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Impact of Financial Crisis on Trading Around the Merger Announcement
Does the magnitude of abnormal activity predict deal outcome?

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PREFACE AND ACKNOWLEDGEMENTS

This work is a manifestation of the knowledge acquired at Erasmus School of Economics, and it symbolises another pillar in my personal development. Therefore, I would like to thank my supervisor Renjie Wang for valuable feedback and assistance. Next, I would like to thank my dear friends for their constructive criticism and help. Finally, I want to thank my family, especially my mother who provided me with this invaluable opportunity of studying at one of the leading European universities.

ABSTRACT

How did the financial crisis in 2008 change market reactions to the merger announcement, and is it possible to estimate merger completion probability based on the magnitude of these reactions? In order to answer these questions, I have used Event study approach accompanied with Probit models, respectively. The extent of abnormal activity around the announcement changed as a result of the financial crisis. Better market anticipation of the deal outcome can be observed after the economic turmoil. In comparison with the pre-crisis period, this is reflected in a higher abnormal activity that accompanies successful deals and lower for unsuccessful deals. Furthermore, I have showed that there is a positive relation between the magnitude of abnormal activity, around the merger announcement day, and merger completion probability.

Keywords: Mergers and Acquisitions, CAAR, CAAV, Short Interest, Deal outcome probability.

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CHAPTER 1 Introduction

This thesis contains insights into two dimensions of merger activity. Firstly, it examines the impact of the 2008 financial crisis on trading activity around the merger announcement. Namely, if there are notable changes in the target's abnormal activity in the form of abnormal return, abnormal volume, and change in short interest. Secondly, it investigates, if the probability of merger completion can be estimated more precisely based on the magnitude of the target's abnormal activity around the merger announcement. I believe that examining these two dimensions can provide a deeper understanding of the target's stock activity and the market reaction to the merger announcement. Furthermore, the availability of new data enables me to examine this activity over-time, hence providing insights into the development of aforementioned market reactions.

There are multiple notable changes in the behavior of abnormal activity. I have compared this activity for two merger waves immediately surrounding the economic turmoil in 2008. Cumulative Average Abnormal Return (CAAR, henceforth) of target's stock price is generally higher for the After-crisis period with the exception of withdrawn deals. This finding suggests better market anticipation of deal outcome, as deals that will be completed later on experience higher abnormal returns (target's shareholders) during the merger announcement. Deals that will be withdrawn, on the other hand, experience significantly lower abnormal returns around the announcement. The opposite pattern is observed for Cumulative Average Abnormal Volume (CAAV, henceforth), as abnormal volume is higher for the Pre-crisis period, again with the exception of withdrawn deals. This finding further illustrates better market anticipation of deal withdrawal in the After-crisis period.

A magnitude of the target's abnormal activity around the merger announcement contains valuable information and can help to predict deal outcome. As I have shown in table 14 (page 28), exceeding certain threshold of abnormal activity increases merger completion probability. I have found that exceeding a CAAR of 9.9%, in the event window immediately surrounding the announcement day (-1, +1), leads to the increase in probability of merger completion by 14.4% and 35.5% for the Pre-crisis and After-crisis period, respectively. From the CAAV perspective, exceeding a threshold of 31.8% in the same event window leads to increase in merger completion probability by 10.7% and 28.9% for the Pre-crisis and After-crisis period, respectively. Both results

are persistent even after controlling for different deal characteristics that have an impact on deal outcome probability such as termination fees, 52-week high distance, hostility or form of financing.

The rest of the paper is organized as follows. Chapter 2 summarizes the existing literature on mergers and the abnormal activity around the merger announcement. In chapter 3, I describe the data selection and methodology used to examine previously mentioned dimensions of the thesis. Chapter 4 summarizes basic results (magnitude of activity), and chapter 5 shows regression analysis and probability assessment. Chapter 6 concludes, and discusses possible improvements to my study.

CHAPTER 2 Literature Review

2.1 Merger activity

Mergers and Acquisitions are considered one of the most important corporate events, and are heavily examined in economic research. It has been concluded (Andrade et al. 2001) that mergers come in waves and tend to cluster by industry. Waves are sparked by industry shocks in the form of deregulation, technological innovations or supply shocks. Gugler et al. (2012) showed that merger waves are strongly correlated with stock market booms and are connected to optimism in financial markets. Their findings support the behavioral hypothesis developed by Rhodes-Kropf et al. (2005) that "misvaluation levels positively correlate with merger activity" and "sectors with relatively larger valuation errors experience greater increase in merger activity". There are two waves contained in the sample that I have used for the analysis. The first wave is known as the Sixth merger wave and developed from 2003 to late 2007. Alexandris et al. (2012) concluded that this wave was characterized by the abundant liquidity. The Sixth merger wave reached its peak in 2007 when more than 4,700 deals were consummated worldwide with the aggregate value of transactions approximately $5,000 billion. The second wave has been developing since mid 2009, with the number of deals (4,400) and aggregate deal value ($4,600 billion) already approaching values of the Sixth merger wave (Institute for Mergers, Acquisitions and Alliances). Merger activity in North America (sample in this research contains deals from North America) has already reached levels of the Pre-crisis period. For instance the value of transactions in 2015 already exceeded the Pre-crisis level ($2, 481 billion).

From the wealth creation perspective there is a clear distinction between target shareholders gains and gains accrued to acquirer shareholders. Jensen and Ruback (1983) firstly showed that target shareholders are clear winners in this game, as the majority of returns are accrued to them. Consistent with their results Andrade et al. (2001), showed that "the average three-day abnormal return (-1, +1) for target firms is 16%, and rises to 24% over the longer event window". Whereas, abnormal returns accrued to acquirer are averaging at 1.8% overtime. In connection to the merger waves Bouwman et al. (2009) found out, that the announcement returns are significantly higher for overvalued markets. This thesis focuses on the activity around the merger announcement from the target shareholders' perspective, and one dimension of the research examines the impact of financial crisis on trading activity around the announcement. Thus, both wealth creation from the targets' perspective and the impact of different periods of misvaluation are examined.

2.2 Event studies

Market reactions (return, volume SI) to the merger announcement are the core of this research. Event studies are used in economic research to measure the impact of various events. Mitchell and Netter (1994) classified that event studies are used "to assess the intensity of unusual returns during the occurrence of an event". Furthermore, they concluded that the market model is ideal for estimating normal performance or "normal expected returns". In line with their conclusion, MacKinlay (1997) pinpointed another benefit - higher R^2 of market model. He argues "the higher the R^2 the greater is the variance reduction of the abnormal return, and the larger is the gain". Next, a literature review of these forms of activity is presented.

2.3 Target's unusual return around the merger announcement

There is a general consensus about the existence of abnormal activity in the form of abnormal returns around the merger announcement. One of the first longer-term studies of pre-announcement activity was done by Mandelker (1974). He found that the target firms gain 13.1% CAAR in period of 7 months before the announcement. Keown and Pinkerton (1981) is considered a pioneer study of this phenomena in shorter-term context. They were the first who used daily holding returns to calculate

abnormal activity. They found positive (27%) Cumulative Average Residual in event window -60 days to +10 days around the announcement for a sample of 194 firms, and that the first positive CAR occurs 25 days prior to the announcement. In line with a semi-strong form of efficient market hypothesis (Malkiel and Fama, 1970), they showed that the market completely reflects new information one day after the announcement. The weakness of their study is in the overlap between the estimation and event window, as this overlap creates a mismatch between normal and abnormal activity (MacKinlay, 1997).

The pre-announcement abnormal activity can be explained by either illegal insider activity (information leakage) or market anticipation. A study executed by the SEC (OCE, 1987) showed that the majority of abnormal activity can be explained via the market anticipation theory. It states that the magnitude of pre-announcement activity depends on the deal characteristics such as media speculation, deal attitude or toehold position by the acquirer. Jarrell and Poulsen (1989) applied the OCE study and measured actual CAR based on previously mentioned characteristics. In the event window (-20, +5) they found 29.1% CAAR, with a strong positive relation to rumors (media speculation). Furthermore, no clear evidence of insider trading impact on high pre-announcement trading was found, thus supporting OCE (1987) findings.

Next, Schwert (1996) examined abnormal activity for a sample of 1814 deals in period from 1975 to 1991. He investigated the pre-announcement activity starting 126 days prior to the announcement and found that the increase in abnormal returns for target company starts 42 trading days prior to the announcement, and that this increase starts to be pronounced 21 days before the announcement. Next, he showed that, a short event window around the announcement (-1, +1) accounts for the majority of CAAR. Furthermore, Schwert also differentiates between completed and withdrawn deals and studies the impact of this characteristic on CAAR magnitude. CAAR is approximately 25% for successful offers and around 19% for unsuccessful offers. He raised the question about the "role played by the market in affecting the outcome of the takeover". In this thesis, I have tried to answer if the magnitude of abnormal activity around the merger announcement affects the probability of deal completion. Hence, I examine the role of the market.

Recent studies also found similar patterns. Andrade, et al. (2001) investigated two windows around the announcement, three days immediately surrounding the merger announcement (-1, +1) and one longer window beginning 20 trading days prior

and ending when deal is either completed or withdrawn. They found that for a short window the abnormal return is 16% and rises to 24% for a longer window. Thus again showing that a short event window immediately surrounding the announcement day accounts for the majority of abnormal activity. Ascioglu, McInish, and Wood (2002) examined trading around the announcement with multiple event windows and found that CAAR of 20% is starting to build significantly around 10 days prior to the announcement. Betton et al. (2008) investigated abnormal activity for 7522 deals for an event window starting 41 days prior to the announcement and ending when the deal is either completed or withdrawn. In this longer event window, the CAAR for the whole sample equals 14.3%, 24% for completed deals, and -10.5% for unsuccessful deals. Also, only the pre-announcement period (-42, -1) was examined with CAAR of 8.3%. Similarly, they reported 10.4% if a merger is successful and 2.8% if it was not. Thus, it again can be concluded that there probably is market anticipation of deal completion and that completed deals experience higher abnormal activity around the merger announcement. Gao and Oler (2012) investigated the pre-announcement activity for a sample of 887 firms. An event window of 20 days prior to the announcement and 5 days after the announcement was used. Abnormal returns started building significantly 9 days before to 2 days after the announcement (21%), with the majority of abnormal returns happening in the three-day event window surrounding the announcement day (18%).

In conclusion, it has been shown that there are abnormal returns around the merger announcement. Few consistent patterns can be stated. First, majority of this abnormal activity comes from short event window (-1, +1). Next, Cumulative Average Abnormal Return is on average approximately 20%. Lastly, there is a relation between deal outcome and the magnitude of abnormal activity.

2.4 Target's unusual trading volume around the merger announcement

Similar to the CAAR analysis, trading volume and its abnormal activity around the merger announcement should also be affected. Keown and Pinkerton (1981) showed that nearly 80% of targets experience 247% higher trading volume one week before the announcement in comparison with trading volume three months before. They also argue "increase in trading volume was not caused by the trading of registered insiders", suggesting that this unusual activity is either caused by illegal insider trading

or market anticipation. The Security and Exchange Study (OCE, 1987) argued that the majority of unusual volume can be explained via the market anticipation theory. Jarrell and Poulsen (1989) provided further evidence on abnormal volume activity prior to the tender offers. Their findings are, however, more conservative as they showed that only 10% of firms experienced higher trading volume one week before the announcement. This is in contrast to 80% of firms identified by Keown and Pinkerton (1981). One possible explanation behind this dispersion is the use of an estimation window (-170, -21) that is too close to the event window (-20, 5). Thus, "normal" mean calculated from estimation window can be driven by abnormal activity.

Murray (1994) examined abnormal volume on a day-to-day basis around the announcement. He showed that in an event window starting 30 days before the announcement and ending 5 days after the announcement, the cumulative average abnormal volume can exceed normal levels by 600%. Approximately 60% of this abnormal activity occurs before the announcement. Schwert (1996) examined 1506 deals and found out that the average volume run-up in pre-announcement period (-42, -1) is about 127.8%. Consistent with the CAAR findings, the abnormal volume is lower for unsuccessful deals. From the regression analysis, it can be concluded that deal completion, tender characteristic, and insider trading prosecutions have positive impact on abnormal trading volume. In contrast, cash financing, and auction have negative impact. It is important to note, that the R-squared of Schwert (1996) volume study is approximately 1,5%. Hence, only a small proportion of CAAV variance is explained. Gao and Oler (2012) showed, for a sample of 976 deals, that abnormal volume becomes statistically significantly different from zero 20 days before the announcement. Their results suggest that on the announcement day, the volume can be 16 times higher than normal levels, and that the volume within window (-1, +1) is 30 times higher than normal. They also conclude, "high trading volume precedes significant share price movements by about 5 trading days". In summary, the abnormal trading volume around the announcement was found in every study. However, the magnitude differs. Furthermore, it seems that deal completion has a positive impact on the magnitude of the CAAV.

2.5 Research question

The discussed studies show the existence of abnormal activity around the merger announcement and that the magnitude of this activity differs. Magnitude is affected by different deal characteristics such as deal attitude or deal outcome. However, the majority of studies are backdated, creating space for further research. There are findings, supporting the claim of deal outcome market anticipation (Schwert, 1997); however, there are no studies that try to assess the probability of merger completion based on the magnitude of the abnormal activity around the announcement. To conclude, I tried to answer two main questions:

1. Did the trading activity around the merger announcement change as a result of the financial crisis in 2008?
2. Can the merger completion probability, be reliably assessed based on the magnitude of abnormal activity around the merger announcement?

This research tries to shows recent developments in the target's stock activity reactions to the merger announcements. This is put into the context of Pre and After-crisis comparison to provide further and deeper understating about the development of this activity. In addition to return and volume analysis, the change in short interest is examined for a further understanding of ongoing activity around the merger announcement. Next, it tries to provide evidence that based on the magnitude of abnormal activity around the merger announcement day, the probability of merger completion can be assessed. I have applied methodologies from the previously described studies and applied them to new data sets. I believe that this combination will contribute to the current literature and provide further insights into the Mergers and Acquisitions activity.

CHAPTER 3 Sample & Methodology

3.1 Sample

I have used two datasets for analysis, with the same global similarities, due to the different data quality. The first dataset with higher data quality, is used to analyze Cumulative Average Abnormal Return and Cumulative Average Abnormal Volume. The second dataset is used for the analysis of change in short interest. This section is

structured as follows: firstly, main mergers & acquisitions data gathering process is described which is affecting both datasets. Afterwards, the construction of both CAAR & CAAV and short interest data samples is described.

Data for M&A sample are gathered using the Security Data Company's U.S. Merger and Acquisition Database, via ThomsonOne, and contains only deals in which both target and acquirer are US based companies. Barnes et al. (2014) showed that SDC database is accurate and that this accuracy improves over time. Hence, observations obtained from this database should be representative. The sample period is from 2003 (start of Sixth merger wave) to 2015, with the condition that all deals have to be completed or withdrawn before 31st of December 2015. Due to the price, volume, and change in short interest analysis only deals in which target is U.S publicly traded firm are selected. The procedure in Gao & Oler (2011) of excluding targets whose stock price were below 3 dollars per share (four weeks prior to the announcement) is used to avoid distressed and illiquid stocks. Furthermore, deals with lower value than 10 million U.S dollars were excluded for the same reason. Next, a deal is considered to be completed only if the acquirer holds 100% of target's equity after the transactions, and only deals in which the acquirer does not hold more than 50% of equity prior to the transactions (this prior holding is considered as toehold position). Multiple of other variables were selected for further analysis, which based on previous literature and economic rationale should have an impact on the results. These are, for instance, toehold position by acquirer prior to the announcement, deal financing or deal attitude. This procedure yields 2760 deals within selected timeframe. The sample period contains one main economic event – financial crisis of 2008, as the impact of this turmoil is the one of the core concepts in this work, I have split the sample into two sub-samples around this event. Deals completed or withdrawn between first of July 2008 and first of July 2009 are excluded. By this, I have tried to tackle the problem of high amount of extreme observations within this one-year period and also create samples with tangible differentiation.

For the stock return and volume data, data from Centre for Research in Securities Prices (CRSP), via Wharton Research Data Services are used. To merge this data with M&A database, matching through the PERMNO identifier is used, as this yields the highest amount of matched deals. To include deals, in which one firm was targeted more than once during the sample into the matching, a unique identifier was created. This unique identifier is based on the PERMNO code but whenever there are

multiple deals for the same PERMNO identifier a new code is generated. Matching M&A data with stock return and volume data based on this principle yields 2362 deals; hence, 86% of M&A dataset is preserved and matched with CRSP data. Note, that this is before excluding the deals from previously explained "crisis window". After deleting observations with insufficient number of observations in the estimation window (this process is explained in subsection 3.2, page 11), and excluding deals within "crisis window" final number of observations is obtained for CAAR/CAAV analysis (1885). Table 1 shows the distribution of deals through time, together with deal status and payment method. As can be observed, the majority of deals were financed by cash and were also completed. The highest number of deals were executed in years immediately preceding the crisis, with a peak in 2007. Furthermore, a positive trend in the number of deals after crisis can be observed. The relatively low number of deals in 2015 is caused by excluding deals that were announced during 2015 but not yet consummated. These findings are in line with M&A reports, for instance JP Morgan (2015).

Table 1: Deals distribution through time

		Deal Status		Payment Method		
Year	Obs.	Withdrawn	Completed	Combined	Cash	Stock
2003	110	19	91	41	40	29
2004	179	29	150	68	69	42
2005	213	49	164	64	121	28
2006	211	43	168	54	133	24
2007	240	60	180	66	146	28
2008	36	15	21	11	24	1
2009	74	17	57	22	37	15
2010	141	34	107	31	95	15
2011	118	47	71	31	74	13
2012	145	47	98	29	105	11
2013	143	44	99	38	91	14
2014	171	64	107	43	100	28
2015	104	22	82	35	59	10
Total	1885	490	1395	533	1094	258

Table 2 shows the distribution of deals among the industries for two different periods. The Pre-crisis period includes deals from first of January 2003 to first of July 2008 (968 deals) and the After-crisis period includes deals from first of July 2008 to 31st of December 2015 (917 deals). Industries are classified based on Fama and French (1997) 12-industry classification. There is no significant difference between distribution among industries for pre and after crisis period. From the deal size

perspective however, we can see an increase in average mean deal between the examined periods. Average deal size in the After-crisis period is higher by approximately 200 million USD. Furthermore, the significant decrease in mean deal size with targets from financial sector is worth noting.

Table 2: Deals distribution among Industries

Industry groups are categorized based on Fama & French 12 industry groups.

		Pre-Crisis		After-Crisis	
Target Macro Industry	Obs.	Obs.	Mean deal size ($M)	Obs.	Mean deal size ($M)
Consumer Products and Services	111	58	1664	53	1142
Energy and Power	122	66	3836	56	4521
Financials	398	220	2010	178	725
Healthcare	245	114	2416	131	3422
High Technology	423	221	1295	202	1329
Industrials	130	65	831	65	2301
Materials	85	35	1730	50	2020
Media and Entertain	97	54	4409	43	6229
Real Estate	79	53	2506	26	2752
Retail	115	52	1276	63	2083
Telecommunications	80	30	3402	50	2646
Total	1885	968	2075	917	2213

To create a sample for short interest analysis, short interest data from Compustat, via Wharton Research Data Services are used. Following the same analogy as described previously, these are merged again based on the PERMNO identifier with M&A data. There were however, a lot of incomplete data points during the matching of short interest data with merger announcement date. Hence, many observations were lost during this process. 1272 M&A deals are correctly matched with short interest data. Table 3 shows the results of this matching and the distribution of deals based on deal status and payment method through time. Similar distribution can be observed as in previous sample, i e., a majority of deals are completed and financed by cash. I believe, that this similarity between the samples, and similarity with M&A statistics, for instance, gathered by JP Morgan (2015), are a good sign of sample representativeness.

Table 3: Deals distribution through time

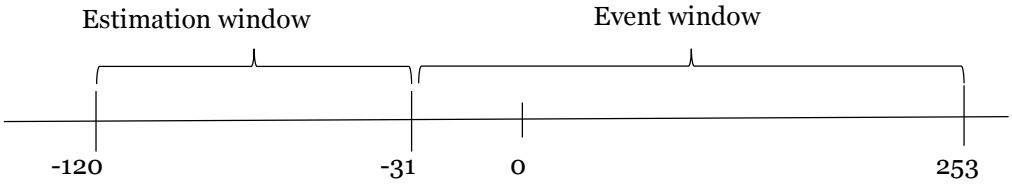
		Deal Status		Payment Method		
Year	Obs.	Withdrawn	Completed	Combined	Cash	Stock
2003	87	8	79	32	30	25
2004	150	13	137	64	55	31

2005	149	20	129	53	82	14
2006	187	21	166	52	111	24
2007	112	18	94	28	66	18
2008	25	9	16	7	17	1
2009	57	11	46	21	24	12
2010	90	18	72	23	61	6
2011	82	26	56	22	51	9
2012	102	28	74	20	76	6
2013	104	28	76	30	61	13
2014	124	39	85	34	69	21
2015	3	1	2	2	1	-
Total	1272	240	1032	388	704	180

3.2 Methodology

The MacKinlay (1997) and Princeton University guide for the construction of event study are used. Normal returns and volumes are calculated based on an estimation window starting -120 trading days prior to the announcement and ending -31 days prior to the announcement. I have examined multiple event windows. The longest one starts 30 days prior to the announcement until the deal is either withdrawn or completed. Figure 1 illustrates the timeline used for the event study. If an overlap between estimation and event window would exist, it would not be possible to disentangle the impact of abnormal volumes and returns from the normal activity (MacKinlay, 1997). Every deal that does not have at least 50% of observations in the estimation period is deleted. Through this, the problem of insufficient number of observations for calculation of unbiased normal return/volume within estimation period is tackled.

Figure 1: Event study timeline



Furthermore, I have also estimated abnormal activity for shorter windows, because long event windows can be sensitive to benchmark returns (Kothari & Warner, 2007). Window 2 is used to show abnormal activity after the merger announcement

took place. Window 6 on the other hand is used to examine the abnormal activity before the announcement. Windows 3, 4, and 5 examine the activity immediately surrounding the event date. These windows are described in table 17 (appendix).

3.2.1 Cumulative Average Abnormal Returns

Schwert (1996) is followed for the calculation of the Cumulative Average Abnormal Returns. I have used the market model to measure normal returns; this model assumes a linear relationship between security and market return (MacKinlay, 1997). First, the normal performance is estimated based on the market model. The market model parameters are estimated by using OLS from day -120 to day -31. The market model regression is constructed as follows:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \qquad t = -120, \dots, -31 \qquad (1)$$

where, dependent variable $R_{i,t}$ is the continuously compounded return of target's stock and the independent variable $\beta_i R_{mt}$ is the continuously compounded return to the CRSP value-weighted portfolio. By running this regression separately for every deal, the normal performance is estimated. Next, the abnormal return is calculated as the difference between estimated normal return and actual return within the event window (equation 2).

$$AR_{it} = R_{it} - \alpha_i - \beta R_{mt} \qquad (2)$$

where, R_{it} is the return of the stock i in day t within the event window, and $\beta_i R_{mt}$ is the estimated normal return from market model regression. Furthermore, the abnormal returns must be aggregated in two dimensions in order to draw conclusions (MacKinlay, 1997). Firstly, across securities, this is done by averaging calculated Abnormal Returns (equation 3). Secondly, through time, this is the concept of Cumulative Average Abnormal Returns (equation 4).

$$AAR_{it} = \left(\frac{1}{N}\right) \sum_{i=1}^{N} AR_{it} \qquad (3)$$

$$CAAR_t = CAR_{t-1} + AAR_t \qquad (4)$$

where, AAR_{it} is the Average Abnormal Return and $CAAR_t$ is the Cumulative Average Abnormal Return. By this aggregation, daily development of CAARs can be examined in addition to single values for specific event windows.

3.2.2 Cumulative Average Abnormal Volume

A similar methodology is followed to calculate Cumulative Average Abnormal Volume. I have transformed the trading volume to the natural logarithm of trading volume to tackle the issue of positive skewness (Murray, 1994). First, the average trading volume is calculated for each firm from estimation window (-120, -31). The average daily (log) volume calculation is based on following equation.

$$ADV_i = \left(\frac{1}{N}\right) \sum_{-31}^{-120} \log\left(VOL_{it}\right) \quad (5)$$

where, ADV_i is the Average Daily Volume for firm i and VOL_{it} is the daily volume for firm i on day t. For further steps the OCE (1987) is followed, specifically the Percentage Abnormal Volume (PAV) approach. This approach should better reflect the nature of abnormal trading volume. PAV is calculated as follows:

$$PAV_{it} = \log\left(VOL_{it}\right)/ADV_i \quad (6)$$

where, PAV_{it} is the Percentage Abnormal Volume calculated for each day from the event window. Again the MacKinlay (1997) and their two dimensions for event study are used.

$$PAAV_{it} = \left(\frac{1}{N}\right) \sum_{i=1}^{N} PAV_{it} \quad (7)$$

$$CAAV_t = CAAV_{t-1} + PAAV_t - 1 \quad (8)$$

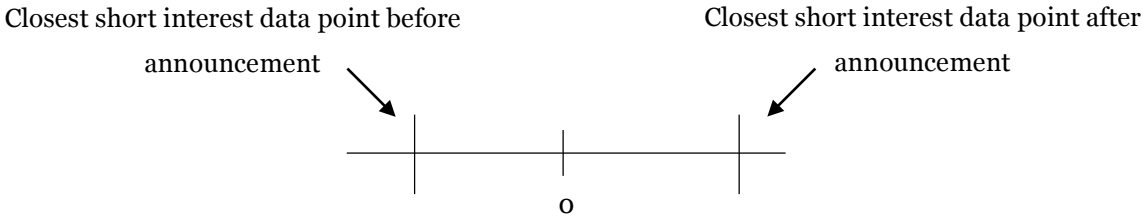
where, $PAAV_{it}$ is the Percentage Average Abnormal Volume, derived as the average of Percentage Abnormal Volume. $CAAV_t$ is the Cumulative Average Abnormal Volume.

3.2.3 Change in Short Interest

A different methodology is followed when examining the change in short interest around the announcement day. Short interest data used for this analysis are reported on a semi-monthly basis after 2007. Before 2007, data were reported only on a monthly basis. Furthermore, collected data corresponds to date three trading days before the reporting take place. Hence, I have adjusted the reported day by this off-set.

The change in short interest around the announcement date is examined by following analogy (illustrated in figure 2). Natural logarithm of short interest is used again as short interest data are similarly skewed.

Figure 2: Short interest event timeline



The change in short interest activity around the announcement day (0) is derived as the percentage increase between the closes short interest data point after the announcement and prior to the announcement. Hence, if the short interest increased over the examined period this rate will be positive and vice versa. Equation 9 illustrates this process.

$$Change\ in\ SI = (\log(SI)_{0+1} - \log(SI)_{0-1}) / \log(SI)_{0-1} \quad (9)$$

where, Change in SI is the abbreviation for previously described difference. $Log(SI)_{0-1}$ is the closes short interest data point before the announcement and $log(SI)_{0+1}$ is the closes short interest data point after the announcement.

3.3.4 Eventus

Lastly, to compare the results obtained by my own calculations, the EVENUTS tool via Wharton Research Data Services is used. To achieve consistency, the same

estimation window is used, as well as the event windows, expect event window 1. Event window 1 is excluded due to the inability to control for deals that are completed or withdrawn after 253 trading days after the announcement. EVENTUS outcome is presented in table 18 (appendix).

CHAPTER 4 Empirical Results

4.1 Results for Cumulative Average Abnormal Returns

Positive CAARs were found in all windows except window 7 (+2, +20). This suggests that the information of the announcement is affecting the market price before and during the announcement. However, it seems it is fully incorporated 2 days after the announcement, which is in line with a semi-strong form of efficient market hypothesis (Malkiel and Fama, 1970). The highest CAAR is documented for tender offers (33,4%). A more pronounced abnormal market reaction can be observed for cash financed deals in comparison with stock deals.

When comparing the Pre-crisis and After-crisis periods, a higher CAAR can be observed for small windows (3, 4, 5), thus implying higher market reaction to the merger announcement in the After-crisis period. For instance, the window 3 (-1, +1) CAAR is higher by 4,5% in comparison with Pre-crisis period. This trend of higher abnormal return is consistent for all windows except window 2 (+1, +20) and window 6 (-30, -2). This finding of a lower CAAR in window 6 suggests that the market is more cautious before the announcement (1.6% vs 2.3%). Furthermore, the market at the day of announcement better and quicker incorporates information Hence, a lower CAAR can be observed for window 2 (4.1% vs 5.1%).

An interesting observation can be made from the dispersion of the CAAR between completed and withdrawn deals. Significantly, a higher positive reaction of the market is observed for deals that will be completed after the announcement, which suggests that the market is anticipating the outcome of the deal. I believe, that these two findings, namely the difference in pre and after-crisis reactions, and difference between withdrawn and completed deals are interesting for further examination.

In appendix (table 18), I have also included the results from EVENTUS for comparison purposes. As can be seen in table 18 my results are similar both in patterns and magnitudes with the results derived from EVENTUS via Wharton Research Data Services. Hence, this depicts the accurate procedure used in my study.

Table 4: Cumulative Average Abnormal Returns

This table summarizes mean CAAR for different event windows as described in Methodology section. Different deal characteristics are used to observe their impact on the CAAR's magnitude.

	(-30, close)	(+1,+20)	(-1,+1)	(-2,+2)	(-5,+5)	(-30,-2)	(+2,+20)
After-crisis	0.197	0.041	0.217	0.220	0.226	0.016	-0.008
Pre-crisis	0.160	0.051	0.172	0.176	0.183	0.023	-0.004
Completed	0.214	0.052	0.228	0.231	0.237	0.021	-0.010
Withdrawn	0.076	0.030	0.099	0.102	0.108	0.015	0.006
Cash financing	0.208	0.051	0.214	0.217	0.225	0.025	-0.006
Stock financing	0.107	0.040	0.142	0.146	0.150	0.010	0.000
Tender offer	0.334	0.075	0.291	0.295	0.309	0.052	-0.003
Horizontal merger	0.170	0.052	0.191	0.194	0.201	0.018	-0.003
Toehold	0.178	0.046	0.194	0.197	0.204	0.020	-0.006

I have tested whether there is a statistically significant mean difference between the Pre and After-crisis CAAR. As can be observed, I have found that the mean difference between Pre-crisis and After-crisis is statistically significantly different from zero for windows 1, 3, 4, and 5. Next, to test if there is a different market reaction based on the deal outcome, the t-test for the difference between completed and withdrawn deals was conducted. The mean difference in this case is statistically significantly different from zero for every event window except window 6. Hence, it can be concluded that there is market anticipation of deal withdrawal or completion, as deals that will be completed experience a significantly higher CAAR around the merger announcement.

Table 5: T-test for CAAR

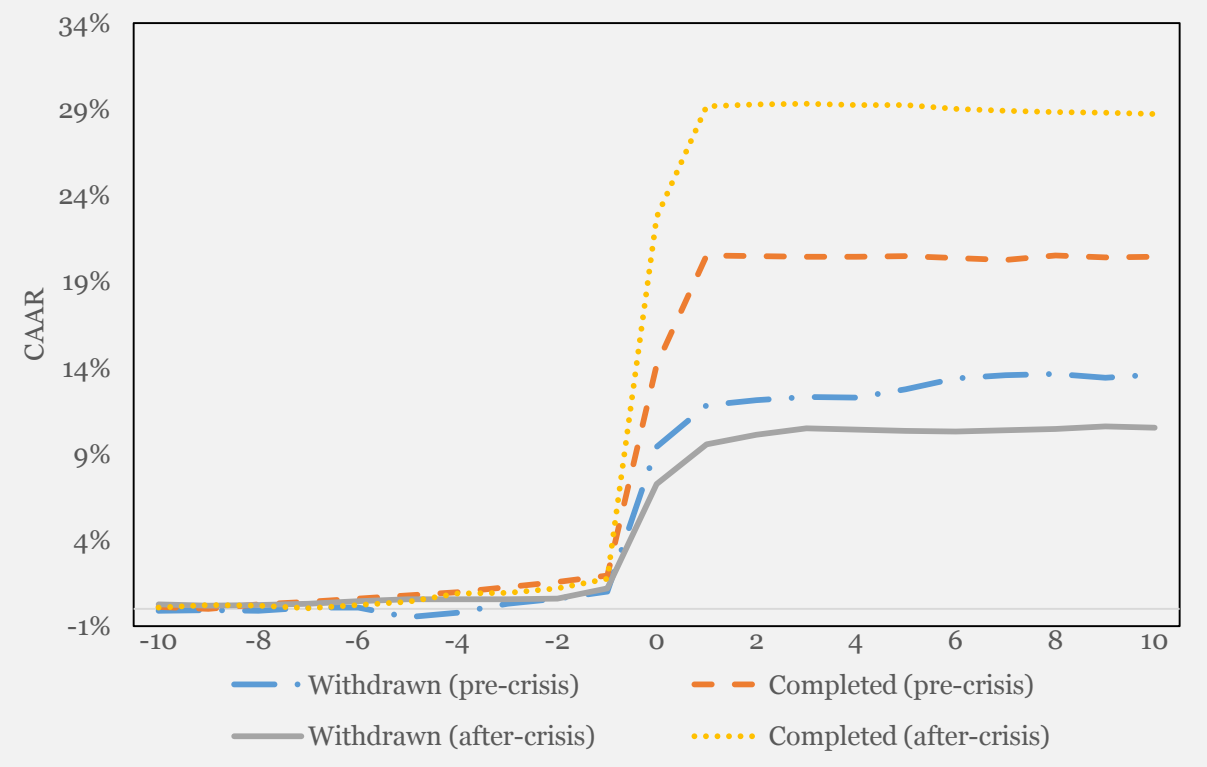
This table summarizes results for t-tests to observe if different populations (After vs. Pre-crisis and Completed vs. Withdrawn) have statistically different mean values of CAARs. T-tests for difference = 0 are presented. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

	(-30, close)	(+1,+20)	(-1,+1)	(-2,+2)	(-5,+5)	(-30,-2)	(+2,+20)
After-crisis	0.197	0.041	0.217	0.220	0.226	0.016	-0.008
Pre-crisis	0.160	0.051	0.172	0.176	0.183	0.023	-0.004
Difference	0.037	-0.009	0.045	0.044	0.043	-0.007	-0.004
T-test	1.727*	-1.170	4.572***	4.41***	4.127***	-1.053	-1.058
Completed	0.214	0.052	0.228	0.231	0.237	0.021	-0.010
Withdrawn	0.076	0.030	0.099	0.102	0.108	0.015	0.006
Difference	0.138	0.022	0.128	0.129	0.129	0.006	-0.015
T-test	5.704***	2.544**	11.708***	11.7***	11.1***	0.776	-3.456***

Figure 3 plots the development of the CAAR for withdrawn vs. completed deals in both periods. The chart is constructed for event window -10 to +10. So, both pre-announcement and post-announcement abnormal activity can be observed. The CAAR for withdrawn deals within the After-crisis period is lower than in the Pre-crisis period, suggesting better anticipation of deal withdrawal by the market. Completed deals, on the other hand, experience higher CAAR in the After-crisis period, supporting the claim of better market anticipation. Figure 3 also shows, that once the announcement is made, the price is reflecting the information immediately; hence, the flat CAAR after day +1. To conclude, in the After-crisis period the CAAR immediately surrounding the announcement are higher for completed deals and lower for withdrawn deals in comparison with the Pre-crisis period.

Figure 3: Target's CAAR

This chart illustrates the development of Cumulative Average Abnormal Return from day -10 through +10. Both completed and withdrawn deals are compared for examined periods surrounding the crisis.



4.2 Results for Cumulative Average Abnormal Volume

The Cumulative Average Abnormal Volume was analyzed for both periods and for different deal characteristics. The summary statistic of the means (CAAV) can be

found in table 6. I have found a positive CAAV across all windows. The highest CAAV can be observed for stock financed deals. In this case, the abnormal activity before the announcement is already exceeding 100%. The lowest CAAV, on the other hand, is documented for deals that are not successful in the future (withdrawn deals) and for tender offers. There is a notable difference between the behavior of the CAAV and CAAR. As can be seen in the CAAVs case, window 3 (-1, +1) accounts for only 10% of the CAAV for the whole of window 1 (-30, close). Hence, the market under-reacts to the announcement and abnormal volumes are present through the whole life of a deal.

Table 6: Cumulative Average Abnormal Volume

This table summarizes the mean CAAV for different event windows as described in Methodology section. Different deal characteristics are used to observe their impact on the CAAV's magnitude.

	(-30, close)	(+1,+20)	(-1,+1)	(-2,+2)	(-5,+5)	(-30,-2)	(+2,+20)
After-crisis	5.564	1.915	0.473	0.652	1.064	0.661	1.701
Pre-crisis	6.710	2.382	0.559	0.807	1.374	1.072	2.110
Completed	6.726	2.513	0.587	0.831	1.392	0.906	2.231
Withdrawn	4.522	1.135	0.318	0.448	0.741	0.776	1.001
Cash financing	5.389	2.029	0.503	0.706	1.166	0.809	1.794
Stock financing	7.852	2.404	0.544	0.778	1.336	1.048	2.139
Tender offer	4.331	2.170	0.553	0.770	1.252	0.859	1.913
Horizontal merger	6.626	2.219	0.516	0.736	1.242	0.894	1.974
Toehold	6.153	2.155	0.517	0.732	1.223	0.872	1.911

Similarly, the t-test for the CAAV is presented in table 7. Firstly, there is a significant mean difference between the Pre and After-crisis CAAV in all the tested event windows. Furthermore, the differences are negative. Hence it can be concluded that there is a significant decrease in CAAV in the After-crisis period. Next, the impact of deal outcome is presented in the lower part of the table 7. There is a positive statistically significant difference between completed and withdrawn deals across all windows except window 6. Thus, it can be stated that deal completion has significant positive impact on CAAV.

Table 7: T-test for CAAV

This table summarizes results for t-tests to observe if different populations (After vs. Pre-crisis and Completed vs. Withdrawn) have statistically different mean values of CAAVs. T-tests for difference = 0 are presented. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

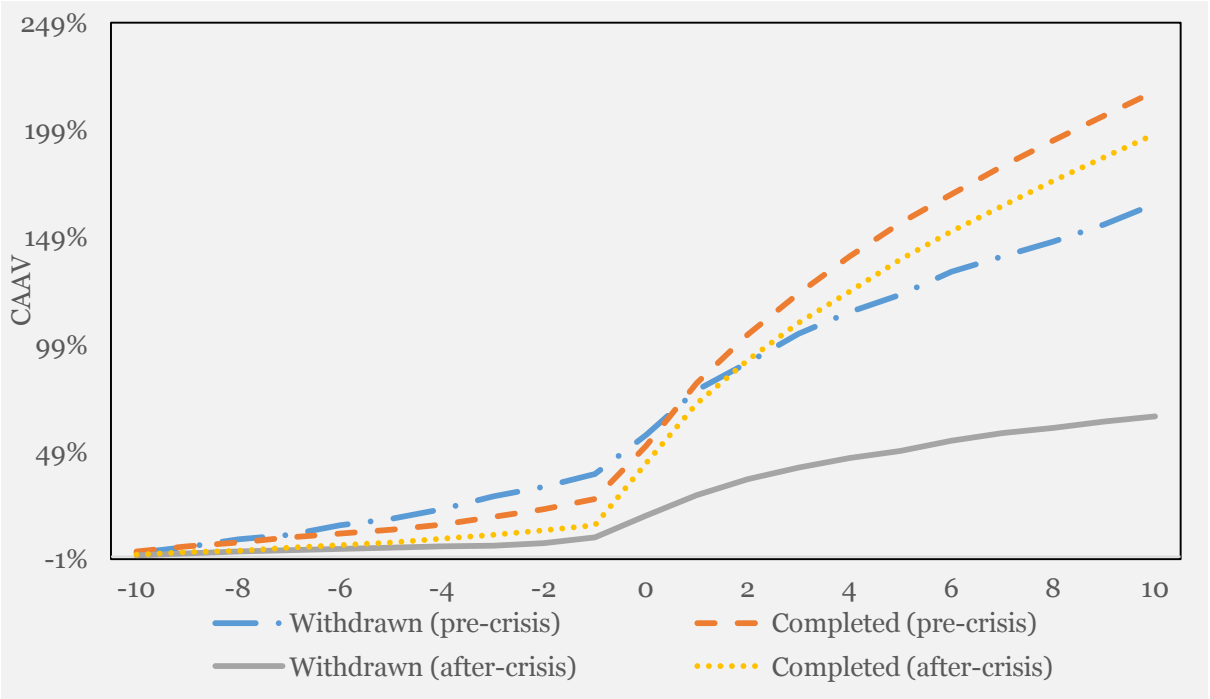
	(-30, close)	(+1,+20)	(-1,+1)	(-2,+2)	(-5,+5)	(-30,-2)	(+2,+20)

After-crisis	5.564	1.915	0.473	0.652	1.064	0.661	1.701
Pre-crisis	6.710	2.382	0.559	0.807	1.374	1.072	2.110
Difference	-1.146	-0.467	-0.086	-0.154	-0.310	-0.411	-0.409
T-test	-2.87***	-4.24***	-4.28***	-5.15***	-5.45***	-5.3***	-4.02***
Completed	6.726	2.513	0.587	0.831	1.392	0.906	2.231
Withdrawn	4.522	1.135	0.318	0.448	0.741	0.776	1.001
Difference	2.204	1.378	0.269	0.383	0.651	0.130	1.230
T-test	4.87***	11.28**	12.17***	11.52***	10.24***	1.47	10.91***

Next, I have constructed a chart plotting the Cumulative Average Abnormal Volume. The CAAV for withdrawn deals is considerably lower for the After-crisis period, which suggests that, the targets that will not be taken over are traded significantly less. The pre-announcement activity is in complete contrast to the Pre-crisis period for withdrawn deals as well. The CAAV of withdrawn deals was the highest, but after the crisis the pre-announcement CAAV is only slightly above 0. For completed deals, on the other hand, the trading volume is similar to the Pre-crisis period. If we however, look only at pre-announcement activity (-10, -1), the CAAV for the After-crisis period is lower for both completed and withdrawn deals. Thus, it can be concluded that there is a lower abnormal activity in the pre-announcement period in the After-crisis sample.

Figure 4: Target's CAAV

This chart illustrates the development of Cumulative Average Abnormal Volumes from day -10 through +10. Both completed and withdrawn deals are compared for examined periods surrounding the crisis.



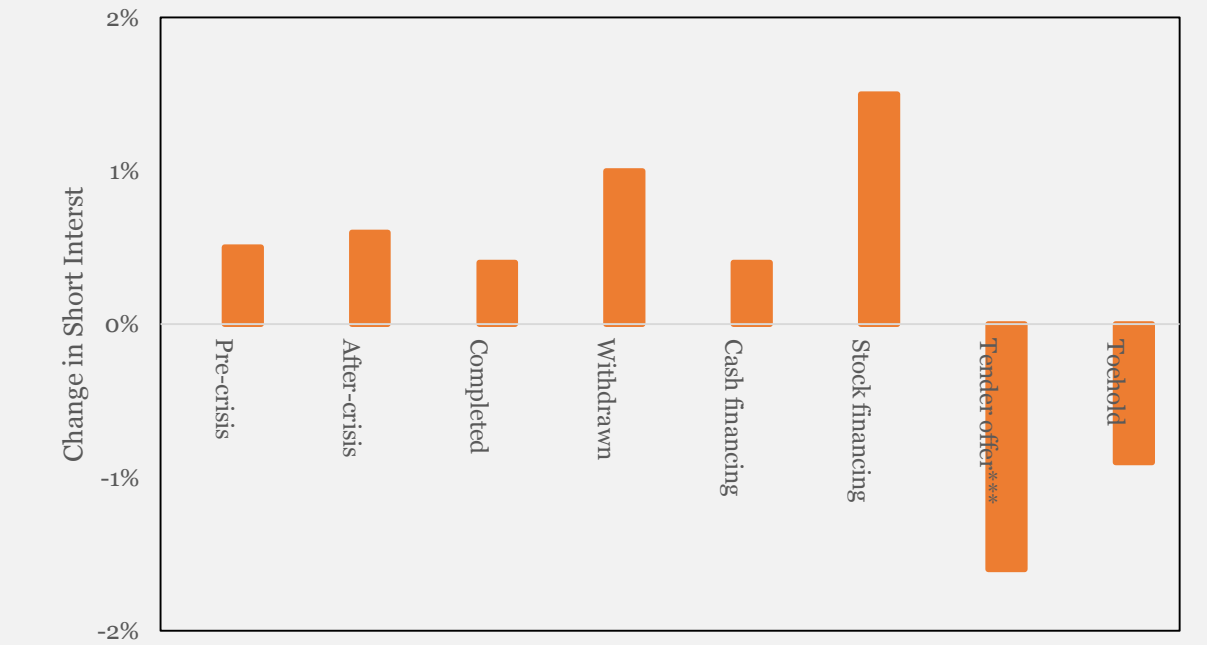
Both CAAR and CAAV show similar patterns in the trading activity. The pre-announcement windows are lower for the After-crisis data, suggesting market cautiousness. Abnormal activity is lower for withdrawn deals in both studies; this is even more pronounced for the After-crisis period. The lower After-crisis CAAR and CAAV for withdrawn deals show that the market is doing a better job in the anticipation of the deal withdrawal. Furthermore, there is a significant mean difference in CAAR and CAAV for the examined characteristics, confirming that these results are expected to hold for a new population.

4.3 Results for Short Interest analysis

Finally, the results for changes in short interest are presented. Merger announcement is accompanied with the average increase of 0,5% in short interest. Figure 5 plots the percentage change in the short interest around the announcement for different deal characteristics, as well as for two different timeframes. As can be observed, only one statistically significant result is found. In case of a tender offer, the short interest around the announcement decreases by 1,6% (significant at 1% level). Furthermore, there are results with a relatively high t-statistics that are not significant on generally recognized levels. Firstly, withdrawn deals experience a higher increase in short interest around the announcement than deals that are completed later on. Secondly, the After-crisis data experiences higher increase (T-stat 1,16) in short interest in comparison with Pre-crisis data. Furthermore, stock financed deals have three times higher increase in short interest than it is for cash financed deals, suggesting that market participants are more willing to short deals financed by stock. Unfortunately, the low statistical significance of these results disables me to make further conclusion based on change in short interest around the announcement.

Figure 5: Short Interest change around the announcement

This figure illustrates the percentage change in short interest between two data points immediately surrounding the announcement date. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.



CHAPTER 5 Regression Analysis

As the basic results suggests, different deal characteristics can contribute to the magnitude of the abnormal activity. Hence, to investigate the impact of various deal characteristics, the regression analysis is used. Due to the OLS regression's vulnerability to deviations from normality, I have used robust forms of regressions to put less weight on extreme observations (Bergeron et al., 2008). Based, on the previously discussed results, I have selected deal characteristics that should have the highest impact on both CAAR and CAAV around the announcement. In both tests, the window 3 (-1, +1) is used to examine the impact of different deal characteristics on the magnitude of CAAR and CAAV. Window 3 was chosen because of significant t-tests between the Pre and After-crisis period, as well as completed and withdrawn deals for both CAAR and CAAV (table 5 and table 7, respectively). Furthermore, in the CAAR's case window 3 reflects basically whole abnormal activity. If a deal characteristic can explain the abnormal activity magnitude, we should observe statistically significant coefficients. First, the regression analysis of CAAR is presented. Next, the CAAV results are discussed. In addition to simple regression analysis, I have used Probit regressions

to analyze the probability of the merger completion based on magnitude of abnormal activity around the announcement day. By assessing the merger completion probability, I try to show tangible economic relevance of my study building on expectations from previous studies, that there should be a relation between magnitude of abnormal activity and deal outcome. Lastly, the impact of different deal characteristics on change in short interest is examined.

5.1 Cumulative Average Abnormal Return

Table 8 summarizes the results of the CAAR regression analysis during window 3. The same models are used for the Pre-crisis and After-crisis timeframes for comparison purposes. Model 1 is simple linear regression, and uses completed deal characteristic as an independent variable. Positive coefficient is more pronounced for the After-crisis sample with a higher R-squared as well, suggesting that completed deals have higher CAARs in examined window in After-crisis period. Model 2 incorporates cash financing and tender offer dummies. Both effects are positively related to the magnitude of CAAR and are significant. Hostile bids are added in Model 3. Similar to the completed deal the effect of hostility is more pronounced for After-crisis period. To conclude, the After-crisis data have higher R-Squared across all models and higher coefficients for completed deal and hostile dummies. These findings are consistent with the expectations based on basic results. For instance, as figure 3 shows, the After-crisis completed deals experienced significantly higher CAAR than in the Pre-crisis period.

Table 8: Regression analysis (CAAR)

This table reports robust form of OLS regressions results of Cumulative Average Abnormal Return on multiple deal characteristics.

$$CAAR\ (window\ 3)_{i,t} = \alpha + \beta Completed_{i,t} + \gamma Cash_{i,t} + \delta Tender_{it} + \mu Hostile_{it} + \varepsilon$$

where the dependent variable is CAAR in window 3 (-1, +1). Model 1 contains only dummy for completed deals as an independent variable. Model 2 adds dummies for cash financed deals and tender offers as explanatory variables. Model 3 contains dummy for hostile mergers as well. Models are not fixed for time or industry, and are divided into two timeframes. Pre-crisis period contains 968 deals, whereas After-crisis period contains 917 deals. T-statistics are presented in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3

	Pre-Crisis			After-Crisis		
Completed deal	0.076	0.083	0.086	0.186	0.193	0.211
	(5.99***)	(6.25***)	(6.33***)	(13.03***)	(11.85***)	(12.81***)
Cash financed deal		0.068	0.069		0.059	0.069
		(5.80***)	(5.9***)		(3.48***)	(4.09***)
Tender offer		0.060	0.055		0.07	0.053
		(2.40**)	(2.19**)		(2.76***)	(2.00**)
Hostile			0.075			0.214
			(1.75**)			(3.8***)
Intercept	0.112***	0.064***	0.061***	0.09***	0.038***	0.018***
R-squared	0.028	0.078	0.08	0.126	0.154	0.168
Year fixed effects	NO	NO	NO	NO	NO	NO
Industry fixed effects	NO	NO	NO	NO	NO	NO
N	968	968	968	917	917	917

Table 9 summarizes the results of interaction regressions between multiple deal characteristics and the After-crisis period. As expected, there is a statistically significant difference between the Pre and After-crisis period, for completed deals on 1% level. Deals completed in the After-crisis period experience a higher CAAR than deals completed in the Pre-crisis period.

Table 9: Interaction regression (CAAR)

This table reports results of interaction regressions between multiple deal characteristics and CAAR.

$$\text{CAAR (window 3)}_{i,t} = \alpha + \text{After\_crisis}_{i,t} + \text{Completed}_{i,t} + \text{After\_crisis} * \text{Completed} + \cdots + \varepsilon$$

where the dependent variable is CAAR in window 3 (-1, +1). Model 1 contains interaction between completed deals and After-crisis period. Model 2 adds interaction between cash financed deal or tender offer characteristics and After-crisis. Model 3 adds hostile interaction with After-crisis. T-statistics are presented in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively

	Model 1	Model 2	Model 3
Completed deal	0.076	0.083	0.086
	(5.99***)	(5.13***)	(5.27***)
After-crisis	-0.021	-0.026	-0.043
	(-1.11)	(-1.1)	(-1.78*)
Completed x After-crisis	0.109	0.110	0.125
	(5.00***)	(4.93**)	(5.53***)
Cash financed deal		0.068	0.069
		(5.07***)	(5.17***)
Cash financed deal x After-crisis		-0.009	0
		(-0.45)	(0.01)
Tender offer		0.060	0.055
		(2.77***)	(2.54**)
Tender x After-crisis		0.010	-0.003
		(0.35)	(-0.09)
Hostile			0.075
			(1.26)

Hostile x After-crisis			0.14
			(1.8*)
Intercept	0.112***	0.064***	0.061***
R-squared	0.099	0.132	0.14
N	1885	1885	1885

Furthermore, I have fixed for time, industry and added deal size control variable to examine the robustness of the results. These factors are naturally prone to affect the abnormal activity. For instance, to avoid skewed results driven by abnormal activity in a certain year, controlling for time is necessary. Furthermore, I have controlled for deal size, as this characteristic can also have an impact on the magnitude of the trading activity. Table 10 summarizes these results. Deal completion characteristic is still significant on 1% level. Other deal characteristics follow similar patterns as in non-controlled regression. But, the effect of cash financing diminishes in the After-crisis period. The deal size control variable has a statistically significant impact (on 1% level) on the CAAR just in the Pre-crisis period. To conclude, deal completion has a significantly positive impact on CAAR magnitude even after fixing for time, industry and controlling for deal size.

Table 10: Fixed effects multiple regression (CAAR)

This table reports robust form of OLS regressions results of Cumulative Average Abnormal Return on multiple deal characteristics with time fixed effects as well as industry fixed effects.

$$CAAR\ (window\ 3)_{i,t} = \alpha + \beta Completed_{i,t} + \gamma Cash_{i,t} + \delta Tender_{it} + \mu Hostile_{it} + \varepsilon$$

where the dependent variable is CAAR in window 3 (-1, +1). Model 1 contains only dummy for completed deals as an independent variable. Model 2 adds dummies for cash financed deals and tender offers as explanatory variables. Model 3 contains dummy for hostile mergers and control for deal size (log). Models are fixed for time, industry, and are divided into two timeframes. Pre-crisis period contains 968 deals, whereas After-crisis period contains 917 deals. T-statistics are presented in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
	Pre-Crisis			After-Crisis		
Completed deal	0.086	0.091	0.102	0.174	0.175	0.199
	(5.63***)	(5.98***)	(6.73***)	(10.16***)	(9.23***)	(10.41***)
Cash financed deal		0.070	0.063		0.04	0.043
		(5.55***)	(5.22***)		(1.67*)	(1.76*)
Tender offer		0.061	0.057		0.069	0.052
		(2.12**)	(1.89*)		(2.91***)	(2.21**)
Hostile			0.1			0.223
			(2.79***)			(3.25***)
Deal size			-0.008			-0.008
			(-1.83*)			(-1.58)

Intercept	0.104***	0.056***	0.102***	0.099***	0.062**	0.093**
R-squared	0.028	0.078	0.08	0.126	0.153	0.164
Year fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
N	968	968	968	917	917	917

5.2 Cumulative Average Abnormal Volume

Table 11 summarizes the regression analysis for CAAV, specifically activity during window 3. Different independent variables are used based on the basic results presented in chapter 4. Stock financing of the deal, horizontal merger, and hostile bids together with completed deal characteristic should have the highest impact on the CAAV in window 3. Model 1 shows simple linear regression of deal completion impact on the CAAV. As can be observed, there is a positive relation between CAAV magnitude and completed deal characteristic, suggesting that completed deals experience higher abnormal volume than withdrawn deals. This effect is, as in the CAAR analysis, more pronounced for the After-crisis period and is significant on 1% level. Model 2 incorporates stock financing and horizontal merger as independent variables. Stock financing of the deal does not produce significant results. Mergers within one industry led to higher trading volume during the announcement in Pre-crisis period. In contrast, horizontal mergers have a lower CAAV during the announcement in the After-crisis period. Both results are significant on 1% level. Finally, the impact of hostility is added to Model 2. If the bid is hostile, there is a positive impact on the abnormal trading volume in window 3 (After-crisis), result is significant on 1% level.

Table 11: Regression analysis (CAAV)

This table reports robust form of OLS regressions results of Cumulative Average Abnormal Volume on multiple deal characteristics.

$$CAAV\ (window\ 3)_{i,t} = \alpha + \beta Completed_{i,t} + \gamma Stock_{i,t} + \delta Horizontal_{it} + \mu Hostile_{it} + \varepsilon$$

where the dependent variable is CAAV in window 3 (-1, +1). Model 1 contains only dummy for completed deals as an independent variable. Model 2 adds dummies for stock financed deals and horizontal mergers as explanatory variables. Model 3 contains dummy for hostility as well. Models are not fixed for time or industry, and are divided into two timeframes. Pre-crisis period contains 968 deals, whereas After-crisis period contains 917 deals. T-statistics are presented in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
	Pre-Crisis			After-Crisis		

Completed deal	0.152	0.133	0.131	0.345	0.335	0.341
	(4.01***)	(3.46***)	(3.38***)	(16.05***)	(15.05***)	(14.94***)
Stock financed deal		-0.033	-0.033		-0.011	-0.013
		(-0.72)	(-0.72)		(-0.25)	(-0.28)
Horizontal merger		0.114	0.115		-0.1	-0.099
		(3.98***)	(3.96***)		(-3.56***)	(-3.52***)
Hostile			-0.046			0.1
			(-0.81)			(2.26**)
Intercept	0.438***	0.381***	0.382***	0.237***	0.319***	0.312***
R-squared	0.016	0.028	0.028	0.178	0.192	0.193
Year fixed effects	NO	NO	NO	NO	NO	NO
Industry fixed effects	NO	NO	NO	NO	NO	NO
N	968	968	968	917	917	917

Table 12 summarizes regression results for interactions between multiple deal characteristics and the After-crisis period. Completed deals in the After-crisis period experience significantly higher (on 1% level) CAAV in comparison with the Pre-crisis period. Contrary, horizontal deals experience a significantly lower CAAV in the After-crisis period.

Table 12: Interaction regression (CAAV)

This table reports results of interaction regressions between multiple deal characteristics and CAAV.

$$CAAR\ (window\ 3)_{i,t} = \alpha + \text{After\_crisis}_{i,t} + Completed_{i,t} + After\_crisis * Completed + \cdots + \varepsilon$$

where the dependent variable is CAAR in window 3 (-1, +1). Model 1 contains interaction between completed deals and After-crisis period. Model 2 adds interaction between cash financed deal or tender offer characteristics and After-crisis period. Model 3 adds hostile interaction with After-crisis. T-statistics are presented in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively

	Model 1	Model 2	Model 3
Completed deal	0.152	0.133	0.131
	(4.55***)	(3.94***)	(3.87***)
After-crisis	-0.202	-0.062	-0.07
	(-5.24***)	(-1.28)	(-1.43)
Completed x After-crisis	0.195	0.202	0.21
	(4.38***)	(4.47**)	(4.58***)
Stock financed deal		-0.033	-0.033
		(-0.87)	(-0.88)
Stock financed deal x After-crisis		0.021	0.02
		(0.37)	(0.38)
Horizontal merger		0.115	0.115
		(3.89***)	(3.9***)
Horizontal x After-crisis		-0.215	-0.215
		(-4.98***)	(-4.96***)
Hostile			-0.046

Hostile x After-crisis			(-0.38) 0.146 (0.93)
Intercept	0.438***	0.381***	0.382***
R-squared	0.085	0.099	0.095
N	1885	1885	1885

Again, to test the stability across time, industry and control for deal size, I have applied fixed effects to previous regressions. These results are presented in table 13. The deal completion has a still significant impact in both timeframes; the effect is more pronounced in the After-crisis period. Stock financing characteristic in Model 2 is an insignificant measure after controlling (After-crisis period). The effect of the horizontal merger is insignificant for the Pre-crisis period and stays significant for the After-crisis data. For the After-crisis period, the hostile bid characteristic has a higher coefficient and higher statistical significance when compared with non-controlled regression. In comparison to the CAAR, deal size has significant (on 1% level) negative impact on magnitude of CAAV in window 3 for both time-frames.

Table 13: Fixed effects multiple regression (CAAV)

This table reports robust form of OLS regressions results of Cumulative Average Abnormal Volume on multiple deal characteristics with time fixed effects as well as industry fixed effects.

$$CAAV\ (window\ 3)_{i,t} = \alpha + \beta Completed_{i,t} + \gamma Stock_{i,t} + \delta Horizontal_{it} + \mu Hostile_{it} + \varepsilon$$

where the dependent variable is CAAV in window 3 (-1, +1). Model 1 contains only dummy for completed deals as an independent variable. Model 2 adds dummies for stock financed deals and horizontal mergers as explanatory variables. Model 3 contains dummy for hostile mergers, and includes deal size (log) control variable. Models are fixed for time, industry, and are divided into two timeframes. Pre-crisis period contains 968 deals, whereas After-crisis period contains 917 deals. T-statistics are presented in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
	Pre-Crisis			After-Crisis		
Completed deal	0.114	0.114	0.176	0.351	0.335	0.408
	(2.54**)	(2.54**)	(3.37***)	(9.75***)	(9.11***)	(9.59***)
Stock financed deal		-0.083	-0.079		-0.006	0.045
		(-1,82*)	(-2.1**)		(-0.12)	(-0.95)
Horizontal merger		0.052	0.049		-0.097	-0.102
		(1.55)	(1.43)		(-3.46**)	(-3.83***)
Hostile			0.2			0.254
			(3.34***)			(3.72***)
Deal size			-0.01			-0.069
			(-6.97***)			(-6.87***)

Intercept	0.469***	0.446***	1.022***	0.234***	0.316***	0.708***
R-squared	0.016	0.022	0.15	0.178	0.192	0.294
Year fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
N	968	968	968	917	917	917

5.3 Assessment of merger completion probability

As a last step in the regression analysis for CAAR and CAAV, I have used Probit regression to estimate the probability of merger completion if abnormal activity in window 3 exceeds a certain threshold. This should add "tangible" economic implication to the research. Table 19 (appendix) clearly demonstrates that there is a positive relationship between merger completion and the magnitude of abnormal activity around the merger announcement.

To better illustrate this relation, I have used certain thresholds for abnormal activity, and assessed the impact of exceeding this threshold on merger completion probability. Table 14 summarizes these results, model 1 investigates the probability of merger completion based on CAAR, threshold for CAAR is set to be 9,9% which is the mean CAAR for withdrawn deals in window 3. Hence, we can observe if exceeding a threshold of 9,9% has an impact on the probability of merger completion. For the Pre-crisis period, exceeding the threshold of 9,9% in the window 3 increases the probability of merger completion by 14,4%; this result is significant at 1% level. The marginal effect is even higher for the After-crisis period, implying that, exceeding the threshold of 9,9% increases the probability of merger completion by 35,5%. These findings are in line with the expectations based on previously discussed results. As figure 3 illustrates, CAAR is lower for withdrawn deals in the After-crisis period; hence, exceeding average as threshold should yield higher merger completion probability. When whole sample (Model 3) is analyzed, the probability of merger completion increases by 25,6% when the threshold is exceeded.

Table 14: Probability of merger completion

Regressions of deal completion on CAAR/CAAV (window 3) exceeding average. Probit regression is used:

$$pr(Completed)_{i,t} = \alpha + \beta(CAAR\ or\ CAAV > average\ for\ withdrawl)_{i,t} + \varepsilon$$

where dependent variable Completed equals one if deal is successful, and CAAR or CAAV > average for withdrawn equals one if this condition is true. For Both CAAR and CAAV window 3 is used. Average CAAR for the withdrawn is 9,9% for the whole sample. Average CAAV for the withdrawn is 31,8%. Three models are presented, namely CAAR for both timeframes, CAAV for both timeframes, and the effect on whole sample (1885 deals). Probit coefficients (coef.) its marginal effects (margin) are included, also the Percentage of correctly predicted observations is presented. Z-scores are presented in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

	Pre-Crisis			After-Crsis		
	Coef.	Intercept	Margin	Coef.	Intercept	Margin
CAAR	0.526	0.518	0.144	1.184	-0.186	0.355
	(5.63***)	(7.4***)	(5.84***)	(12.80***)	(-2.77***)	(18.14***)
Corr. classified	79.55%			73.83%		
CAAV	0.379	0.771	0.107	0.860	0.278	0.289
	(2.78***)	(15.67***)	(2.8***)	(7.66***)	(5.65***)	(8.37***)
Corr. classified	79.55%			68.16%		

	CAAR			CAAV		
	Coef.	Intercept	Margin	Coef.	Intercept	Margin
Whole sample	0.865	0.157	0.256	0.610	0.533	0.193
	13.32***	3.31***	15.35***	7.09***	15.49***	7.3***
Corr. classified	74.01%			74.01%		

Secondly, the probability of merger completion is estimated for CAAV. The threshold is set at 31,8%, which is again the average CAAV in window 3 for withdrawn deals. Significant results at 1% level can again be observed. In the Pre-crisis period, exceeding the threshold of 31,8% increases the probability of merger completion by 10,7%. As expected, due to the significantly lower abnormal volume for withdrawn deals in the After-crisis period, the probability of merger completion increases to 28,9%, if the threshold is exceeded. From whole sample perspective, the probability increases by 19,3% if the threshold is exceeded.

Table 15 summarizes the results for the merger completion probability assessment with additional control variables that should also have an impact on this probability. Firstly, approximately 80% of deals contain termination fees as part of the acquisition agreement (Jeon and Ligon, 2011). The proportion is, based on the SDC data, 78.9% in the sample used in this paper. After running the simple linear regression, termination fee does seem as a relevant factor in explaining merger completion due to the relatively high variance of completion explained as measured by R-squared (20%). Because the presence of these fees should also influence merger completion probability, I have included this as control variable in Probit regression

(Model 2). The marginal effects of added variable are significant, and follow similar pattern of higher increase in probability for the After-crisis period. For instance, in the After-crisis period, the presence of termination fee, as part of an acquisition agreement, increases the merger completion probability by 33.3%, at the same time exceeding the CAAR threshold of 9.9% increases this probability by 24.4%. Thus, the marginal effect of exceeding the CAAR threshold decreased from 35.5% to 24.4%% as a result of controlling for termination fee. But, this effect is still significant at 1% level. Next, the distance to 52-week high is included as a control variable in Model 3. Baker et al. (2012) showed that the closer the offer price to the 52-week high of target's stock, the higher the probability of merger completion. Similarly, I have examined if there is a positive relation between 52-week high and closing price at the announcement date. I have also found a positive relationship between these two variables, i e., the closer the 52-week high to announcement date closing price the higher the probability of merger completion. The marginal effect of this distance is only significant in the After-crisis period and its magnitude is low (below 1%). Both, high abnormal activity (above threshold) and termination fee variables are still significant and experienced only slight change in coefficients. To conclude, the marginal effect of exceeding a certain threshold of abnormal activity decreases with termination fee and is slightly affected by the announcement day price distance to the 52-week high. But, its impact on merger completion probability still remains significant and positive even after controlling for the presence of termination fee and 52-week high distance.

Table 15: Probability of merger completion with control variables

$$pr(Successful)_{i,t} = \alpha + \beta(CAAR\ or\ CAAV)_{i,t} + \gamma TF_{i,t} + \delta 52w - high_{it} + \varepsilon$$

where dependent variable Successful equals one if deal is completed, and CAAR or CAAV > average for withdrawn equals one if this condition is true. In addition to table 12, control variables termination fee and 52-week high are used. Marginal effects of Probit models presented, also the Percentage of correctly predicted observations is presented. Z-scores are presented in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

CAAR	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
	Pre-Crisis			After-Crisis		
Window 3 > 9.9%	0.144 (5.63***)	0.107 (4.43***)	0.107 (4.42***)	0.355 (18.14***)	0.244 (11.22***)	0.24 (11.00***)
Termination fee		0.258 (9.82***)	0.258 (9.83***)		0.333 (16.69***)	0.328 (16.26***)
52-week high distance			0.001 (0.71)			0.003 (1.78*)

Correctly classified	79.55%	81.30%	81.30%	73.83%	79.72%	81.13%
Obs.	968	968	968	917	917	917

CAAV	Model 1	Model 2	Model 3	Model 1	Model 2	Model 23
	Pre-Crisis			After-Crisis		
Window 3 > 31.8%	0.107	0.083	0.082	0.289	0.179	0.175
	(2.8***)	(2.29**)	(2.26**)	(8.37***)	(5.67***)	(5.60***)
Termination fee		0.274	0.274		0.388	0.38
		(10.6***)	(10.6***)		(21.48***)	(20.53***)
52-week high distance			0.001			0.004
			(0.70)			(2.32**)
Correctly classified	79.55%	80.06%	80.06%	68.16%	79.72%	80.70%
Obs.	968	968	968	917	917	917

Furthermore, based on the methodology from Baker et al. (2012), the persistency of effect is tested with additional characteristics. For CAAR Probit regression these additional control variables are cash financing (decrease the completion probability), tender (increase the probability), and hostile (decrease the probability). For CAAV Probit regression, I have included following control variables stock financing (increase merger completion probability), merger within one industry (increase the probability), and hostile (decrease the probability). Table 20 in appendix illustrates these results, and shows that the effect is persistent even after adding the aforementioned control variables.

In conclusion, it has been shown that exceeding a certain threshold has a positive and persistent effect on merger completion probability. These results are similar for both CAAR and CAAV analysis and are persistent after adding control variables. A higher increase in probability was observed for deals consummated in the After-crisis period, suggesting better market anticipation.

5.4 Change in Short Interest

Table 16 summarizes the results of the regression analysis of change in short interest around the announcement. Change in short interest is a dependent variable in this regression analysis. Independent variables are selected based on the basic results. Withdrawn deals, stock financing, tender offer, and toehold position by theacquirer are used and are allocated into three different models. I do not use the Pre and After-crisis periods due to the relatively low number of observations, which causes results to be

insignificant for split sample. Furthermore, all models have low R-squared, thus results have a low relevance and have to be described cautiously, as a very low proportion of change in short interest variance is explained. Only tender offer characteristic yields significant results on 1% level. Hence, consistent with already presented findings, there is a negative relation between tender offers and change in short interest. This result is also observed after controlling for time. In addition, I have controlled for time and size. These results with fixed effects are included in appendix (table 21), due to the high degree of similarity with previously non-fixed regressions with only minor changes in coefficients.

Table 16: Regression analysis (Short Interest)

This table reports robust form of OLS regression results of change in Short Interest on multiple deal characteristics.

$$Short\ Interest_{i,t} = \alpha + \beta Withdrawn_{i,t} + \gamma Stock_{i,t} + \delta Tender_{it} + \mu Toehold_{it} + \varepsilon$$

where the dependent variable is the change in short interest around the announcement. Model 1 contains only dummy for withdrawn deals as an independent variable. Model 2 adds dummies for stock financed deals and tender offers as explanatory variables. Model 3 contains dummy for hostile mergers as well. Models are not fixed for time or deal size, and are divided into two timeframes. Only data for whole sample are presented. T-statistics are included in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% level, respectively.

	Model 1	Model 3	Model 4
	Whole sample		
Withdrawn deal	0.006	0.006	0.007
	(-0.74)	(0.65)	(0.81)
Stock financed deal		0.010	0.010
		(0.82)	(0.81)
Tender offer		-0.022	-0.022
		(-3.23***)	(-3.20***)
Toehold			0.006
			(-1.32)
Intercept	0.003	0.005	0.006
R-squared	0.0003	0.005	0.005
Year fixed effects	NO	NO	NO
Number of observations	1272	1272	1272

I have also estimated Probit regression to see if there is an increase in probability of merger completion for change in short interest. Deal completion is used as a dependent variable, whereas the change in short interest is used as an independent

variable. Unfortunately, the findings are not significant. However, I believe that the relatively high z-score for the After-crisis period can provide some insights. The mean change in short interest around the announcement for After-crisis period is 0,55%. If the change is more positive (higher increase in short interest around the announcement) than this threshold, the probability of merger completion decreases by 16,7%. These findings are summarized in table 22 (appendix).

CHAPTER 6 Conclusion

This study set out to examine the impact of the financial crisis in 2008 on the trading activity (from target's perspective) around the merger announcement. Three forms of activity were studied: abnormal return, abnormal volume, and change in short interest. Furthermore, it investigates if there is a relation between the magnitude of the abnormal activity around the announcement and the merger completion probability.

In line with the literature, I have identified the presence of abnormal activity from all three perspectives: abnormal returns, abnormal volumes, and change in short interest. As has been shown, the financial crisis had an impact on the magnitude of this activity. Results suggest that the market is doing a better job in anticipating deal outcome, as deals with positive outcome experience higher abnormal activity in comparison with the Pre-crisis period. In contrast, withdrawn deals experience lower CAAR than in the Pre-crisis period. Furthermore, I have demonstrated that the magnitude of this activity has an impact on the deal completion probability and that this impact is persistent even after controlling for additional factors such as presence of termination fees, reference point distance or form of financing. The main empirical findings together with corresponding results are summarized within the respective empirical chapters: Empirical results (chapter 4, page 15) and Regression analysis (chapter 5, page 21).

The finding that the magnitude of abnormal activity is affecting merger completion probability erodes economic research, as it is common to use the assumption that the probability of merger completion or withdrawal is 50:50 at the time of the announcement. Table 14 (page 28) clearly demonstrates that exceeding CAAR threshold of 9.9% (-1, +1) in the After-crisis period leads to increase in merger completion probability by 24%. For instance, Giglio and Shue (2014) use the 50:50 assumption in their research on how does the merger completion probability develop

over time. As my research shows, there are factors affecting the completion probability (magnitude of abnormal activity or termination fee) that are known to the market at merger announcement day. Hence, these factors should be reflected in the starting probability.

It is important to note, that there are possible improvements for further research in this topic. Firstly, there is a difficulty in using the fixed effects in Probit regressions. In contrast to linear regressions, including dummies does not give a consistent estimator in non-linear regressions, leading to biased standard errors and coefficients (Green, 2002). Thus, I do not have 100% confidence in the persistency of my probability results over time and their dependence on industry. Secondly, I have only used one methodology for calculating CAAR and CAAV. Hence, for obtaining results with a higher robustness it can be interesting to replicate the same study with different methodologies of calculation. Furthermore, the sample that I have used only includes mergers in which both target and acquirer are US based firms. Thus, it can be interesting to examine if the discussed results are observable in different markets as well.

The announcement of a merger and more importantly the outcome of a merger have significant economic impact for both target and acquirer shareholders. The findings presented show that shareholders can obtain valuable information from the magnitude of abnormal activity around the merger announcement and can assess the probability of deal outcome with higher degree of certainty. It also demonstrates that after the financial crisis, the market is doing a better job in anticipating deal outcome and that the activity around the announcement reflects this anticipation.

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Appendix

Table 17: Event windows

Name	Event window
Window 1	(-30, close)
Window 2	(+1,+20)
Window 3	(-1,+1)
Window 4	(-2,+2)
Window 5	(-5,+5)
Window 6	(-30,-2)
Window 7	(+2,+20)

Table 18: CAARs from EVENTUS event study tool

	(+1,+20)	(-1,+1)	(-2,+2)	(-5,+5)	(-30,-2)	(+2,+20)
After-crisis	0.049	0.217	0.219	0.226	0.017	-0.004
Pre-crisis	0.053	0.176	0.180	0.188	0.026	-0.001
Completed	0.058	0.223	0.227	0.235	0.028	-0.005
Withdrawn	0.033	0.117	0.118	0.125	0.006	0.002
Cash financing	0.054	0.215	0.217	0.225	0.025	-0.004
Stock financing	0.055	0.160	0.165	0.170	0.020	0.008
Tender offer	0.079	0.278	0.282	0.294	0.046	0.003
Toehold	0.036	0.181	0.173	0.177	-0.011	-0.010

Table 19: Probability of merger completion - continuous variable

	Pre-Crisis			After-Crisis		
	Coef.	Intercept	Margin	Coef.	Intercept	Margin
CAAR	1.575	0.587	0.433	2.870	0.040	0.897
	(5.28***)	(9.41***)	(5.4***)	(10.92***)	(-0.65)	(13.11***)
Corr. classified	79.44%			73.94%		
CAAV	0.440	0.597	0.123	2.570	-0.551	0.747
	(3.94***)	(8.24***)	(3.96***)	(13.42***)	(-6.49***)	(18.07***)
Corr. classified	79.55%			82.01%		

Table 20: Predicting deal completion with additional control variables

CAAR	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
	Pre-crisis			After-crisis		
Window 3 > 9.9%	0,144	0,149	0.155	0.355	0.315	0.312
	(5.63***)	(6.02***)	(6.36***)	(18.14***)	(14.8***)	(15.74***)
Cash financed deal		-0.120	-0.127		-0.229	-0.251
		(-4.75***)	(-5.05***)		(-8.44***)	(-9.69***)
Tender offer		0.110	0.143		0.15	0.231
		(2,42***)	(3.04***)		(3.66***)	(5.19***)

Hostile			-0.414 (-4.14***)			Omitted
Correctly classified	79.55%	79.55%	79.75%	73.83%	82.22%	83.87%
N	968	968	968	917	917	917

CAAV	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
	Pre-crisis			After-crisis		
Window 3 > 31.8%	0.107	0.109	0.112	0.289	0.284	0.303
	(2.8***)	(2.93***)	(3.02***)	(8.37***)	(8.55***)	(8.98***)
Stock financed deal		0.127	0.125		0.288	0.299
		(3.09***)	(3.04***)		(5.76***)	(5.92***)
Horizontal merger		0.114	0.118		-0.154	-0.157
		(4.43***)	(4.62***)		(-4.68***)	(-4.8***)
Hostile			-0.315 (-3.22***)			Omitted
Correctly classified	79.55%	79.55%	79.65%	68.16%	68.16%	69.52%
N	968	968	968	897	897	897

Table 21: SI fixed effects

	Model 1	Model 3	Model 4
	Whole sample		
Withdrawn deal	0.005	0.005	0.006
	(0.68)	(0.59)	(0.76)
Stock financed deal		0.010	0.010
		(0.90)	(0.89)
Tender offer		-0.022	-0.022
		(-3.41***)	(-3.37***)
Toehold			-0.017
			(-1.38)
Intercept	0.004	0.005	0,006
R-squared	0.0002	0.004	0.005
Year fixed effects	YES	YES	YES
Deal size fixed effects	YES	YES	YES
N	1272	1272	1272

Table 22: Probability of merger completion based on change in Short Interest

	Whole sample		Pre-crisis		After-crisis	
	Coef.	z-score	Coef.	z-score	Coef.	z-score
Probit	-0.212	-0.680	0.054	0.110	-0.500	-1.030

Intercept	0.884	21.74***	1.209	19.35***	0.585	10.48***
Mean (change in SI)	0.005		0.005		0.005	
Marginal effect	-0.057	-0.680	0.010	0.110	-0.167	-1.030
Correctly classified		81.13%		88.68%		71.95%