%	31	6.43%	162	120	74.07%	20	12.35%	33.61%	4.15%		30.30%
2018	571	57	9.98%	35	6.13%	154	127	82.47%	14	9.09%	26.97%	2.45%		24.56%
2019	287	20	6.97%	31	10.80%	116	100	86.21%	6	5.17%	40.42%	2.09%		30.00%
2020	204	12	5.88%	12	5.88%	107	71	66.36%	5	4.67%	52.45%	2.45%		41.67%
Total	11,624	1,675	14.41%	619	5.33%	4,224	3,530	83.57%	472	11.17%	36.34%	4.06%		28.18%

Table 2: descriptive statistics daily

	Observations	Mean	Standard Deviation	Min	Max
Shares Outstanding	18,001,804	126296.7	449,810.200	21.000	29,200,000.000
Net Income	15,417	442.835	1,887.229	-33,226.000	76,311.000
Total Assets	15,439	18,718.380	117,667.600	0.252	3,246,076.000
Transaction Value Buyback	11,447	775.527	4,486.924	.006	315,000.000
Transaction Value Takeovers	3,903	2,538.090	8,856.963	.013	164746.9
Excess Returns	17,841,341	0.007	9.367	-71.227	1,583.273

2.2.2   Quarterly data

Here, the descriptive statistics of the quarterly dataset will be discussed. Starting with the yearly numbers of share repurchase and takeover announcements, completions and withdrawals (table 3 on the next page).

Within the quarterly sample, 13% of the announced share repurchase programs are completed. 5% of the announcements are withdrawn. With respect to the takeover announcements, 85% of the announced takeovers is completed and 11% is withdrawn. The total ratio between buyback and takeover announcements is 1.90%. Between buyback announcements and takeovers withdrawn the number is 1.61%. The ratio between completed share repurchase programs and takeover withdrawals is 0.21% in the quarterly dataset. Other descriptive statistics are stated in table 4 on the next page.

3   Methodology

3.1   Two sampled t-tests

The first method used to analyze the data are two sampled t-tests. Multiple t-tests are performed. First of all, t-tests are performed to check whether repurchase or takeover behavior is different during crises. This analysis compares the proportion of buybacks and takeovers performed before, during and after the Global Financial Crisis (GFC) in 2008 and before and during the COVID-19 pandemic. At the time of writing this paper, the COVID-19 pandemic is still on-going and therefore no proper analysis can be performed regarding the number of buybacks and takeovers after this crisis.

Furthermore, to validate hypothesis one, the means of the excess returns of companies are analyzed before and after the event of a buyback or takeover announcement, completion or withdrawal. In addition, the average cash and debt levels for companies that have announced, completed or withdrawn a buyback or takeover are compared to those that have not.

The outcome of a t-test is a t-score. This is the ratio between the difference within a certain group and between the two groups. When a t-score is higher, there is a bigger difference between the two groups analyzed. When the t-score is lower, the difference is smaller and the averages of the two groups are thus closer to each other. When the t-score is high enough, and its corresponding p-value is below the significance level of 0.05, the null hypothesis is rejected, and it has to be assumed that the means of both groups are significantly different from each other.

Table 3: yearly buyback and takeover announcements completions and withdrawals (quarterly)

The percentages indicate the ratio between buyback announcements or completions and takeover announcements or completions and takeover announcements or withdrawals, BB = Buyback, TO = Takeover.

Year	Buyback Announced	Buyback Complete	%	Buyback Withdrawn	%	Takeover Announced	Takeover Completed	%	Takeover Withdrawn	%	BB vs TO announcements	BB vs TO withdrawn	BB announcements vs TO withdrawn
2000	104	16	15.38%	18	17.31%	25	24	96.00%	1	4.00%	24.04%	23.08%	0.96%
2001	114	25	21.93%	5	4.39%	14	13	92.86%	1	7.14%	12.28%	11.40%	0.88%
2002	159	16	10.06%	4	2.52%	8	7	87.50%	1	12.50%	5.03%	4.40%	0.63%
2003	275	40	14.55%	9	3.27%	7	5	71.43%	2	28.57%	2.55%	1.82%	0.73%
2004	351	48	13.68%	3	0.85%	8	8	100.00%	0	0.00%	2.28%	2.28%	0.00%
2005	287	44	15.33%	8	2.79%	8	7	87.50%	1	12.50%	2.79%	2.44%	0.35%
2006	191	22	11.52%	1	0.52%	6	5	83.33%	1	16.67%	3.14%	2.62%	0.52%
2007	283	30	10.60%	5	1.77%	4	4	100.00%	0	0.00%	1.41%	1.41%	0.00%
2008	698	71	10.17%	9	1.29%	10	5	50.00%	4	40.00%	1.43%	0.72%	0.57%
2009	321	35	10.90%	7	2.18%	5	4	80.00%	0	0.00%	1.56%	1.25%	0.00%
2010	430	46	10.70%	17	3.95%	0	0	0.00%	0	0.00%	0.00%	0.00%	0.00%
2011	444	55	12.39%	18	4.05%	1	1	100.00%	0	0.00%	0.23%	0.23%	0.00%
2012	164	30	18.29%	17	10.37%	1	1	100.00%	0	0.00%	0.61%	0.61%	0.00%
2013	225	38	16.89%	17	7.56%	1	1	100.00%	0	0.00%	0.44%	0.44%	0.00%
2014	574	97	16.90%	67	11.67%	3	1	33.33%	2	66.67%	0.52%	0.17%	0.35%
2015	611	84	13.75%	49	8.02%	3	3	100.00%	0	0.00%	0.49%	0.49%	0.00%
2016	356	39	10.96%	36	10.11%	5	4	80.00%	0	0.00%	1.40%	1.12%	0.00%
2017	249	26	10.44%	17	6.83%	7	6	85.71%	0	0.00%	2.81%	2.41%	0.00%
2018	218	18	8.26%	12	5.50%	2	1	50.00%	0	0.00%	0.92%	0.46%	0.00%
2019	138	6	4.35%	10	7.25%	0	0	0.00%	0	0.00%	0.00%	0.00%	0.00%
2020	125	10	8.00%	10	8.00%	2	2	100.00%	0	0.00%	1.60%	1.60%	0.00%
Total	6,317	796	12.60%	339	5.37%	120	102	85.00%	13	10.83%	1.90%	1.61%	0.21%

(The final percentage columns correspond to the printed headers: BB vs TO announcements, BB vs TO withdrawn, BB announcements vs TO withdrawn, BB completions vs TO withdrawn.)

Table 4: descriptive statistics quarterly

	Observations	Mean	Standard Deviation	Min	Max
Shares Outstanding	12,016	176.151	635.602	0.050	17,791.250
Non-operating income	11,137	0.082	216.030	-6,925.000	5,013.000
Total Assets	11,253	17,477.780	115,209.900	0.045	2,901,659.000
Transaction Value Buyback	12,064	404.245	2,432.336	-	152,000.000
Transaction Value Takeovers	12,156	21.548	685.669	-	49,260.630
Cash	7,106	767.719	3,944.464	-	153,201.000
Debt	12,164	24.877	609.221	-	38,782.000
Excess Returns	11,864	0.100	5.329	-38.975	495.291

When performing t-tests, it is important to control for equal or unequal variances. Levene's test is used to test the null hypothesis that the variances of both groups are equal. When the outcome of Levene's test is smaller than the 0.05 significance level, unequal variances are assumed and taken into consideration when performing the t-tests.

3.2 Correlations

For the correlations between buybacks and takeovers Fisher's exact test is used. It measures the correlation between two categorical variables as opposed to normal correlations that are used for continuous variables. The Fisher's exact test is actually a test of independence and does not say anything about the size or direction about the correlation. However, it is used as a basis for this paper to determine the interdependence between buybacks and takeovers. The null hypothesis of Fisher's exact test is that the events of share buybacks and takeovers announcements, completions and withdrawals are independent. So, when the p-value of the tests is below the 5% significance level the null hypothesis can be rejected and dependence between the variables can be assumed. The outcomes of the correlations are used to answer hypothesis 3.

3.3 Regressions

Hypothesis one will be tested by regressing the excess returns of a firm on share repurchases and takeovers. In total, sixteen models based on daily data and eighteen regressions based on quarterly data are created to analyze the effect of share repurchases on excess returns. First, solely the effects of buybacks and takeovers on excess returns are examined. The control variables mentioned in the data section are added later to improve the accuracy of the regressions.

Panel data regressions are also used to analyze the effect of share repurchases and takeovers on the cash and debt levels of a firm. These regressions are based on just the quarterly datasets because only firms' quarterly balance sheet items were available from the databases used in this paper. All in all, eighteen regressions are performed to analyze the impact of share repurchases and takeovers on cash levels and fifteen to show the effect of these events on firm debt levels.

The effect of share repurchases on cash and debt levels are analyzed because they can be used to calculate a firm's enterprise value. This is shown by the following formula:

$$Enterprise\ value = Market\ Capitalization + Total\ Debt - Cash\ \&\ cash\ equivalents \qquad (1)$$

This formula describes the theoretical takeover price if a firm were to be bought. Therefore, if cash levels after a repurchase increase, the firm value goes down and vice versa.

To check the validity of hypothesis two, the same model for excess returns will be used as stated above. Next, a model that will only show the effects of investments made by a firm on excess returns is created. Lastly, a model that regresses the excess returns on share repurchases *and* investments will be constructed. These models will then be compared to see whether there is a difference in the coefficients for share repurchases and investments. When this is the case, their impact on firm value is different.

Hypothesis three will be tested with a Linear Probability Model (LPM). A LPM is a special version of a general OLS regression but the dependent variable for each observation is either zero (0) or one (1). Here, eight models will be constructed to compare the effects of buyback announcements and completions on takeover announcements and withdrawals.

Both fixed effects and random effects regressions were generated. The regressions were followed by Hausman tests to check whether fixed effects estimators or random effects estimators were consistent. The outcomes of these tests led to choosing fixed effects models for interpretation. This also holds for the probit models discussed in the next section.

3.4 Probit models

For hypothesis four, a probit model will be used to measure the impact of share repurchases on takeover probability. Specifically, buyback announcements and completions are regressed on takeover announcements, completions, and withdrawals. To analyze the dataset with daily intervals, nine probit regressions are performed. Eighteen models are created for the dataset with quarterly intervals. The coefficients obtained from a probit regression are not easily interpretable. Therefore, the marginal effects of the independent variables should be interpreted. The marginal effects indicate how much the probability of the dependent variable changes when one of the values of the independent variables is changed, holding all other independent variables constant. The marginal effects differ from the coefficient of a normal regression because they depend on the values of all other regressors and their coefficients.

3.5 Hazard rate models/survival analysis

Using hazard rate models, the time it takes to complete a takeover once a company has announced a takeover, is analyzed. With survival analysis, the term 'failure' is used to define the occurrence of a takeover completion. The survival time is the time between announcement and failure. The dependent variable of a hazard rate model is duration. This variable is a combination of a time and an event variable. This time variable is the time it takes for the event to occur. The hazard rate is the probability of the event taking place at time 't' provided that

the company is still a target for takeover at time t. The probability that the duration time will be less than t is:

$$F(t) = P(T \leq t) = \int_0^t f(s)ds$$

The survival function is therefore the probability that the duration until the takeover will be at least t, yielding:

$$S(t) = 1 - F(t) = P(T \geq t)$$

The hazard rate is the probability that the event will occur after time t, given that it has lasted until time t. Specifically, this function only applies when a company has not been taken over yet. The hazard rate function is characterized by $\lambda(t)$ describing the changes in the risk of completing a takeover per time interval. From this, the complete formula of the hazard rate follows:

$$\lambda(t) = \frac{f(t)}{S(t)} = \lim_{\Delta t \to 0} \left(\frac{P(t \leq T < t + \Delta t | T \geq t)}{\Delta t} \right) = -\frac{S'(t)}{S(t)}$$

Where:

- $\lambda(t) = P(T > t) = 1 - F(t)$ is the survival function
- $F(t) = P(T \leq t)$ is the exit time distribution function
- $f(t) = \frac{dF(t)}{dt}$ is the density function of the exit time distribution

The change in time approaches zero, making the interval very small. Eventually, at a certain point in time, the change of a takeover being completed will be calculated. From this, a function is plotted. From this function, the probability of an exit at a certain point in time can be derived. When the hazard rate is one, there is no correlation between the time and the influencing factors. Higher than one indicates an increase in hazard rate and a decrease in survival time. Lower than one indicates a decrease in hazard, with an increase in survival time.

4 Results

In this part, the results found from analyzing the data by using aforementioned methods will be discussed. The t-tests, regressions, correlations, probit models and hazard rate models will be reviewed and interpreted.

4.1 Two sampled t-tests

4.1.1 Levene's tests

Levene's test is used to examine whether unequal or equal variances should be assumed. This is important to investigate before executing the two sampled t-tests since the outcomes of the t-tests are different when assuming either equal or unequal variances. With respect to the daily data, for the buyback and takeover announcement, completion and withdrawal events, all p-values of the Levene's test were greater than 0.05 implying that equal

variances for excess returns should be assumed. For both the GFC and COVID-19 crisis the p-values were lower than 0.05. Hence, unequal variances were assumed for these t-tests.

For the quarterly data, the outcomes of Levene's test show that before and after a buyback or takeover announcement, completion or withdrawal unequal variances in cash can be assumed since the p-value of Levene's test is lower than 0.05. Similar to the outcomes for the daily analysis, for the GFC and COVID-19 crisis, unequal variances can be assumed as well. For all other tests (debt and excess returns) before and after a share repurchase or takeover announcement, completion or withdrawal, equal variances should be assumed because the p-values are greater than 0.05. Please refer to appendix 8.1.1 and 8.1.2 for the full results of the t-tests and the outcomes of Levene's test for equality of variances.

4.1.2 Takeovers and buybacks during crises

4.1.2.1 Daily data

To begin with, the t-tests for the GFC and COVID-19 crisis. From the results it becomes apparent that the proportion of takeover announcements before and during the GFC are significantly different. More specific, there is significant evidence that there were fewer takeover announcements during the financial crisis than before the financial crisis. However, this difference is close to zero. In addition, there is significant evidence to accept the hypothesis that there is a difference in the average proportion of takeover announcements during and after the GFC. Moreover, from the analysis it becomes apparent that the average number of takeover announcements is higher during the financial crisis when compared to the post-financial crisis situation. However, this result is insignificant, for, if it were significant, the results would be analogous to the theory written by Brian Salsberg (2020) in the Harvard Business Review. He states in his article that companies that made significant acquisitions during the financial crisis outperform those that did not (Salsberg, 2020). The proportion of buyback announcements during and after the GFC is higher than before the GFC. This contradicts a study by Beverly Hirtle in 2013. In her research, a strong decline in share repurchases is observed. The number of buybacks is lower after the GFC than during the financial crisis. However, the differences found in this research approximate zero.

With respect to the COVID-19 crisis only the situation before and during the crisis are analyzed. There is significant evidence that the average number of takeover announcements during the COVID-19 crisis is lower. As explained in Forbes by Harroch, Lipkin and Smith, the COVID-19 crisis is different from usual crises. The pandemic has an impact on more than just the financial system. The valuation of sellers, the appetite of buyers to get deals done in a short amount of time and other factors that influence M&A deals are affected (Harroch, Lipkin,

Smith, 2013). However, there is significant evidence to assume that there are more buyback announcements during the COVID-19 pandemic. This is not entirely as expected. Since the differences during pre-crisis, during crisis and post-crisis are very small, the data is kept in the sample.

4.1.2.2 Quarterly data

There is significant evidence that there were more buyback announcements during the financial crisis. The proportion of buybacks is also higher after the GFC compared to before the GFC. Lastly, after the GFC the proportion of buybacks was lower than during the financial crisis. During the COVID-19 pandemic, there were less buyback announcements than before. There is, however, significant evidence that there were fewer takeover announcements during the financial crisis in 2008. Even after the financial crisis the average proportion of takeovers was lower than before. These are the exact same results as from the daily dataset.

With respect to the COVID-19 pandemic, the quarterly dataset leads to the same results as the dataset with daily intervals.

To conclude, from both the daily and quarterly analysis on takeover and buyback announcements with respect to the crises, it becomes apparent that there were fewer takeover announcements and more buyback announcements during the financial crisis than before the financial crisis. In addition, there were more takeover and buyback announcements during the GFC than after the financial crisis and both analyses show significant evidence that there were more takeover announcements and less buyback announcements before the financial crisis compared to the post-financial crisis situation. Finally, during the COVID-19 pandemic, there are less takeover and buyback announcements.

4.1.3 Excess returns

4.1.3.1 Daily data

Two-sampled t-tests were also performed to analyze whether there was a significant difference in excess returns before and after a buyback or takeover announcement, completion, or withdrawal.

There is no significant evidence that there is a difference in excess returns before and after a buyback announcement. The same holds for takeover announcements as the p-value is 0.552. For this reason, it cannot be concluded from the t-tests results that takeover announcements have a significant impact on the excess returns of a firm.

When analyzing the effect of the completion of a share repurchase or a takeover, the p-values are 0.713 and 0.543 respectively. This implies that both null hypotheses must be

accepted. Therefore, the average excess returns of the firms in this sample are not significantly different before or after the completion of a buyback or a takeover.

Lastly, the difference in excess returns before and after the withdrawal of a buyback and takeover are analyzed. The p-values of these t-tests are 0.951 and 0.918 respectively, meaning that it cannot be concluded that the excess returns are significantly different between firms that have or have not withdrawn a buyback or takeover announcement.

4.1.3.2 *Quarterly data*

For excess returns in the quarterly dataset, the t-tests indicate that the excess returns for firms that either announced, completed, or withdrew a share repurchase, the excess returns are lower. These results match the results of the t-tests performed on the daily data. However, the results for buyback announcements are different. For the daily analysis, the excess returns for firms that announced a share repurchase is higher. Unfortunately, the results of the t-test on excess returns are insignificant for all events and therefore can not be interpreted. If the results were significant, lower excess returns for firms that have announced or completed a buyback would contradict Dann, 1980. He found evidence that firm values significantly increase within one day of the stock repurchase announcement and that these increases are permanent in that share prices do not return to their pre-announcement date levels (Dann, 1980).

With respect to takeover announcements, completions, and withdrawals, all differences in means are positive indicating the average excess returns for firms that have announced, completed, or withdrawn a share repurchase are lower. However, these results are not significant either and it cannot be concluded whether a buyback adds more value to a firm than a takeover.

To conclude, the t-tests on excess returns for both the daily data and quarterly data do not show any significant differences. Therefore, it should be assumed that the announcement, completion or withdrawal of either a share repurchase program or a takeover have no impact on the excess returns before or after these events.

4.1.4 Cash and debt

From the t-tests performed on cash to compare the means before and after a buyback or takeover announcement, completion and withdrawal, it becomes apparent that there is significant evidence that after a buyback announcement or completion, the average cash held by a firm is 495 million or 1,082 million dollars higher respectively. When taking formula (1) mentioned in section 3.3 into account, a higher cash balance for firms that have performed a buyback implies a lower firm value. These findings therefore contradict hypothesis 1. This outcome is somewhat remarkable as most firms use excess cash to repurchase shares. However,

it could be the case that the group that have announced or completed share repurchases already had more cash on hand. Therefore, the average cash held by this group can, of course, be higher. In addition, firms can also use debt to finance their repurchases. It could be the case that in this sample, debt is used more frequently than cash for buybacks. There is also significant evidence that in firms that have withdrawn their share repurchase program, the average cash balance is also higher. The logical explanation for this outcome is that these firms did not use excess cash to complete the announced share repurchase.

The t-tests that analyzed the difference in average debt for firms that have announced, completed or withdrawn a buyback or takeover show that the debt is lower for the firms that were involved in one of these events. When the debt is lower, the enterprise value of a firm is also lower. Therefore, firms that have announced, completed or withdrawn a share repurchase have a lower enterprise value. These results are however not significant so no actual conclusions can be drawn from them. However, had these results been significant, then they would contradict the theory written by Sinha in 1991. He states that managers of firms use debt to finance share repurchases to bond themselves to reduce perquisite consumption and increase investment in the firm. He finds that there must be a trade-off between the benefit of a reduced probability of a takeover and the cost of an increased likelihood of bankruptcy (Sinha, 1991). If debt is used for a repurchase, then the average debt for firms that have performed buybacks should have been higher. This is not the case for our results.

4.2 Correlations

4.2.1 Daily data

As an initial analysis, correlations are calculated between takeover and buyback announcements, buyback announcements and takeover completions, buyback announcements and takeover withdrawals, and buyback completions and takeover announcements. Please refer to the tables below for the p-values from the Fisher exact test conducted using daily and

Table 5: Summary of Fisher's Exact test outcomes

Fisher's exact test p-values. Fisher's exact test shows the dependency between two nominal variables. In this table the dependency between buyback announcements and withdrawals and takeover announcements and withdrawals. Top number indicates two-sided p-values, bottom one sided.

	Takeover Announcement	Takeover Withdrawal
Buyback Announcement	0.206	0.263
	0.141	0.263
Buyback Completion	0.008	1.000
	0.008	0.957

quarterly data. The complete contingency tables and Fisher test outcomes can be found in appendix 8.2.1.

From these results it becomes apparent that there is no significant evidence for dependency of buyback announcements on takeover announcements, or withdrawals. There is however a significant dependency between takeover announcements and the completion of a buyback. This implies that there must be some correlation between the announcement of a takeover and the completion of a buyback. The size and direction of this effect will be further discussed in part 4.3.1. There is no significant dependency observed between takeover withdrawals and the completion of buybacks.

4.2.2 Quarterly data

For the quarterly data, Fisher's exact test is also used to analyze the dependency of buyback announcements and completions on takeover announcements and withdrawals.

Table 6: Summary of Fisher's Exact test outcomes (quarterly)

Fisher's exact test p-values. Fisher's exact test shows the dependency between two nominal variables. In this table the dependency between buyback announcements and withdrawals and takeover announcements and withdrawals. Top number indicates two-sided p-values, bottom one sided.

	Takeover Announcement	Takeover Withdrawal
Buyback Announcement	0.000	0.408
	0.000	0.231
Buyback Completion	0.408	0.593
	0.231	0.593

With respect to the quarterly data, there is significant evidence for the dependency of buyback announcements on takeover announcements. This implies that there must be a correlation between the announcement of a takeover and an announcement of a share repurchase. The size and direction of this effect will also be further discussed in section 4.3.1 where linear probability models are interpreted. There is no significant evidence in the quarterly analysis for a dependency between buyback announcements and takeover withdrawals or between buyback completions and takeover announcements/withdrawals.

4.3 Regressions

4.3.1 Relationship between repurchases and takeovers

4.3.1.1 Daily data

As an extension to the correlations found in part 4.2, eight regression models are created to analyze the relationship between share buybacks and takeovers. Please refer to table 7 for a summary of the obtained coefficients. The full regression tables are shown in appendix 8.3.1.1.

Table 7: Daily LPM Model

Linear probability models based on daily data. The numbers between brackets depict the standard errors of the coefficients. These models show the increase or decrease in probability of an event occuring.

| | *Dependent variable* | | | | | | | |
| | Buyback Announced | | Buyback Completed | | Takeover Announced | | Takeover Withdrawn | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Buyback Announced			0.001 (0.000)	0.001 (0.000)		0.0001 (0.000)		0.0001 (0.000)
Buyback Completed		0.001 (0.001)			-0.0000017*** (0.000)		-0.0000386** (0.000)	0.000 (0.000)
Takeover Announced	0.001 (0.001)	0.001 (0.000)		0.000 (0.000)				0.000 (0.000)
Shares Outstanding		0.000 (0.000)		0.000 (0.000)				0.000 (0.000)
Transaction Value		0.000 (0.000)		0.000 (0.000)				0.000 (0.000)
Net Sales LTM		0.000*** (0.000)		0.000*** (0.000)				0.000 (0.000)
Total Assets		0.000 (0.000)		0.000 (0.000)				0.000*** (0.000)
Constant	0.001*** (0.000)	0.001*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Observations	18,006,374	18,000,882	18,006,374	18,000,882	18,006,374	18,006,374	18,000,882	18,000,882
R²	0.036	0.090	0.005	0.021	0.003	0.002	0.045	0.045

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

Model one regresses the announcement of a takeover on the announcement of a share repurchase. The outcome of the regression is a positive relationship between takeover announcements and buyback announcements. However, this coefficient is not significant, but very close to significant at the 10% level with p-value of 0.129 (appendix 8.3.1, table 33). The same holds for model two where there is also a near-significant (p-value of 0.122, appendix 8.3.1, table 34) positive relationship between takeover announcements and buyback announcements. As noted in section 4.2, there is significant evidence that there is a dependency between takeover announcements and buyback completions. This also becomes apparent when examining the results of model three and four. Both models have the completion of a buyback as the dependent variable. Model three regresses takeover announcements on buyback completions without control variables. Model four includes the control variables. As shown in appendix 8.3.1 table 35 and 36, both coefficients are 0.001 and very close to the significance level of 10% (p-values of 0.114 and 0.109 respectively). If these coefficients were significant, it would have implied that if a takeover is announced of a specific firm, the chance of a completion of a buyback at that firm rises with 0.1% when keeping all other coefficients constant.

The most compelling results from the daily regression analyses are described in model five and seven. In model five it can be observed that the completion of a buyback reduces the probability of a takeover being withdrawn by 0.17 bps. For model seven this number more than doubles with a coefficient of 0.39 bps. This is contradictory to the findings of Cheng and Zhang in 2012. They state that buying back shares is effective in deterring ex post takeover bids with high ex ante takeover likelihood. They also state that firms with higher ex ante takeover likelihood pay a higher average price to repurchase shares, which is consistent with firms using share buybacks as a takeover defense (Cheng & Zhang, 2012).

4.3.1.2 Quarterly data

In total, eight linear probability models are created based on the quarterly dataset to observe the relationship between buyback and takeover announcements completions and withdrawals. Please refer to table 8 on the next page to see the all the coefficients obtained and to appendix 8.3.1.2 to see the full regression outcomes.

Linear probability models based on daily data. The numbers between brackets depict the standard errors of the coefficients. These models show the increase or decrease in probability of an event occuring.

Table 8: quarterly LPM models

	Dependent variable:							
	Takeover Announced				Takeover Withdrawn			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Buyback Announced	-0.004*		-0.006**		-0.001		0.000	
	(0.003)		(0.003)		(0.001)		(0.002)	
Buyback Complete		0.001		0.003		0.000		-0.001
		(0.010)		(0.004)		(0.002)		(0.001)
Transaction Value			0.000	0.000**			0.000	0.000
			(0.000)	(0.000)			(0.000)	(0.000)
Total Assets			0.000	0.000			0.000	0.000
			(0.000)	(0.000)			(0.000)	(0.000)
Shares Outstanding			0.000	0.000			0.000	0.000
			(0.000)	(0.000)			(0.000)	(0.000)
Non-Operating Income			0.000	0.000			0.000	0.000
			(0.000)	(0.000)			(0.000)	(0.000)
Net Sales			0.000	0.000			0.000	0.000
			(0.000)	(0.000)			(0.000)	(0.000)
Constant	0.012***	0.010***	0.013***	0.008***	0.002***	0.001***	0.001***	0.002***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Observations	12,164	12,164	11,053	11,053	12,164	12,164	10,981	10,981
R^2	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.000

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

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From the table above, one can see that there is one significant relationship. Namely, between the announcement of a buyback and the announcement of a takeover. In model one, a buyback announcement decreases the probability of a takeover being announced by 0.004 percentage points. Model three in which control variables are added to the regression shows, the announcement of a share repurchase decreases the probability of a takeover announcement. The addition of control variables reveals that the p-value of the coefficient of a share repurchase announcement decreases from 0.092 to 0.040 which makes the model more significant. The fact that there is significant evidence that share repurchases decrease the probability of a takeover being announced contradicts the findings by Billet and Xue in 2007. They find a significantly positive relationship between share repurchases and takeover probability (Billet & Xue, 2007). A negative relationship, as obtained by the results in this research, seems logical as the announcement of a share repurchase signals positive information to the market which should increase the share price/value of the company. This makes the company less attractive for a possible takeover.

4.3.2   Excess returns

4.3.2.1   Daily data

In total, sixteen models were created for analysis of the daily data in order to observe the effect of buyback and takeover announcements, completions, and withdrawals on the excess returns of the companies. Please refer to table 9 on the next page for comparison of the coefficients of the daily regressions. The full outcomes of the regressions can be found in appendix 8.3.2.

In model one, it can be observed that buyback announcements have a positive effect on excess returns. Unfortunately, this result is not significant, and no conclusions can be drawn. However, if this result were significant, the positive effect on excess returns could have been due to the positive signal of a share buyback, as per Bagnoli, Gordon and Lipman in 1989. They posit that a share repurchase is a positive signal to stockholders about the firm's value under the current management (Bagnoli, Gordon & Lipman, 1989).

Interestingly, as shown in model three, the withdrawal of a buyback also has a positive effect on the excess returns of a firm. The excess returns of a firm increase by 0.019 percent after a withdrawal of a buyback. This is peculiar as the announcement of a buyback is a sign of financial stability and therefore the withdrawal of a buyback plan should be a negative signal to the market and decrease excess returns.

Table 9: Regressions with buyback and takeover annoucements, completions and withdrawals on excess returns

Regression results with excess returns as the dependent variable. The numbers between brackets depict the standard errors of the coefficients.

	Dependent variable:							
	Excess Returns							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Models without control variables								
Buyback Announced	0.122			0.154				
	(0.113)			(0.14)				
Buyback Completed		-0.016		-0.170				
		(0.031)		(0.142)				
Buyback Withdrawn			0.019**	-0.135				
			(0.009)	(0.14)				
Takeover Announced					0.172**			0.061**
					(0.007)			(0.016)
Takeover Completed						0.188**		0.128**
						(0.008)		(0.018)
Takeover Withdrawn							0.105**	0.044**
							(0.018)	(0.025)
Constant	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	17,841,341	17,841,341	17,841,341	17,841,341	17,841,341	17,841,341	17,841,341	17,841,341
R²	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Panel B: Models with control variables								
Buyback Announced	0.011			0.014*				
	(0.010)			(0.007)				
Buyback Completed		-0.021		-0.033				
		(0.035)		(0.029)				
Buyback Withdrawn			0.045	0.032				
			(0.032)	(0.034)				
Takeover Announced					0.190**			2.431
					(0.008)			(5.465)
Takeover Completed						0.201**		2.658
						(0.009)		(6.93)
Takeover Withdrawn							0.079**	-3.065
							(0.022)	(5.319)
Shares Outstanding	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Transaction Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Net Sales LTM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total Assets	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.085***	0.085***	0.085***	0.085***	0.085***	0.085***	0.085***	83.263***
	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)	(33.415)
Observations	17,840,858	17,840,858	17,840,858	17,840,858	17,840,858	17,840,858	17,840,858	17,840,858
R²	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002

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

Results from models five to eight indicate that takeover announcements, completions and withdrawals all have a significant positive impact. According to Kang (2009), a takeover can have both positive and negative effects. The positive effects arise from the reduction of the agency problem. However, a takeover can also reduce current shareholders' wealth and bring a myopic attitude to operational planning.

When adding control variables to the regression analysis it becomes apparent that in model twelve buyback announcements increase excess returns with 0.0014 percentage points. Because of this positive effect on excess returns, the offer of an acquirer has to be higher than before the announcement. This result is backed by evidence from Bagwell in 1991. In his research, he finds that a share repurchase increases the cost to a potential acquirer as it alters the distribution of shareholder reservation values. One of Bagwell's crucial insights is that repurchases can eliminate shareholders with the lowest reservation values, leaving the acquirer facing those with a relatively higher valuation.

4.3.2.2 Quarterly data

The regressions on excess returns using quarterly data led to multiple outcomes. In total, eighteen models were created and analyzed. The coefficients obtained are shown in table 10 on the next page. The full regression results can be found in appendix 8.3.2.

The coefficient of the announcement of share buybacks is -0.072 in model one and is significant at the 5% level. This indicates that share repurchase announcements decrease excess returns by 0.072 percentage points. Similar coefficients are observed in model four, nine, ten, thirteen, and eighteen. Therefore, it can be concluded that share repurchases are detrimental to shareholder returns and as a result decrease firm value. This implies that the shares (may) become less attractive to stockholders and thereby increasing their willingness to sell their shares to possible acquirers. This is not in line with the research by Bagnoli, Gordon and Lipman in 1989. Their findings indicate that share repurchases are a positive signal to stockholders about the firm's value under the current management, convincing them to hold onto their shares (Bagnoli, Gordon & Lipman, 1989). However, when looking at the coefficients for buyback completions, it becomes clear that after the completion of a share repurchase, excess returns increase again. The excess returns reincrease by approximately half of the percentage points lost due to the buyback announcement. So, in the end, there is still a decline in excess returns of about 0.0035 percentage points after a buyback announcement followed by a buyback completion.

Table 10: Regressions using quarterly data with buyback and takeover announcement completions and withdrawals on excess returns
Regression results with excess returns as the dependent variable. The numbers between brackets depict the standard errors of the coefficients.

					Dependent variable:				
					Excess Returns				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Models without control variables									
Buyback Announced	-0.072**			-0.076**					-0.076**
	(0.029)			(0.030)					(0.030)
Buyback Complete		0.009		0.030*					0.030*
		(0.015)		(0.017)					(0.017)
Buyback Withdrawn			-0.007	0.015					0.015
			(0.021)	(0.023)					(0.023)
Takeover Announced					0.003**			-0.157	-0.128
					(0.071)			(0.194)	(0.200)
Takeover Complete						-0.002		0.155	0.108
						(0.091)		(0.215)	(0.220)
Takeover Withdrawn							0.087	0.244	0.199
							(0.113)	(0.279)	(0.231)
Constant	0.138***	0.100***	0.100***	0.138***	0.100***	0.100***	0.100***	0.100***	0.138***
	(0.015)	(0.001)	(0.001)	(0.015)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
Observations	11,864	11,864	11,864	11,864	11,864	11,864	11,864	11,864	11,864
R²	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.001

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Panel B: Models with control variables									
Buyback Announced	-0.071**			-0.076**					-0.076**
	(0.030)			(0.031)					(0.032)
Buyback Complete		0.013		0.034*					0.034*
		(0.016)		(0.019)					(0.019)
Buyback Withdrawn			0.000	0.021					0.022
			(0.022)	(0.024)					(0.024)
Takeover Announced					0.011			-0.264	-0.264
					(0.092)			(0.415)	(0.415)
Takeover Complete						0.016		0.280	0.252
						(0.117)		(0.431)	(0.432)
Takeover Withdrawn							0.059	0.323	0.301
							(0.129)	(0.434)	(0.435)
Transaction Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total Assets	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shares Outstanding	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Non-Operating Income	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Net Sales	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.171***	0.131***	0.132***	0.171***	0.131***	0.131***	0.131***	0.131***	0.171***
	(0.017)	(0.004)	(0.004)	(0.017)	(0.004)	(0.004)	(0.004)	(0.004)	(0.017)
Observations	10,711	10,711	10,711	10,711	10,711	10,782	10,782	10,782	10,782
R²	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001

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

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One final significant result from the quarterly regression analysis on excess returns is the fact that a takeover announcement has a significant positive effect on excess returns. This is because of stock price arbitrage during the pre-takeover period. In stock price arbitrage traders buy shares of a targeted company at a lower price than the takeover price. After the takeover has been completed, these traders can sell their shares for a profit.

4.3.3 Cash and debt

Different models are created to observe the effect of buyback and takeover announcements, completions and withdrawals on the cash and debt levels of a firm. In table 11 on the next page, the outcomes of the regressions of buyback and takeover announcements, completions and withdrawals on cash are presented. The full regression tables for cash and debt can be found in appendix 8.3.

From model three, four and nine, it becomes clear that the withdrawal of a buyback has a positive effect on the cash balance of a firm. More specifically, in model nine, the model with the greatest significance, cash reserves of a firm increase with 246.3 million dollars whenever a repurchase program is withdrawn. This is logical, as this cash is not used for the buyback as announced.

When adding control variables to the regressions, there is significant evidence that a buyback has a negative effect on cash held by a company. One can see this in model ten, thirteen and eighteen where the coefficients for a buyback announcement are -194.5, -200.3, and -200.5 respectively. This is in line with previous research by Harris and Raviv (1988) that saw share repurchases affect the capital structure of companies. When considering the formula of enterprise value, a lower cash balance leads to an increase in firm value. Therefore, these results are also in line with Dann (1980) who states in his paper that firm values significantly increase after a stock repurchase announcement.

Unfortunately, the regressions performed to analyze the effect of share repurchases and takeover announcements, completions, and withdrawal on debt, provided no significant coefficients. Therefore, these coefficients are not interpretable, and no conclusions can be drawn from these results. However, if they were significant and interpretable, all coefficients are negative. This indicates that the announcement, completion, and withdrawal of share repurchase programs would lead to a lower debt balance on a firm's balance sheet. When considering the formula for firm value as mentioned in the methodology, this would imply a lower firm value. The same holds for takeover announcements, completions and withdrawals. The regression tables for debt can be found in appendix 8.3.4.

Table 11: Regressions using quarterly data with buyback and takeover announcement completions and withdrawals on cash

Regressions of buyback announcements completions and withdrawals on cash using quarterly data. In panel A the regressions are performed without control variables. Panel B consists of models with control variables. The numbers between brackets are the standard errors of the coefficients.

	Dependent variable:								
					Cash				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: regressions without control variables									
Buyback Announced	-137.470			-143.100					-143.135
	(136.565)			(141.506)					(141.680)
Buyback Complete		-125.572		-77.159					-77.347
		(107.533)		(114.221)					114.327
Buyback Withdrawn			225.672**	245.134**					246.246**
			(96.566)	(104.239)					(104.288
Takeover Announced					102.405			-191.315	-152.198
					(90.743)			(135.556)	(153.595)
Takeover Complete						104.588		295.903*	280.597
						(101.563)		(169.392)	(199.137)
Takeover Withdrawn							229.025	490.341*	476.618*
							(235.359)	(271.634)	(262.531)
Constant	847.558***	776.006***	759.747***	847.261***	767.200***	767.351***	767.466***	767.233***	846.636***
	(79.314)	(7.099)	(3.411)	(79.031)	(0.460)	(0.357)	(0.199)	(0.420)	(79.115)
Observations	7,106	7,106	7,106	7,106	7,106	7,106	7,106	7,106	7,106
R²	0.009	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Panel B: regressions with control variables									
Buyback Announced	-194.512*			-200.274**					-200.449*
	(109.512)			(116.642)					(117.266)
Buyback Complete		-112.687		-53.022					-51.813
		(123.404)		(131.650)					(131.814)
Buyback Withdrawn			185.550	217.300*					218.869*
			(123.983)	(134.491)					(134.638)
Takeover Announced					246.322			-18.815	-16.745
					(250.674)			(53.482)	(53.805)
Takeover Complete						387.190		407.406	(288.101)
						(398.631)		(423.006)	(385.254)
Takeover Withdrawn							16.005	62.102	113.631
							(26.195)	(68.883)	(80.511)
Transaction Value	0.097	0.090	0.089	0.096	-0.017	-0.029	0.008	-0.029	0.096
	(0.123)	(0.123)	(0.123)	(0.123)	(0.018)	(0.029)	(0.019)	(0.029)	(0.123)
Total Assets	0.011	0.011	0.011	0.011	0.010	0.010	0.010	0.010	0.011
	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)
Shares Outstanding	2.279**	2.289**	2.283**	2.286**	2.343**	2.343**	2.343**	2.343**	2.286**
	(1.021)	(1.029)	(1.026)	(1.023)	(1.096)	(1.096)	(1.096)	(1.096)	(1.023)
Non-Operating Income	-1.677**	-1.689**	-1.692**	-1.677**	-1.723*	-1.723*	-1.723*	-1.723*	-1.678**
	(0.811)	(0.815)	(0.813)	(0.810)	(0.894)	(0.894)	(0.894)	(0.895)	(0.810)
Net Sales	-0.111	-0.110	-0.112	-0.112	-0.098	-0.098	-0.098	-0.098	-0.111
	(0.150)	(0.150)	(0.150)	(0.150)	(0.154)	(0.154)	(0.154)	(0.154)	(0.151)
Constant	428.427	324.576	314.705	429.315	348.095	347.832	349.174	347.832	427.923
	(293.091)	(263.425)	(263.573)	(293.991)	(257.287)	(257.325)	(257.148)	(257.365)	(294.527)
Observations	7,031	7,031	7,031	7,031	7,031	7,031	7,031	7,031	7,031
R²	0.034	0.034	0.033	0.034	0.028	0.028	0.028	0.028	0.034

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

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4.3.4 Investments versus buybacks

The last models created consider investments and share repurchase announcements, completions, and withdrawals. The results can be found in the table below.

Table 12: regressions buybacks and investments on excess returns

Regressions of investements and buyback announcements, completions, and withdrawals on excess returns. Numbers between brackets depict the standard error of the coefficients.

	Dependent variable:							
	Excess Returns							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Buyback Announced	-0.072**				-0.072**			-0.076**
	(0.029)				(0.029)			(0.030)
Buyback Complete		0.009				0.009		0.030*
		(0.015)				(0.015)		(0.017)
Buyback Withdrawn			-0.007				-0.007	0.015
			(0.021)				(0.759)	(0.023)
Investments				0.000	0.000	0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.138***	0.100***	0.100***	0.101***	0.139***	0.100***	0.101***	0.138***
	(0.015)	(0.001)	(0.001)	(0.000)	(0.015)	(0.001)	(0.001)	(0.015)
Observations	11,864	11,864	11,864	11,864	11,864	11,864	11,864	11,864
R^2	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001

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

As discussed previously, the results show that buybacks announcements have a significant negative impact on the excess returns of a firm. In model eight shown above, one can see however that the completion of a buyback does increase excess returns. However, this does not offset the negative returns obtained from the announcement. The purpose of this analysis was to see whether investments or share repurchase programs add more value to a company. Unfortunately, the phenomenon stated by Laura Schneider in the Harvard Business Review in 2017 cannot be disproven. She mentions that share repurchases add value in the short run, but that the most sustainable way of adding value to a company are long-term investments. From the results of this analysis, it can only be concluded that buybacks lower firm value and that there is no significant impact of investments.

4.4 Probit models

4.4.1.1 Daily data

Probit models are an alternative to the linear probability models presented earlier. These models are included in this paper as a robustness test.

With respect to the analysis of daily data, nine probit models are created to observe the effect of buyback announcements and completions on takeover announcements, completions and withdrawals. Please refer to appendix 8.4.1 for the full probit regressions.

In table 13 on the next page, one can observe the marginal effects yielded by the probit models. For model one, there is significant evidence at the 10% level to conclude that the announcement of a share repurchase plan increases the probability of a takeover being announced by 0.00017 percentage points. This contradicts Bagnoli, Gordon and Lipman in 1989 and Bagwell's findings in 1991 that buybacks increase firm value and protect against takeovers. It is however in line with research by Billet & Xue in 2007 in that they find a positive relationship between repurchases and takeover probability. Model two is in line with the findings of Bagnoli, Gordon and Lipman. There is significant evidence that the announcement of a buyback decreases the probability of a takeover announcement by 0.0001701 percentage point. In addition, in this regression it becomes apparent that the number of shares outstanding decreases the chance of a takeover announcement. Excess returns increase the probability of a takeover announcement and trading volume also increases the probability of a takeover announcement. The number of shares outstanding has a negative effect on takeover announcement probability as more shares outstanding correlates to more owners thus decisionmakers, ergo, making it harder to acquire a certain company. Higher excess returns indicate that a firm is outperforming the benchmark and thus performing well. A high trading volume in rising markets means that a company is seen as a healthy company. Therefore, a higher trading volume increases the probability of a takeover announcement.

Models four and five indicate that the completion of a buyback increases the probability of a takeover being announced by 0.0005 and 0.0006 percentage points respectively. Models six, seven, and eight do not show any significant relationship between either a share repurchase announcement or completion and takeover completions. Finally, in model nine, the effect of share repurchase announcements on takeover withdrawals is analyzed. The marginal effect of a share repurchase announcement is positive, and the announcement of a share repurchase increases the probability of a takeover being withdrawn by 0.002 bps.

Table 13: full overview of marginal effects yielded by probit models based on daily data of buyback announcements and completions on takeover announcements completions and withdrawals. Numbers between brackets depict the standard errors of the marginal effects.

Marginal effects of buyback announcements and completions on takeover announcements completions and withdrawals.

| | Dependent variable: | | | | | | | | |
| | Takeover Announced | | | | Takeover Completed | | | | Takeover Withdrawn |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Buyback Announced	0.0001685*	-0.0001701*	0.0001251		-0.0001027	-0.0001119		-0.0003627	0.0000155
	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
Buyback Completed				0.0004561***	0.0005587***		0.0004522	0.7050177	
				(0.000)	(0.000)		(0.042)	(441.601)	
Shares Outstanding				-0.0004094*	-0.0003333***	-0.0003333***	-0.0003333***	-0.000333	
				(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	
Excess Returns				0.0002412***		0.0001911***	0.0001912***	0.0001912	
				(0.000)		(0.000)	(0.000)	(0.001)	
Trading Volume				0.0003768***		0.0003066***	0.0003065***	0.0003065	
				(0.000)		(0.000)	(0.000)	(0.001)	
Observations	18,006,274	8,474,223	18,006,274	18,006,274	18,006,274	8,474,223	17,841,341	8,474,223	18,006,274

4.4.1.2   Quarterly data

Probit models were also created to analyze the quarterly dataset used in this paper. In total, eighteen probit models are constructed. Table 14 on the next page summarizes the marginal effects obtained from the quarterly data. Appendix 8.4.2 shows the full probit models including the coefficients.

To begin with, the marginal effects in model one three four and six show that the announcement of a share repurchase decreases the probability of a takeover announcement with about 0.011 percentage points. In addition, there is significant evidence at the 0.01 confidence level that the announcement of share repurchase programs also decreases the probability of a takeover being completed. Based on the findings mentioned earlier, the most plausible explanation for this phenomenon is the signaling hypothesis. This hypothesis has been described both by Ofer and Thakor in 1987 and by Constantinides and Grundy in 1989. They posit that managers signal the actual value of a company by either using a dividend or share repurchase. An analogous explanation is that a manager is unwilling to overpay for a share repurchase when the firm's value under his control is low. Therefore, a share repurchase is a positive signal for stockholders about the enterprise value, convincing them not to sell to possible acquirors (Bagnoli, Gordon & Lipman 1989). Because of this mechanism, the announcement and completion probabilities of takeovers goes down.

It was expected that the announcement of buybacks would have a positive effect on the withdrawals of takeovers because of the process described above. However, the obtained marginal effects are in fact negative, but also non-interpretable because these effects are insignificant.

Table 14: full overview of marginal effects yielded by probit models based on quarterly data
Marginal effects of buyback announcements and completions on takeover announcements completions and withdrawals. Numbers between brackets depict the standard errors of the marginal effects.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: takeover announced as dependent variable						
Buyback Announced	-0.010***		-0.011***	-0.011***		-0.012***
	(0.002)		(0.002)	(0.002)		(0.002)
Buyback Completed		0.000	0.005		-0.001	0.009
		(0.000)	(0.004)		(0.002)	(0.007)
Total Assets				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Shares Outstanding				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Non-Operating Income				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Net Sales				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Observations	12,164	12,164	12,164	11,060	11,060	11,060
	(7)	(8)	(9)	(10)	(11)	(12)
Panel B: takeover complete as dependent variable						
Buyback Announced	-0.010***		-0.011***	-0.011***		-0.012***
	(0.002)		(0.002)	(0.002)		(0.002)
Buyback Completed		0.000	0.005		-0.001	0.009
		(0.000)	(0.004)		(0.002)	(0.007)
Total Assets				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Shares Outstanding				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Non-Operating Income				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Net Sales				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Observations	12,164	12,164	12,164	11,060	11,060	11,060
Panel C: takeover withdrawn as dependent variable						
	(13)	(14)	(15)	(16)	(17)	(18)
Buyback Announced	0.000		-0.001	-0.001		-0.001
	(0.001)		(0.001)	(0.001)		(0.001)
Buyback Completed		0.052	0.001		0.000	0.001
		(0.315)	(0.001)		(0.002)	(0.002)
Total Assets				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Shares Outstanding				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Non-Operating Income				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Net Sales				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Observations	12,164	12,164	12,164	11,060	11,060	11,060

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

4.5 Hazard rate models

4.5.1.1 Daily data

In this section, five different hazard rate models will be discussed. A summary of all the hazard rates and coefficients can be found in table 15 on the next page. For the full models refer to appendix 8.5.1.

In model one, the hazard rate is 1.698. Unfortunately, this result is insignificant. However, had the hazard ratio been significantly different from one, it would imply that the length of survival, i.e., the time it takes between a takeover announcement and completion will decrease when a buyback is announced. A logical explanation for this phenomenon would be that due to the buyback, the value of a firm increases and therefore becomes a more attractive target to be taken over.

Table 15: hazard rate model outcomes based on daily data

Hazard rate models based on daily data. The numbers between brackets depict the standard errors. The top number for each variable is the hazard rate and the bottom number is the coefficient.

	(1)	(2)	(3)	(4)	(5)
Buyback Announced	1.698		0.777	4.442	
	(1.240)		(1.077)	(3.816)	
	0.529		-0.252	1.491	
	(0.731)		(1.387)	(1.460)	
Buyback Complete		2.399	3.087		4.442
		(2.051)	(5.030)		(5.128)
		0.875	1.127		1.491
		(0.855)	(1.629)		(1.154)
Shares Outstanding				0.743***	0.743***
				(0.000)	(0.029)
				-0.297***	-0.297***
				(0.000)	(0.039)
Excess Returns				0.983	0.983
				(0.004)	(0.027)
				-0.017	-0.017
				(0.004)	(0.027)
Trading Volume				1.181***	1.181***
				(0.007)	(0.028)
				0.167***	0.167***
				(0.007)	(0.024)
Observations	3,253	3,253	3,253	2,483	2,483
Number of failures	3,166	3,166	3,166	2,446	2,446

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

The evidence that managers signal a firms' actual value by using a share repurchase is backed by Ofer and Thakor (1987) and Constantinides and Grundy (1989). Model two has a hazard ratio of 2.399 indicating that a completed share repurchase plan decreases the time to exit (takeover completion). This hazard ratio is also insignificant and therefore uninterpretable. Model three, where both the announcements and completions are taken into account, does not yield any significant results either. In model four and five, control variables are taken into account. When looking at the results, the number of shares outstanding actually increases the length of survival (hazard ratio of 0.743). So, if a firm has more shares outstanding, it takes longer on average for a takeover to be completed. These results are significant and can be explained by the fact that if there are more shares outstanding, more people (or the same amount of people with a bigger vote) have a say in the future of the company. Therefore, it could take longer to get to an agreement between the target and the acquirer(s). Furthermore, the hazard ratio of the trading volume is 1.181. This is a significant result and indicates that if the trading volume increases, the time to takeover completion decreases. In both model four and five, the announcement of a buyback has a very high hazard rate which would indicate that the time between the announcement and completion of a takeover decreases.

Furthermore, below represents the hazard rate functions grouped by buyback announcement. The red line indicates the hazard rate for the group with buyback announcements and the grey line for the group where no share repurchase announcement has taken place.

Graph 1: smooth hazard rate model daily data
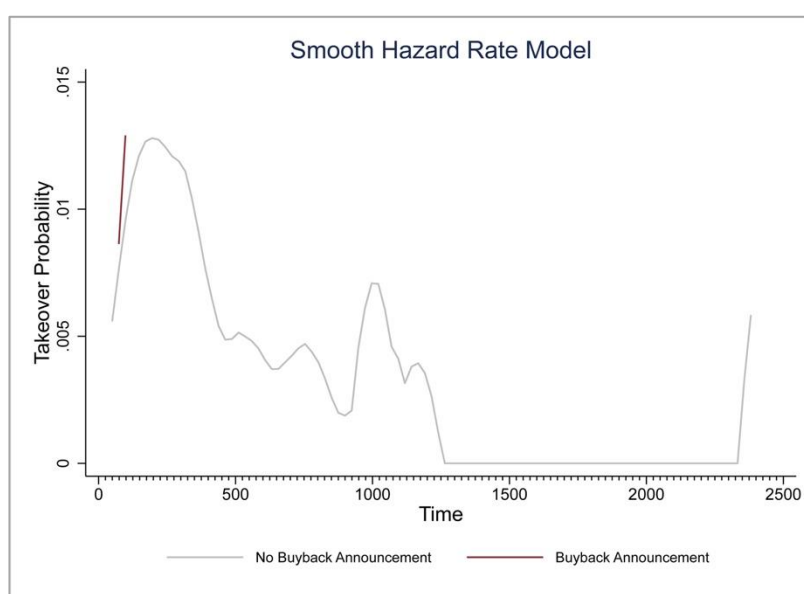
From the figure it becomes apparent that in the first ten to thirty days the probability of a takeover rises for both companies that did or did not announce a share repurchase program.

After 75 days, the hazard rate for companies that engaged in a share repurchase plan stops. This means that in this sample, after 75 days, there are no more completions of takeovers for companies that have announced a buyback. However, when there is a buyback announcement, the probability of a takeover being completed increases. This indicates that the value added to companies by performing a share repurchase makes them an interesting target for acquirers. The probability of a takeover being completed rises from 0.0080 to 0.0130 in these 75 days.

Because there are no more takeover completions after 75 days for companies that have performed a buyback it becomes clear that share buybacks are only used as a defensive strategy for a limited amount of time after a takeover announcement. One final interesting result from the hazard rate model is that for companies without buyback announcements in the first 200 days, the probability of a takeover increases and thereafter there is a decrease in this probability. However, after 900 days the probability of a takeover being completed increases again for a short amount of time. A possible explanation for this phenomenon could be the following. There are several steps in the process of a takeover, including industry and competitor analysis, evaluation of growth opportunities and investigations of possible economies of scale. There are many factors that can either make a takeover a quick and smooth process or a slow and tough procedure. For instance, when a company is acquiring a target in the same industry, the industry analysis will be effortless decreasing the time to completion. However, when the target company is in a different industry, this analysis can be time consuming. This could explain the spike in takeover probability after 900 days.

4.5.1.2 Quarterly data

For the analysis of the quarterly data, six hazard rate models are created. The coefficients and hazard rates are summarized in table 16 on the next page. The full outcomes of the models are presented in appendix 8.5.2.

Model two is the first model that yielded significant hazard rates. The hazard rate of the completion of a buyback is 5.026. This implies that when a buyback is completed, the time to complete a takeover decreases. A possible explanation for this is the following. Due to a share repurchase, there are less shares outstanding. If there are less shares outstanding, the ownership of a certain company is more concentrated, and decisions can be made more easily. Therefore, share buybacks could lead to quicker decisions with respect to mergers and acquisitions. The same holds for model three where there is also a significant hazard rate of 5.009. There are no other significant hazard rates provided by the quarterly hazard rate models. Lastly, the smooth hazard curve for the quarterly data is presented below.

Table 16: hazard rate model outcomes based on quarterly data

Hazard rate models based on quarterly data. The numbers between brackets depict the standard errors. The top number for each variable is the hazard rate and the bottom number is the coefficient.

	(1)	(2)	(3)	(4)	(5)	(6)
Buyback Announced	1.340		1.012	2.614		1.917
	(0.468)		(0.388)	(3.816)		(1.261)
	0.293		0.012	0.961		0.651
	(0.349)		(0.384)	(1.460)		(0.658)
Buyback Complete		5.056**	5.009**		11.744	9.275
		(4.064)	(4.292)		(25.753)	(12.552)
		1.621**	1.611**		2.463	2.227
		(0.804)	(0.857)		(2.193)	(1.353)
Total Assets				1.000	1.000	1.000
				(0.000)	(0.000)	(0.000)
				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Shares Outstanding				0.997	0.998	0.997
				(0.004)	(0.002)	(0.002)
				-0.003	-0.002	-0.003
				(0.004)	(0.002)	(0.002)
Non-Operating Income				0.997	0.997	0.996
				(0.007)	(0.005)	(0.005)
				-0.003	-0.003	-0.004
				(0.007)	(0.005)	(0.005)
Net Sales				1.000	1.000	1.000
				(0.001)	(0.000)	(0.000)
				0.003	0.000	0.000
				(0.005)	(0.000)	(0.000)
Observations	94	94	94	86	86	86
Number of failures	94	94	94	86	86	86

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

The graph shows that the takeover probability rises equally for firms that have and those that have not announced a share repurchase program for the first 50 days, starting from day 50 (in effect days 50-100). This is in line with the research by Billet and Xue in 2007. They find a significantly positive relation between open market share repurchases and takeover probability. This indicates that when takeover probability increases, the amount of share repurchases increases.

Graph 2: smooth hazard rate model quarterly data
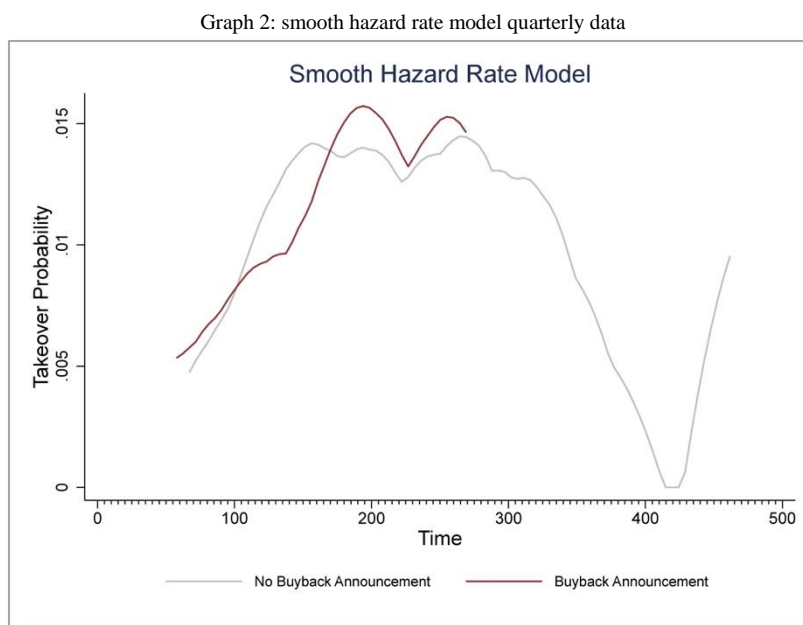
The hazard rate curve above shows the same, but here from the perspective of share repurchases instead of that of takeover probability. After approximately the 100th day until the 170th day in the analysis the takeover probability of firms that have announced a buyback is lower than that of firms that did not. Furthermore, after the 170th day, the takeover probability of firms that have done an announcement of a share repurchase rises above the takeover probability of firms that did not announce a share repurchase. A similar explanation as before may apply, that is, share repurchases reduce the number of shares outstanding and therefore decisions on mergers and acquisitions are made more easily by firm management. After 265 days, there are no more takeovers for firms that have performed buybacks and the takeover probability is at its peak for firms that did not announce a share repurchase. From this moment onwards, the takeover probability plummets to nearly 0.0% at 415 days after the announcements. This either indicates that after 265 days most of the takeovers are already completed, or that after 265 days most of the takeover offers are withdrawn if they are not completed yet. After the 425th day there is an incline in takeover probability. This is possible due to the same explanation given in section 4.5.1.1.

5 Conclusion

In this part, the results will be used to check the validity of the four hypotheses stated in the introduction of this paper. Hereafter, the research question will be answered.

Hypothesis one states: *Share repurchases increase firm value by decreasing cash and changing the capital structure.* From the t-test performed on quarterly data, it cannot be concluded that firms that repurchase their shares decrease their cash balance and thereby increase their firm value. The t-tests led to opposing results. As mentioned in the results section, it could be the case that the group of firms announcing or completing buybacks already had more cash on hand or that more debt is used for repurchases in this sample. From the regressions performed on firms' cash balances, it became apparent that buyback withdrawals have a positive effect on the cash balance of a firm. More interesting is the fact that the announcement of a buyback has a negative effect on the cash balances. This means that the announcement of a share repurchase already increases the firm value by having a negative effect on cash balances. There is no evidence for changes in debt balances for firms when a share repurchase is announced, completed, or withdrawn. Elaborating on firm value, from the regressions on the daily data, buyback announcements have a significant positive effect on excess returns. However, the quarterly regressions show the opposite of this. Here it is observed that share repurchase announcements decrease excess returns. The completion of a share repurchase increases the excess returns, but this increase is not enough to offset the negative excess returns caused by the share repurchase announcement.

To summarize, the paired sampled t-test did not confirm the hypothesis. However, regression analysis presented significant evidence for a negative effect of share buyback announcements on cash balances. Nonetheless, regression models also show that the combination of a share repurchase announcement and completion are still detrimental for excess returns. Therefore, the announcement of a buyback does change the capital structure by having a negative effect on cash balances. However, the conclusion that share repurchases actually increase firm value cannot be drawn.

Hypothesis two, *share repurchases add more value to a company in the long run than investments.* From the regression models created in this paper, this hypothesis cannot be validated. The results show that the combination of a buyback announcement and completion lower excess returns obtained by a firms' stock. With respect to investments made by a firm, there is no significant evidence that investments have an impact on excess returns. Therefore, this hypothesis cannot be validated, and it must be concluded that share repurchases by itself decrease firm value and that investments have no impact.

Hypothesis three states the following: *There is a positive correlation between share repurchases and takeover announcements.* The Fisher's exact test indicates that there is a correlation between the completion of a buyback and the announcement of a takeover. Further analysis of quarterly data reveals a significant correlation between buyback announcements and takeover announcements. This evidence is supported by the regressions of buyback announcements on takeover announcments with control variables based on the quarterly data. Namely, these regressions yielded a negative coefficient. This implies that the announcement of a buyback reduces the probability of a takeover being announced. Therefore, hypothesis three cannot be accepted and it must be concluded that the opposite is true, there is a negative correlation between share repurchase announcements and takeover announcements. This seems like a logical outcome, as share repurchases signal positive information to the market. This positive information in turn increases the market price of the company making it a less attractive target.

Finally, hypothesis 4: *"The probability of a takeover succeeding decreases after a share repurchase."* From the analysis of daily data there is evidence that the announcement of a share repurchase decreases the probability of a takeover being announced. This is in line with previous literature by Bagnoli, Gordon and Lipman. Another finding from this regression is that the number of shares outstanding negatively relates to the probability of a takeover. However, the regressions performed also indicate that the completion of a share repurchase increases the probability of the announcement of a takeover more. Therefore, analysis of the daily data led to somewhat contradictory results. Even though the results of the daily data were inconsistent, the results of the quarterly data were not. The quarterly models show that the announcement of a share repurchase decreases the probability of a takeover announcement and completion. These results are consistent with previous literature by Ofer and Thakor in 1987 and Constantinides and Grundy in 1989. The hazard rate models run on the daily data show that even though a buyback is announced, in the first month of a takeover announcement, the probability of a takeover being completed rises and is higher than that of firms that have not announced a buyback. In addition, from the hazard rate models obtained from the quarterly dataset, after 100 days after the announcement of a takeover, probability of a takeover being completed is lower for firms that have announced a repurchase plan. However, a completed buyback does reduce the time it takes between a takeover announcement and completion. Based on the outcomes of the probit and hazard rate models, hypothesis four is accepted and it can therefore be concluded that the success of a takeover decreases after a share repurchase.

To conclude, the research question of this paper is:

Can share repurchases be used by firm management to defend themselves against takeovers, and what are the consequences of share repurchases for the likelihood of being taken over and for firm value?

Research conducted and described in this article has shown that repurchases indeed lower the probability of a takeover announcement. In addition, firms that have announced a share repurchase program have a lower probability of a takeover succeeding. There is also significant evidence that repurchase announcements decrease cash balances and withdrawals increase cash balances. So, buyback activity does change the capital structure. However, there is opposing evidence with respect to firm value. Namely, firm value decreases when a share repurchase is completed after it has been announced.

With the takeover announcement probability and the probability of a takeover succeeding being lower for firms that did perform a buyback, buybacks can be used by management to defend themselves against takeovers. However, this mechanism doesn't lie in value changes of the firm. This is most certainly due to the signaling effect of share repurchases as explained by Bagnoli, Gordon and Lipman in 1989.

To conclude, share repurchases can be used by firm management to defend against takeovers, share repurchases do change the capital structure, and the likelihood of being taken over by other firms decreases with share repurchases. Nonetheless, the research presented above should be extended, more on this in the discussion section hereafter.

6 Discussion

In this part, the relevance of the results obtained from this research will be discussed and, some limitations of this research are addressed. These limitations then offer some insights in elaborations that can be made on this paper.

The results of this paper contribute to the existing literature in a few ways. First, this paper shows that the probability of a takeover succeeding decreases for firms that have performed or when they even only announced a buyback. This implies that firm management can indeed use share repurchases to protect themselves against takeovers, as was confirmed also by Bagnoli, Gordon and Lipman in 1989. They as they showed that firm management can signal positive information about the firm by performing buybacks. This paper focusses only on Northern American firms but can easily be applied to other countries.

Another contribution of this paper is the insight it offers on changes in cash balances by firms. This extends the research of Sinha in 1991 with its focus on debt levels. Cash balances decrease for firms that have announced a buyback and there is no evidence for changes in debt whenever a share repurchase is announced. This implies that there are more cash financed share

repurchases in this sample. Lastly, this paper incorporates hazard rate models. This is not frequently used in the analysis of share repurchases as a strategy to deter takeover probability.

These results matter because they indicate that if a takeover is announced, firms can use buybacks to reduce the probability of a takeover succeeding. In addition, pre takeover announcement, share buybacks can be used by firms to defend themselves against takeovers.

The first limitation of this research is that there is no real indication but only assumptions of the mechanism behind the decrease in probability of takeovers being announced or takeovers succeeding after a share repurchase. This paper did not show that this was due to an increase in firm value. So, the question remains, what causes buybacks to deter takeover probability?

This leads to some recommendations for future research. First, more company financials should be used in the analysis to increase the number of control variables. This can enhance the analysis performed in this paper and might lead to more robust or even more significant results.Second, this analysis should be stretched out to other regions instead of focusing on listed northern American firms. Share repurchase behavior can be very different across countries. There are different regulations, as stated in a paper by Kim, Schremper and Varaiya in 2004. They find that in many nations, open market repurchases are subject to relatively strict regulations in terms of disclosure and execution. Therefore, useful insights might be obtained if the analysis in this paper is applied to different countries around the world.

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8 Appendix

8.1 T-test and Levene's test outcomes

8.1.1 Daily data

Table 17: T-test results daily data GFC and COVID-19 crisis

	Great Financial Crisis		COVID-19 Crisis	
	Takeover Announcements	Buyback Announcements	Takeover Announcements	Buyback Announcements
		Before vs during		
Mean difference	0.000	0.000	0.000	0.000
t-value	5.509	-11.500	3.290	11.433
p-value	0.000	0.000	0.001	0.000
		Before vs After		
Mean difference	0.000	0.000		
t-value	12.079	-11.765		
p-value	0.000	0.000		
		During vs After		
Mean difference	0.000	0.000		
t-value	1.325	5.867		
p-value	0.185	0.000		

Table 18: T-test results daily data excess returns

	Buyback Announcement	Takeover Announcement	Buyback Completion	Takeover Completion	Buyback Withdrawn	Takeover Withdrawn
			Excess Returns			
Mean difference	-0.087	-0.860	0.084	-0.096	0.023	-0.044
t-value	-0.999	-0.595	0.368	-0.609	0.062	-0.102
p-value	0.318	0.552	0.713	0.543	0.951	0.918

Table 19: Levene's test daily data GFC and COVID-19

	Variable Tested	
Event	Buyback Announcement	Takeover Announcement
Great Financial Crisis	0.000*	0.000*
COVID-19 Crisis	0.000*	0.000*

Note: * indicates unequal variances

Table 20: Levene's test daily data GFC and COVID-19

	Variable Tested	
Event	Price	Excess returns
Buyback Announcement	0.706	0.134
Buyback Completion	0.540	0.847
Buyback Withdrawal	0.722	0.845
Takeover Announcement	0.218	0.585
Takeover Completion	0.251	0.574
Takeover Withdrawal	0.710	0.916

Note: * indicates unequal variances

8.1.2 Quarterly data

Table 21: T-test results quarterly data GFC and COVID-19 crisis

	Great Financial Crisis		COVID-19 Crisis	
	Takeover Announcements	Buyback Announcements	Takeover Announcements	Buyback Announcements
		Before vs During		
Mean difference	0.012	-0.317	0.007	0.332
t-value	3.307	-22.790	2.769	19.483
p-value	0.001	0.000	0.006	0.000
		Before vs After		
Mean difference	0.018	-0.117		
t-value	7.016	-11.658		
p-value	0.000	0.000		
		During vs After		
Mean difference	0.006	0.200		
t-value	2.293	15.689		
p-value	0.022	0.000		

Table 22: T-tests of cash debt and excess returns before and after buyback/takeover announcement completion or withdrawal

	Buyback Announcement	Takeover Announcement	Buyback Completion	Takeover Completion	Buyback Withdrawn	Takeover Withdrawn
			Cash			
Mean difference	-495.440	-19.229	-1082.483	-187.630	-554.646	241.704
t-value	-5.511	-0.029	-3.698	-0.239	-2.641	0.151
p-value	0.000	0.977	0.000	0.811	0.009	0.880
			Debt			
Mean difference	11.421	17.765	18.383	15.377	31.757	30.897
t-value	0.939	0.288	0.756	0.230	0.865	0.165
p-value	0.348	0.774	0.450	0.818	0.387	0.869
			Excess Returns			
Mean difference	0.053	-0.096	0.138	-0.108	0.129	-0.124
t-value	0.552	-0.195	0.715	-0.203	0.445	-0.085
p-value	0.581	0.845	0.475	0.839	0.657	0.933

Table 23: Levene's test for unequal variances GFC and COVID-19 Crisis (quarterly)

	Variable Tested	
Event	Buyback Announcement	Takeover Announcement
Great Financial Crisis	0.000*	0.000*
COVID-19 Crisis	0.000*	0.001*

*Note: unequal variances denoted with **

Table 24: Levene's test for unequal variances cash debt excess returns (quarterly)

	Variable Tested		
Event	Cash	Debt	Excess returns
Buyback Announcement	0.000*	0.065	0.054
Buyback Completion	0.000*	0.133	0.274
Buyback Withdrawal	0.007*	0.085	0.399
Takeover Announcement	0.933	0.566	0.825
Takeover Completion	0.802	0.646	0.789
Takeover Withdrawal	0.818	0.742	0.916

*Note: unequal variances denoted with **

8.2 Fisher's exact test results and two-way contingency tables

8.2.1 Daily data

Table 25: Two-way table of Takeover and Buyback Announcements (daily)

	Takeover Announcement		
Buyback Announcement	No	Yes	Total
No	17,990,531	4,219	17,994,750
Expected Frequency	17,990,528.7	4,221.3	17,994,750.0
Yes	11,619	5	11,624
Expected Frequency	11,621.3	2.7	11,624.0
Total	18,002,150	4,224	18,006,374
Expected Frequency	18,002,150.0	42,240.0	18,006,374.0

Fisher's exact test	0.206
1-sided Fisher's exact test	0.141

Table 26: Two-way table of Buyback Announcements and Takeover Withdrawals (daily)

	Takeover Withdrawals		
Buyback Announcement	No	Yes	Total
No	17,994,279	471	17,994,750
Expected Frequency	17,994,278.3	471.7	17,994,750.0
Yes	11,623	1	11,624
Expected Frequency	11,623.7	0.3	11,624.0
Total	18,005,902	472	18,006,374
Expected Frequency	18,005,902.0	472.0	18,006,374.0

Fisher's exact test	0.263
1-sided Fisher's exact test	0.263

Table 27: Two-way table of Buyback Completions and Takeover Withdrawals

	Takeover Withdrawals		
Buyback Completion	No	Yes	Total
No	18,004,227	1,675	18,005,902
Expected Frequency	18,004,227.0	1,675.0	18,005,902.0
Yes	472	-	472
Expected Frequency	472.0	-	472.0
Total	18,004,699	1,675	18,006,374
Expected Frequency	18,004,699.0	1,675.0	18,006,374.0

Fisher's exact test	1.000
1-sided Fisher's exact test	0.957

Table 28: Two-way table of Buyback Completions and Takeover Announcements (daily)

	Takeover Announcement		
Buyback Completion	No	Yes	Total
No	18,000,478	4,221	18,004,699
Expected Frequency	18,000,475.4	4,223.6	18,004,699.0
Yes	1,672	3	1,675
Expected Frequency	1,674.6	0.4	1,675.0
Total	18,002,150	4,224	18,006,374
Expected Frequency	18,002,150.0	4,224.0	18,006,374.0

Fisher's exact test	0.008
1-sided Fisher's exact test	0.008

8.2.2 Quarterly data

Table 29: Two-way table of Takeover and Buyback Announcements (quarterly)

Buyback Announcement	Takeover Announcement		
	No	Yes	Total
No	5,761	86	5,847
Expected Frequency	5,790.0	75.0	5,865.0
Yes	6,424	34	6,458
Expected Frequency	6,395.0	63.0	6,458.0
Total	12,185	120	12,305
Expected Frequency	12,185.0	120.0	12,305.0

Fisher's exact test	0.000
1-sided Fisher's exact test	0.000

Table 30: Two-way table of Buyback Announcements and Takeover Withdrawals (quarterly)

Buyback Announcement	Takeover Withdrawals		
	No	Yes	Total
No	5,839	8	5,847
Expected Frequency	5,840.8	6.2	5,847.0
Yes	6,453	5	6,458
Expected Frequency	6,451.2	6.8	6,458.0
Total	12,292	13	12,305
Expected Frequency	12,292.0	13.0	12,305.0

Fisher's exact test	0.408
1-sided Fisher's exact test	0.231

Table 31: Two-way table of Buyback Completions and Takeover Withdrawals (quarterly)

Buyback Completion	Takeover Withdrawals		
	No	Yes	Total
No	11,471	821	12,292
Expected Frequency	11,470.9	821.1	12,292.0
Yes	12	1	13
Expected Frequency	12.1	0.9	13.0
Total	11,483	822	12,305
Expected Frequency	11,483.0	822.0	12,305.0

Fisher's exact test	0.593
1-sided Fisher's exact test	0.593

Table 32: Two-way table of Buyback Completions and Takeover Announcements (quarterly)

Buyback Completion	Takeover Announcement		
	No	Yes	Total
No	5,839	6,453	12,292
Expected Frequency	5,840.8	6,451.2	12,292.0
Yes	8	5	13
Expected Frequency	6.2	6.8	13.0
Total	5,847	6,458	12,305
Expected Frequency	5,847.0	6,458.0	12,305.0

Fisher's exact test	0.408
1-sided Fisher's exact test	0.231

8.3 Regression tables

8.3.1 Linear probability models

8.3.1.1 Daily data

Table 33: Daily LPM Model 1

R2	0.036	Correlation(u_i, xb)	-0.006
Number of observations	18,006,374	rho	0.001
Observations per group (average)	2,649	p-value of F-test	0.129

Buyback Announcement	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Announcement	0.001	0.001	1.520	0.129	0.000	0.002
Constant	0.001	0.000	5192.770	0.000	0.001	0.001

Table 34: Daily LPM Model 2

R2	0.0902	Correlation(u_i, xb)	-0.005
Number of observations	18,000,882	rho	0.001
Observations per group	2,648	F-test	0.000

Buyback Announcement	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Announcement	0.001	0.001	1.550	0.122	0.000	0.002
Shares Outstanding	0.000	0.000	0.320	0.748	0.000	0.000
Transaction Value	0.000	0.000	0.770	0.442	0.000	0.000
Net Sales LTM	0.000	0.000	3.410	0.001	0.000	0.000
Total Assets	0.000	0.000	1.420	0.155	0.000	0.000
Constant	0.001	0.000	49.350	0.000	0.001	0.001

Table 35: Daily LPM Model 3

R2	0.005		Correlation(u_i, xb)		-0.002
Number of observations	18,006,374		rho		0.001
Observations per group (average)	2,649		p-value of F-test		0.114

Buyback Completed	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Announcement	0.001	0.000	1.580	0.114	0.000	0.001
Constant	0.000	0.000	964.810	0.000	0.000	0.000

Table 36: Daily LPM Model 4

R2	0.0211		Correlation(u_i, xb)		0.000
Number of observations	18,000,882		rho		0.001
Observations per group	2,648		F-test		0.000

Buyback completion	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover announcement	0.001	0.000	1.600	0.109	0.000	0.002
Shares Outstanding	0.000	0.000	-0.390	0.698	0.000	0.000
Transaction Value	0.000	0.000	0.290	0.770	0.000	0.000
Net Sales LTM	0.000	0.000	3.910	0.000	0.000	0.000
Total Assets	0.000	0.000	0.950	0.342	0.000	0.000
Constant	0.000	0.000	19.790	0.000	0.000	0.000

Table 37: Daily LPM Model 5

R2	0.003		Correlation(u_i, xb)		0.001
Number of observations	18,006,374		rho		0.007
Observations per group (average)	2,649		p-value of F-test		0.000

Takeover Withdrawn	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Completed	0.000	0.000	-4.780	0.000	0.000	0.000
Constant	0.000	0.000	79000.000	0.000	0.000	0.000

Table 38: Daily LPM Model 6

R2	0.002		Correlation(u_i, xb)		-0.001
Number of observations	18,006,374		rho		0.007
Observations per group (average)	2,649		p-value of F-test		0.425

Takeover Withdrawn	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.000	0.000	0.800	0.425	-0.0001	0.0002374
Constant	0.000	0.000	470.980	0.000	0.000	0.000

R2		0.0445		Correlation(u_i, xb)		-0.002
Number of observations		18,000,882		rho		0.007
Observations per group		2,648		F-test		0.000

Takeover Withdrawal	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Completion	-0.00004	0.000	-2.210	0.027	0.000	0.000
Shares Outstanding	0.000	0.000	-0.770	0.440	0.000	0.000
Transaction value	0.000	0.000	-1.000	0.319	0.000	0.000
Net Sales LTM	0.000	0.000	0.970	0.330	0.000	0.000
Total Assets	0.000	0.000	0.520	0.604	0.000	0.000
Constant	0.000	0.000	25.460	0.000	0.000	0.000

Table 40: Daily LPM Model 8

R2		0.0445		Correlation(u_i, xb)		-0.002
Number of observations		18,000,882		rho		0.007
Observations per group		2,648		F-test		0.000

Takeover Withdrawal	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Announcement	0.0001	0.000	0.800	0.421	0.000	0.000
Shares Outstanding	0.000	0.000	-0.770	0.440	0.000	0.000
Transaction value	0.000	0.000	-0.900	0.366	0.000	0.000
Net Sales LTM	0.000	0.000	1.110	0.266	0.000	0.000
Total Assets	0.000	0.000	-0.050	0.961	0.000	0.000
Constant	0.000	0.000	25.310	0.000	0.000	0.000

8.3.1.2 Quarterly data

Table 41: Quarterly LPM model 1

R2		0.001		Correlation(u_i, xb)		0.028
Number of observations		12,164		rho		0.698
Observations per group (average)		2		p-value of F-test		0.092

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.004	0.003	-1.690	0.092	-0.010	0.001
Constant	0.012	0.001	8.830	0.000	0.009	0.015

Table 42: Quarterly LPM model 2

R2		0.000		Correlation(u_i, xb)		-0.010
Number of observations		12,164		rho		0.698
Observations per group (average)		2		p-value of F-test		0.776

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.001	0.004	0.280	0.776	-0.007	0.009
Constant	0.010	0.000	36.560	0.000	0.009	0.010

Table 43: Quarterly LPM model 3

R2	0.001		Correlation(u_i, xb)		0.029
Number of observations	11,053		rho		0.711
Observations per group (average)	2		p-value of F-test		0.269

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.006	0.003	-2.050	0.040	-0.011	0.000
Transaction Value	0.000	0.000	1.570	0.116	0.000	0.000
Total Assets	0.000	0.000	1.300	0.192	0.000	0.000
Shares Outstanding	0.000	0.000	-0.150	0.883	0.000	0.000
Non-Operating Income	0.000	0.000	1.180	0.239	0.000	0.000
Net Sales	0.000	0.000	-0.900	0.369	0.000	0.000
Constant	0.013	0.001	8.890	0.000	0.010	0.016

Table 44: Quarterly LPM model 4

R2	0.001		Correlation(u_i, xb)		-0.093
Number of observations	11,053		rho		0.194
Observations per group (average)	2		p-value of F-test		0.941

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.003	0.004	0.720	0.472	-0.005	0.010
Transaction Value	0.000	0.000	2.390	0.017	0.000	0.000
Total Assets	0.000	0.000	-0.970	0.332	0.000	0.000
Shares Outstanding	0.000	0.000	-1.680	0.093	0.000	0.000
Non-Operating Income	0.000	0.000	-2.080	0.037	0.000	0.000
Net Sales	0.000	0.000	1.100	0.273	0.000	0.000
Constant	0.008	0.000	17.650	0.000	0.007	0.009

Table 45: Quarterly LPM model 5

R2	0.000		Correlation(u_i, xb)		-0.011
Number of observations	12,164		rho		0.444
Observations per group (average)	2		p-value of F-test		0.294

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.001	0.001	-1.050	0.294	-0.003	0.001
Constant	0.002	0.001	2.970	0.003	0.001	0.003

Table 46: Quarterly LPM model 6

R2	0.000		Correlation(u_i, xb)		-0.006
Number of observations	12,164		rho		0.444
Observations per group (average)	2		p-value of F-test		0.853

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.000	0.002	-0.190	0.853	-0.004	0.004
Constant	0.001	0.000	8.280	0.000	0.001	0.001

Table 47: Quarterly LPM model 7

R2		0.000			Correlation(u_i, xb)	-0.003
Number of observations		10,981			rho	0.461
Observations per group (average)		2			p-value of F-test	0.000

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.000	0.002	-0.190	0.853	-0.005	0.004
Transaction Value	0.000	0.000	-0.990	0.320	0.000	0.000
Total Assets	0.000	0.000	1.200	0.232	0.000	0.000
Shares Outstanding	0.000	0.000	-1.320	0.187	0.000	0.000
Non-Operating Income	0.000	0.000	0.400	0.687	0.000	0.000
Net Sales	0.000	0.000	-0.640	0.525	0.000	0.000
Constant	0.001	0.000	7.830	0.000	0.001	0.002

Table 48: Quarterly LPM model 8

R2		0.000			Correlation(u_i, xb)	-0.009
Number of observations		10,981			rho	0.461
Observations per group (average)		2			p-value of F-test	0.000

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.001	0.001	-1.040	0.298	-0.003	0.001
Transaction Value	0.000	0.000	0.390	0.693	0.000	0.000
Total Assets	0.000	0.000	1.190	0.235	0.000	0.000
Shares Outstanding	0.000	0.000	-1.400	0.161	0.000	0.000
Non-Operating Income	0.000	0.000	0.630	0.529	0.000	0.000
Net Sales	0.000	0.000	-0.710	0.476	0.000	0.000
Constant	0.002	0.001	2.990	0.003	0.001	0.003

8.3.2 Excess returns

8.3.2.1 Daily data

Table 49: Regression results model 1 daily

R2		0.000			Correlation(u_i, xb)	0.000
Number of observations		17,841,341			rho	0.073
Observations per group (average)		2,625			p-value of F-test	0.278

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.122	0.113	1.080	0.278	-0.099	0.343
Constant	0.007	0.000	97.670	0.000	0.007	0.007

Table 50: Regression results model 2 daily

R2		0.000			Correlation(u_i, xb)	0.000
Number of observations		17,841,341			rho	0.073
Observations per group (average)		2,625			p-value of F-test	0.597

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-0.016	0.031	-0.530	0.597	-0.077	0.044
Constant	0.007	0.000	2514.210	0.000	0.007	0.007

Table 51: Regression results model 3 daily

R2		0.000			Correlation(u_i, xb)	0.000
Number of observations		17,841,341			rho	0.073
Observations per group (average)		2,625			p-value of F-test	0.034

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Withdrawn	0.019	0.009	2.120	0.034	0.001	0.036
Constant	0.007	0.000	24000.000	0.000	0.007	0.007

<div align="center">Table 52: Regression results model 4 daily</div>

R2		0.000		Correlation(u_i, xb)		0.000
Number of observations		17,841,341		rho		0.073
Observations per group (average)		2,625		p-value of F-test		0.112

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.154	0.140	1.100	0.272	-0.121	0.428
Buyback Completed	-0.170	0.142	-1.200	0.232	-0.449	0.109
Buyback Withdrawn	-0.135	0.140	-0.960	0.335	-0.410	0.140
Constant	0.007	0.000	97.680	0.000	0.007	0.007

<div align="center">Table 53: Regression results model 5 daily</div>

R2		0.000		Correlation(u_i, xb)		0.000
Number of observations		17,841,341		rho		0.073
Observations per group (average)		2,625		p-value of F-test		0.000

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Announcement	0.172	0.007	24.980	0.000	0.159	0.186
Constant	0.007	0.000	4434.730	0.000	0.007	0.007

<div align="center">Table 54: Regression results model 6 daily</div>

R2		0.000		Correlation(u_i, xb)		0.000
Number of observations		17,841,341		rho		0.073
Observations per group (average)		2,625		p-value of F-test		0.000

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Completed	0.188	0.008	24.160	0.000	0.173	0.204
Constant	0.007	0.000	4697.650	0.000	0.007	0.007

<div align="center">Table 55: Regression results model 7 daily</div>

R2		0.000		Correlation(u_i, xb)		0.000
Number of observations		17,841,341		rho		0.073
Observations per group (average)		2,625		p-value of F-test		0.000

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Withdrawn	0.105	0.018	5.710	0.000	0.069	0.141
Constant	0.007	0.000	15000.000	0.000	0.007	0.007

<div align="center">Table 56: Regression results model 8 daily</div>

R2		0.000		Correlation(u_i, xb)		0.000
Number of observations		17,841,341		rho		0.248
Observations per group (average)		2,625		p-value of F-test		0.000

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Announcement	0.061	0.016	3.690	0.000	0.028	0.093
Takeover Completed	0.128	0.018	6.990	0.000	0.092	0.163
Takeover Withdrawn	0.044	0.025	1.770	0.076	-0.005	0.093
Constant	0.007	0.000	4453.390	0.000	0.007	0.007

Table 57: Regression results model 9 daily

R2	0.0003	Correlation(u_i, xb)	-0.079
Number of observations	17,840,858	rho	0.073
Observations per group (average)	2,624	F-test	0.851

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Announcement	0.011	0.010	1.090	0.277	-0.009	0.031
Shares Outstanding	-0.000	0.000	-0.910	0.362	-0.000	0.000
Transaction Value	0.000	0.000	0.940	0.349	-0.000	0.000
Net Sales LTM	0.000	0.000	0.030	0.977	-0.000	0.000
Total Assets	0.000	0.000	0.080	0.937	-0.000	0.000
Constant	0.085	0.085	1.000	0.319	-0.082	0.252

Table 58: Regression results model 10 daily

R2	0.0003	Correlation(u_i, xb)	-0.079
Number of observations	17,840,858	rho	0.073
Observations per group (average)	2,624	F-test	0.914

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Completed	-0.02	0.035	-0.600	0.551	-0.088	0.047
Shares Outstanding	0.000	0.000	-0.910	0.362	0.000	0.000
Transaction Value	0.000	0.000	0.970	0.330	0.000	0.000
Net Sales LTM	0.000	0.000	0.620	0.537	0.000	0.000
Total Assets	0.000	0.000	0.110	0.909	0.000	0.000
Constant	0.085	0.085	1.000	0.319	-0.082	0.252

Table 59: Regression results model 11 daily

R2	0.0003	Correlation(u_i, xb)	-0.079
Number of observations	17,840,858	rho	0.073
Observations per group (average)	2,624	F-test	0.618

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Withdrawn	0.045	0.032	1.380	0.166	-0.019	0.108
Shares Outstanding	0.000	0.000	-0.910	0.362	0.000	0.000
Transaction Value	0.000	0.000	0.970	0.333	0.000	0.000
Net Sales LTM	0.000	0.000	0.330	0.743	0.000	0.000
Total Assets	0.000	0.000	0.090	0.931	0.000	0.000
Constant	0.085	0.085	1.000	0.319	-0.082	0.252

Table 60: Regression results model 12 daily

R2	0.0003	Correlation(u_i, xb)	-0.079
Number of observations	17,840,858	rho	0.250
Observations per group (average)	2,624	F-test	0.000

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Buyback Announcement	0.014	0.007	1.930	0.054	0.000	0.028
Buyback Completion	-0.033	0.029	-1.130	0.257	-0.089	0.024
Buyback Withdrawn	0.032	0.034	0.930	0.351	-0.035	0.099
Shares Outstanding	0.000	0.000	-0.910	0.362	0.000	0.000
Transaction Value	0.000	0.000	0.920	0.355	0.000	0.000
Net Sales LTM	0.000	0.000	0.080	0.939	0.000	0.000
Total Assets	0.000	0.000	0.070	0.946	0.000	0.000
Constant	0.085	0.085	1.000	0.319	-0.082	0.252

Table 61: Regression results model 13 daily

R2		0.0003		Correlation(u_i, xb)		-0.079
Number of observations		1,840,910		rho		0.073
Observations per group (average)		2,624		F-test		0.000

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Announcement	0.190	0.008	23.390	0.000	0.174	0.206
Shares Outstanding	0.000	0.000	-0.910	0.361	0.000	0.000
Transaction Value	0.000	0.000	-1.960	0.050	0.000	0.000
Net Sales LTM	0.000	0.000	-3.090	0.002	0.000	0.000
Total Assets	0.000	0.000	0.850	0.395	0.000	0.000
Constant	0.085	0.085	1.000	0.319	-0.082	0.252

Table 62: Regression results model 14 daily

R2		0.0003		Correlation(u_i, xb)		-0.079
Number of observations		1,840,910		rho		0.073
Observations per group (average)		2,624		F-test		0.000

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Completed	0.201	0.009	22.650	0.000	0.184	0.218
Shares Outstanding	0.000	0.000	-0.910	0.361	0.000	0.000
Transaction Value	0.000	0.000	-0.250	0.805	0.000	0.000
Net Sales LTM	0.000	0.000	-2.740	0.006	0.000	0.000
Total Assets	0.000	0.000	0.830	0.408	0.000	0.000
Constant	0.085	0.085	1.000	0.319	-0.082	0.252

Table 63: Regression results model 15 daily

R2		0.0003		Correlation(u_i, xb)		-0.079
Number of observations		1,840,910		rho		0.073
Observations per group (average)		2,624		F-test		0.000

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Withdrawn	0.079	0.022	3.630	0.000	0.036	0.122
Shares Outstanding	0.000	0.000	-0.910	0.361	0.000	0.000
Transaction Value	0.000	0.000	3.610	0.000	0.000	0.000
Net Sales LTM	0.000	0.000	0.010	0.992	0.000	0.000
Total Assets	0.000	0.000	0.860	0.390	0.000	0.000
Constant	0.085	0.085	1.000	0.319	-0.082	0.252

Table 64: Regression results model 16 daily

R2		0.0002		Correlation(u_i, xb)		-0.079
Number of observations		1,840,910		rho		0.250
Observations per group (average)		2,624		F-test		0.000

Excess Returns	Coefficient	Standard Error	t value	p value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	2.431	5.465	0.440	0.656	-8.281	13.144
Takeover Completed	2.658	6.193	0.430	0.668	-9.482	14.797
Takeover Withdrawn	-3.065	5.319	-0.580	0.565	-13.492	7.363
Shares Outstanding	0.000	0.000	-0.940	0.349	-0.001	0.000
Transaction Value	0.001	0.000	2.640	0.008	0.000	0.001
Net Sales LTM	0.000	0.000	-1.370	0.170	-0.001	0.000
Total Assets	0.000	0.000	0.790	0.431	0.000	0.001
Constant	83.263	33.415	2.490	0.013	17.760	148.766

8.3.2.2 Quarterly data

Table 65: Excess Returns regression results model 1 quarterly

R2		0.001		Correlation(u_i, xb)		-0.002
Number of observations		11,864		rho		0.961
Observations per group (average)		2		p-value of F-test		0.012

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.072	0.029	-2.520	0.012	-0.128	-0.016
Constant	0.138	0.015	9.140	0.000	0.109	0.168

Table 66: Excess Returns regression results model 2 quarterly

R2		0.000		Correlation(u_i, xb)		-0.007
Number of observations		11,864		rho		0.961
Observations per group (average)		2		p-value of F-test		0.551

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.009	0.015	0.600	0.551	-0.021	0.040
Constant	0.100	0.001	97.120	0.000	0.098	0.102

Table 67: Excess Returns regression results model 3 quarterly

R2		0.000		Correlation(u_i, xb)		0.004
Number of observations		11,864		rho		0.961
Observations per group (average)		2		p-value of F-test		0.735

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Withdrawn	-0.007	0.021	-0.310	0.753	-0.049	0.035
Constant	0.100	0.001	164.540	0.000	0.099	0.102

Table 68: Excess Returns regression results model 4 quarterly

R2		0.001		Correlation(u_i, xb)		-0.003
Number of observations		11,864		rho		0.961
Observations per group (average)		2		p-value of F-test		0.072

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.076	0.030	-2.560	0.011	-0.135	-0.018
Buyback Complete	0.030	0.017	1.710	0.087	-0.004	0.064
Buyback Withdrawn	0.015	0.023	0.640	0.520	-0.030	0.060
Constant	0.138	0.015	9.170	0.000	0.109	0.168

Table 69: Excess Returns regression results model 5 quarterly

R2		0.000		Correlation(u_i, xb)		0.002
Number of observations		11,864		rho		0.961
Observations per group (average)		2		p-value of F-test		0.970

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	0.003	0.071	0.040	0.970	-0.136	0.141
Constant	0.100	0.001	142.540	0.000	0.099	0.102

Table 70: Excess Returns regression results model 6 quarterly

R2		0.000		Correlation(u_i, xb)		-0.002
Number of observations		11,864		rho		0.961
Observations per group (average)		2		p-value of F-test		0.980

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Complete	-0.002	0.091	-0.020	0.980	-0.180	0.175
Constant	0.100	0.001	131.430	0.000	0.099	0.102

Table 71: Excess Returns regression results model 7 quarterly

R2		0.000		Correlation(u_i, xb)		0.000
Number of observations		11,864		rho		0.961
Observations per group (average)		2		p-value of F-test		0.442

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Withdrawn	0.087	0.113	0.770	0.442	-0.135	0.309
Constant	0.100	0.000	807.830	0.000	0.100	0.100

Table 72: Excess Returns regression results model 8 quarterly

R2		0.001		Correlation(u_i, xb)		0.000
Number of observations		11,864		rho		0.961
Observations per group (average)		2		p-value of F-test		0.743

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-0.157	0.194	-0.810	0.420	-0.538	0.224
Takeover Complete	0.155	0.215	0.720	0.471	-0.266	0.575
Takeover Withdrawn	0.244	0.225	1.080	0.279	-0.197	0.685
Constant	0.100	0.001	128.960	0.000	0.099	0.102

Table 73: Excess Returns regression results model 9 quarterly

R2		0.001		Correlation(u_i, xb)		-0.004
Number of observations		11,864		rho		0.961
Observations per group (average)		2		p-value of F-test		0.212

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-0.128	0.200	-0.640	0.521	-0.520	0.263
Buyback Announced	-0.076	0.030	-2.550	0.011	-0.135	-0.018
Buyback Complete	0.030	0.017	1.710	0.087	-0.004	0.064
Takeover Complete	0.108	0.220	0.490	0.624	-0.323	0.539
Buyback Withdrawn	0.015	0.023	0.630	0.526	-0.030	0.059
Takeover Withdrawn	0.199	0.231	0.860	0.388	-0.253	0.652
Constant	0.138	0.015	9.110	0.000	0.109	0.168

Table 74: Excess Returns regression results model 10 quarterly

R2		0.001		Correlation(u_i, xb)		-0.002
Number of observations		10,711		rho		0.964
Observations per group (average)		2		p-value of F-test		0.014

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.071	0.030	-2.360	0.018	-0.131	-0.012
Total Assets	0.000	0.000	1.050	0.294	0.000	0.000
Shares Outstanding	0.000	0.000	-2.320	0.020	0.000	0.000
Non-Operating Income	0.000	0.000	-1.500	0.132	0.000	0.000
Net Sales	0.000	0.000	-1.630	0.102	0.000	0.000
Transaction Value	0.000	0.000	1.230	0.217	0.000	0.000
Constant	0.171	0.017	10.040	0.000	0.137	0.204

Table 75: Excess Returns regression results model 11 quarterly

R2		0.001		Correlation(u_i, xb)		-0.004
Number of observations		10,711		rho		0.964
Observations per group (average)		2		p-value of F-test		0.081

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.013	0.016	0.790	0.432	-0.019	0.045
Transaction Value	0.000	0.000	0.620	0.536	0.000	0.000
Total Assets	0.000	0.000	0.940	0.350	0.000	0.000
Shares Outstanding	0.000	0.000	-2.320	0.021	0.000	0.000
Non-Operating Income	0.000	0.000	-1.780	0.075	0.000	0.000
Net Sales	0.000	0.000	-1.570	0.115	0.000	0.000
Constant	0.131	0.004	31.920	0.000	0.123	0.139

Table 76: Excess Returns regression results model 12 quarterly

R2		0.001		Correlation(u_i, xb)		-0.003
Number of observations		10,711		rho		0.964
Observations per group (average)		2		p-value of F-test		0.094

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Withdrawn	0.000	0.022	-0.010	0.992	-0.044	0.044
Transaction Value	0.000	0.000	0.610	0.542	0.000	0.000
Total Assets	0.000	0.000	0.940	0.345	0.000	0.000
Shares Outstanding	0.000	0.000	-2.330	0.020	0.000	0.000
Non-Operating Income	0.000	0.000	-1.760	0.078	0.000	0.000
Net Sales	0.000	0.000	-1.570	0.116	0.000	0.000
Constant	0.132	0.004	33.300	0.000	0.124	0.140

Table 77: Excess Returns regression results model 13 quarterly

R2		0.001		Correlation(u_i, xb)		-0.003
Number of observations		10,711		rho		0.964
Observations per group (average)		2		p-value of F-test		0.033

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.076	0.031	-2.420	0.016	-0.138	-0.014
Buyback Complete	0.034	0.019	1.830	0.067	-0.002	0.071
Buyback Withdrawn	0.021	0.024	0.900	0.369	-0.025	0.068
Transaction Value	0.000	0.000	1.270	0.204	0.000	0.000
Total Assets	0.000	0.000	1.000	0.317	0.000	0.000
Shares Outstanding	0.000	0.000	-2.370	0.018	0.000	0.000
Non-Operating Income	0.000	0.000	-1.550	0.121	0.000	0.000
Net Sales	0.000	0.000	-1.650	0.098	0.000	0.000
Constant	0.171	0.017	10.020	0.000	0.137	0.204

Table 78: Excess Returns regression results model 14 quarterly

R2		0.000		Correlation(u_i, xb)		-0.003
Number of observations		10,782		rho		0.964
Observations per group (average)		2		p-value of F-test		0.018

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	0.011	0.092	0.120	0.901	-0.168	0.191
Transaction Value	0.000	0.000	0.640	0.520	0.000	0.000
Total Assets	0.000	0.000	0.980	0.329	0.000	0.000
Shares Outstanding	0.000	0.000	-2.260	0.024	0.000	0.000
Non-Operating Income	0.000	0.000	-1.630	0.103	0.000	0.000
Net Sales	0.000	0.000	-1.650	0.098	0.000	0.000
Constant	0.131	0.004	33.120	0.000	0.123	0.138

Table 79: Excess Returns regression results model 15 quarterly

R2		0.000		Correlation(u_i, xb)		-0.003
Number of observations		10,782		rho		0.964
Observations per group (average)		2		p-value of F-test		0.020

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Complete	0.016	0.117	0.140	0.891	-0.213	0.245
Transaction Value	0.000	0.000	0.500	0.617	0.000	0.000
Total Assets	0.000	0.000	0.980	0.329	0.000	0.000
Shares Outstanding	0.000	0.000	-2.260	0.024	0.000	0.000
Non-Operating Income	0.000	0.000	-1.630	0.103	0.000	0.000
Net Sales	0.000	0.000	-1.650	0.098	0.000	0.000
Constant	0.131	0.004	32.980	0.000	0.123	0.138

Table 80: Excess Returns regression results model 16 quarterly

R2		0.000		Correlation(u_i, xb)		-0.003
Number of observations		10,782		rho		0.964
Observations per group (average)		2		p-value of F-test		0.019

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Withdrawn	0.059	0.129	0.460	0.649	-0.193	0.311
Transaction Value	0.000	0.000	2.030	0.043	0.000	0.000
Total Assets	0.000	0.000	0.970	0.330	0.000	0.000
Shares Outstanding	0.000	0.000	-2.260	0.024	0.000	0.000
Non-Operating Income	0.000	0.000	-1.630	0.102	0.000	0.000
Net Sales	0.000	0.000	-1.650	0.098	0.000	0.000
Constant	0.131	0.004	33.840	0.000	0.123	0.138

Table 81: Excess Returns regression results model 17 quarterly

R2		0.000		Correlation(u_i, xb)		-0.003
Number of observations		10,782		rho		0.964
Observations per group (average)		2		p-value of F-test		0.056

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-0.264	0.415	-0.640	0.525	-1.077	0.550
Takeover Complete	0.280	0.431	0.650	0.515	-0.565	1.126
Takeover Withdrawn	0.323	0.434	0.740	0.457	-0.529	1.174
Transaction Value	0.000	0.000	0.460	0.647	0.000	0.000
Total Assets	0.000	0.000	0.980	0.328	0.000	0.000
Shares Outstanding	0.000	0.000	-2.260	0.024	0.000	0.000
Non-Operating Income	0.000	0.000	-1.630	0.103	0.000	0.000
Net Sales	0.000	0.000	-1.660	0.098	0.000	0.000
Constant	0.131	0.004	32.940	0.000	0.123	0.138

Table 82: Excess Returns regression results model 18 quarterly

R2		0.001		Correlation(u_i, xb)		-0.003
Number of observations		10,782		rho		0.964
Observations per group (average)		2		p-value of F-test		0.022

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-0.264	0.415	-0.640	0.525	-1.077	0.550
Buyback Announced	-0.076	0.032	-2.410	0.016	-0.138	-0.014
Buyback Complete	0.034	0.019	1.840	0.065	-0.002	0.071
Takeover Complete	0.252	0.432	0.580	0.560	-0.594	1.098
Buyback Withdrawn	0.022	0.024	0.910	0.364	-0.025	0.069
Takeover Withdrawn	0.301	0.435	0.690	0.489	-0.551	1.153
Transaction Value	0.000	0.000	1.270	0.203	0.000	0.000
Total Assets	0.000	0.000	1.000	0.319	0.000	0.000
Shares Outstanding	0.000	0.000	-2.370	0.018	0.000	0.000
Non-Operating Income	0.000	0.000	-1.570	0.117	0.000	0.000
Net Sales	0.000	0.000	-1.650	0.099	0.000	0.000
Constant	0.171	0.017	9.940	0.000	0.137	0.205

8.3.3 Cash

Table 83: Cash regression results model 1 quarterly

R2		0.009		Correlation(u_i, xb)	-0.087
Number of observations		7,106		rho	0.644
Observations per group (average)		2		p-value of F-test	0.314

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-137.470	136.565	-1.010	0.314	-405.210	130.270
Constant	847.558	79.314	10.690	0.000	692.061	1003.055

Table 84: Cash regression results model 2 quarterly

R2		0.000		Correlation(u_i, xb)	-0.083
Number of observations		7,106		rho	0.644
Observations per group (average)		2		p-value of F-test	0.243

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-125.572	107.553	-1.170	0.243	-336.434	85.290
Constant	776.006	7.099	109.320	0.000	762.089	789.923

Table 85: Cash regression results model 3 quarterly

R2		0.000		Correlation(u_i, xb)	0.018
Number of observations		7,106		rho	0.644
Observations per group (average)		2		p-value of F-test	0.020

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Withdrawn	225.672	96.566	2.340	0.019	36.352	414.993
Constant	759.747	3.411	222.740	0.000	753.060	766.435

Table 86: Cash regression results model 4 quarterly

R2		0.006		Correlation(u_i, xb)	-0.081
Number of observations		7,106		rho	0.644
Observations per group (average)		2		p-value of F-test	0.056

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-143.100	141.506	-1.010	0.312	-420.527	134.328
Buyback Complete	-77.159	114.221	-0.680	0.499	-301.094	146.775
Buyback Withdrawn	245.134	104.239	2.350	0.019	40.769	449.499
Constant	847.261	79.031	10.720	0.000	692.318	1002.205

Table 87: Cash regression results model 5 quarterly

R2		0.000		Correlation(u_i, xb)	-0.002
Number of observations		7,106		rho	0.644
Observations per group (average)		2		p-value of F-test	0.259

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	102.405	90.743	1.130	0.259	-75.499	280.309
Constant	767.200	0.460	1668.860	0.000	766.298	768.101

Table 88: Cash regression results model 6 quarterly

R2		0.000		Correlation(u_i, xb)		0.001
Number of observations		7,106		rho		0.644
Observations per group (average)		2		p-value of F-test		0.303

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Complete	104.588	101.563	1.030	0.303	-94.530	303.706
Constant	767.351	0.357	2147.550	0.000	766.650	768.051

Table 89: Cash regression results model 7 quarterly

R2		0.000		Correlation(u_i, xb)		-0.004
Number of observations		7,106		rho		0.644
Observations per group (average)		2		p-value of F-test		0.204

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Withdrawn	299.025	235.359	1.270	0.204	-162.404	760.455
Constant	767.466	0.199	3861.910	0.000	767.076	767.856

Table 90: Cash regression results model 8 quarterly

R2		0.000		Correlation(u_i, xb)		-0.002
Number of observations		7,106		rho		0.644
Observations per group (average)		2		p-value of F-test		0.198

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announcement	-191.315	135.556	-1.410	0.158	-457.078	74.448
Takeover Complete	295.903	169.392	1.750	0.081	-36.195	628.001
Takeover Withdrawn	490.341	271.634	1.810	0.071	-42.207	1022.888
Constant	767.233	0.420	1827.210	0.000	766.410	768.056

Table 91: Cash regression results model 9 quarterly

R2		0.000		Correlation(u_i, xb)		-0.081
Number of observations		7,106		rho		0.644
Observations per group (average)		2		p-value of F-test		0.061

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-152.198	153.595	-0.990	0.322	-453.327	148.931
Buyback Announced	-143.135	141.680	-1.010	0.312	-420.904	134.634
Buyback Complete	-77.347	114.327	-0.680	0.499	-301.489	146.796
Takeover Complete	280.597	199.137	1.410	0.159	-109.818	671.012
Buyback Withdrawn	246.246	104.288	2.360	0.018	41.787	450.705
Takeover Withdrawn	476.618	262.531	1.820	0.070	-38.084	991.320
Constant	846.636	79.115	10.700	0.000	691.529	1001.743

Table 92: Cash regression results model 10 quarterly

R2		0.034		Correlation(u_i, xb)	0.266
Number of observations		7,031		rho	0.549
Observations per group (average)		2		p-value of F-test	0.002

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-194.512	109.451	-1.780	0.076	-409.094	20.070
Transaction Value	0.097	0.123	0.790	0.428	-0.144	0.338
Total Assets	0.011	0.012	0.930	0.354	-0.013	0.035
Shares Outstanding	2.279	1.021	2.230	0.026	0.277	4.281
Non-Operating Income	-1.677	0.811	-2.070	0.039	-3.267	-0.088
Net Sales	-0.111	0.150	-0.740	0.458	-0.405	0.182
Constant	428.437	293.091	1.460	0.144	-146.180	1003.054

Table 93: Cash regression results model 11 quarterly

R2		0.034		Correlation(u_i, xb)	0.269
Number of observations		7,031		rho	0.548
Observations per group (average)		2		p-value of F-test	0.002

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-112.687	123.404	-0.910	0.361	-354.626	129.251
Transaction Value	0.090	0.123	0.730	0.465	-0.151	0.331
Total Assets	0.011	0.012	0.920	0.358	-0.013	0.035
Shares Outstanding	2.289	1.029	2.220	0.026	0.272	4.307
Non-Operating Income	-1.689	0.815	-2.070	0.038	-3.288	-0.091
Net Sales	-0.110	0.150	-0.730	0.463	-0.405	0.184
Constant	324.576	263.425	1.230	0.218	-191.880	841.032

Table 94: Cash regression results model 12 quarterly

R2		0.033		Correlation(u_i, xb)	0.269
Number of observations		7,031		rho	0.549
Observations per group (average)		2		p-value of F-test	0.000

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Withdrawn	185.550	123.983	1.500	0.135	-57.524	428.624
Transaction Value	0.089	0.123	0.720	0.472	-0.153	0.330
Total Assets	0.011	0.012	0.920	0.357	-0.013	0.035
Shares Outstanding	2.283	1.026	2.230	0.026	0.272	4.295
Non-Operating Income	-1.692	0.813	-2.080	0.038	-3.286	-0.097
Net Sales	-0.112	0.150	-0.740	0.458	-0.407	0.183
Constant	314.705	263.573	1.190	0.233	-202.040	831.451

Table 95: Cash regression results model 13 quarterly

R2		0.034		Correlation(u_i, xb)	0.265
Number of observations		7,031		rho	0.550
Observations per group (average)		2		p-value of F-test	0.001

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-200.274	116.642	-1.720	0.086	-428.954	28.407
Buyback Complete	-53.022	131.650	-0.400	0.687	-311.127	205.084
Buyback Withdrawn	217.300	134.491	1.620	0.106	-46.374	480.974
Transaction Value	0.096	0.123	0.780	0.435	-0.145	0.338
Total Assets	0.011	0.012	0.910	0.361	-0.013	0.035
Shares Outstanding	2.286	1.023	2.230	0.025	0.281	4.292
Non-Operating Income	-1.677	0.810	-2.070	0.039	-3.265	-0.088
Net Sales	-0.112	0.150	-0.740	0.458	-0.407	0.183
Constant	429.315	293.991	1.460	0.144	-147.067	1005.697

Table 96: Cash regression results model 14 quarterly

R2		0.028		Correlation(u_i, xb)		0.283
Number of observations		7,031		rho		0.557
Observations per group (average)		2		p-value of F-test		0.005

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	246.322	250.674	0.980	0.326	-245.134	737.778
Transaction Value	-0.017	0.018	-0.970	0.334	-0.052	0.018
Total Assets	0.010	0.013	0.760	0.445	-0.016	0.036
Shares Outstanding	2.343	1.096	2.140	0.033	0.195	4.491
Non-Operating Income	-1.723	0.894	-1.930	0.054	-3.476	0.031
Net Sales	-0.098	0.154	-0.640	0.525	-0.401	0.205
Constant	348.095	257.287	1.350	0.176	-156.326	852.517

Table 97: Cash regression results model 15 quarterly

R2		0.028		Correlation(u_i, xb)		0.283
Number of observations		7,031		rho		0.557
Observations per group (average)		2		p-value of F-test		0.005

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Complete	387.190	398.631	0.970	0.331	-394.342	1168.722
Transaction Value	-0.029	0.029	-1.020	0.309	-0.085	0.027
Total Assets	0.010	0.013	0.760	0.445	-0.016	0.036
Shares Outstanding	2.343	1.096	2.140	0.033	0.195	4.491
Non-Operating Income	-1.723	0.894	-1.930	0.054	-3.476	0.031
Net Sales	-0.098	0.154	-0.640	0.525	-0.401	0.205
Constant	347.832	257.325	1.350	0.177	-156.663	852.328

Table 98: Cash regression results model 16 quarterly

R2		0.028		Correlation(u_i, xb)		0.283
Number of observations		7,031		rho		0.557
Observations per group (average)		2		p-value of F-test		0.004

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Withdrawn	16.005	26.195	0.610	0.541	-35.351	67.360
Transaction Value	0.008	0.019	0.430	0.666	-0.029	0.046
Total Assets	0.010	0.013	0.760	0.446	-0.016	0.036
Shares Outstanding	2.343	1.096	2.140	0.033	0.195	4.490
Non-Operating Income	-1.723	0.894	-1.930	0.054	-3.476	0.030
Net Sales	-0.098	0.154	-0.630	0.525	-0.401	0.205
Constant	349.174	257.148	1.360	0.175	-154.974	853.322

Table 99: Cash regression results model 17 quarterly

R2			0.028		Correlation(u_i, xb)		0.283
Number of observations			7,031		rho		0.556
Observations per group (average)			2		p-value of F-test		0.012

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-18.815	53.482	-0.350	0.725	-123.668	86.038
Takeover Complete	407.406	423.006	0.960	0.336	-421.913	1236.724
Takeover Withdrawn	62.102	68.883	0.900	0.367	-72.947	197.150
Transaction Value	-0.029	0.029	-1.030	0.305	-0.086	0.027
Total Assets	0.010	0.013	0.760	0.445	-0.016	0.036
Shares Outstanding	2.343	1.096	2.140	0.033	0.195	4.491
Non-Operating Income	-1.723	0.895	-1.930	0.054	-3.476	0.031
Net Sales	-0.098	0.154	-0.640	0.525	-0.401	0.205
Constant	347.806	257.365	1.350	0.177	-156.768	852.380

Table 100: Cash regression results model 18 quarterly

R2			0.034		Correlation(u_i, xb)		0.265
Number of observations			7,031		rho		0.549
Observations per group (average)			2		p-value of F-test		0.006

Cash	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-16.745	53.805	-0.310	0.756	-122.231	88.742
Buyback Announced	-200.449	117.266	-1.710	0.087	-430.353	29.455
Buyback Complete	-51.813	131.814	-0.390	0.694	-310.239	206.613
Takeover Complete	288.101	385.254	0.750	0.455	-467.205	1043.406
Buyback Withdrawn	218.869	134.638	1.630	0.104	-45.094	482.832
Takeover Withdrawn	113.631	80.511	1.410	0.158	-44.213	271.476
Transaction Value	0.096	0.123	0.780	0.436	-0.146	0.338
Total Assets	0.011	0.012	0.910	0.361	-0.013	0.035
Shares Outstanding	2.286	1.023	2.230	0.026	0.280	4.293
Non-Operating Income	-1.678	0.811	-2.070	0.039	-3.268	-0.089
Net Sales	-0.111	0.151	-0.740	0.459	-0.407	0.184
Constant	427.923	294.527	1.450	0.146	-149.509	1005.354

8.3.4 Debt

Table 101: Regressions using quarterly data with buyback and takeover announcement completions and withdrawals on debt

	Dependent variable:					
	Debt					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: models without control variables						
Buyback Announced	-5.399		-3.564			-3.568
	(24.088)		(25.272)			(25.312)
Buyback Complete		-17.598	-16.729			-16.728
		(14.173)	(16.414)			(16.430)
Buyback Withdrawn			-1.182			-1.186
			(7.152)			(0.868)
Takeover Announced				-0.367		-0.669
				(0.365)		(9.613)
Takeover Complete					-0.520	0.072
					(0.515)	(15.355)
Takeover Withdrawn						-0.634
						(15.069)
Constant	33.216***	31.512***	33.339***	30.364***	30.365***	33.348***
	(12.510)	(0.927)	(12.432)	(0.004)	(0.004)	(2.670)
Observations	12,164	12,164	12,164	12,164	12,164	12,164
R²	0.000	0.000	0.000	0.000	0.000	0.000

	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Panel B: models with control variables									
Buyback Announced	-7.951			-5.516					-5.527
	(25.743)			(27.040)					(27.156)
Buyback Complete		-21.553		-20.318					-20.333
		(17.462)		(19.862)					(19.915)
Buyback Withdrawn			-2.354	-3.568					-3.596
			(2.012)	(8.522)					(8.466)
Takeover Announced					-0.533			0.296	0.283
					(0.779)			(0.610)	(0.590)
Takeover Complete						-0.766		-1.063	-1.548
						(1.107)		(1.242)	(10.234)
Takeover Withdrawn							-0.063	-0.385	-0.094
							(0.214)	(0.531)	(8.456)
Transaction Value	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	-0.001
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Total Assets	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shares Outstanding	0.026	0.027	0.026	0.027	0.027	0.027	0.027	0.027	0.027
	(0.027)	(0.027)	(0.027)	(0.028)	(0.027)	(0.027)	(0.027)	(0.027)	(0.028)
Non-Operating Income	0.038	0.038	0.037	0.038	0.036	0.036	0.036	0.036	0.038
	(0.049)	(0.049)	(0.049)	(0.049)	(0.048)	(0.048)	(0.048)	(0.048)	(0.049)
Net Sales	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.005
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Constant	26.527	23.700***	22.307***	26.622***	21.876***	21.877***	21.872***	21.877***	26.660
	(16.286)	(6.331)	(6.941)	(16.292	(7.268)	(7.268)	(7.268)	(7.269)	(16.430)
Observations	10,981	10,981	10,981	10,981	11,053	11,053	11,053	11,053	11,053
R²	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001

Note: numbers between brackets depict the standard errors   *p<0.1;   **p<0.05;   ***p<0.01

Table 102: Debt regression results model 1 quarterly

R2	0.000	Correlation(u_i, xb)	0.006
Number of observations	12,164	rho	0.591
Observations per group (average)	2	p-value of F-test	0.820

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-5.497	24.088	-0.230	0.819	-52.718	41.723
Constant	33.216	12.510	2.660	0.008	8.693	57.738

Table 103: Debt regression results model 2 quarterly

R2	0.000	Correlation(u_i, xb)	0.006
Number of observations	12,164	rho	0.591
Observations per group (average)	2	p-value of F-test	0.214

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-17.598	14.173	-1.240	0.214	-45.380	10.185
Constant	31.512	0.927	33.980	0.000	29.694	33.330

Table 104: Debt regression results model 3 quarterly

R2	0.000	Correlation(u_i, xb)	0.007
Number of observations	12,164	rho	0.591
Observations per group (average)	2	p-value of F-test	0.659

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-3.564	25.272	-0.140	0.888	-53.105	45.976
Buyback Complete	-16.729	16.414	-1.020	0.308	-48.906	15.448
Buyback Withdrawn	-1.182	7.152	-0.170	0.869	-15.201	12.837
Constant	33.339	12.432	2.680	0.007	8.968	57.711

Table 105: Debt regression results model 4 quarterly

R2		0.000		Correlation(u_i, xb)		0.003
Number of observations		12,164		rho		0.591
Observations per group (average)		2		p-value of F-test		0.314

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-0.367	0.365	-1.010	0.314	-1.083	0.348
Constant	30.364	0.004	8433.810	0.000	30.357	30.371

Table 106: Debt regression results model 5 quarterly

R2		0.000		Correlation(u_i, xb)		0.002
Number of observations		12,164		rho		0.591
Observations per group (average)		2		p-value of F-test		0.313

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Complete	-0.520	0.515	-1.010	0.313	-1.529	0.489
Constant	30.365	0.004	7032.520	0.000	30.357	30.374

Table 107: Debt regression results model 6 quarterly

R2		0.000		Correlation(u_i, xb)		0.007
Number of observations		12,164		rho		0.591
Observations per group (average)		2		p-value of F-test		0.944

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-0.669	9.613	-0.070	0.944	-19.514	18.175
Buyback Announced	-3.568	25.312	-0.140	0.888	-53.187	46.052
Buyback Complete	-16.728	16.430	-1.020	0.309	-48.936	15.481
Takeover Complete	0.072	15.355	0.000	0.996	-30.027	30.172
Buyback Withdrawn	-1.186	7.119	-0.170	0.868	-15.141	12.770
Takeover Withdrawn	-0.634	15.069	-0.040	0.966	-30.173	28.905
Constant	33.348	12.502	2.670	0.008	8.841	57.855

Table 108: Debt regression results model 7 quarterly

R2		0.002		Correlation(u_i, xb)		-0.031
Number of observations		10,981		rho		0.598
Observations per group (average)		2		p-value of F-test		0.864

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-7.951	25.743	-0.310	0.757	-58.417	42.515
Transaction Value	0.000	0.000	-0.880	0.378	-0.001	0.001
Total Assets	0.000	0.000	-0.830	0.405	0.000	0.000
Shares Outstanding	0.026	0.027	0.970	0.334	-0.027	0.080
Non-Operating Income	0.038	0.049	0.780	0.437	-0.058	0.133
Net Sales	0.005	0.004	1.530	0.125	-0.002	0.012
Constant	26.527	16.286	1.630	0.103	-5.399	58.453

Table 109: Debt regression results model 8 quarterly

R2		0.002		Correlation(u_i, xb)		-0.030
Number of observations		10,981		rho		0.598
Observations per group (average)		2		p-value of F-test		0.847

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Completed	-21.553	17.462	-1.230	0.217	-55.785	12.678
Transaction Value	-0.001	0.001	-0.950	0.342	-0.002	0.001
Total Assets	0.000	0.000	-0.850	0.398	0.000	0.000
Shares Outstanding	0.027	0.027	0.970	0.333	-0.027	0.080
Non-Operating Income	0.038	0.049	0.780	0.437	-0.058	0.134
Net Sales	0.005	0.004	1.530	0.125	-0.001	0.012
Constant	23.700	6.331	3.740	0.000	11.289	36.112

Table 110: Debt regression results model 9 quarterly

R2		0.002		Correlation(u_i, xb)		-0.033
Number of observations		10,981		rho		0.598
Observations per group (average)		2		p-value of F-test		0.854

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Withdrawn	-2.354	2.012	-1.170	0.242	-6.299	1.591
Transaction Value	-0.001	0.001	-0.910	0.361	-0.002	0.001
Total Assets	0.000	0.000	-0.840	0.403	0.000	0.000
Shares Outstanding	0.026	0.027	0.960	0.335	-0.027	0.080
Non-Operating Income	0.037	0.049	0.770	0.443	-0.058	0.133
Net Sales	0.005	0.004	1.540	0.124	-0.001	0.012
Constant	22.307	6.941	3.210	0.001	8.699	35.915

Table 111: Debt regression results model 10 quarterly

R2		0.002		Correlation(u_i, xb)		-0.029
Number of observations		10,981		rho		0.598
Observations per group (average)		2		p-value of F-test		0.948

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-5.516	27.040	-0.200	0.838	-58.524	47.492
Buyback Complete	-20.318	19.862	-1.020	0.306	-59.254	18.617
Buyback Withdrawn	-3.568	8.522	-0.420	0.675	-20.274	13.137
Transaction Value	0.000	0.001	-0.960	0.336	-0.001	0.001
Total Assets	0.000	0.000	-0.840	0.402	0.000	0.000
Shares Outstanding	0.027	0.028	0.970	0.331	-0.027	0.081
Non-Operating Income	0.038	0.049	0.790	0.432	-0.057	0.134
Net Sales	0.005	0.004	1.530	0.126	-0.002	0.012
Constant	26.622	16.292	1.630	0.102	-5.315	58.559

Table 112: Debt regression results model 11 quarterly

R2		0.002		Correlation(u_i, xb)		-0.035
Number of observations		11,053		rho		0.598
Observations per group (average)		2		p-value of F-test		0.827

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	-0.533	0.779	-0.680	0.494	-2.060	0.994
Transaction Value	0.000	0.000	1.110	0.269	0.000	0.000
Total Assets	0.000	0.000	-0.850	0.396	0.000	0.000
Shares Outstanding	0.027	0.027	0.980	0.326	-0.027	0.080
Non-Operating Income	0.036	0.048	0.760	0.448	-0.058	0.130
Net Sales	0.006	0.004	1.520	0.128	-0.002	0.013
Constant	21.876	7.268	3.010	0.003	7.628	36.124

Table 113: Debt regression results model 12 quarterly

R2	0.002	Correlation(u_i, xb)	-0.035
Number of observations	11,053	rho	0.598
Observations per group (average)	2	p-value of F-test	0.828

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Complete	-0.766	1.107	-0.690	0.489	-2.936	1.404
Transaction Value	0.000	0.000	1.160	0.244	0.000	0.000
Total Assets	0.000	0.000	-0.850	0.396	0.000	0.000
Shares Outstanding	0.027	0.027	0.980	0.326	-0.027	0.080
Non-Operating Income	0.036	0.048	0.760	0.448	-0.058	0.130
Net Sales	0.006	0.004	1.520	0.128	-0.002	0.013
Constant	21.877	7.268	3.010	0.003	7.630	36.125

Table 114: Debt regression results model 13 quarterly

R2	0.002	Correlation(u_i, xb)	-0.035
Number of observations	11,053	rho	0.598
Observations per group (average)	2	p-value of F-test	0.885

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Withdrawn	-0.063	0.214	-0.300	0.766	-0.482	0.355
Transaction Value	0.000	0.000	0.930	0.351	0.000	0.000
Total Assets	0.000	0.000	-0.850	0.396	0.000	0.000
Shares Outstanding	0.027	0.027	0.980	0.326	-0.027	0.080
Non-Operating Income	0.036	0.048	0.760	0.448	-0.058	0.130
Net Sales	0.006	0.004	1.520	0.128	-0.002	0.013
Constant	21.872	7.268	3.010	0.003	7.625	36.119

Table 115: Debt regression results model 14 quarterly

R2	0.002	Correlation(u_i, xb)	-0.035
Number of observations	11,053	rho	0.598
Observations per group (average)	2	p-value of F-test	0.943

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	0.296	0.610	0.480	0.628	-0.900	1.492
Takeover Complete	-1.063	1.242	-0.860	0.392	-3.498	1.373
Takeover Withdrawn	-0.385	0.531	-0.730	0.468	-1.425	0.655
Transaction Value	0.000	0.000	1.160	0.245	0.000	0.000
Total Assets	0.000	0.000	-0.850	0.396	0.000	0.000
Shares Outstanding	0.027	0.027	0.980	0.326	-0.027	0.080
Non-Operating Income	0.036	0.048	0.760	0.448	-0.058	0.130
Net Sales	0.006	0.004	1.520	0.129	-0.002	0.013
Constant	21.877	7.269	3.010	0.003	7.628	36.127

Table 116: Debt regression results model 15 quarterly

R2	0.001	Correlation(u_i, xb)	-0.029
Number of observations	11,053	rho	0.598
Observations per group (average)	2	p-value of F-test	0.997

Debt	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Takeover Announced	0.283	0.590	0.480	0.631	-0.873	1.439
Buyback Announced	-5.527	27.156	-0.200	0.839	-58.763	47.709
Buyback Complete	-20.333	19.915	-1.020	0.307	-59.374	18.708
Takeover Complete	-1.548	10.234	-0.150	0.880	-21.610	18.514
Buyback Withdrawn	-3.596	8.466	-0.420	0.671	-20.192	13.000
Takeover Withdrawn	-0.094	8.456	-0.010	0.991	-16.670	16.483
Transaction Value	0.000	0.001	-0.960	0.337	-0.001	0.001
Total Assets	0.000	0.000	-0.840	0.402	0.000	0.000
Shares Outstanding	0.027	0.028	0.970	0.332	-0.027	0.081
Non-Operating Income	0.038	0.049	0.790	0.432	-0.057	0.134
Net Sales	0.005	0.004	1.530	0.127	-0.002	0.012
Constant	26.660	16.430	1.620	0.105	-5.548	58.868

8.3.5 Investments and buybacks

Table 117: Investments Regression Results model 1 quarterly

R2	0.000	Correlation(u_i, xb)	0.001
Number of observations	11,864	rho	0.961
Observations per group (average)	2	p-value of F-test	0.185

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Investments	0.000	0.000	-1.330	0.185	0.000	0.000
Constant	0.101	0.000	453.960	0.000	0.100	0.101

Table 118: Investments Regression Results model 2 quarterly

R2	0.001	Correlation(u_i, xb)	-0.002
Number of observations	11,864	rho	0.961
Observations per group (average)	2	p-value of F-test	0.020

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Investments	0.000	0.000	-1.030	0.304	0.000	0.000
Buyback Announced	-0.072	0.029	-2.520	0.012	-0.128	-0.016
Constant	0.139	0.015	9.160	0.000	0.109	0.168

Table 119: Investments Regression Results model 3 quarterly

R2	0.000	Correlation(u_i, xb)	-0.004
Number of observations	11,864	rho	0.961
Observations per group (average)	2	p-value of F-test	0.343

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Investments	0.000	0.000	-1.330	0.183	0.000	0.000
Buyback Complete	0.009	0.015	0.590	0.552	-0.021	0.040
Constant	0.100	0.001	95.080	0.000	0.098	0.102

Table 120: Investments Regression Results. model 4 quarterly

R2	0.000	Correlation(u_i, xb)	0.002
Number of observations	11,864	rho	0.961
Observations per group (average)	2	p-value of F-test	0.391

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Investments	0.000	0.000	-1.310	0.191	0.000	0.000
Buyback Withdrawn	-0.007	0.022	-0.310	0.759	-0.049	0.036
Constant	0.101	0.001	158.990	0.000	0.100	0.102

Table 121: Investments Regression Results model 5 quarterly

R2	0.001	Correlation(u_i, xb)	-0.003
Number of observations	11,864	rho	0.961
Observations per group (average)	2	p-value of F-test	0.072

Excess Returns	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Investments	0.000	0.000	-1.080	0.281	0.000	0.000
Buyback Announced	-0.076	0.030	-2.560	0.011	-0.135	-0.018
Buyback Complete	0.030	0.017	1.710	0.087	-0.004	0.064
Buyback Withdrawn	0.015	0.023	0.650	0.517	-0.030	0.060
Constant	0.138	0.015	9.190	0.000	0.109	0.168

8.4 Probit models

8.4.1 Daily data

Table 122: Probit model 1 daily

Number of observations	18,006,274
Observations per group (average)	2,649
Rho	0.07

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.209	0.127	1.640	0.100	-0.041	0.458
Constant	-3.522	0.006	-586.690	0.000	-3.534	-3.510

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.00017	0.00010	1.64000	0.10000	-0.00003	0.00037

Table 123: Probit model 2 daily

Number of observations	8,474,223
Observations per group (average)	1,247
Rho	0.289

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.273	0.215	-1.270	0.205	-0.694	0.149
Shares Outstanding	-0.473	0.010	-46.520	0.000	-0.493	-0.453
Excess Returns	0.279	0.007	42.790	0.000	0.266	0.291
Trading Volume	0.435	0.007	61.780	0.000	0.422	0.449
Constant	-3.211	0.091	-35.460	0.000	-3.389	-3.033

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.00017	0.00009	-1.830	0.067	-0.00035	0.00000
Shares Outstanding	-0.00041	0.00002	-26.170	0.000	-0.00044	-0.00030
Excess Returns	0.00024	0.00001	25.160	0.000	0.00022	0.00000
Trading Volume	0.00038	0.00001	28.260	0.000	0.00035	0.00040

Table 124: Probit model 3 daily

Number of observations	18,006,274
Observations per group (average)	2,649
Rho	0.06

Takeover complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.185	0.140	1.320	0.188	-0.090	0.460
Constant	-3.572	0.006	-564.590	0.000	-3.584	-3.559

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.00013	0.00010	1.320	0.188	-0.00006	0.00031

Table 125: Probit model 4 daily

Number of observations	18,006,274
Observations per group (average)	2,649
Rho	0.06

Takeover complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.673	0.184	3.660	0.000	0.313	1.034
Constant	-3.572	0.006	-564.610	0.000	-3.584	-3.559

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.00046	0.00013	3.650	0.000	0.00021	0.00070

Table 126: Probit model 5 daily

Number of observations	18,006,274
Observations per group (average)	2,649
Rho	0.06

Takeover complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.152	0.261	-0.580	0.562	-0.664	0.360
Buyback Complete	0.825	0.319	2.580	0.010	0.199	1.451
Constant	-3.572	0.006	-564.580	0.000	-3.584	-3.559

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.00010	0.00018	-0.580	0.562	-0.00045	0.00024
Buyback Complete	0.00056	0.00022	2.580	0.010	0.00013	0.00098

Table 127: Probit model 6 daily

Number of observations	8,474,223
Observations per group (average)	1,247
Rho	0.331

Takeover Complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.215	0.219	-0.980	0.326	-0.643	0.214
Shares Outstanding	-0.495	0.011	-44.060	0.000	-0.517	-0.473
Excess Returns	0.284	0.007	39.530	0.000	0.270	0.298
Trading Volume	0.455	0.008	57.840	0.000	0.440	0.471
Constant	-3.348	0.103	-32.650	0.000	-3.549	-3.147

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.00011	0.00009	-1.300	0.193	-0.00028	0.00000
Shares Outstanding	-0.00033	0.00001	-23.390	0.000	-0.00036	-0.00030
Excess Returns	0.00019	0.00001	22.360	0.000	0.00017	0.00020
Trading Volume	0.00031	0.00001	25.420	0.000	0.00028	0.00030

Table 128: Probit model 7 daily

Number of observations	8,474,223
Observations per group (average)	1,247
Rho	0.331

Takeover Complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.397	0.256	1.550	0.121	-0.105	0.898
Shares Outstanding	-0.495	0.011	-44.060	0.000	-0.517	-0.472
Excess Returns	0.284	0.007	39.540	0.000	0.270	0.298
Trading Volume	0.455	0.008	57.830	0.000	0.440	0.471
Constant	-3.347	0.103	-32.650	0.000	-3.548	-3.140

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.00045	0.00045	1.000	0.320	-0.00044	0.00130
Shares Outstanding	-0.00033	0.00001	-23.390	0.000	-0.00036	-0.00030
Excess Returns	0.00019	0.00001	22.360	0.000	0.00017	0.00020
Trading Volume	0.00031	0.00001	25.430	0.000	0.00028	0.00030

Table 129: Probit model 8 daily

Number of observations	8,474,223
Observations per group (average)	1,247
Rho	0.331

Takeover Complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-4.711	1607.354	0.000	0.998	-3155.067	3145.645
Buyback Complete	5.107	1607.354	0.000	0.997	-3145.250	3155.463
Shares Outstanding	-0.495	0.011	-44.060	0.000	-0.517	-0.473
Excess Returns	0.284	0.007	39.550	0.000	0.270	0.298
Trading Volume	0.455	0.008	57.830	0.000	0.440	0.471
Constant	-3.347	0.103	-32.650	0.000	-3.548	-3.146

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.00036	0.04198	-0.010	0.993	-0.08265	0.08190
Buyback Complete	0.70502	441.601	0.000	0.999	-864.817	866.200
Shares Outstanding	-0.00033	0.00058	-0.570	0.566	-0.00147	0.00080
Excess Returns	0.00019	0.00078	0.250	0.806	-0.00133	0.00170
Trading Volume	0.00031	0.00060	0.510	0.612	-0.00088	0.00140

Table 130: Probit model 9 daily

Number of observations	18,006,274
Observations per group (average)	2,649
Rho	0.105

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.319	0.261	1.220	0.221	-0.192	0.830
Constant	-4.246	0.037	-113.410	0.000	-4.319	-4.172

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.000016	0.000013	1.200	0.228	-0.000010	0.000041

8.4.2   Quarterly data

Table 131: Probit model 1 quarterly

Number of observations	12,164
Observations per group (average)	2
Rho	0.000

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.372	0.073	-5.090	0.000	-0.516	-0.229
Constant	-2.178	0.042	-51.390	0.000	-2.261	-2.095

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.010	0.002	-4.760	0.000	-0.014	-0.006

Table 132: Probit model 2 quarterly

Number of observations	12,164
Observations per group (average)	2
Rho	0.543

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-0.076	0.215	-0.350	0.725	-0.498	0.347
Constant	-3.382	0.777	-4.350	0.000	-4.906	-1.858

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.000	0.000	-0.240	0.811	-0.001	0.001

Table 133: Probit model 3 quarterly

Number of observations	12,164
Observations per group (average)	2
Rho	0.005

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.394	0.078	-5.050	0.000	-0.547	-0.241
Buyback Complete	0.141	0.162	0.870	0.384	-0.176	0.457
Constant	-2.183	0.047	-46.000	0.000	-2.276	-2.090

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.011	0.002	-4.780	0.000	-0.015	-0.006
Buyback Complete	0.005	0.004	1.170	0.243	-0.003	0.012

Table 134: Probit model 4 quarterly

Number of observations	11,060
Observations per group (average)	2
Rho	0.000

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.412	0.077	-5.320	0.000	-0.563	-0.260
Total Assets	0.000	0.000	0.830	0.409	0.000	0.000
Shares Outstanding	0.000	0.000	-1.140	0.256	-0.001	0.000
Non-Operating Income	0.000	0.000	0.090	0.925	-0.001	0.001
Net Sales	0.000	0.000	-0.210	0.836	0.000	0.000
Constant	-2.123	0.046	-45.690	0.000	-2.214	-2.032

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.011	0.002	-5.230	0.000	-0.014	-0.007
Total Assets	0.000	0.000	0.800	0.422	0.000	0.000
Shares Outstanding	0.000	0.000	-1.130	0.258	0.000	0.000
Non-Operating Income	0.000	0.000	0.090	0.925	0.000	0.000
Net Sales	0.000	0.000	-0.210	0.836	0.000	0.000

Table 135: Probit model 5 quarterly

Number of observations	11,060
Observations per group (average)	2
Rho	0.124

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-0.046	0.165	-0.280	0.781	-0.370	0.278
Total Assets	0.000	0.000	0.770	0.441	0.000	0.000
Shares Outstanding	0.000	0.000	-1.240	0.214	-0.001	0.000
Non-Operating Income	0.000	0.000	-0.010	0.993	-0.001	0.001
Net Sales	0.000	0.000	-0.620	0.534	0.000	0.000
Constant	-2.432	0.044	-55.860	0.000	-2.518	-2.347

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-0.001	0.003	-0.280	0.781	-0.007	0.005
Total Assets	0.000	0.000	0.750	0.456	0.000	0.000
Shares Outstanding	0.000	0.000	-1.230	0.219	0.000	0.000
Non-Operating Income	0.000	0.000	-0.010	0.993	0.000	0.000
Net Sales	0.000	0.000	-0.620	0.535	0.000	0.000

Table 136: Probit model 6 quarterly

Number of observations	11,060
Observations per group (average)	2
Rho	0.000

Takeover Announced	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.441	0.082	-5.360	0.000	-0.603	-0.280
Buyback Complete	0.211	0.166	1.270	0.203	-0.114	0.535
Total Assets	0.000	0.000	0.770	0.441	0.000	0.000
Shares Outstanding	0.000	0.000	-1.110	0.265	-0.001	0.000
Non-Operating Income	0.000	0.000	0.070	0.942	-0.001	0.001
Net Sales	0.000	0.000	-0.280	0.777	0.000	0.000
Constant	-2.122	0.047	-45.630	0.000	-2.214	-2.031

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.012	0.002	-4.950	0.000	-0.016	-0.007
Buyback Complete	0.005	0.004	1.270	0.205	-0.003	0.014
Total Assets	0.000	0.000	0.750	0.453	0.000	0.000
Shares Outstanding	0.000	0.000	-1.110	0.267	0.000	0.000
Non-Operating Income	0.000	0.000	0.070	0.942	0.000	0.000
Net Sales	0.000	0.000	-0.280	0.776	0.000	0.000

Table 137: Probit model 7 quarterly

Number of observations	12,164
Observations per group (average)	2
Rho	0.002

Takeover complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.454	0.081	-5.570	0.000	-0.613	-0.294
Constant	-2.218	0.046	-47.860	0.000	-2.309	-2.127

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.010	0.002	-5.010	0.000	-0.014	-0.006

Table 138: Probit model 8 quarterly

Number of observations	12,164
Observations per group (average)	2
Rho	0.731

Takeover complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-0.003	0.273	-0.010	0.990	-0.538	0.532
Constant	-4.481	0.409	-10.950	0.000	-5.283	-3.679

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
BBComplete	0.000	0.000	-0.010	0.990	0.000	0.000

Table 139: Probit model 9 quarterly

Number of observations	12,164
Observations per group (average)	2
Rho	0.005

Takeover complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.487	0.088	-5.520	0.000	-0.661	-0.314
Buyback Complete	0.207	0.176	1.180	0.239	-0.138	0.552
Constant	-2.222	0.054	-41.290	0.000	-2.328	-2.117

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.011	0.002	-4.780	0.000	-0.015	-0.006
Buyback Complete	0.005	0.004	1.170	0.243	-0.003	0.012

Table 140: Probit model 10 quarterly

Number of observations		11,060			
Observations per group (average)		2			
Rho		0.006			

Takeover Complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.508	0.088	-5.790	0.000	-0.680	-0.336
Total Assets	0.000	0.000	0.910	0.362	0.000	0.000
Shares Outstanding	0.000	0.000	-1.070	0.284	-0.001	0.000
Non-Operating Income	0.000	0.000	0.100	0.924	-0.001	0.001
Net Sales	0.000	0.000	-0.020	0.982	0.000	0.000
Constant	-2.174	0.055	-39.200	0.000	-2.282	-2.065

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.011	0.002	-5.430	0.000	-0.014	-0.007
Total Assets	0.000	0.000	0.880	0.378	0.000	0.000
Shares Outstanding	0.000	0.000	-1.060	0.288	0.000	0.000
Non-Operating Income	0.000	0.000	0.100	0.924	0.000	0.000
Net Sales	0.000	0.000	-0.020	0.982	0.000	0.000

Table 141: Probit model 11 quarterly

Number of observations		11,060			
Observations per group (average)		2			
Rho		0.139			

Takeover Complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-0.047	0.179	-0.260	0.792	-0.398	0.303
Total Assets	0.000	0.000	0.830	0.405	0.000	0.000
Shares Outstanding	0.000	0.000	-1.170	0.240	-0.001	0.000
Non-Operating Income	0.000	0.000	-0.030	0.980	-0.001	0.001
Net Sales	0.000	0.000	-0.540	0.587	0.000	0.000
Constant	-2.525	0.047	-53.880	0.000	-2.617	-2.433

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	-0.001	0.002	-0.280	0.781	-0.005	0.004
Total Assets	0.000	0.000	0.800	0.424	0.000	0.000
Shares Outstanding	0.000	0.000	-1.160	0.245	0.000	0.000
Non-Operating Income	0.000	0.000	-0.030	0.980	0.000	0.000
Net Sales	0.000	0.000	-0.540	0.588	0.000	0.000

Table 142: Probit model 12 quarterly

Number of observations		11,060			
Observations per group (average)		2			
Rho		0.007			

Takeover Complete	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.554	0.095	-5.810	0.000	-0.740	-0.367
Buyback Complete	0.290	0.182	1.590	0.112	-0.067	0.647
Total Assets	0.000	0.000	0.830	0.406	0.000	0.000
Shares Outstanding	0.000	0.000	-1.040	0.299	-0.001	0.000
Non-Operating Income	0.000	0.000	0.060	0.949	-0.001	0.001
Net Sales	0.000	0.000	-0.130	0.897	0.000	0.000
Constant	-2.174	0.057	-37.990	0.000	-2.286	-2.062

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.012	0.002	-5.230	0.000	-0.016	-0.007
Buyback Complete	0.009	0.007	1.210	0.225	-0.005	0.022
Total Assets	0.000	0.000	0.810	0.420	0.000	0.000
Shares Outstanding	0.000	0.000	-1.030	0.303	0.000	0.000
Non-Operating Income	0.000	0.000	0.060	0.949	0.000	0.000
Net Sales	0.000	0.000	-0.130	0.897	0.000	0.000

Table 143: Probit model 13 quarterly

Number of observations	12,164
Observations per group (average)	2
Rho	0.038

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.166	0.173	-0.960	0.336	-0.505	0.172
Constant	-3.054	0.221	-13.840	0.000	-3.487	-2.622

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	0.000	0.001	-0.830	0.406	-0.002	0.001

Table 144: Probit model 14 quarterly

Number of observations	12,164
Observations per group (average)	2
Rho	0.002

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.052	0.315	0.170	0.868	-0.565	0.669
Constant	-3.077	0.098	-31.330	0.000	-3.270	-2.885

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.000	0.001	0.170	0.868	-0.002	0.002

Table 145: Probit model 15 quarterly

Number of observations	12,164
Observations per group (average)	2
Rho	0.001

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.189	0.180	-1.050	0.295	-0.543	0.165
Buyback Complete	0.163	0.336	0.490	0.627	-0.495	0.821
Constant	-2.997	0.111	-26.920	0.000	-3.216	-2.779

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.001	0.001	-1.010	0.313	-0.002	0.001
Buyback Complete	0.001	0.001	0.480	0.630	-0.002	0.003

Table 146: Probit model 16 quarterly

Number of observations	11,060
Observations per group (average)	2
Rho	0.000

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.174	0.173	-1.000	0.316	-0.513	0.165
Total Assets	0.000	0.000	-0.210	0.832	0.000	0.000
Shares Outstanding	-0.001	0.001	-0.620	0.536	-0.002	0.001
Non-Operating Income	0.000	0.001	0.350	0.726	-0.002	0.003
Net Sales	0.000	0.000	0.230	0.822	0.000	0.000
Constant	-2.902	0.120	-24.080	0.000	-3.138	-2.666

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.001	0.001	-1.000	0.320	-0.002	0.001
Total Assets	0.000	0.000	-0.220	0.829	0.000	0.000
Shares Outstanding	0.000	0.000	-0.610	0.543	0.000	0.000
Non-Operating Income	0.000	0.000	0.350	0.728	0.000	0.000
Net Sales	0.000	0.000	0.220	0.822	0.000	0.000

Table 147: Probit model 17 quarterly

Number of observations	11,060
Observations per group (average)	2
Rho	0.007

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.081	0.324	0.250	0.803	-0.554	0.715
Total Assets	0.000	0.000	-0.250	0.805	0.000	0.000
Shares Outstanding	-0.001	0.001	-0.650	0.517	-0.003	0.001
Non-Operating Income	0.001	0.001	0.350	0.724	-0.002	0.003
Net Sales	0.000	0.000	0.170	0.868	0.000	0.000
Constant	-2.991	0.126	-23.770	0.000	-3.238	-2.745

Marginal Effects

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Complete	0.000	0.002	0.220	0.822	-0.003	0.003
Total Assets	0.000	0.000	-0.250	0.801	0.000	0.000
Shares Outstanding	0.000	0.000	-0.630	0.528	0.000	0.000
Non-Operating Income	0.000	0.000	0.350	0.726	0.000	0.000
Net Sales	0.000	0.000	0.170	0.868	0.000	0.000

Table 148: Probit model 18 quarterly

Number of observations	11,060
Observations per group (average)	2
Rho	0.000

Takeover Withdrawn	Coefficient	Standard Error	t-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.203	0.184	-1.100	0.271	-0.563	0.158
Buyback Complete	0.195	0.343	0.570	0.569	-0.476	0.867
Total Assets	0.000	0.000	-0.210	0.835	0.000	0.000
Shares Outstanding	-0.001	0.001	-0.620	0.534	-0.002	0.001
Non-Operating Income	0.000	0.001	0.340	0.731	-0.002	0.003
Net Sales	0.000	0.000	0.200	0.838	0.000	0.000
Constant	-2.902	0.119	-24.430	0.000	-3.135	-2.669

	Marginal Effect	Delta Standard Error	z-value	p-value	95% confidence interval	
					lower bound	upper bound
Buyback Announced	-0.001	0.001	-1.060	0.288	-0.002	0.001
Buyback Complete	0.001	0.002	0.450	0.655	-0.003	0.005
Total Assets	0.000	0.000	-0.210	0.832	0.000	0.000
Shares Outstanding	0.000	0.000	-0.610	0.541	0.000	0.000
Non-Operating Income	0.000	0.000	0.340	0.732	0.000	0.000
Net Sales	0.000	0.000	0.200	0.839	0.000	0.000

8.5 Hazard rate models

8.5.1 Daily data

Table 149: Hazard Rate model 1 daily

Number of observations	3,253
Failures (takeover completed)	3,166
Wald Chi²	0.520
P-value	0.469

Variable	Hazard Ratio	Coefficient	Z value	P value	95% Confidence interval			
					Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
Buyback Announced	1.698 (1.240)	0.529 (0.731)	0.720	0.469	0.406	7.107	-0.903	1.961

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients

Table 150: Hazard Rate model 2 daily

Number of observations	3,253
Failures (takeover completed)	3,166
Wald Chi²	1.050
P-value	0.305

Variable	Hazard Ratio	Coefficient	Z value	P value	95% Confidence interval			
					Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
Buyback Complete	2.399 (2.051)	0.875 (0.855)	1.020	0.306	0.449	12.820	-0.801	2.551

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients

Table 151: Hazard Rate model 3 daily

Number of observations	3,253
Failures (takeover completed)	3,166
Wald Chi²	1.080
P-value	0.583

Variable	Hazard Ratio	Coefficient	Z value	P value	95% Confidence interval			
					Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
Buyback announced	0.777 (1.077)	-0.252 (1.387)	-0.180	0.856	0.051	11.769	-2.970	2.465
Buyback Complete	3.087 (5.030)	1.127 (1.629)	0.690	0.489	0.127	75.217	-2.066	4.320

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficies

Table 152: Hazard Rate model 4 daily

Number of observations	2,483
Failures (takeover completed)	2,446
Wald Chi²	81.300
P-value	0.000

Variable	Hazard Ratio	Coefficient	Z value	P value	Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
						95% Confidence interval		
Buyback Announced	4.442	1.491	1.290	0.196	0.462	42.673	-0.771	3.754
	(5.128)	(1.543)						
Shares Outstanding	0.743	-0.297	-7.520	0.000	0.688	0.803	-0.374	-0.219
	(0.029)	(0.039)						
Excess Returns	0.983	-0.017	-0.620	0.535	0.932	1.037	-0.070	0.036
	(0.027)	(0.027)						
Trading Volume	1.181	0.167	7.070	0.000	1.128	1.237	0.121	0.213
	(0.028)	(0.024)						

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients

Table 153: Hazard Rate model 5 daily

Number of observations	2,483
Failures (takeover completed)	2,446
Wald Chi²	81.300
P-value	0.000

Variable	Hazard Ratio	Coefficient	Z value	P value	Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
						95% Confidence interval		
Buyback Completed	4.442	1.491	1.290	0.196	0.462	42.673	-0.771	3.754
	(5.128)	(1.154)						
Shares Outstanding	0.743	-0.297	-7.520	0.000	0.688	0.803	-0.374	-0.219
	(0.029)	(0.039)						
Excess Returns	0.983	-0.017	-0.620	0.535	0.932	1.037	-0.070	0.036
	(0.027)	(0.027)						
Trading Volume	1.181	0.167	7.070	0.000	1.128	1.237	0.121	0.213
	(0.028)	(0.024)						

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients

8.5.2 Quarterly data

Table 154: Hazard Rate model 1 quarterly

Number of observations	94
Failures (takeover completed)	94
Wald Chi²	0.700
P-value	0.402

Variable	Hazard Ratio	Coefficient	Z value	P value	Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
						95% Confidence interval		
Buyback Announced	1.340	0.293	0.840	0.402	0.676	2.657	-0.392	0.977
	(0.468)	(0.349)						

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients

Table 155: Hazard Rate model 2 quarterly

Number of observations	94
Failures (takeover completed)	94
Wald Chi²	4.060
P-value	0.044

Variable	Hazard Ratio	Coefficient	Z value	P value	Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
						95% Confidence interval		
Buyback Complete	5.056	1.621	2.020	0.044	1.046	24.436	0.045	3.196
	(4.064)	(0.804)						

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients

Table 156: Hazard Rate model 3 quarterly

Number of observations	94
Failures (takeover completed)	94
Wald Chi²	4.060
P-value	0.132

					95% Confidence interval			
Variable	Hazard Ratio	Coefficient	Z value	P value	Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
Buyback announced	1.012	0.012	0.030	0.975	0.477	2.148	-0.740	0.764
	(0.388)	(0.384)						
Buyback Complete	5.009	1.611	1.880	0.060	0.934	26.864	-0.068	3.291
	(4.292)	(0.857)						

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients

Table 157: Hazard Rate model 4 quarterly

Number of observations	86
Failures (takeover completed)	86
Wald Chi²	0.570
P-value	0.990

					95% Confidence interval			
Variable	Hazard Ratio	Coefficient	Z value	P value	Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
Buyback Announced	2.614	0.961	0.660	0.510	0.149	45.705	-1.901	3.822
	(3.816)	(1.460)						
Total Assets	1.000	0.000	-0.440	0.663	1.000	1.000	0.000	0.000
	(0.000)	(0.000)						
Shares Outstanding	0.997	-0.003	-0.670	0.504	0.989	1.006	-0.011	0.006
	(0.004)	(0.004)						
Non-Operating Income	0.997	-0.003	-0.460	0.648	0.984	1.010	-0.016	0.010
	(0.007)	(0.007)						
Net Sales	1.000	0.003	0.650	0.517	0.999	1.001	-0.001	0.001
	(0.001)	(0.005)						

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients

Table 158: Hazard Rate model 5 quarterly

Number of observations	86
Failures (takeover completed)	86
Wald Chi²	1.520
P-value	0.910

					95% Confidence interval			
Variable	Hazard Ratio	Coefficient	Z value	P value	Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
Buyback Completed	11.744	2.463	1.120	0.261	0.160	863.818	-1.835	6.761
	(25.753)	(2.193)						
Total Assets	1.000	0.000	-0.770	0.440	1.00	1.00	0.000	0.000
	(0.000)	(0.000)						
Shares Outstanding	0.998	-0.002	-0.950	0.340	0.994	1.002	-0.007	0.002
	(0.002)	(0.002)						
Non-Operating Income	0.997	-0.003	-0.500	0.619	0.987	1.008	-0.013	0.008
	(0.005)	(0.005)						
Net Sales	1.000	0.000	0.920	0.355	1.000	1.001	0.000	0.001
	(0.000)	(0.000)						

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients

Table 159: Hazard Rate model 6 quarterly

Number of observations	86
Failures (takeover completed)	86
Wald Chi²	14.570
P-value	0.024

Variable	Hazard Ratio	Coefficient	Z value	P value	95% Confidence interval			
					Hazard Ratio Lower Bound	Hazard Ratio Upper Bound	Coefficient lower bound	Coefficient upper bound
Buyback Announced	1.917	0.651	0.990	0.322	-0.638	1.940	-0.638	1.940
	(1.261)	(0.658)						
Buyback Completed	9.275	2.227	1.650	0.100	-0.425	4.880	-0.425	4.880
	(12.552)	(1.353)						
Total Assets	1.000	0.000	-1.170	0.241	0.000	0.00	0.000	0.000
	(0.000)	(0.000)						
Shares Outstanding	0.997	-0.003	-1.700	0.089	-0.006	0.000	-0.006	0.000
	(0.002)	(0.002)						
Non-Operating Income	0.996	-0.004	-0.680	0.494	-0.014	0.007	-0.014	0.007
	(0.005)	(0.005)						
Net Sales	1.000	0.000	1.530	0.125	0.000	0.001	0.000	0.001
	(0.000)	(0.000)						

Note: Numbers between brackets represent the standard error of the hazard ratios and coefficients