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The effect of investor attention on abnormal returns for targets during acquisition announcements

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PREFACE AND ACKNOWLEDGEMENTS

This thesis explores the relationship between abnormal investor attention and abnormal returns for targets in the context of acquisition announcements. While the main body of the thesis focuses on discussing prior research and the methods for empirical analysis, the results carry broader implications. The use of non-traditional data sources to predict stock price movements offers valuable insights for investors and academics alike. I would like to express my gratitude towards my thesis supervisor, Dr J.J.G. Lemmen, for the support and feedback, my family and my friends for the encouragement and understanding and all the researchers and authors whose work laid the foundation for this study.

ABSTRACT

This thesis examines the effect of investor attention on abnormal returns for targets in the period surrounding acquisition announcements through the use of an event study and OLS regression analyses. The dataset encompasses acquisitions of listed US targets announced between 2004 and 2022. Google Search Volume is obtained from the Google Trends database to serve as a proxy for investor attention. The results suggest that targets experience significant and substantial abnormal returns, coupled with increased investor attention in the days surrounding the acquisition. Evidence is also presented for a positive effect of increased investor on these abnormal returns.

Keywords: Investor attention, Event study, Abnormal returns, Acquisition announcements

JEL Classification: B260, G140, G340

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 Introduction

Mergers and acquisitions (M&A) represent pivotal moments in a company's trajectory as they serve as strategic tools for firms to gain competitive advantages by increasing their market share, achieve geographical expansion, or diversify their product portfolios. The anticipated synergies associated with these transactions often encourage bidders to offer a substantial premium over the target's value in order to generate a competitive bid. Unsurprisingly, the announcements of such transactions have a substantial impact on the stock prices of the companies involved and are generally associated with a high level of investor attention.

Despite the availability of a considerable amount of research in the field of acquisition announcements and their effects on stock prices, the role of investor attention in these effects has mostly been disregarded. While the majority of prior research suggests these announcements lead to abnormal returns for participating firms, with target firms in particular having been observed to experience considerable increases in stock prices (Datta et al., 1992), little evidence exists on the extent to which investor attention influences these returns. This thesis seeks to resolve this oversight by providing an answer to the following research question:

"What is the effect of investor attention on abnormal returns for target firms in the period surrounding the acquisition announcement?"

The thesis contributes to the existing literature and understanding of the effect of acquisition announcements on abnormal returns for targets by providing recent and comprehensive evidence. The use of an expansive dataset of acquisition announcements over a significant period of time increases the robustness of the findings. In line with prior research, the evidence suggests targets of acquisition announcements earn positive abnormal returns of 28.74% over the 11 days surrounding an acquisition announcement, of which the majority is obtained on the day of the announcement itself combined with the first day after the announcement.

The paper also contributes to the comprehension of the effects of acquisition announcements on investor attention by testing the hypothesis that targets of M&A transactions attract increased interest from investors during these periods. The use of daily Google Trends data as a proxy for investor attention allows for more detailed analysis of these effects than previous studies and is also used to shed some light on theories of insider trading. The findings provide evidence of a substantial increase in investor attention to the target's securities on the day of the announcement as well as the day prior

to the announcement. The results also suggest that this increase in attention diminishes swiftly over the days following the announcement.

Finally, by providing evidence of the effects of increased investor attention on abnormal returns for target firms in the period surrounding acquisition announcements, the paper contributes to the literature on the determinants of abnormal returns for targets. The existing literature on effects of increased attention on stock prices of participants of M&A transactions largely revolves around the effects for acquirors. This context accentuates the relevance of this study. Evidence is presented of a positive effect of increased investor attention to a target's securities on the abnormal returns on average. This effect is most pronounced on the days immediately surrounding the announcement.

In conclusion, this thesis provides empirical evidence of the impact of investor attention on the abnormal returns of target firms during M&A announcements. By examining the effect, this study provides insights for investors, managers, and policymakers on the factors that drive price movements for targets in the event of acquisition announcements, which can be useful for decision-making, public relations and communications strategies and regulations regarding fairness and transparency in the stock markets. The remainder of the thesis will be structured as follows: Chapter 2 comprises a review of the relevant literature, Chapter 3 explains how the data was obtained and provides a brief preliminary analysis of the data, Chapter 4 describes the research methodology, in Chapter 5 the results are presented, and Chapter 6 concludes by providing the answer to the main research question.

2 Literature Review

Mergers and Acquisitions have been a topic of considerable interest among researchers in finance and economics for many decades as they bear significant implications for the firms involved, their shareholders, and the broader market. This literature review aims to provide an overview of the current debate and research findings on the relationship between investor attention, abnormal returns for target companies and acquisition announcements.

2.1 Mergers and acquisitions

2.1.1 Value creation

Prior research in the field of mergers and acquisitions has focused to a large extent on the market's perception of value creation through acquisitions (Haleblian et al., 2009). While the objective for most acquisitions is to increase the value of the combination of the two companies through synergies and strengthen the acquirors position within the market, evidence has suggested these objectives are not always met. The most straightforward metric to measure investors' perception of success of a merger or acquisition to generate these synergies is by observing the changes in share prices of target and bidder firms around the announcement of such an event. By using event study methodology to analyse these returns, scholars found non meaningful and in some cases negative effects on the share prices of acquirors (Dodd, 1980; Franks et al., 1988; Kaplan & Weisbach, 1992; Mulherin & Boone, 2002; Graham et al., 2002) However, when assessing the returns accrued by target firms, results were more optimistic and showed acquisition announcements had a positive effect on the stock prices of these firms on average (Dodd, 1980; Bradley, Desai & Kim, 1988; Franks et al., 1988; Jarrell & Poulsen, 1989; Franks & Harris, 1989; Datta et al., 1992; Kaplan & Weisbach, 1992; Mulherin & Boone, 2000; Graham et al., 2002). These results did not come as a complete surprise as acquiring firms typically offer a substantial premium over the target's stock price, providing investors with an incentive to purchase the stock and secure this premium once the acquisition materialises. The main findings from these papers, relevant to the first hypothesis are summarized in table 1 and form the premise for the first hypothesis:

H1 = Target firms experience positive abnormal returns in the period surrounding the acquisition announcement

2.1.2 Abnormal return determinants

Considering a wealth of research on the abnormal returns for targets already exists, this paper will briefly review the most used determinants for these returns and adopt them as control variables. Extensive discussion of the potential reasons why these variables have been observed to impact abnormal returns for targets is out of the scope of this paper.

The first control variable that is included is the size of the deal. Alexandridis et al. (2013) assert that smaller targets on average earn higher returns in the period surrounding acquisition announcements, indicating its relevance as a predictor of the abnormal returns. Similarly, Franks & Harris (1989) also find smaller targets obtain higher premiums in takeovers.

Another important determinant of abnormal returns is the method of payment. Bidders may propose offers for the target's shares using cash, stocks in the bidder's company, or a combination of the two. As the use of stocks as the primary method of payment can be interpreted as a signal that the acquiror is of the opinion that it's stock is overvalued at the time of the announcement, cash offers are linked to higher abnormal returns on average (Franks et al., 1988; Loughran & Vijh, 1997; Datta et al., 1992).

Deal attitude is also adopted as a determinant of abnormal returns in prior studies. Offers from acquiring firms can in some cases be unsolicited and not approved by the current management of the target firm. In these cases, where the bidder firm is thus attempting to take over the target firm in a hostile manner as opposed to a friendly offer, an additional premium is often required to convince the majority of the shareholders to tender their shares in spite of the recommendation of the target's management to decline the offer. Consequently, hostile offers have been observed to elicit higher returns for target firms during the announcement (Jensen & Ruback, 1983; Franks et al., 1988; Jarrel & Poulsen, 1989; Martynova & Renneboog, 2008).

The relatedness of the industry of the acquiring and target firms is another proposed determinant of abnormal returns during acquisition announcements. (Morck, Shleifer, & Vishny, 1990; Singh & Montgomery, 1987) When both firms operate within similar or complementary sectors, more potential synergies are anticipated, which can influence the perceived value of the acquisition and, in turn, the abnormal returns. For instance, when an acquiring firm increases its presence in an industry with which it has familiar operational expertise or complementary capabilities, the potential for successful integration and realisation of synergies is deemed higher. This expectation can translate into a higher acquisition premium and abnormal returns. Conversely, acquisitions involving firms from unrelated industries can be met with scepticism due to the challenges of integration and the potential lack of

clear strategic rationale. As such, industry relatedness becomes a crucial factor in forecasting the abnormal returns during acquisition announcements.

Finally, the analysis also will also account for the specific industry a target is active in. Prior research has provided evidence for variation in acquisition premia across different industries (Haunschild, 1994). Considering the abnormal returns for targets are a result of anticipation of the acquisition premium, the target's industry is included as a control variable.

Although a wealth of evidence has been collected on the effects of several determinants, an interesting potential predictor of acquisition returns has remained relatively unexplored and is therefore investigated in this thesis, the effect of investor attention.

Table 1. Meta-analysis of prior research
The table presents a meta-analysis of the most important papers mentioned in the literature on abnormal returns for targets and acquirors in the period surrounding acquisition announcements. The table includes the time period and region of the sample used in the research as well as the main methodology and control variables used in the analysis. The results column display the most important findings of the paper that are relevant to this thesis.

Author(s) (Publication year)	Time period	Region	Method	Control variables	Results
Dodd (1980)	1970-1977	US	Event Study MM	n.a.	**Acquirors** CAR (-10,10) = -0.07** **Targets** CAR (-10,10) = 0.34***
Bradley, Desai & Kim (1988)	1963-1984	US	Event Study MM	Competition, Regulatory environment	**Acquirors** CAR (-5, 5) = 0.01** **Targets** CAR (-5, 5) = 0.32***
Franks et al. (1988)	1975-1984	US	Event Study MM	Payment method, Deal attitude, Competition	**Acquirors** CAR (-5, 5) = -0.01* **Targets** CAR (-5, 5) = 0.28***
Jarrel & Poulsen (1989)	1963-1986	US	Event Study MM	Target size, Regulatory environment, Deal attitude	**Acquirors** CAR (-20, 10) = 0.01** **Targets** CAR (-20, 10) = 0.29***
Franks & Harris (1989)	1955-1985	UK	Event Study MM MAM	Target size, Competition, Offer type	**Acquirors** CAR (month 0) = 0.01** **Targets** CAR (month 0) = 0.23***
Datta et al. (1992)	Dating back to 1948	US	Meta-analysis	Payment method, Offer type	**Acquirors** CAR (-10, 10) = 0.00 **Targets** CAR (-10, 10) = 0.22***
Kaplan & Weisbach (1992)	1971-1982	US	Event Study MM	Deal success	**Acquirors** CAR (-5, 5) = -0.01*** **Targets** CAR (-5, 5) = 0.27***
Mulherin & Boone (2000)	1990-1999	US	Event Study MAM	Deal type, Industry	**Acquirors** CAR (-1, 1) = -0.00 **Targets** CAR (-1, 1) = 0.21***
Graham et al. (2002)	1980-1995	US	Event Study MM	n.a.	**Acquirors** CAR (-1, 1) = -0.01*** **Targets** CAR(-1, 1) = 0.23***
Alexandris et al. (2013)	1990-2007	US	Event Study MM	Deal value	**Large targets** CAR (-1, 1) = 0.24*** **Small targets** CAR (-1, 1) = 0.17***

Reported significance levels: *** p<0.01, ** p<0.05, * p<0.1

2.2 Investor attention

Given the substantial consequences of mergers and acquisitions, the announcements of these events naturally attract a lot of attention. Merger announcements are often the subject of journal headlines and high profile transactions frequently make their way into the news. Given the potential for substantial effects on stock prices resulting from these announcements, discussed in the previous subchapter, these events draw the attention of investors in particular. Drake, Roulstone & Thornock (2012) for example, find acquisition announcements to be associated with a large and significant increase in attention on the announcement date. The following hypothesis is posed with regards to investor attention around acquisition announcements.

H2 = Investor attention to target firms increases in the period surrounding the acquisition announcement

2.2.1 A proxy for attention

An important issue to consider in this context is the method of identifying investor attention. To test the hypothesis, a valid proxy is required that enables distinction between increases and decreases in the amount of attention investors allocate to a target firm. Previous research has employed various proxies for investor attention ranging from the amount times a company was mentioned in news and headlines (Barber & Odean, 2008) to the trading volume metrics or extreme returns of its stock (Gervais, Kaniel & Mingelgrin, 2001, Barber & Odean, 2008). More recently, internet search volume has emerged as a proxy for attention. This method was first introduced by Ginsberg et al. (2009) who successfully used Google search volume to predict the spread of the influenza virus ahead of the US Centers for Disease and Control Prevention. Due to the study's success, the Google Search Volume Index (SVI) as a proxy for attention was quickly adopted by scholars in alternative research disciplines. The first widely recognised financial study to incorporate Google SVI was conducted by Da, Engelberg and Gao (2011) who first proposed Google SVI as the direct measure of investor attention.

Contrary to news and headlines, they state, search volume is a revealed attention measure: searching a stock on Google means someone is undoubtedly paying attention to it, whereas a news article in a journal does not guarantee attention unless it is actually read. Using trading volume or extreme returns as a measure of investor attention can also be misleading as they capture trading activity, which can be driven by factors unrelated to investor attention.

Although Google SVI data circumvents these issues, it also comes with certain challenges. A primary constraint is that Google does not disclose raw search data. Instead, they provide indexed figures for the total amount of searches for a certain search term relative to maximum number of searches for the same term within a chosen timeframe, after controlling for any potential trends related to internet usage or the number of Google users. The representation of search volume will be discussed in more detail in the following chapter, but this implicates that SVI cannot be used to examine the cross-sectional variances in magnitude of the search volume across a broad range of search terms. Furthermore, Google calculates SVI from a random subset of actual historical search data, leading to minor disparities in data for the same search terms depending on the moment of retrieval (Da, Engelberg and Gao, 2011).

Finally, with the goal of capturing an accurate measure of investor attention, the issue arises what search term to observe. Opting for the name of the company may inadvertently capture search behaviour from non-investors who may just be looking to find information on the company's products for example. Using stock tickers as the search terms of interest mitigates this by including only people looking for financial information regarding the company's securities. However, using tickers brings along another limitation. Several companies have ambiguous stock tickers which could cause data contamination. Ticker symbols can coincidently be short words, or they can overlap with popular acronyms such as SPOT (Spotify) or GRAY (Graycliff Exploration Ltd). A strategy for mitigating this risk used in previous research involves manually removing companies with ambiguous stock tickers from the database. While this ensures data integrity, it is a labour-intensive process and prone to manual errors.

2.2.2 Investor attention and abnormal returns

According to the efficient market hypothesis introduced by Fama (1970), security prices should reflect all available information at any given time. However, for this assumption to hold, investors trading in these securities have to be aware of all information regarding these securities at any given time. As investors have a limited amount of attention, they have to divide across a large set of possible stocks to invest in, the possibility arises that stocks that receive more attention adjust to news more efficiently. This implies different returns can be observed across multiple securities depending on the level of attention they are able to attract.

The implication is far from recent as Merton introduced "recognition of investor" as one of the four parameters that cause cross-sectional differences in equilibrium expected returns in 1987, indicating it is an important predictor of stock performance.

Previous research has shown that an increase in investor attention on average leads to an increase in the stock price of a security. In their seminal paper Da, Engelberg & Gao (2011) find increases in investor attention, measured by using Google SVI, predict higher stock prices in the next two weeks. In a similar study, Joseph, Wintoki & Zhang (2011) provide more evidence for the effect of investor attention on returns. They use a sorted portfolio analysis and conclude portfolios with the highest search intensity in the preceding week on average generate significantly higher daily abnormal returns than the portfolios with the lowest search intensity. Furthermore, Chapman (2018) provides evidence for investor attention explaining positive returns around earning announcements and Lou (2014) observes increased advertising spending to lead increases in investor attention and short-term stock returns, indicating it can be in the interest of acquirors to attract attention ahead of stock financed acquisitions. Currently, two theories regarding the explanation for the effects of investor attention on stock returns dominate the field: the price pressure hypothesis and the efficient price discovery theory.

2.2.3 Efficient price discovery

The first theory regarding the cause effect of investor attention on stock returns is that increased investor attention leads to reduced information asymmetry and a more efficient market. Previous studies have provided extensive evidence for delayed price reactions to news such as stock splits and bond rating changes (Desai & Jain, 1997), and earnings announcements (Bernard & Thomas, 1989; Foster, Olsen & Shevlin, 1984). These findings suggest market information diffuses gradually, not instantly, and investor neglect of information releases could cause temporary mispricing of securities. Increased attention from investors to certain stocks or events decreases the required time for this information to be incorporated in the prices and can thus be a determinant of stock returns. Previous research supporting the efficient price discovery hypothesis primarily focusses on the effects of investor inattention, underreactions to new information, and consequential price drifts. Dellavigna & Pollet (2009) for example, find a 15% lower immediate response to Friday earnings announcements and a 70% higher delayed response. They attribute this underreaction to investor inattention on Friday's.

2.2.4 Price pressure hypothesis

In line with the efficient price discovery theory, the price pressure hypothesis is also based on the assumption that investors to have limited attention. The difference between the two theories is, whereas the efficient price discovery theory suggests the effect of investor attention to stocks is regulated through an increase market efficiency, the price pressure hypothesis assumes these effects

are the result of behavioural biases. As Barber & Odean (2008) accurately state, the average investor has an abundance of stocks to choose from when making the decision to invest and only limited attention to divide between these options. It is only natural that companies that are able to draw their attention are more likely to be considered as an option to invest in. They therefore pose, that investors are net buyers of attention-grabbing stocks. The price pressure hypothesis has been studied in earlier works, by Barber & Loeffler (1993) for example, who found positive abnormal returns and substantial increases in trading volume for stocks that were mentioned in the Wall Street Journal.
Support of one of the two theories surrounding the effects of abnormal attention has historically been found by analysing the long-term returns. If the initial increase in stock prices is reversed over the following period, this is a sign of overreaction and considered evidence for the price pressure hypothesis. Conversely, initial price movements that are sustained over time are interpreted as evidence for the efficient price discovery theory as the market does not correct the price increases or decreases.

2.2.5 Acquisition announcements, investor attention & abnormal returns

Although investor attention and its effect on stock prices has received considerable attention from academics, and the abnormal returns for targets in the period surrounding acquisition announcements have been researched intensively as well, only a limited number of scholars have attempted to present evidence for the potential effects of investor attention on these abnormal returns. Louis & Sun (2010) first mention this absence and presume it was assumed that large corporate events would always attract sufficient investor attention. In their research similar to that of Dellavigna & Pollet (2009) however, they find market reactions to Friday announcements to be muted by examining returns for acquirors, consistent with the notion that investors are less tentative on Fridays. Reyes (2018) provides more evidence of the effects of investor attention on returns during the acquisition announcements and uses Google SVI as proxy for attention. He finds the effect of investor attention on returns to merger participants depend on the new coverage the firm receives on the day of the announcement. Specifically, for firms with news coverage, increased attention to a firm is observed to have a positive effect on the abnormal returns, while it has a negative effect on abnormal returns for firms that do not receive news coverage on the day of the announcement. However, although the dataset used does not exclude targets like in the paper by Louis & Sun (2010), targets are extremely underrepresented in the study and only make up 0.01% of the 806 firms. Considering acquisition announcements have historically been linked to substantial abnormal returns for targets specifically, the absence of research on the connection between these abnormal returns and investor attention is surprising and provides substantial relevance for this thesis. As the effects of abnormal attention have been observed to

increase share prices around corporate events through price pressure, or accelerated information diffusion, the third and final hypothesis is as follows.

H3 = Investor attention has a positive effect on abnormal returns in the period surrounding the acquisition announcement

2.2.6 Insider trading

Prior research has shown positive abnormal returns for targets already occur before the announcement of an acquisition. Keown & Pinkerton (1981) for example, observe positive cumulative abnormal returns and increased trading volume in the weeks leading up to the announcement and attribute these findings to leakage of insider information and illegal insider trading. Their argument was that insiders aware of the deal before it is announced, are able to invest in the target's stock before the premium is incorporated in the price and can thus profit from the significant price increases targets experience on average on the day of the announcement. Jensen & Ruback (1983) however, state the positive abnormal returns for targets prior to the announcement date could also be attributed to occurrences before the acquisition announcement that contain public information which increases the chances for a company to become the target for a takeover. In other words, these returns do not necessarily signal illegal trading activity, but speculative trading by investors able to anticipate potential acquisitions. Analysis of SVI data in the period before the acquisition announcement can be useful in providing evidence for one of these theories. If a relatively small group of insiders is responsible for the early abnormal returns through purchasing the stock ahead of the announcement, it is unlikely to see a large increase in attention to the target before the announcement. However, if investors are able to use public information to predict what firms are likely to be targets of acquisitions in the near future, the stock of these companies would likely be the subject of increased scrutiny in the run-up to the announcement. Siganos (2013) finds evidence for the market expectation hypothesis, in line with the theory suggested by Jensen & Ruback (1983) by analysing abnormal returns prior to the acquisition announcement, but after the first peak in abnormal search volume. However, the evidence suggests only 36% of the target price run-ups can be attributed to early investor recognition of potential acquisition targets. Although more thorough research is required to make a strong assumption regarding the subject, display of early increases in attention to targets would provide evidence for the argument against the insider trading hypothesis.

2.3 Summary

Overall, the literature on acquisition announcements, investor attention and abnormal returns has provided valuable insights and identified several key relationships. This review has highlighted the assumptions, findings, and theories from the literature and research in this field. Although there is a platitude of evidence for positive abnormal returns for targets around acquisition announcements available and previous research has also shown a link between increased investor attention and positive abnormal returns, little is still known about the effect of increased attention on abnormal returns for targets during acquisition announcements. Reyes (2018) provides evidence for a rise in investor attention measured in abnormal SVI during acquisition announcements and observes it explains part of the abnormal returns for the participants. However, considering the sample of this paper consists of over 99% acquiring firms, the effect on returns for targets of M&A transactions remains relatively unexplored. This paper will seek to shed light on this subject by testing the assumption that part of the variation in abnormal returns for targets in the period surrounding acquisition announcements can be explained by increased investor attention. For overview purposes, the three hypotheses discussed in the literature overview and tested in this thesis are repeated in the summary below:

H1 = Target firms experience positive abnormal returns in the period surrounding the acquisition announcement
H2 = Investor attention to target firms increases in the period surrounding the acquisition announcement
H3 = Investor attention has a positive effect on abnormal returns in the period surrounding the acquisition announcement

3 Data

T identify and quantify the extent to which investor attention impacts target firm abnormal returns in the context of acquisition announcements, a comprehensive dataset is assembled that combines the relevant information used for the analysis from multiple sources. In this chapter the data collection and preparation processes are outlines and summary statistics are discussed, offering an overview of the data's main characteristics. First, the criteria for the selection of the acquisition announcements are discussed, secondly the stock prices and return data are described, and then an overview is provided for the investor attention data measured using SVI. Finally, descriptive statistics for the obtained sample are presented and a brief preliminary analysis of the data is provided.

3.1 Acquisition announcements

Acquisition announcements for the period between January 2004 and December 2022 were collected using the Refinitiv Eikon database. The timeframe was chosen to obtain a broad dataset in coordination with the availability of Google SVI data, which is available from 2004 onwards. Deal specific information regarding the deal value, the method of payment, the attitude towards the offer and the industries in which the target and acquiror are active are also obtained from the Refinitiv Eikon database to serve as control variables for variation in abnormal returns in the regression analysis. A more detailed description of these variables is presented in Table 2.

To ensure the relevance and consistency of the dataset, some criteria were imposed on the inclusion of acquisition announcements in the sample. These criteria are in line with prior research exploring the impact of acquisition announcements on abnormal returns. First, the sample was restricted to target firms located in the United States, allowing for a focus on a single market with a relatively homogeneous regulatory, legal, and financial environment, and a broad availability of historical financial datapoints. Secondly, the sample was limited to only include target firms that were publicly listed on a stock exchange at the time of the announcement. This criterion is crucial as it ensures the availability of stock price data used for the calculation of returns. Furthermore, only acquisition bids that were for more than 30% of the target company's outstanding shares have been included. This threshold is based on the assumption that substantial ownership changes are more likely to result in significant shifts in corporate control and strategic direction and are expected to have a more pronounced effect on stock prices. Similar criteria have been commonly employed in previous studies examining the impact of acquisition announcements on target firm returns (Song & Walkling, 2000; Danbolt, Siganos & Vagenas-Nanos, 2015). Finally, observations for which the deal value is not available or less than 10 million are excluded from the sample in line with similar studies in the field of abnormal returns for targets and acquirors by Malatesta, P. H. (1983). By applying these criteria to

the acquisition announcements retrieved from Refinitiv Eikon comprehensive dataset of 3,933 announcements is constructed.

Table 2. Deal and firm related variables and definitions

This table presents the definitions for the deal and firm related variables of interest that were obtained from Refinitiv Eikon alongside the announcement data

Variable	Description
Deal value	The offer price in millions of US Dollars
Payment type	A categorical variable describing the method of payment divided between the categories Cash, Shares, Mixed and Unknown
Deal attitude	A categorical variable describing the attitude of the target's management towards the acquisition proposal divided between the categories Friendly, Hostile, Neutral and Not Applicable
Relatedness	A dummy variable for the relatedness of the target and acquiror industry. The variable equals 1 when the acquiror and target are active in the same industry
Industry	A categorical variable containing the industry in which the target is active. The following industries are recognised in the sample: Consumer Products and Services, Consumer Staples, Energy and Power, Financials, Healthcare, High Technology, Industrials, Materials, Media and Entertainment, Real Estate, Retail and Telecommunications

3.2 Stock prices and returns

Next, stock prices for all targets in the sample are retrieved from Datastream. In order to calculate the abnormal returns, prices are obtained both the target and the main index on which it is listed for an estimation window and an event window. When selecting the estimation and event window it is important to ensure there is a gap between the estimation window and the event window, and that the estimation window is of sufficient size to obtain reliable normal performance parameter estimates (MacKinlay, 1997). This study employs a 500-day estimation window, starting 550 days before the event date and ending 51 days before the event date. The event window is the period of interest during which the abnormal returns are calculated. Stock prices are obtained for an event window ranging from 5 days before to 5 days after the date of the acquisition announcement. The 11-day event window allows for analysis of potential effects of leaked information impacting the prices before the announcement was made and delayed responses to the release of information in the days following the acquisition announcement. Using the stock price data from the estimation and event windows, returns and abnormal returns are calculated for each firm in the sample. The methods used for the calculation of these statistics are outlined in the following chapter. Insufficient stock price information was available for 342 targets from the original sample, bringing the total amount of deals in the dataset down to 3,591.

3.3 Google SVI

In order to measure investor attention, SVI data is obtained from Google Trends for a period of 90 days before the acquisition announcement until 5 days after the announcement date. This data serves as a proxy for the level of interest in a particular target firm, enabling the possibility to quantify investor attention and investigate its potential impact on stock price changes around the acquisition announcement. As touched upon in the literature overview, Google does not provide raw data for the popularity of search terms. Instead, SVI is defined by Google as:

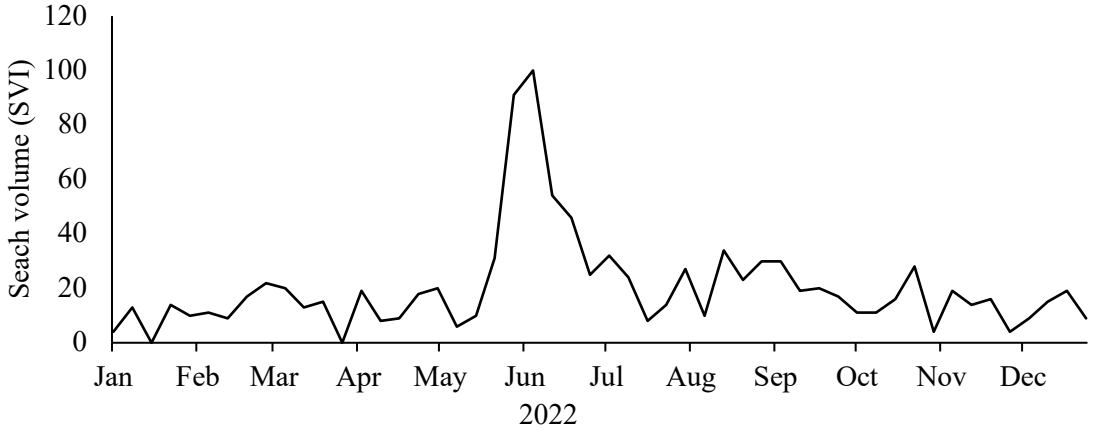
$$SVI_{it} = \frac{Searches_{i\tau}}{Total\ Searches_t \times Constant_i} \quad (1)$$

$SVI_{it} = Indexed\ search\ volume\ for\ firm\ i\ on\ day\ t$
$Searches_{it} = Total\ number\ of\ searches\ for\ all\ search\ terms\ on\ day\ t$
$Constant_i = Scaling\ factor\ for\ firm\ i$

The reason search volume for the search term of interest is divided by total search volume is to eliminate potential trends in the total number of Google Searches (Reyes, 2018). However, this transformation has implications for the interpretation of the SVI figures.

To provide an example of SVI data, figure 1 displays the search interest for the search term “How to become a fighter pilot” in 2022. The SVI value of 100 in week 22, which happens to be the week after the much-anticipated sequel of Top Gun was released, marks the week for which interest in the search term as a proportion of all searches on Google was at its peak. Indexing the data to the total amount of searches for any search term allows for analysis of popularity of the term over time without the need for correction to changes in total search volume. This does entail however, that when comparing the SVI value of 100 to a previous value of 20, the search term was not necessarily used five times as much on that day, but it was five times more popular compared to the total amount of searches.

Figure 1. Figure 1. Google SVI for the search term "How to become a fighter pilot" in 2022
This figure displays the weekly Google search volume index for the search term "How to become a fighter pilot" in 2022



Following Da, Engelberg, & Gao (2011), the search term used to measure investor attention to a target is the target's stock ticker. Ticker symbols are less ambiguous than company names and searches using ticker symbols as the search term are more likely to reflect searches for financial information. Since tickers are firm specific and generally unique, this variable should provide a direct and timely proxy for investor information demand to a specific firm on a given day (Drake, Roulstone & Thornock, 2012). Insufficient SVI data was available for 296 target firm tickers, resulting in a remaining dataset of 3,055 acquisition announcements.

Next, observations of acquisition announcements for targets with ambiguous ticker symbols were manually removed from the sample to mitigate noise in the search term popularity. This includes one letter ticker symbols (e.g., "Y", "P" & "S"), abbreviations (e.g., "DD", "GK" & "EV"), common words (e.g., "FOX", "SPOT" & "PILL"), names (e.g., "ADAM", "HUGH" & "NICK") and tickers which represent the company name or brand (e.g. "DELL"). This led to a further exclusion of 240 targets with ambiguous tickers (7.86%) from the sample. Da, Engelberg & Gao (2011) make a similar distinction and find approximately 7% of the tickers to be ambiguous.

Finally, further cleaning of the data is done by removing the observations for which the offer was announced over the weekend (136 instances) considering investors are unable to trade on weekend days, and excluding transactions where the offer price was lower than the target firm's share price one week prior to the announcement (194 instances). Acquisition announcements for which the offer price is at a discount to the target firm's share price are generally related to bankruptcies or similar cases in which the target firm is in financial distress and could potentially distort the results in case they are included. These filtering criteria result in a final sample of 3,081 observations. The complete selection process is summarised in table 2.

Table 3. Data Filtering Table
This table presents an overview of the criteria used for the selection of the sample. For each step the number of exclusions and the remaining number of observations is displayed.

Criterium	Observations	Δ Delta
All acquisition announcements 01/01/2004-31-12-2022	955,896	
Target based in the USA	227,754	-728,142
Target is publicly traded	17,789	-209,965
Percentage of shares acquired >30%	4,236	-13,553
Deal value > 10m USD	3,933	-303
Stock price data available	3,591	-342
SVI data available	3,295	-296
Stock tickers non-ambiguous	3,055	- 240
Remove weekend announcements	2,919	-136
Exclude bankruptcies	2,725	-194

3.4 *3.4 Descriptive statisitcs*

In order to gain a better understanding of the sample, descriptive statistics for the main variables of interest are presented and the distribution and characteristics of the data are discussed. This helps with gaining a better understanding of the dataset before moving on to the main analysis. The methods used to compute the (cumulative) abnormal returns and search volume are specified in the following chapter.

As can be seen in table 3, the average return for a target is approximately 0.03 or 3% on a day in the event window with a median of 0%, a minimum recorded return of -72% and a maximum of 721%. These values suggest a positively skewed distribution with a significant variability, which is confirmed through the high skewness value. The statistics also point towards a very high level of kurtosis, implying heavy tails in the distribution. These figures provide solid reasons for considering transformations to the variable which will be discussed in more detail in the following chapter. The abnormal returns (ARs) follow a very similar distribution which is expected for a sufficiently large dataset. The cumulative abnormal returns (CARs) across the different event windows are also positively skewed, although to a lesser degree, suggesting a distribution with a long right tail and outliers. On average a target experiences cumulative abnormal returns of 27% in the three days surrounding the acquisition announcement and this figure increases slightly for cumulative abnormal returns recorded across the broader event windows.

The SVI data for targets during the event window, with an average of 27.57 and a median of 17.00, is moderately positively skewed. Abnormal search volume (ASVI) during the 10-day event window has a mean close to 0, which is explained is more detail in the results chapter. Cumulative abnormal search volume (CASVI) decreases as the event window over which it is cumulated expands, suggesting the abnormal search volume is most prominent around the day of the announcement and diminishes over time.

The average deal value for the sample is approximately 2.4bn USD, with a mean of 544m, a minimum of 10m (the threshold) and a maximum of 79.4bn USD. The distribution of deal value is also positively skewed with heavy tails and will undergo transformations for the statistical analysis.

Table 4. Descriptive Statistics (Main variables)
This table presents the descriptive statistics of the main return and SVI variables and the Deal Value. Daily Returns and SVI data for the event window are included alongside their respective (cumulative) abnormal values. The event windows across which the cumulative abnormal variables are computed are included in parentheses.

Variable	Obs.	Mean	Median	St. dev.	Min.	Max.	Skew.	Kurt.
Returns (Event window)	29,975	0.03	0.00	0.14	-0.72	7.21	15.01	512.40
AR (Event window)	29,975	0.03	0.00	0.14	-0.72	7.21	15.03	512.93
CAR (-1, 1)	2,725	0.27	0.20	0.36	-1.00	7.24	6.80	98.63
CAR (-2, 2)	2,725	0.28	0.21	0.36	-1.25	7.23	6.61	96.82
CAR (-5, 5)	2,725	0.29	0.22	0.37	-1.33	7.22	6.35	89.59
SVI (Event window)	29,975	27.57	17.00	31.26	0.00	100.00	0.72	2.17
ASVI 1 (Event window)	29,975	-0.01	0.00	1.80	-4.62	4.62	0.02	4.33
CASVI (-1, 1)	2,725	0.45	0.00	1.87	-4.62	4.62	0.11	3.84
CASVI (-2, 2)	2,725	0.17	0.00	1.85	-4.62	4.62	0.04	3.97
CASVI (-5, 5)	2,725	-0.10	0.00	1.85	-4.62	4.62	0.00	3.98
Deal value (USD millions)	2,725	2,375	544	5,951	10	79377	6.34	55.93

Table 5 contains the descriptive statistics for the dummy variables used as controls in the regression analysis. The statistics show that the majority of the deals in the dataset are cash offers, acquisition announcements were almost exclusively well received and over half of the acquirors announced an acquisition of a target active in the same industry. The targets in the sample were active in a variety of industries, of which Technology, Financials and Healthcare are the most dominant.

Table 5. Descriptive Statistics (Control variables)
This table presents the descriptive statistics for the control variables. For each category in the variables the frequency is provided alongside its relative presence in the dataset in %

Variable	Category	Frequency	%
Payment type	Cash	1,712	62.83
	Mixed	500	18.35
	Shares	353	12.95
	Unknown	160	5.87
Attitude	Friendly	2,652	97.32
	Hostile	22	0.81
	Neutral	7	0.26
	Not applicable	44	1.61
Relatedness	No	951	34.9
	Yes	1,774	65.1
Industry	Consumer Products and Services	137	5.03
	Consumer Staples	86	3.16
	Energy and Power	215	7.89
	Financials	526	19.3
	Healthcare	457	16.77
	High Technology	561	20.59
	Industrials	193	7.08
	Materials	115	4.22
	Media and Entertainment	103	3.78
	Real Estate	105	3.85
	Retail	128	4.7
	Telecommunications	99	3.63

The following chapter will discuss the computation of the main variables in more detail and present the methods used for the analysis.

4 Methods

To find the answer to the main research question regarding the effect of investor attention on abnormal returns for targets in the period surrounding acquisition announcements, the analysis of the two components of this question is first considered. The hypothesis that targets experience abnormal returns during this period is tested using an event study analysis. Then, two measures of abnormal investor attention are introduced to test the second hypothesis that attention to targets increases around the announcement date. Finally, the impact of investor attention on abnormal returns for targets is tested through a regression analysis. This chapter elaborates in depth on the methodologies used to test the hypotheses. The first section will provide a detailed discussion of the event study methodology utilized to calculate abnormal returns. The second section will focus on the measurement of abnormal investor attention. And the final section will discuss the regression analysis that is used to answer the main research question of this thesis.

4.1 Event study

This section outlines the methods used to test the first hypothesis:

H1 = Target firms experience positive abnormal returns in the period surrounding the acquisition announcement

An event study is used to measure the impact of an event on the value of a firm using financial market data (MacKinlay, 1997). The method is based on the efficient market hypothesis introduced by Fama (1970) suggesting that information is immediately reflected in the prices of securities. This implies that the changes of a company's stock on the day of an acquisition announcement reflect the market's interpretation of the advantages or disadvantages to this announcement. Event studies typically analyse a window of a number of days surrounding the event of interest in order to capture potential information leakage effects or delayed responses to the news as well. The event window in this study covers the period of 5 days leading up to the acquisition announcement to 5 days after the announcement. In order to distinguish between the share of the returns that can be attributed to the announcement effect and the returns that are associated with market wide conditions, the abnormal returns are calculated for this period. The abnormal returns are defined as the difference between a firm's actual returns and the expected returns and calculated using the formula presented below.

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (2)$$

$AR_{i,t} = Abnormal\ return\ for\ firm\ i\ on\ day\ t$
$R_{i,t} = Observed\ return\ for\ firm\ i\ on\ day\ t$
$E(R_{i,t}) = Expected\ return\ for\ firm\ i\ on\ day\ t$

The expected returns are estimated over the estimation window using the market model which assumes a linear relationship between the security return and the market return (Brown & Warner, 1985; MacKinlay, 1997). Formula 2 describes the calculation of the expected returns in more detail.

$$E(R_{i,t}) = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (3)$$

$E(R_{i,t}) = Expected\ return\ for\ firm\ i\ on\ day\ t$
$\alpha_i = The\ intercept\ of\ firm\ i$
$\beta_i = The\ slope\ parameter\ for\ firm\ i$
$R_{m,t} = The\ market\ return\ on\ day\ t$
$\varepsilon_{i,t} = The\ error\ term\ of\ firm\ i\ on\ day\ t$

The parameters are estimated for each firm over the estimation period using an Ordinary Least Squares (OLS) regression. The estimation window used in this study spans from 550 days before the acquisition announcement to 50 days before the announcement and is selected to be long enough to generate robust estimates (McWilliams & Siegel, 1997). After calculating the abnormal returns for each firm individually, the average abnormal returns for all firms in the sample are calculated for each day in the event window.

$$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{i,t} \quad (4)$$

$AAR_t = Average\ abnormal\ return\ on\ day\ t$
$N = Total\ amount\ of\ firms\ in\ the\ sample$
$AR_{i,t} = Abnormal\ return\ for\ firm\ i\ on\ day\ t$

The observed AARs are tested for significance using the cross-sectional test statistic. The test statistic is calculated as follows.

$$t = \sqrt{N}\,\frac{AAR_t}{S_{AR_t}} \tag{5}$$

$t = Cross\ sectional\ test\ statistic$
$N = \ Total\ amount\ of\ firms\ in\ the\ sample$
$AAR_t = Average\ abnormal\ return\ on\ day\ t$
$S_{AAR_t} = Standard\ deviation\ of\ AR_t$

Using the abnormal returns calculated for each firm, the cumulative abnormal returns (CARs) are calculated as the sum of abnormal returns over the event window as can be seen in formula 5.

$$CAR_{i_{(t_1,t_2)}} = \sum_{t=\,t_1}^{t} AR_{i,t} \tag{6}$$

$CAR_{i_{(t_1,t_2)}} = Cumulative\ abnormal\ returns\ for\ firm\ i\ from\ t_1\ to\ t_2$
$AR_{i,t} = Abnormal\ return\ for\ firm\ i\ on\ day\ t$

CARs are computed for three different event windows in the study (-1, 1), (-2, 2) and (-5, 5). The smaller the time frame, the less chance that other events could possibly occur and affect the returns. However, a larger timeframe is able to capture the effects of leaked information and delayed responses. Similar to the computation of AARs, the cumulative average abnormal returns (CAARs) are then calculated for the full sample as follows:

$$CAAR_{(t,t_2)} = \frac{1}{N}\sum_{i=1}^{N} CAR_{i_{(t_1,t_2)}} \tag{7}$$

$CAAR_{(t_1,t_2)} = Cumulative\ average\ abnormal\ returns\ for\ event\ window\ (t_1, t_2)$
$N = \ Total\ number\ of\ firms\ in\ the\ sample$
$CAR_{i_{(t_1,t_2)}} = Cumulative\ abnormal\ returns\ for\ firm\ i\ from\ t_1\ to\ t_2$

Cross-Sectional test statistics are again employed to analyse the statistical significance of the CAARs and were computed in the following manner:

$$t = \sqrt{N}\,\frac{CAAR_{(t_1,t_2)}}{S_{CAR_{(t_1,t_2)}}} \tag{8}$$

$t = Cross\ sectional\ test\ statistic$
$N = \ Total\ number\ of\ firms\ in\ the\ sample$
$CAAR_{(t_1,t_2)} = Cumulative\ average\ abnormal\ returns\ for\ event\ window\ (t_1, t_2)$
$S_{CAR_t} = Standard\ deviation\ of\ CAR_{(t_1,t_2)}$

4.2 Investor attention

The following section focusses on the methods used for testing the second hypothesis:

H2: Investor attention to target firms increases in the period surrounding the acquisition announcement

As described in the Data chapter, the Search Volume Index (SVI) is employed as a proxy for investor attention. Abnormal search volume is calculated to capture the differences in the level of attention to the target firms during the acquisition announcement period different from the expected levels. The abnormal search volume index (ASVI) is defined as the relative change in SVI on day t compared to day t-1. This method of ASVI computation is in line with previous studies by Siganos (2013) and Reyes (2018).

$$ASVI_{i,t} = \ln(1 + SVI_{i,t}) - \ln(1 + SVI_{i,t-1}) \tag{2}$$

$ASVI_{i,t} = Abnormal\ search\ volume\ for\ firm\ i\ on\ day\ t$
$SVI_{i,t} = Indexed\ search\ volume\ for\ firm\ i\ on\ day\ t$

Average abnormal SVI (AASVI) is then computed for the full sample to observe the average effects to attention for target firms in the period surrounding the acquisition announcement. AASVI is defined as follows:

$$AASVI_t = \frac{1}{N}\sum_{i=1}^{N} ASVI_{i,t} \tag{10}$$

$AASVI_t = Average\ abnormal\ search\ volume\ on\ day\ t$
$N = \ Total\ number\ of\ firms\ in\ the\ sample$
$ASVI_{i,t} = Abnormal\ search\ volume\ for\ firm\ i\ on\ day\ t$

The AASVI values for each day in the event period are tested for significance using the cross-sectional test statistic, in this case defined by:

$$t = \sqrt{N}\ \frac{AASVI_t}{S_{SVI_t}} \tag{11}$$

$t = Cross\ sectional\ test\ statistic$
$N = \ Total\ number\ of\ firms\ in\ the\ sample$
$AASVI_t = Average\ abnormal\ search\ volume\ on\ day\ t$
$S_{SVI_t} = Standard\ deviation\ of\ SVI_t$

Similar to the calculation of the cumulative abnormal returns to the stock prices, cumulative abnormal investor attention (CASVI) is calculated for each firm by aggregating the ASVI values over the selected event windows (12), the cumulative average abnormal investor attention (CAASVI) is computed by taking the average CASVI of the sample (13) and the CAASVI results are tested for significance using the cross-sectional test statistic (14).

$$CASVI_{i_{(t_1,t_2)}} = \sum_{t=\,t_1}^{t_2} ASVI_{i,t} \tag{12}$$

$CASVI_{i_{(t_1,t_2)}} = Cumulative\ abnormal\ attention\ for\ firm\ i\ from\ t_1\ to\ t_2$
$ASVI_{i,t} = Abnormal\ attention\ for\ firm\ i\ on\ day\ t$

$$CAASVI_{(t_1,t_2)} = \frac{1}{N}\sum_{i=1}^{N} CASVI_{i_{(t_1,t_2)}} \tag{13}$$

$CAASVI_{(t_1,t_2)} = Cumulative\ average\ abnormal\ attention\ in\ event\ window\ (t_1, t_2)$
$N = \ Total\ number\ of\ firms\ in\ the\ sample$
$CASVI_{i_{(t_1,t_2)}} = Cumulative\ abnormal\ attention\ for\ firm\ i\ from\ t_1\ to\ t_2$

$$t = \sqrt{N}\ \frac{CAASVI_{(t_1,t_2)}}{S_{CASVI_{(t_1,t_2)}}} \tag{14}$$

$t = Cross\ sectional\ test\ statistic$
$N = \ Total\ number\ of\ firms\ in\ the\ sample$
$CAASVI_{(t_1,t_2)} = Cumulative\ average\ abnormal\ attention\ in\ event\ window\ (t_1, t_2)$
$CASVI_{i_{(t_1,t_2)}} = Cumulative\ abnormal\ attention\ for\ firm\ i\ from\ t_1\ to\ t_2$

4.3 Regression analysis

Having laid out the methodologies for calculating abnormal returns and abnormal attention during the event period, the following section discusses the methods used for testing the main hypothesis.

H3 = Investor attention has a positive effect on abnormal returns in the period surrounding the acquisition announcement

A regression model is required that captures the effect of abnormal investor attention, measured by search volume on abnormal returns, while controlling for the previously discussed variables that have been observed to impact abnormal returns during acquisition announcements.

Considering the dataset has a panel structure and the control variables include time-invariant categorical variables, a random effects panel data fitted regression model (15) is first employed to test the effect of ASVI on AR across the three different event windows.

$$AR_{i,t} = \beta_0 + \beta_1 ASVI_{i,t} + \beta_2 Ln(Deal\ Value)_i + \sum \beta_3 Payment_i + \sum \beta_4 Attitude_i + \beta_5 Relatedness_i + \sum \beta_6 Industry_i \quad (15)$$

$AR_{i,t} = Abnormal\ return\ for\ firm\ i\ on\ day\ t$
$\beta = Coefficient\ that\ represents\ the\ effect\ of\ each\ variable\ on\ the\ AR_{i,t}$
$ASVI_{i,t} = Abnormal\ attention\ for\ firm\ i\ on\ day\ t$
$Ln(Deal\ Value)_i = Natural\ logarithm\ of\ the\ deal\ value\ for\ firm\ i$
$Payment_i = Vector\ of\ dummy\ variables\ for\ the\ payment\ type\ used\ for\ firm\ i$
$Attitude_i = Vector\ of\ dummy\ variables\ for\ the\ deal\ attitude\ for\ firm\ i$
$Relatedness_i = Dummy\ variable\ for\ the\ industry\ relatedness\ of\ firm\ i$
$Industry_i = Vector\ of\ dummy\ variables\ for\ the\ industry\ of\ firm\ i$

The vectors of dummy variables of the control variables include all the categories outlined in the previous chapter. Each variable in the vector is associated with a coefficient which represents its impact on abnormal returns. The primary coefficient of interest in the regression is β_1, which estimates the effect of investor attention (as captured by the abnormal SVI) on the abnormal returns of the target firm during the event window. A positive and statistically significant β_1 would provide empirical support for the main hypothesis.

After running the panel regression, the Lagrange multiplier test of Breusch and Pagan (1980) was employed to test for significant variation across firms (For the test statistics, see Appendix A). Considering no significant evidence for variation across firms was found, the random effects panel regression model does not add value over a pooled Ordinary Least Squares (OLS) regression. The results for the random effects model are included in Appendix B for robustness, but the OLS regression results are presented and discussed in the next Chapter. Robust standard errors are used to correct for heteroskedasticity in the residuals.

Finally, to further ensure the comprehensiveness of the analysis, the previously obtained CARs for the three event windows are also regressed on the corresponding CASVIs using the OLS model (16). The results from this regression will provide insights on the effects of the aggregated measures of investor attention on abnormal returns.

$$CAR_{i_{(t_1,t_2)}} = \beta_0 + \beta_1 CASVI_{i_{(t_1,t_2)}} + \beta_2 Ln(Deal\ Value)_i + \sum \beta_3 Payment_i + \beta_4 Attitude_i + \sum \beta_5 Relatedness_i + \sum \beta_6 Industry_i \quad (16)$$

$CAR_{i_{(t_1,t_2)}} = Cumulative\ abnormal\ returns\ for\ firm\ i\ from\ t_1\ to\ t_2$
$\beta = Coefficient\ that\ represents\ the\ effect\ of\ each\ variable\ on\ the\ AR_{it}$
$CASVI_{i_{(t_1,t_2)}} = Cumulative\ abnormal\ attention\ for\ firm\ i\ from\ t_1\ to\ t_2$
$Ln(Deal\ Value)_i = Natural\ logarithm\ of\ the\ deal\ value\ for\ firm\ i$
$Payment_i = Vector\ of\ dummy\ variables\ for\ the\ payment\ type\ used\ for\ firm\ i$
$Attitude_i = Vector\ of\ dummy\ variables\ for\ the\ deal\ attitude\ for\ firm\ i$
$Relatedness_i = Dummy\ variable\ for\ the\ industry\ relatedness\ of\ firm\ i$
$Industry_i = Vector\ of\ dummy\ variables\ for\ the\ industry\ of\ firm\ i$

5 Results

In this chapter, the empirical findings of the study are presented. The hypotheses are reiterated and the corresponding results are presented as evidence for support or rejection of each of the hypotheses. Analysis of the statistical characteristics of the results is also discussed, including tests for normality, heteroskedasticity and multicollinearity. Finally, potential endogeneity issues and the steps taken to address these issues are outlined.

5.1 Abnormal returns

This section presents the results used to test the first hypothesis:

H1 = Target firms experience positive abnormal returns in the period surrounding the acquisition announcement

As discussed in the previous chapter the abnormal returns for each target firm are calculated using the market model. The average abnormal returns are then computed for the full sample for each day of the event window along with the corresponding cross sectional test statistics. The results are presented in table 5.

The reported cross-sectional test statistics point towards significant results for the 5 days preceding the acquisition announcement, the day of the announcement itself and the 2 days following the announcement. All average abnormal returns on these days are positive and the average abnormal returns on the day of the announcement and the following day are substantial in size.

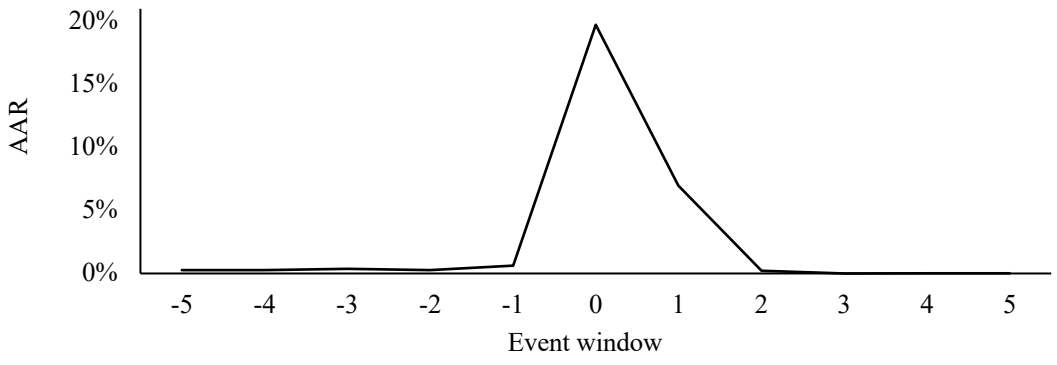
Table 6. Average Abnormal Returns (AARs) over the 11-day event window
This table examines the first hypothesis about the impact of an acquisition announcement on the stock returns of all firms. The average abnormal return is calculated using the market model. The cross sectional test statistic is calculated for statistical significance.

Event Day	*AAR*	*t statistic*
-5	0.29%	2.36**
-4	0.27%	4.10***
-3	0.37%	3.83***
-2	0.25%	3.21***
-1	0.62%	5.49***
0	19.73%	30.85***
1	6.98%	17.57***
2	0.21%	2.20**
3	0.00%	-0.01
4	0.01%	0.13
5	0.01%	0.36

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

By plotting the AARs over the event window (figure 2), a peak in the average abnormal returns can clearly be observed on the day of the announcement followed by a significant positive AAR on the day following the announcement. The effects of the announcement are mostly limited to these two days.

Figure 2. Average Abnormal Returns (AARS) over the 11-day event window
The figure displays the average abnormal returns presented in table 5 over the 11-day event window (-5, 5) where 0 is the day of the announcement.



Next, the abnormal returns are aggregated for each firm individually, and then the cumulative average abnormal returns for the full sample are computed. The CAARs are presented in table 7 alongside their corresponding cross-sectional test statistics.

Table 7. Cumulative Average Abnormal Returns (CAARs)
This table examines the first hypothesis using CAARs across all firms for different event windows. CAARs are calculated for 3-day, 5-day, and 11-day event windows. The cross-sectional test statistic is calculated for statistical significance.

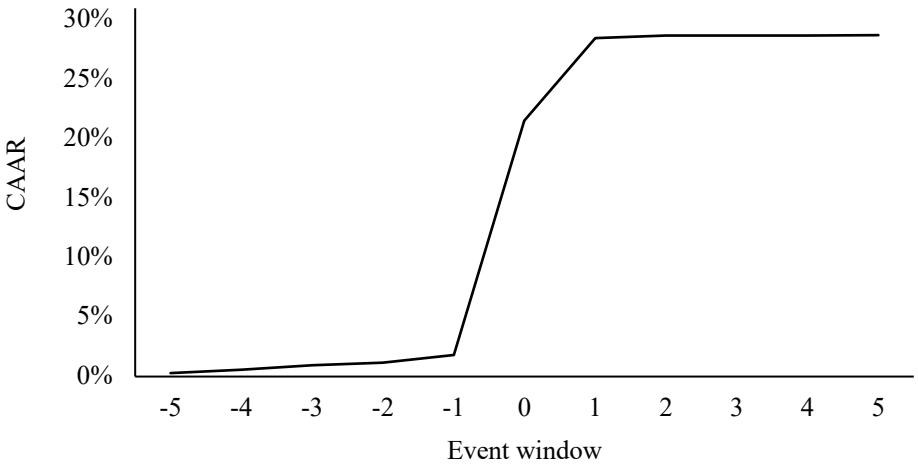
Event Window	*CAAR*	*t statistic*
(-1, 1)	27.33%	39.68***
(-2, 2)	27.79%	40.42***
(-5, 5)	28.74%	40.77***

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

As can be seen from the results presented above, all CAARs are significant at the 1% level. The value of the CAARs increases only slightly over the increased event window size, consistent with the small AARs observed on the days leading up to and following the acquisition announcement.

Analysing the cumulative average abnormal returns in a graph (Figure 3) confirms the previously observed patterns. The average abnormal returns accumulate slowly during the days leading up to the event date, rise quickly on the day of the announcement and the day after, and the elevated share price is maintained in the following days. These findings are in line with prior research and the first hypothesis.

Figure 3. Cumulative Average Abnormal Returns (CAARs) over the 11-day event window
The figure displays the cumulative average abnormal returns over the 11-day event window (-5, 5) where 0 is the day of the announcement.



5.2 Abnormal investor attention

Following the results for the (cumulative) average abnormal returns, this section will continue by presenting the results related to investor attention to test the second hypothesis:

H2: Investor attention to target firms increases in the period surrounding the acquisition announcement

Table 8 presents the results for the average abnormal search volume calculations for each day in the event period along with the cross-sectional tests statistics for statistical significance. The most significant effect is measured on the day of the acquisition announcement when interest in the target firm dramatically increases. The positive and significant value on day t-1 suggests investor attention also increases on the day before the announcement and the significant and negative values on the days following the day of the acquisition announcement suggest interest decreases quickly after the news is out. The increased attention on the day preceding the announcement could be interpreted as a result of the ability of investors to predict acquisitions before they are announced. Together with the observation of limited abnormal returns to targets in the days leading up to the announcement, these results also provide some evidence against the insider trading hypothesis (see section 2.1.6).

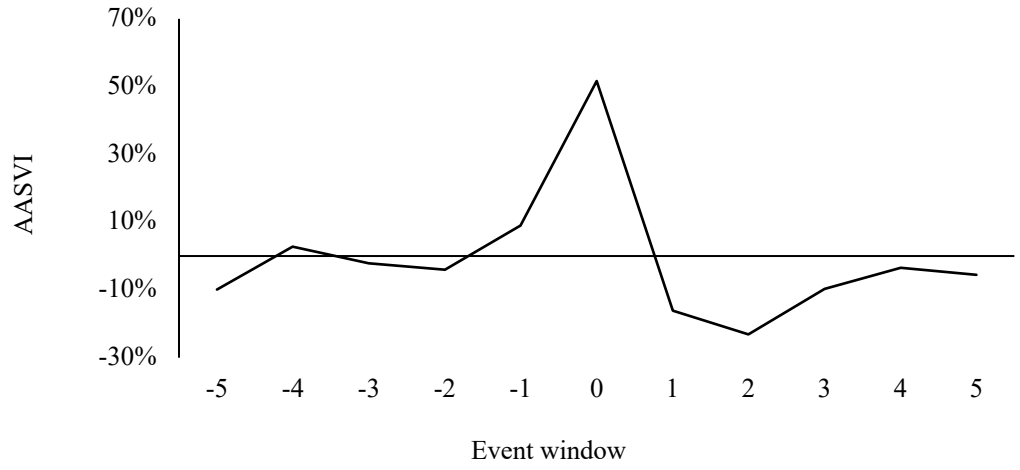
Table 7 . Average Abnormal Investor Attention (AASVI) over the 11-day event window
This table examines the second hypothesis about the impact of an acquisition announcement on investor attention for all firms. The average abnormal investor attention is calculated using the log difference of SVI_t and SVI_{t-1} The cross sectional test statistic is calculated for statistical significance.

Event Day	*AASVI*	*t statistic*
-5	-9,82%	-3,01***
-4	2,81%	0,83
-3	-2,13%	-0,62
-2	-4,01%	-1,20
-1	9,04%	2,74***
0	51,64%	14,11***
1	-16,08%	-4,64***
2	-23,12%	-6,56***
3	-9,75%	-2,81***
4	-3,41%	-1,01
5	-5,60%	-1,69*

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

When looking at the AASVI plotted over the 11-day event window in figure 4, it can clearly be observed that the peak in search volume on the day of the announcement follows a slight increase on the day leading up to the announcement and precedes a sharp decline in search interest on the following days.

Figure 4. Average Abnormal Search Volume (AASVI) over the 11-day event window
The figure displays the average abnormal search volume measured using the daily log differences of SVI presented in table 7 over the 11-day event window (-5, 5) where 0 is the day of the announcement.



The cumulative average abnormal attention across the different even windows is computed by aggregating the ASVI across the different event windows for each firm and then calculating the average for the dataset. The results are presented in table 9. CAASVI is significant at the 1% level for each event window. The most significant and substantial CAASVI is observed over the smallest 3-day event window and indicates a total average abnormal search volume of 44.61%. Another interesting observation is that the CAASVI for the broadest event window of 11 days is negative, indicating the total average search volume decreases more than it increases over the 11 days surrounding the acquisition announcement.

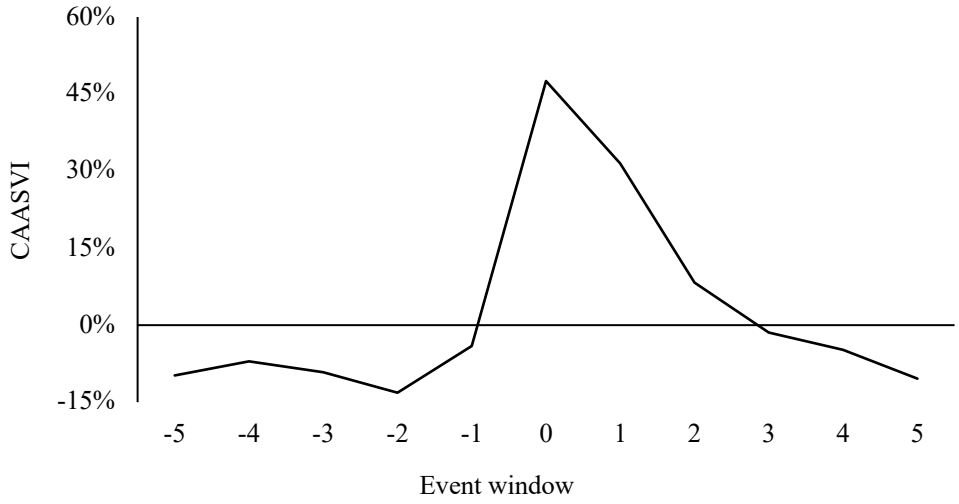
Table 8. Cumulative Average Abnormal Investor Attention (CAASVI)
This table examines the second hypothesis using CAASVI across all firms using different event windows. Cumulative average abnormal investor attention (CAASVI) is calculated for 1-day, 2-day, and 5-day event windows.

Event Window	*CAASVI*	*t statistic*
(-1, 1)	44.61%	12.44***
(-2, 2)	17.48%	4.93***
(-5, 5)	-10.42%	-2.94***

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

When analysing the cumulative average abnormal search volume using the graph presented in figure 5, the pattern becomes more apparent. The CAASVI is only positive on the day of the announcement and the two following days, which is due to the unexpected negative ASVI on the first day of the event window. On the final day of the event window the increase in search interest has already declined to approximately the same level where it was after the first day.

Figure 5. Cumulative Average Abnormal Search Volume (CAASVI) over the 11-day event window
The figure displays the cumulative average abnormal search volume measured using the sum of the daily log differences of SVI over the 11-day event window (-5, 5) where 0 is the day of the announcement.



5.3 Regression analyses

In this section, the results are presented for the regression analyses used to test the third and final hypothesis:

H3 = Investor attention has a positive effect on abnormal returns in the period surrounding the acquisition announcement

As discussed in the previous chapter, a pooled OLS regression model is employed for the test on the panel data across the three selected event windows. Results for these regression models are presented in table 9.

The results show a constant of 0.061 (6%), 0.043 (4.3%) and 0.021 (2.1%) respectively for the three different event window sizes. These coefficient estimates are significant and can be interpreted as an indication of the mean abnormal return for a firm on a given day within the respective event window.

The estimated coefficients for the main variable of interest in the analysis, ASVI, are significant at the 1% level across all the event windows and decrease in size as the event window becomes broader. This implies the effect of abnormal investor attention on abnormal returns is stronger in the days immediately surrounding the acquisition announcement. As ASVI is defined as the difference of the natural logarithm of SVI on day t and the natural logarithm of SVI on day t-1, the parameter can be interpreted as the average percentage points change in abnormal returns, given a 1% change in SVI from day t-1 to day t. In other words, if the search volume for a stock increases by 1% on a day in the 3-day event window, the abnormal returns for this stock increase by 0.018 (1.8 percentage points) on average.

Moving on to the analysis of the control variables, the natural logarithm of deal value is also significant at the 1% level for each event window size. The coefficient estimates are negative and also decrease in absolute size for the broader event windows. A negative relationship between deal value and abnormal returns thus exists which is stronger in the days immediately surrounding the acquisition announcement. The coefficient is not considerably large as it implies that a transaction double the size earns approximately 0.0076 (0.76%) less abnormal returns on each day of the 3-day event window on average.

Consistent with findings in previous research, the results show acquisitions made using cash are related to higher abnormal returns for targets on average. The estimated coefficients show a positive relationship across all event windows compared to offers made with mixed payments or shares. These estimates are relative to the “unknown” category. However, only the coefficient estimates of the “Shares” dummy variable are somewhat significant at the 10% level for the 3-day and the 11-day event window. Although the sizes and signs of the coefficient estimates are in line with prior research, the results do not show a significant effect of payment type on abnormal returns.

An interesting observation are the substantial and significant values of the coefficient estimates for the deal attitude dummy variables. These indicate targets that are friendly, hostile or neutral to the offer earn substantially higher abnormal returns during the period surrounding the acquisition announcement when compared to the “not applicable” category. In the most notable cases, targets for which the management is neutral or friendly towards the offer earn on average an additional 0.083 (8.3 percentage points) or 0.081 (8.1 percentage points) abnormal return on days in the 3-day event window. These results are unexpected as prior research has presented findings of positive abnormal

returns for targets of which the management resisted the offer. These results should be interpreted with caution however, given that the number of Friendly deals in the sample was heavily overrepresented (see section 3.4).

The relatedness dummy variable is significant at the 1% level across all event windows and shows a diminishing effect. The coefficient estimate indicates targets experience 0.02 (2 percentage points) higher returns on average on each of the days in the 3-day event window if the target is active in the same industry as the acquiror. This could be related to the increase in perceived synergy possibilities for companies active in the same industry discussed earlier.

Finally, the regression model controls for the industry in which the targets are active. In depth analysis of the industry effects are out of the scope of this research, but the results show targets of acquisitions made in the Healthcare industry earned significantly higher abnormal returns on average, and targets active in Real Estate or Retail earn significantly lower abnormal returns. Targets in the remaining industries do not experience significantly different returns from each other.

To ensure the robustness of the findings and confirm the model's assumptions, several statistical tests are implemented. Using the Breusch–Pagan/Cook–Weisberg Test, heteroskedasticity was detected in the residuals and thus robust standard errors were employed. The variance inflation factors were obtained to detect potential multicollinearity for which no evidence was found. A Skewness-Kurtosis (Jarque-Bera) test is used to test for normality of the residuals too. Evidence was found for violation of the normality assumption, but the large sample size of the dataset suggests this does not necessarily have severe concequences as the OLS estimators are approximately normal according to the central limit theorem.

Table 9. Pooled OLS regression models for Abnormal Returns (AR) and Abnormal Investor Attention (ASVI)
The table contains the results for the pooled OLS regression model across the three different event windows.

	Dependent Variable: Abnormal Return		
	Event Window (-1 , 1)	*Event Window (-2, 2)*	*Event Window (-5, 5)*
Constant	0.061***	0.043***	0.021***
	(0.021)	(0.014)	(0.006)
Abnormal Investor Attention (ASVI)	0.018***	0.013***	0.006***
	(0.002)	(0.001)	(0.001)
Log (Deal Value)	-0.011***	-0.006***	-0.003***
	(0.002)	(0.001)	(0.001)
Cash	0.017	0.011	0.004
	(0.019)	(0.012)	(0.005)
Mixed	-0.008	-0.004	-0.003
	(0.019)	(0.012)	(0.006)
Shares	-0.032*	-0.016	-0.010*
	(0.019)	(0.012)	(0.006)
Friendly	0.081***	0.046***	0.022***
	(0.008)	(0.005)	(0.002)
Hostile	0.042**	0.024**	0.011*
	(0.019)	(0.012)	(0.006)
Neutral	0.083**	0.047**	0.023**
	(0.035)	(0.022)	(0.010)
Relatedness	0.020***	0.012***	0.005***
	(0.006)	(0.004)	(0.002)
Industry Fixed Effects	Yes	Yes	Yes
Observations	8,175	13,625	29,975
R-squared	0.041	0.027	0.012

Clustered standard errors at the target firm level are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Following the previous model, the results for the OLS regression analysis of the cumulative abnormal returns on cumulative abnormal investor attention are presented in table 10. As mentioned in the previous chapter these results provide insights on the effects of the aggregated abnormal investor attention on the total abnormal returns for the different event windows after controlling for the additional independent variables.

The constant for the cumulative abnormal returns models is significant at the 1% level across all event windows. In line with expectations, the coefficient estimates for the constant are approximately the value of the panel regression coefficient estimates multiplied by the amount of days in each event window. The constant can be interpreted as a base average abnormal return to targets over the days surrounding the acquisition announcement, assuming all other variables in the regression to have a value of 0. The cumulative average abnormal returns increase for the broader event windows, but the majority of the returns is captured in the 3-day period.

Considering the CASVI cumulates the differences in abnormal attention across the event window, it also captures the decreases in attention following an initial spike. This entails CASVI essentially represents the amount of abnormal attention which is retained over the event window. For this reason, the coefficient estimates are not approximately the value of the coefficient estimates in the panel regression multiplied by the number of days in the event period. The results for the 3-day event window and the 5-day event window retain significance at the 1% and the 5% level respectively. The coefficient of 0.011 (1.1 percentage points) can in this case be interpreted as an approximation of the average increase of the cumulative abnormal returns for a target, for a one percent increase in abnormal search volume, sustained over the event window. The same holds for the 0.009 (0.9 percentage points) for the 5-day event period. These results show that cumulative investor attention is linked to the cumulative abnormal results, but this relationship is stronger in the days immediately surrounding the acquisition announcement and diminishes quickly. The results align with the earlier observation of an immediate increase in investor attention on the day of the announcement followed by a sharp decline in the following days.

The control variables yield similar results as the panel regression method. Higher deal values are on average related to relatively lower CARs for the targets and the type of payment does not make a significant difference in cumulative abnormal returns except for slightly significant negative effects of offers made with shares in the smallest and broadest event window. All deal attitude categories different from “not applicable” show a significant and positive impact on the cumulative abnormal returns with “Friendly” and “Neutral” received deals being related to the highest CARs. Acquisitions announcements for targets active in the same industry as the acquiror generate significantly higher CARs and targets active in healthcare experience higher cumulative abnormal returns when compared

to targets in the other industries as opposed to those active in Real Estate or Retail which experience significantly lower CARs on average.

Table 10. Regression of Cumulative Abnormal Returns (CAR) on Cumulative Abnormal Investor Attention (CASVI)
The table contains the results for the OLS regression model across the three different event windows.

	Dependent Variable: Cumulative Abnormal Return		
	Event Window (-1 , 1)	*Event Window (-2, 2)*	*Event Window (-5, 5)*
Constant	0.184***	0.214***	0.228***
	(0.059)	(0.063)	(0.064)
Cumulative Abnormal Investor Attention (CASVI)	0.011***	0.009**	-0.003
	(0.004)	(0.003)	(0.004)
Log (Deal Value)	-0.033***	-0.032***	-0.034***
	(0.005)	(0.005)	(0.005)
Cash	0.052	0.058	0.043
	(0.052)	(0.053)	(0.053)
Mixed	-0.025	-0.020	-0.031
	(0.052)	(0.053)	(0.054)
Shares	-0.095*	-0.082	-0.109**
	(0.053)	(0.054)	(0.054)
Friendly	0.245***	0.228***	0.242***
	(0.026)	(0.031)	(0.032)
Hostile	0.128***	0.119**	0.125**
	(0.049)	(0.051)	(0.053)
Neutral	0.247***	0.239***	0.256**
	(0.085)	(0.091)	(0.107)
Relatedness	0.060***	0.059***	0.054***
	(0.015)	(0.015)	(0.016)
Industry Fixed Effects	Yes	Yes	Yes
Observations	2,725	2,725	2,725
R-squared	0.099	0.095	0.096

Robust standard errors are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

5.4 Summary

Overall, the results provide significant evidence of substantial positive abnormal returns for targets in the period surrounding acquisition announcements as well as a considerable increase in investor attention measured by search volume. Furthermore, evidence is also provided for the effects of investor attention on the abnormal returns for targets in the period surrounding an acquisition announcement. The significant and positive coefficient estimates in across the different regression models align with the hypothesized positive effects of attention on the average returns.

The negative effects of deal size are expected and in line with prior research. Signs and magnitudes for the coefficients related to the different types of payments, although not significant, are also similar to previous findings. The substantial and significant coefficient estimates for the deal attitude, most notably the “Friendly”, and “Neutral” variables are unexpected. These values are likely to be impacted by the distribution of the sample, with over 97% of the deals being categorized as friendly. Insufficient data for the other categories may have introduced bias in the estimated coefficients. However, higher abnormal returns for targets that operate in the same industry as the acquiror are in line with prior research. The higher average abnormal returns observed in the Healthcare industry are also not unexpected as mergers and acquisitions within this industry are often linked to substantial premiums for target shareholders. The opposite holds for M&A activity in the Retail and Real Estate industry indicating the significant and negative coefficient estimates for these industries are not surprising.

5.5 Robustness checks

A number of checks are carried out to ensure the robustness of the findings. In line with the research by Da, Engelberg and Gao (2011) and Siganos (2013), the regressions are also run on the complete dataset without the exclusion of the noisy ticker symbols (see section 3.3) and find similar results.

Additional regression models are also estimated without the use of deal attitude as an explanatory variable, because of the unexpected coefficient estimates for the dummy variables. Results from these regression models are similar to the presented findings, except for the estimate of the constant which increases by obtaining a large part of the effects previously allocated to the deal attitude.

6 Conclusion

This final chapter will conclude by formally rejecting or accepting the hypotheses and providing an answer to the main research question. Limitations to the thesis and recommendations for further research in the field are also discussed.

H1 = Target firms experience positive abnormal returns in the period surrounding the acquisition announcement

The first hypothesis regarding positive abnormal returns for targets in the period surrounding acquisition announcements is accepted. The results show positive and significant abnormal returns on the 5 days preceding the announcement date, on the day of the announcement and on the two days following the announcement. Overall, cumulative abnormal returns for the three different event windows are all significant and substantial. The abnormal returns for targets are heavily concentrated around the day of the announcement with the most notable effects being observed on the day itself and the first day following the announcement.

H2: Investor attention to target firms increases in the period surrounding the acquisition announcement

The second hypothesis regarding the increased investor attention in the period surrounding the acquisition announcement is also accepted. The results show significant increases in investor attention on the day before the announcement as well as the day of the announcement. On average, the increase in attention is reversed however on the subsequent days in the event period. As opposed to the abnormal returns for target's stock prices which are sustained throughout the event period, cumulative abnormal attention across the broadest event window is negative. This indicates that the high peak in interest diminishes quickly, and positive abnormal attention is thus only observed in the days directly surrounding the event. Considering the additional abnormal returns to targets are also observed to diminish rapidly after the day of the announcement, it is not surprising to observe that the interest of investors in the relevant securities also decreases.

H3 = Investor attention has a positive effect on abnormal returns in the period surrounding the acquisition announcement

The final hypothesis regarding the effect of investor attention on abnormal returns during the period surrounding acquisition announcements is also accepted. The results from the regression analysis show positive and significant coefficient estimates for the measures of abnormal investor attention,

after controlling for other determinants of abnormal returns for targets in the context of acquisition announcements. Evidence is thus provided of a positive relationship between abnormal investor attention and abnormal returns for targets during the acquisition announcement period providing an answer to the main research question of this thesis.

Although the answer to the research question is supported by results which were obtained after thorough consideration of the applied methods and tests, some limitations to the research are important to mention. First, Google SVI is not a perfect proxy for investor attention. As previously mentioned, Google Trends does not provide raw data of the total amount of search interest in a certain variable. The provided index figures are useful for interpreting the change in interest for a certain search term over time relative to the total search interest, but they do not allow for comparison of total search interest for a large dataset of ticker symbols. Furthermore, although noisy ticker symbols were manually removed from the sample and a robustness check was performed to test the effect of excluding these observations, it is difficult to confirm if all the remaining observed search volume for the ticker symbols was related to the target firm's securities. When excluding the potentially distorted observations, the assumption is made that no abbreviations or brands have gone out of fashion recently and are currently no longer considered ambiguous.

A limitation to the interpretation of the cumulative abnormal investor attention, especially for the broader event windows is introduced through its computation. Considering ASVI has multiple substantial and significant values in the event window with different signs (+/-), the cumulative ASVI is difficult to interpret. If search interest increases by 50% on the day of the announcement for example, and decreases by 50% 4 days later, the value of ASVI over the broad event window is 0, but the absolute value of SVI is lower at the end of the event window than at the beginning. Subsequent research in the effects of investor attention would do well to use alternative measures of ASVI to provide results robust to these types of transformations.

Another interesting recommendation for further research considers the long term effects of increased investor attention and potential price reversal to find an answer to the question whether the results obtained in this thesis are more likely to support the efficient market hypothesis or the price pressure theory. Although research in long term price movements of securities is complicated as the number of variables that could impact the returns increase over time, finding evidence of price reversal after increased abnormal returns due to increased investor attention would suggest the temporary effects are a result of price pressure and market inefficiency.

Finally, as the current existing literature surrounding abnormal returns for targets in the period surrounding acquisition announcements is dominated by event studies and regression analysis, the

introduction of novel methods for testing the suggested theories could provide valuable insights. Future research could increase comprehension regarding the topics by employing artificial intelligence and machine learning algorithms.

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APPENDIX A Breusch Pagan Test

Table A. Test for Random Effects: Breusch and Pagan LM (BPLM) Test
This table displays the relevant test statistics for the BPLM test on the random effects regression models. The results suggest there is no significant variance across firms (p = 1.00). These results suggest a pooled OLS regression may be more appropriate than a random effects panel regression

	Event Window (-1 , 1)	*Event Window (-2, 2)*	*Event Window (-5, 5)*
Test Statistic (chibar2)	0.00	0.00	0.00
P-value (Prob > chibar2)	1.00	1.00	1.00
Estimated components of Variance			
Variance of u (Var(u))	0.00	0.00	0.00
Variance of e (Var(e))	0.07	0.04	0.02

APPENDIX B Random Effects Regression Results

Table B. Random effects regression models for Abnormal Returns (AR) and Abnormal Investor Attention (ASVI)
The table contains the results for the OLS regression model across the three different event windows

	Dependent Variable: Abnormal Return		
	Event Window (-1 , 1)	*Event Window (-2, 2)*	*Event Window (-5, 5)*
Constant	0.061***	0.043***	0.021***
	(0.020)	(0.013)	(0.006)
Abnormal Investor Attention (ASVI)	0.018***	0.013***	0.006***
	(0.002)	(0.001)	(0.001)
Log (Deal Value)	-0.011***	-0.006***	-0.003***
	(0.002)	(0.001)	(0.000)
Cash	0.017	0.011	0.004
	(0.017)	(0.011)	(0.005)
Mixed	-0.008	-0.004	-0.003
	(0.017)	(0.011)	(0.005)
Shares	-0.032*	-0.016	-0.010**
	(0.017)	(0.011)	(0.005)
Friendly	0.081***	0.046***	0.022***
	(0.009)	(0.006)	(0.003)
Hostile	0.042***	0.024**	0.011**
	(0.016)	(0.010)	(0.005)
Neutral	0.083***	0.047***	0.023**
	(0.027)	(0.018)	(0.009)
Relatedness	0.020***	0.012***	0.005***
	(0.005)	(0.003)	(0.001)
Industry Fixed Effects	Yes	Yes	Yes
Observations	8,175	13,625	29,975
Number of firms	2,725	2,725	2,725

Clustered standard errors at the target firm level are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1