BREXIT AND SWEDEN

AN EXAMINATION OF THE SWEDISH STOCK MARKET'S REACTION TO BREXIT

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Abstract:

The decision by the United Kingdom (UK) to leave the European Union (EU) is one of the most recognized political events in modern time. In this thesis, we examine the reaction on the Swedish stock market using three different approaches. First, Abnormal Returns are calculated using the market model as theoretical normal returns. Second, sectoral differences in return are analyzed by an ANOVA-test. Third, a cross-sectional regression analysis is used to find plausible explanations for any Abnormal Return. Our findings support that (1) the Swedish stock market reacted negatively on the event date, followed by a quick recovery. We also observe that (2) the return of at least one sector differs from at least one other during the event window. Furthermore, we recognize that (3) companies with UK exposure were affected more than their Swedish peers, as performance expectations adjusted for added risk. By examining these effects, a better understanding of how the Swedish stock market react upon a large European event is presented and some of the parameters influencing abnormal returns.

Keywords:

Abnormal returns, Brexit, Event study, Stock market, Sweden

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Concepts and definitions

AAR: Average Abnormal Return
ANOVA: Analysis of Variance
AR: Abnormal Return. The difference between actual the return and the theoretical return of a security
Brexit: The term used to describe the UK's exit from the EU
CAAR: Cumulative Average Abnormal Return
EMH: Efficient Market Hypothesis
EU: European Union
GDP: Gross Domestic Product
GICS: Global Industry Classification Standard
Hard Brexit: UK would leave the EU's single market and trade under WTO rules
MM: Market Model
NAA: No Anticipation Assumption.
Soft Brexit: The UK would still have the benefit of free trade with the EU
UK: United Kingdom
WTO: World Trade Organization

Contents

1. INTRODUCTION 5
1.1. Introduction 5
1.2. Contribution 6
1.3. Disposition 6
2. BACKGROUND 7
2.1. European Union 7
2.2. Brexit 7
2.3. Brexit and Sweden 8
3. LITERATURE REVIEW AND THEORETICAL FRAMEWORK 10
3.1. Event studies and capital market efficiency 10
3.2. Previous studies on markets' reaction to events 11
3.3. Previous studies on Brexit 12
4. HYPOTHESIS 14
4.1. Abnormal Returns Hypothesis 14
4.2. Sector-specific hypothesis 14
4.3. Firm-Specific hypothesis 15
5. DATA AND METHODOLOGY 16
5.1. Data and sample selection 16
5.2. Event Study 17
5.2.1. Define the event of interest and time period 18
5.2.2. Define and estimate the normal return 19
5.2.3. Aggregation of the abnormal return and the cumulative abnormal returns 19
5.2.4. Test AAR and CAAR for significance 20
5.3. ANOVA-test and regressions used to explain CAR 20
6. RESULTS 22
6.1. Event study results 22
6.2. Results from the sector study 24
6.2.1. ANOVA test; -1 to 1 24
6.2.2. ANOVA test; -1 to 0 24
6.2.3. ANOVA test; 0 to 1 24
6.3. Results from the cross-sectional regression 26
7. CONCLUSION 29
8. REFERENCES 31
9. APPENDIX 35

1. Introduction

1.1. Introduction

Brexit has been regarded as one of the most recognized political events in modern time. One week prior the Brexit referendum on the 23rd of June 2016, the Bank of England stated that uncertainty about the outcome of a potential Brexit was the 'largest immediate risk' facing the global financial markets. Still, the British people voted to leave the European Union (EU) as the first member ever to do so. In the following day, over two trillion dollars of value which represents 5 percent of the global equity markets were lost. Sweden was not spared from this as the OMXS dropped 7.8 percent representing the largest single-day loss since the financial crisis in 2007-2008.

Previous literature suggests that political events can bring large unexpected movements to equity markets (Niederhoffer, 1971; Kim & Mei, 1994) and Brexit has been no exception to this (Oehler et al, 2017; Burdekin et al, 2018; Ramiah et al, 2017). The most common method used to investigate the effects of Brexit has been the event study methodology. Current literature, however, still lacks a more profound examination of the effects on a non-UK country. As Swedish corporations have a long history of conducting business in the UK, there is of certain interest to further investigate the effects on the Swedish market. We use an event study methodology in accordance with previous literature as a base to examine the following research question:

How did the Brexit referendum affect the Swedish stock markets?

When conducting an event study, one has to assume that the market is efficient in line with the Efficient Market Hypothesis (EMH). As we aim not to challenge the EMH, but rather contribute with a purely empirical examination of the effects from Brexit on the Swedish stock market, we will assume that the EMH holds for this study. A sample of 167 listed Swedish companies was gathered from the Thomson Reuters Eikon terminal and will act as a proxy for the Swedish stock market. Further, an ANOVA-test is used together with a Tukey-post hoc-test to examine if all sectors were equally affected. Finally, in order to further explain the observed reaction, a cross-sectional regression is conducted with parameters reflecting valuation, leverage ratio and firm exposure to the UK.

Our findings suggest that (1) there was an instant sell-off on the Swedish financial market following the referendum outcome. However, this reaction was quickly recovered over the next few days. (2) At least one sector pair significantly differed from the rest suggesting that all sectors were not equally affected. (3) The cross-sectional regression

further supports these findings while adding that UK exposed companies were even more affected as they experienced a lower abnormal return than firms without UK exposure.

As the exit date is yet to come, uncertainty of the long-term implications of Brexit still remains. However, this study contributes to previous research by adding an in-depth analysis of stock market reactions to political events.

1.2. Contribution

This study adds to the current research in three ways. First (1), it provides empirical evidence of how an EU member's stock market reacts when another membership country votes for an exit. Previous literature is mostly focused on the impact of Brexit on the UK itself, while this thesis aims to explain its effects on another EU-member. It is of substantial interest to examine Sweden, as it is heavily dependent on exports and extensive trade with the UK. As Euroscepticism has risen throughout Europe, one cannot exclude the possibility of a similar event reoccurring. Therefore, this thesis brings light to how an EU-member's stock market reacts upon another EU-member's exit.

Second (2), this thesis aims to bring an understanding of how different industries in Sweden are affected by the event of a withdrawal of an EU-member. Previous research has confirmed the relationship between return and sector and therefore, this thesis will provide further guidelines to wheatear this holds for Sweden as well.

Last (3), we provide an insight into how companies with a direct sales exposure to a leaving EU-member are affected by an event like Brexit. Previous studies on Brexit have primarily focused on UK companies and how returns are affected by the level of international sales. Instead, we do the opposite by looking at Swedish companies and how their direct sales towards the UK affect returns in the short-run.

1.3. Disposition

The thesis is structured into eight chapters. *Chapter 2* covers the background of the study and will further examine the event in question and its implication on Sweden. *Chapter 3* consists of a literature review where relevant literature for the asked research question will be presented and explained while the following *Chapter 4* lists the hypotheses that are tested. *Chapter 5* presents the data and choice of methodology for the study and in *Chapter 6* the empirical results will be presented combined with a discussion about them. The final chapter, *Chapter 7*, presents the findings which will be further analyzed for conclusions to be made.

2. Background

2.1. European Union

The European Union dates back to 1958 when the six countries: Belgium, France, Italy, Luxemburg, the Netherlands and Germany founded an economic partnership to promote international trade. Today the purpose of the EU is to promote free trade, a common currency and a joint political agenda. Since the EU was founded, 22 additional countries have joined the Union, and border controls has gradually been removed allowing free movements of goods, services, capital and people. EU has further contributed to observe peace, stability and greater welfare (Europa, 2019). Central and Western Europe has never experienced such a long period without war it has today and the EU has been awarded the Nobel peace award for being the most successful peace project of all times.

Today, the EU is one of the largest trade block and exporter of goods and services globally at the same time as it is the greatest importer for over 100 countries (Europa, 2019). Free trade is one of the most relevant topics addressed by the EU and the representatives' works actively to deregulate global trade barriers. The EU is governed by a parliament where all member states have their own mandate(s) in relation to their population, which implies that all member states have the ability to influence the decisions taken by the Union. However, everything comes with a cost. For example, Sweden has contributed with between 29-39 billion Swedish kronor per year during the last seven years. Although this might seem like a large amount, other countries have paid substantially larger fees; the UK paid 10.575 billion Euros in 2017 only to receive 6.326 billion Euros of grants (Europa, 2019). This, together with other political factors, was one the reasons that led up to the UK referendum held on June 23, 2016 (Hobolt, 2016).

2.2. Brexit

Even with meticulous preparation from the Eurosceptical citizens of the UK, very few actually believed there would be a majority in favor of leaving. According to Hobolt (2016), not even the political leaders in favor of leaving, had an actual idea of how a Brexit would be implemented. However, as the votes were counted and results were reported, 17.4 million citizens had voted in favor of leaving representing roughly 52 percent of all votes. As a result of the referendum, 50 of the Lisbon Treaty was triggered on the 29th of March 2017, notifying the European Council of its intention to pursue with an exit from the EU.

From a poll made by Hobolt (2016), it appears that the main arguments in favor of leaving are immigration control, the costs of EU membership, concerns regarding national security, trust as well as the lack information regarding the consequences. Some even refer to the lack of trust in the Prime Minister/Government as an argument for an exit.

Key arguments, by those in favor of remaining as an EU member were the economic risks associated with leaving the economic stability provided by the EU. Even though the majority of voters supported Brexit, there was a significant difference amongst the different geographical parts of the UK. Most of the supporters to Brexit, were the elderly and individuals from rural areas while the opponents were the younger population and individuals living in larger cities. The Brexit vote also differed by country, with the UK being made up by four independent nations (England, Scotland, Wales and Northern Ireland), not every nation voted for an exit. Both Scotland and Northern Ireland voted against Brexit (56 and 62 percent respectively) while England and Wales voted in favor (52 percent). This has been brought up as a major concern as it divides the British Islands into different camps where each country is affected regardless of their independent national decision. Some even argue that if Northern Ireland remains within the EU, their exports to England will be target of tariffs and strict border controls.

Further, Brexit is expected to have consequences for the UK economy. Without a new trade agreement similar to the open market access available today, the UK GDP is expected to decrease by three percent by the end of 2020 (OECD, 2016). To conclude, regardless of opinion there is a great incentive for all parties involved to get a Brexit as smooth as possible since the economic and political consequences following will be of great impact to everyone (Hobolt, 2016).

2.3. Brexit and Sweden

Swedish corporations have a long history of conducting business in the UK. After the Brexit results were announced, several prominent business figures in Sweden raised public concerns regarding the matter. Ulf Pehrson for example, Vice President of Ericsson's Government & Industry relations stated in an interview with representatives at the Stockholm Chamber of Commerce that there will be consequences for Sweden which hurt trade and new domestic investments. As Swedish exports account for almost 50 percent of the national GDP, making the country heavily dependent on international trade and well-being of other countries (Hatzigeorgiou & Nixon, 2018).

The UK is one of the most important trading partners for Sweden given that 7.2 percent of the total Swedish export volume was exported to the UK in 2016. This ranked Sweden in second place for countries most reliable on UK trade in Europe, only second to Belgium (Hatzigeorgiou & Nixon, 2018). Potential tariffs, customs and other non-tariff barriers that will impact on sales and margins are among the most pressing concerns raised by corporate leaders.

According to a study from Woodford Investment Management (2016), the effects will vary from sector to sector with biggest tariff exposure expected to be on products related to vehicles and consumer staple goods (Protts, 2016; OECD, 2016). Aside from affecting

potential margins, export prices would reduce the demand for Swedish products, negatively affecting companies with large sales exposure to the UK (OECD, 2016).

In addition to increased tariffs on trade, new regulations will be a major concern for companies. In an investigation published by the Swedish National Board of Trade (2017), Brexit would especially hurt the Swedish commercial and professional service sector which annually exports services to the UK of a value of SEK 51 billion. Today, service companies can follow general guidelines regarding public procurement and take advantage of free mobility and free establishment but if the EU and the UK fail to agree on a new bilaterally trade deal, this sector will be regulated by international trade agreements. This will lead to increased costs and make the trade of some services impossible (NBTS, 2017).

3. Literature review and theoretical framework

3.1. Event studies and capital market efficiency

In order to conduct an event study and obtain abnormal returns, three central methodological assumptions have to be made (McWilliams & Siegel, 1997);

- Market efficiency (key assumption)
- No anticipation of the event
- No other event occurring during the event window that might have influenced stock price changes

Following the Brexit vote, most of the European stock markets were affected negatively (Burdekin, Hughson & Gu, 2018). By researches in the field, this is evidence of an efficient capital market, where markets quickly adapt to news that may have an influence on prospects or risk. The paper by Fama (1970) is one of the most prominent within the subject, on which the efficient market hypothesis (EMH) builds upon.

According to Fama, an efficient capital market is a market where all available information is ‘’fully reflected’’ in the price of a security. It permits an investor to purchase a security at the price which reflects the risk-adjusted ownership. Therefore, according to Fama, it is not possible to outperform the market in the long term without taking on additional risk. By testing three different hypotheses Fama concluded that financial markets are efficient in terms of incorporating news into asset prices. The first of these three hypotheses, the weak-form-efficiency, means that you cannot achieve a higher return by following past stock price data while the second, semi strong-form-efficiency means that all new information gets priced in efficiently. The third, strong-form-efficiency means that the market is adjusted for all types of information including both public and private. The results of the first and second hypotheses showed statistical significance, while the third hypothesis is expected to hold as it is illegal and strongly supervised to trade on private information. To further support the research, Fama (1970) stated that three conditions need to hold. The first condition is that there must be a large number of profit-maximizing participants. Second, new information needs to come in randomly and cannot be analyzed beforehand. Third, all participants' attempts to adjust the price of the security immediately when this new information is available.

However, there is an increasing body of literature that questions the EMH. For example, Chan (1996) states that the capital market sometimes underreacts to positive news while overreacting to negative. He also argues that stock prices are predictable and that extreme return movements are reversed even without any new information being revealed. Shiller (2003) presents the same findings as Chan but further emphasizes the behavioral finance aspects, thus, price changes occur not only because of new information but also due to

mass psychology. We realize that there are limitations to the EHM, but since our aim is not to question whether EHM holds but rather to contribute with a purely empirical examination of the effects of Brexit, the EHM will be assumed.

3.2. Previous studies on markets' reaction to events

Niederhoffer (1971) was among the first who examined how major political events impacted the returns on the stock market. He based his research on New York Times headlines following major world events such as US Presidential elections and news related to war during the 1950s and 1960s. He concluded that major political events have a large influence on stock returns and that the greatest share price reactions can be observed within one to two days after the event.

Cutler, Poterba & Summer (1988) declare a difficulty in explaining the stock market's reaction solely on news regarding the fundamental value. Only half of the stock price variance can be explained by news regarding company fundamentals and hence, other parameters affecting the movements and returns of a stock exists. By running a regression using monthly data from 1926-1985 and 1946-1985 they found that macroeconomic news can explain some of the changes in stock prices, but that there are other factors that may affect stock prices like volatility, inflation and money supply. Second, he concludes that non-financial and non-macro fundamental events also move stock prices. Therefore, major global and/or political events might move markets in accordance with the results found by Niederhoffer (1971), but no evidence of statistical significance was found as some of the largest movements could not be explained by any new release of information.

However, Kim and Mei (1994) found that political development can have an impact on stock prices. By conducting an event study, they examined the Hong Kong stock market's movement in relation to major political events in depth. This is also in line with an event study by Dangol (2008) on the Nepalese stock market, which exhibits a significant relationship between political uncertainty and negative stock returns. Further, Dangol also presents evidence that the share price adjustment takes up to three days following the event.

Kim and Mei (2001) found significant results on volatility and returns when analyzing the political risks and its effects on the Hong Kong stock market again in 2001. They found that a significant move in the market can be associated with political news and that volatility seems to increase more on bad news than good. This is in line with the results of a study carried out on the largest political events in Germany during the 1900s by Bittlingmayer (1998). During the First World War, there was a significant increase in volatility on the German stock market which was followed by a steady decline when the political situation stabilized.

Research also exist covering the subject of how new trade agreements might affect the returns of the stock market. Moser and Rose (2014) for example, analyzed over 200 trade agreements announcements spanning over 80 economies during a time period of 20 years. Their findings indicate that there exists strong evidence that when trade agreements are signed, especially between countries with already extensive trading, stock markets tend to experience positive returns.

3.3. Previous studies on Brexit

Over two trillion dollars of value representing 5 percent of the Global equity markets were lost at the first trading day following the UK referendum. Worst performing were European countries with high debt to GDP ratios such as Portugal, Ireland, Italy, Greece, and Spain (PIIGS). Using an event study approach, Burdekin et al. (2018) found that PIIGS stock markets collectively experienced a negative abnormal return of 5 percent during the event day. Amongst the best performing stock markets on the Brexit announcement were not surprisingly nations outside of the EU such as Brazil, Russia, India, China and South Africa (BRICS).

Oehler, Horn & Wendt (2017) researched the relation between firm internalization impact and its correlation with short-term (intraday) stock returns during Brexit. They conducted their study based on companies included in the FTSE 100. By doing an event study of the first trading minutes on the first trading day after Brexit, they found that companies with a higher level of international sales were less affected than their domestically exposed counterparties. Their findings suggest that diversification plays an important role for investors when country-specific risk events take place.

According to Ramiah, Pham & Moosa (2017), the Brexit referendum affected some sectors more than others. In their study on the sectoral effects of Brexit on UK companies, they find that the banking and travel/leisure sectors were the ones experiencing the lowest abnormal return although most sectors reacted negatively. They elaborate on possible explanations, one which entailed increased costs when banks would move their headquarters from the UK to other regions. Furthermore, they discuss the anticipated decrease of the Sterling Pound, making it more expensive for UK citizens to travel abroad. The sectors holding up the best were the Beverages, Aerospace and Defense, Forestry and Paper, Tobacco and Alternative Energy industries.

However, there is research stating that Brexit will be irrelevant to the financial services sector. According to Ringe (2018), it is in the joint interest of the UK and EU to find an agreement on retaining the benefits of a single market for financial services in Europe. If the UK and the EU fail to achieve such an agreement, private solutions of market actors are likely to occur. This would lead to, in either of the cases, that the long-term substantial effect on financial services is limited.

With the final Brexit date pushed forward from Mars to October 2019 and with no current agreement on the" leave package", the uncertainty of the long-term implications of Brexit still remains.

4. Hypothesis

Given the research question, previously conducted studies within similar fields (Niederhoffer, 1971; Kim and Mei, 1994, 2001; Dangol, 2008) and the literature surrounding the theoretical background, a number of hypotheses can be formulated.

4.1. Abnormal Returns Hypothesis

First hypothesis:

> **H1:** The outcome of the Brexit Referendum was unexpected and had a statistically negative effect on the returns of the Swedish Stock market $AR \neq 0$

This hypothesis will be tested using an event study methodology, measuring cumulative abnormal returns surrounding the event of interest, i.e. the Brexit referendum. The event study builds upon the assumption of efficient markets and that the event outcome was unexpected. This means that the market efficiently incorporates newly available information into share prices. As previously discussed, Brexit could be seen as a widely unexpected event as most polls and experts indicated that the ‘’stay side’’ would gain majority.

4.2. Sector-specific hypothesis

Previous studies exhibit a difference in returns depending on the sector (Oehler et al., 2017; Ramiah et al., 2017). Public information indicated that some goods and services were target to higher tariffs and new regulations thus should be more affected (OECD, 2016). Based on this, we argue that under the efficient market hypothesis, the sectoral differences should be reflected in the company returns upon Brexit. Given this, the following hypothesis is formulated:

Second hypothesis:

> **H2:** The mean abnormal return is not the same for all sectors

This hypothesis will be tested using an ANOVA-test, comparing the means of all industries to see if any differ from the others. Further, a Tukey post-hoc test will be used in order to obtain which means that differed and in what way.

4.3. Firm-Specific hypothesis

The following hypothesis builds upon the theory that firm's specific characteristics should have an impact on returns. Companies with UK exposure are believed to be affected negatively following Brexit due to increased barriers of trade. Under the efficient markets hypothesis, this will have a substantial impact on companies' returns. We also believe that firm-specific metrics such as valuation and leverage ratio will have an effect as they are important for stability and returns, which is in line of previous research (Bhandari, 1988; Loughran & Wellman, 2010; Fama & French, 1995).

Third hypothesis:

> **H3:** Companies' UK exposure and firm-specific metrics do have an impact on companies' returns surrounding the Brexit Referendum

This hypothesis will be tested through a cross-sectional regression. A more thorough description of the included variables can be found in the methodology section 6.3.

5. Data and Methodology

5.1. Data and sample selection

In order to construct a proxy representing the Swedish stock market, we have gathered data from the Thomson Reuters Eikon terminal. Publicly listed companies in Sweden and their returns have been retrieved as per daily closing prices in SEK during the relevant time period surrounding the Brexit referendum. Some companies have been removed from the dataset because of various reasons, mentioned below, that would make them unsuitable for the study according to existent literature.

As the Nordic exchanges were closed on the 24th of June due to the multinational ‘’midsommarafton’’ holiday, a small number of companies had to be removed due being cross-listed. This is done in order to give a representable view of the initial reaction of Brexit on Swedish stocks. As cross-listed companies trade on two or more exchanges, of which at least one was open on June 24th, this would affect their initial reaction. Further, Pirinsky and Wang (2006) concluded that companies with headquarters located abroad have weaker co-movement. Therefore, we exclude stocks with international headquarters to obtain a better understanding of the fluctuations on the Swedish market specifically. All companies with missing data 20 days upon the event, was also disregarded from the sample. This is in accordance with the Brown & Warner (1980) guidelines when conducting an event study. Finally, we are left with a sample consisting of 167 Swedish companies that were publicly listed in Sweden at the time of the event (Appendix 4).

The index used as a benchmark market portfolio for the event study is the MSCI World Index. The MSCI World Index represents large- and mid-cap companies from 23 developed countries all around the world (MSCI, 2018). This data is also retrieved from Thomson Reuters Eikon as per daily closing prices expressed in SEK.

To be able to conduct the sector study, we divide the companies into different groups using the Global Industry Classification Standard in accordance with Bhojraj, Lee & Oler (2003) provided by Thomson Reuters Eikon. Their study exhibits that the GICS system is significantly better in explaining cross-sectional variations and key financial ratios than other classification systems such as the Standard Industry Classification (SIC) and North American Industry Classification System (NAICS). Below are the summary statics of sector classification:

Table 1. Company sectors

Table 1 exhibits the companies in the sample categorized into groups using the Global Industry Classification Standard.

Industry	Freq	Percent	Cum
Communication Services	6	3.59	3.59
Consumer Discretionary	27	16.17	19.76
Consumer Staples	7	4.19	23.95
Energy	2	1.20	25.15
Financials	12	7.19	32.34
Health Care	17	10.18	42.51
Industrials	48	28.74	71.26
Information Technology	20	11.98	83.23
Materials	8	4.79	88.02
Real Estate	20	11.98	100.00
Total	167	100.00	

Furthermore, to determine if companies in the sample have exposure to the UK each individual company's annual report is examined. If a company states that they obtain revenue from the UK in their sales breakdown, we classify them as exposed to the UK. Annual reports are obtained through Valu8 and are as of 2015. The way of collecting data is subject to improvement as all companies do not specify their revenue by region. However, to give more robustness to our dataset, more thorough controls are made using the company's as well as subsidiary webpages. If no results are found using the above-mentioned methods, the company is disregarded as the UK exposed. Below are the summary statistics of UK exposure:

Table 2. Company UK Exposure

	Freq.	Percentage
Companies without UK Exposure	62	37.13
Companies with UK Exposure	105	62.87
Total	167	100.00

5.2. Event Study

There are different structures one can apply when conducting an event study. In this paper, MacKinlay's (1997) general method of carrying out an event study will be used as a main template for the methodology structure.

5.2.1. Define the event of interest and time period

Event of interest

This paper aims to investigate the Brexit event which occurred on the evening of the 23rd of June 2016. The first Swedish trading day following Brexit was Monday the 27th hence this is used as the event day (day 0).

Time Period

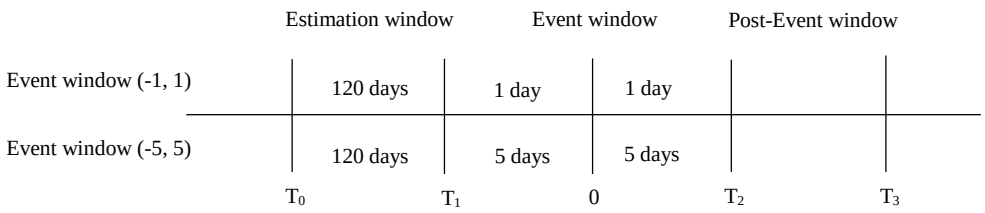
The time frame of an event study can be divided into three different main windows: the estimation period, the event window and the post-event window. The event window is divided into sub-windows with a time period before and up to the event of interest, the event of interest itself and a period after.

When identifying the time frame for the event window, it is customary to define that window as a longer period than just the day of the event of interest, also including periods of times surrounding the event (MacKinlay, 1997). The opinions regarding how long the event window should be differ in academic literature and between fields. When examining cumulative abnormal returns following American cross-listings, Karolyi (1993) study the listing week. This can be compared to the event window suggested by MacKinlay (1997) who proposes a time frame of at least 1 day before the event of interest to 1 day after. Further, Brown and Warner (1985) use an event window of -5 and +5 days when simulating an event with stochastic effects. Dangol (2008) experienced lagging returns on stock reaction to political events of up to 3 days and therefore used an event window from -10 to 10 days. Previous literature therefore disagree in regards to length of event window. Based on this information we set our initial event window days to -5 to 5 later divided into subsequences in order to capture the entire event movement. However, if the event effect is found within a smaller window our initial one will be disregarded.

The estimation period prior to the event window also varies between different researchers and can differ from 100 to 300 days prior to the event (Peterson, 1989). However most suggestions point towards approximately 120 trading days, therefore, we will use 120 days in our event study in accordance to MacKinlay (1997)

Figure 1: Timeline

Figure 1 illustrates the timeline used in the event study to calculate the abnormal and cumulative abnormal returns.



Where T_1-T_0 represents the estimation window, T_2-T_1 represents the event window.

5.2.2. Define and estimate the normal return

In order to measure the impact of the event, the abnormal returns have to be calculated. To do this, one has to know the normal return i.e. the theoretical return of a security in case the event never occurred. As MacKinlay describes, the abnormal return for firm *i* at event date *t* is equal to:

$$AR_{it} = R_{it} - E(R_{it}|X_t) \quad (1)$$

Where AR_{it} is the abnormal return, R_{it} is the actual return of stock i at time t and $(R_{it} \mid X_t)$ is the theoretical normal return.

Strong (1992) gives an overview of different approaches that can be used to estimate the normal return, some more data generating intense than others using the Arbitrage Pricing Theory or economic models inspired by CAPM. However, MacKinlay (1997) mentions two other common models for calculating the normal return. The constant mean return model and the market model.

Brown and Warner (1980, 1985) argue that the Constant Mean Return Model gives results similar to much more advanced models. However, a study conducted by Cable and Holland (1999) raises a cautious warning about the strength of these models (CAPM, Constant Mean Return Model), questioning the old literature. Their results suggest that the market model has the most explanatory power, and it is also the most used model according to Armitage (1995). Based on the stated arguments, the Market Model is conducted when computing the abnormal returns in this study:

$$AR_{i,t} = R_{i,t} - \left(\hat{\alpha}_i + \hat{\beta}_i \times R_{m,t}\right) + \varepsilon_{i,t} \quad (2)$$

Where AR_i is the abnormal return on company i at time t and $(\alpha_i + \beta_i \times R_{mt})$ is the normal return given by the Market Model. The $\hat{\alpha}_i$ and $\hat{\beta}_i$ are acquired through a robust regression estimation. Robust standard errors are used due to possible heteroscedasticity.

5.2.3. Aggregation of the abnormal return and the cumulative abnormal returns

The objective of this study is to find a general answer and in order to investigate any general or overall effects, the abnormal returns calculated in the previous section must be aggregated. We want to examine the impact of Brexit on the entire sample and not on individual companies, and thus we aggregate through time and then find average abnormal returns for the period. The following formula presented by MacKinlay (1997) is used to calculate the average abnormal returns:

$$\overline{AR_\tau} = \frac{1}{N} \sum_{i=1}^{N} \widehat{AR_{i\tau}} \quad (3)$$

To calculate the cumulative abnormal returns, we aggregate abnormal returns through time. This to be able to observe the abnormal returns during different time spans in the event window. CAR is for company *i* in the event window τ_1 to τ_2:

$$\widehat{CAR}(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau=2} \widehat{AR_{i\tau}} \quad (4)$$

The average cumulative return for the entire sample in the event windows is calculated by:

$$\overline{CAR}(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau=2} \overline{AR_{i\tau}} \quad (5)$$

5.2.4. Test AAR and CAAR for significance

The AAR and CAAR will be tested for their respective significance. This is done through a t-test.

5.3. ANOVA-test and regressions used to explain CAR

The following section will consist of the method used to investigate our second and third hypothesis. An ANOVA-test will be used to examine if the mean abnormal return for all sectors were equal (or if any differ from another) during the days surrounding the Brexit Referendum. We test the hypothesis that some sectors were affected more (or less) by Brexit. As we cannot exclude heteroscedasticity with certainty, we add a non-parametric Kruskal-Wallis test to see if the results are in line with the ANOVA-test. If so, we expect the ANOVA results to be trustworthy.

A cross-sectional model is developed to test the firm-specific characteristics hypothesis. Constructing a cross-sectional regression model is a common phenomenon in economics when examining which factors that might affect security returns (Kothari & Warner, 2007). Table 3 below will present the main empirical variables used in the regression and the theoretical reasoning behind incorporating them.

Table 3. Cross-sectional regression variables

Table 3 illustrates and explains the variables used in the cross-sectional regression model. The data is retrieved through Thomson Reuters Eikon and companies' annual reports.

CAR_i	The cumulative abnormal return from the Swedish companies in the event window.	Dependent variable
$EVEBITDA_i$	Enterprise Value/Earnings Before Interest, Taxes, Depreciation and Amortization. It is a financial multiple that is used to value companies. The main perk of using this financial metric is that it takes into account that companies have different levels of debt. Substantial research shows the existing correlation between Enterprise Valuation metrics and stock returns. Loughran and Wellman (2010) for example, conclude that firms with a higher multiple should experience lower returns and vice versa.	Independent variable
PBV_i	Price to Book value. Price to book value is calculated by dividing the firms' market cap by the book value of its assets. In previous research, the impact on share returns from price to book value has been broadly examined. For example, Chan and Chen (1991) and Fama and French (1995) concludes that low price to book firms are riskier and, therefore, more likely to fail under "adverse economic conditions" than other companies.	Independent variable
$MKTCAP_i$	Logarithmic Market Capitalization. We transform our market cap variable to a log variable in order to make the relationship between the dependent and independent variable linear, and correct for exponential growth in accordance with Brooks (2014). Ever since Banz (1981) discussed size and stock returns, the so-called "size effect" has been broadly used when explaining company returns. It means that smaller firms should experience higher returns according to empirical research. Following this documented relationship, the market cap is included in the regression.	Independent variable
DE_i	Debt to Equity Ratio. This ratio is commonly regarded to as one of the main leverage ratios of a firm and is used to evaluate both the risk and financial health of a company. Bhandari (1988) has shown that there is a relationship between stock return and D/E ratio. This is also confirmed by Barbee et al. (1996) and will therefore be included in the regression for its possible explanatory power. The debt to equity ratio can be calculated using the annual or quarterly report. The data for debt to asset ratios has been retrieved from Eikon Thomson Reuters which calculates D/E as per the last annual report.	Independent variable
$UKEX_i$	UK exposure of Swedish company. The multiple ''UKEX'' is a variable reflecting each individual company's exposure towards the UK. ''UKEX'' is implemented as a dummy variable with the number 1 if the annual report states that a company has sales within the UK and 0 otherwise. We have manually calculated the ratio by using the annual report of 2015 for each individual company. If there is no specification in the annual report, an assumption of zero percent is applied. Companies with recurring revenue in the UK should be more affected as these companies' goods and services could be target for barriers of trade in the future.	Dummy variable

$$CAR_i = \beta_{0i} + \beta_{1i}EVEBITDA + \beta_{2i}PBV + \beta_{3i}MKTCAP + \beta_{4i}DE + \beta_{5i}UKEX + \varepsilon_{it} \quad (6)$$

6. Results

6.1. Event study results

In the following section, the empirical results from the event study will be presented.

Table 4. The Abnormal return
Table 4 presents the average abnormal returns (AR) for the full sample consisting of 167 Swedish firms. Abnormal returns are calculated using the market model (equation 3). The ARs are presented for each day of the event window from -5 to +5 days with day 0 representing the first trading day following Brexit. Returns are presented in percentage with their respective t-statistics in the parenthesis.

Days relative to the Brexit referendum	AR
– 5	1.92***
	(11.95)
– 4	1.76***
	(10.61)
– 3	0.158
	(1.31)
– 2	0.317***
	(2.70)
– 1	0.941***
	(7.80)
0	– 4.09***
	(-20.85)
1	0.401
	(1.59)
2	1.35***
	(7.22)
3	0.756***
	(4.23)
4	1.14***
	(7.06)
5	– 0.0884
	(-0.58)
Observations	167

t statistics in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

The results are based on the equations presented in section 6 and are calculated using an OLS regression. As discussed earlier, the outcome of the referendum was unexpected and the significant abnormal return of -4.09 percent on the first trading day (Day 0) supports this. Interesting to notice is the significant positive returns the days prior to the event. During these days polls in well-reputed news outlets such as the Financial Times indicated that the UK would remain within the EU. One can argue that the positive abnormal return on the days before Brexit is due to markets incorporating assumptions of a stay within the European Union. We also observe significant positive abnormal returns for the days after

Brexit. Probably relating to speculations regarding the consequences of a potential "hard" or "soft" Brexit with special trade deals being tailored with the EU, acting as market support (Mardell, 2016). Bank of England and other institutions presented statements which could have further influenced returns. However, as concluded by Dangol (2008), the correct market adjustment sometimes take up to a few days following the event which also could be the case with the Swedish stock market reaction following Brexit.

Table 5. The Cumulative Abnormal Returns

Table 5 presents the average cumulative abnormal returns (CAR) for the 167 Swedish stocks. The CAR is calculated by aggregating the ARs presented in table 1. The results are presented in percentage form with t statistics in parenthesis.

	– 5 to 5	– 1 to 1	– 1 to 0	0 to 1
CAR	4.53***	– 2.51***	– 2.46***	– 3.47***
	(9.31)	(-9.51)	(-10.91)	(-13.37)
Observations	167	167	167	167

t statistics in parentheses

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

Looking at table 5, we have aggregated the abnormal returns to the specific event windows. As previously discussed, we observe that the abnormal returns in the longer event window (-5 to 5) were significantly positive and because of this, a shorter event window suggested in MacKinlay is used when further testing the cross regression model to examine the negative abnormal returns in section 7.3.

In the other event windows investigated, we observe negative abnormal returns realized at a 1 percent significance level. This indicates that these days were highly affected by the event, in line with the Swedish Stock Exchanges drop of -6.3 percent within the first minutes and a total of -7.8 percent on the day. These results are supported by previous findings around stock market reactions to the outcome of the Brexit referendum (Oehler, 2017; Burdekin et al., 2018). It is also consistent with previous literature like Niederhoffer (1971) and Bittlingmayer (1998) who concludes that the outcome of a large political event can have a significant impact on the stock market. Given these results, the first hypothesis **H1**: ''*the outcome of the Brexit Referendum was unexpected and had a statistically negative effect on the returns of the Swedish Stock market AR≠0''* is supported. The event did have an effect on the Swedish stock market, AR≠0.

6.2. Results from the sector study

A one-way ANOVA is used to determine whether any sector had a mean abnormal return that would differ from the others. The test is applied on all three time periods to see if there was any significant difference in any given period. The data is mean plus/minus the standard error. The sectors were classified into ten different groups: Consumer Discretionary (n = 27), Consumer Staples (n = 7), Communication Services (n = 6), Energy (n = 2), Financials (n = 12), Health Care (n = 17), Industrials (n = 48), Information Technology (n = 20), Materials (n = 8) and Real Estate (n = 20), as illustrated in Table 1.

6.2.1. ANOVA test; -1 to 1

There was a statistically significant difference between groups as determined by the one-way ANOVA (F (9,157) = 2.49, p = .0109) in the timespan -1 to 1. A Tukey post-hoc test revealed that the CAR was statistically significantly higher in the Real Estate sector compared to the Industrials sector (.0302 ± .0087, p = .023). However, there were no statistically significant differences between the other sectors. A plausible explanation for the Real Estate sector being different from Industrials is that the exposure towards the UK tends to be lower amongst Real Estate companies, while Industrials are very export-reliant (Hatzigeorgiou & Nixon, 2018).

The result from the ANOVA-test is further supported by a non-parametric Kruskal Wallis-test.

6.2.2. ANOVA test; -1 to 0

There was no statistically significant difference between groups as determined by one-way ANOVA (F (9,157) = 1.15, p = .3308) for the -1 to 0 timespan. Therefore, we cannot say that any sectors mean abnormal returns differed from the others. This implies that all sectors mean return were equal, showing signs that the selloff taking place at in this event window was equally distributed between industries. What makes this different from the results in 7.2.1 is that the Real Estate sector most probably was affected initially, but made a quicker recovery as the market adjusted their expectations.

The result from the ANOVA-test is further supported by a non-parametric Kruskal Wallis-test.

6.2.3. ANOVA test; 0 to 1

There was a statistically significant difference between groups as determined by one-way ANOVA (F (9,157) = 3.02, p = .0023) in the timespan 0 to 1, in line with the timespan -1 to 1. Once again, the Tukey post-hoc test revealed that the CAR was statistically significantly higher in the Real Estate sector compared to the Industrials sector (.0328 ± .0085, p = .006). One can argue that the same holds for Industrials compared to

Health Care as well, however, the result is just outside the significance level of 95% (-.0278 ± .0090, p = 0.070*).* Other than these, there were no statistically significant differences between sectors. As discussed in 6.2.1 and 6.2.2, our theory that Real Estate made a quicker recovery compared to Industrials can be confirmed. One can also argue that the Industrial sector was the most affected, as their mean negative abnormal return is the highest amongst all sectors. We would, therefore, like to emphasize our statement from 6.2.1, stating that Sweden is an industrial reliant country with a large amount of exports coming from the Industrial and Basic Material sectors. Thus, these sectors should be affected more than others in long-run as real expectation regarding the Brexit is adjusted for. Our results are in line with Ramiah et al., (2017), declaring that some sectors were more negatively affected than others.

The result from the ANOVA-test is further supported by a non-parametric Kruskal Wallis-test.

From this, we can find partial support for our second hypothesis **H2**: *''The mean abnormal return is not the same for all sectors''* as at least one sector pair differed in two of the timespans.

6.3. Results from the cross-sectional regression

This section presents the results from the cross-sectional regression. As explained in the methodology section we can here observe to what extent each parameter affected the Cumulative Abnormal Returns.

Table 6. Regression outputs

Table 6 presents the output of the cross-sectional regression each event windows of interest. CAR is calculated by aggregating ARs obtained from the abnormal return formula. The variables included in this regression is EV/EBITDA, P/BV, D/E, LN Market Cap and UK Exposure. UK exposure is represented by a dummy variable with number 1 if true and 0 otherwise. The results are presented in percentage with t statistics in parenthesis.

	CAR -1 to 1	CAR -1 to 0	CAR 0 to 1
EV/EBITDA	-0.00531	-0.013	-0.00515
	(-0.27)	(-0.99)	(-0.25)
P/BV	0.0196	0.0186	0.0121
	(0.96)	(1.10)	(0.52)
D/E	-0.0976	-0.0924	-0.0599
	(-0.91)	(-0.92)	(-0.55)
LN Market Cap	0.0967	0.0288	0.160
	(0.75)	(0.28)	(1.26)
UK Exposure	-1.83***	-0.759*	-1.70***
	(-3.40)	(-1.66)	(-3.28)
Constant	-3.24	-2.35	-5.61**
	(-1.22)	(-1.05)	(-2.08)
N	167	167	167

t statistics in parentheses

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

From Table 6 we observe different results over the three time periods. In common for all three timespans, UK exposure is the only variable being significant, however, the level of significance differ between time periods investigated. The strongest significance is realized within the -1 to 1 and 0 to 1 timespans at the 1 percent level. This supports our hypothesis that companies with UK exposure were affected more by Brexit than their peers. However, in the -1 to 0 timespan we observe significance only at the 10 percent level, indicating a weaker correlation. A plausible explanation to this could be that the market participants did not emphasize the UK exposure as much as in the later timespan. Further, as the market later interpreted news on tariffs and other cross-border regulations that could possibly emerge (OECD, 2016), companies exporting to the UK will experience higher cost. Once again, this implicates that the markets adjusted their expectations on future returns to the new risks associated with Brexit. Our findings further support that the full adjustment of stock prices to political information in some cases takes up to a few days which is in line to Dangol (2008). However, as UK exposure is the only

variable showing significance any given level, our findings seems to contradict previous research concluding the importance of the other metrics used. While true for other events, Brexit can be regarded as a special situation and thus, companies with UK exposure should me more affected than those who are not. One can argue that company multiples had a limited impact on the abnormal return in this study, due to the low need of adaption.

Further, as the ANOVA-test concluded that the Industrial sector differed in two of the timespans, it is included in order to see if sectors has any explanatory value on the abnormal returns. Therefore, we add an additional variable to represent this, hence the following regression is used:

$$CAR_i = \beta_{0i} + \beta_{1i}UKEX + \beta_{2i}LNMKTCAP + \beta_{3i}PBV + \beta_{4i}EVEBITDA + \beta_{5i}DE + \beta_{6i}Industrials + \varepsilon_{it} \quad (6)$$

When running the regression with the additional parameter we conclude that Industrials was not significant in the -1 to 0 timespan, as previously indicated by the ANOVA results. Therefore, we once again expect that the sell-off occurred regardless of with sector the security belonged to. In the other timespans, however, the Industrial sector showed a negative relationship to Abnormal Returns together with UK exposure. This indicates that if a company had UK exposure or were classified as an Industrial company they tended to deliver lower returns. A plausible explanation for this could be that 8 out of 20 companies with the highest sales percentage in the UK are Industrials (Swedbank, 2019). However, aside from its direct exposure, Swedish industrial companies also have a large indirect exposure through its supply chain (Hatzigeorgiou & Nixon, 2018). The combination of these two factors could act as a possible reason why we observe that Industrial companies are experiencing lower significant abnormal returns than the other sectors.

Table 7. Extended regression output

Table 7 presents the output of the extended cross-sectional regression for the event windows of interest. CAR is calculated by aggregating ARs obtained from the abnormal return formula. The variables included in this regression is EV/EBITDA, P/BV, D/E, LN Market Cap, UK Exposure and the Industrials sector. The results are presented in percentage form with t statistics in parenthesis.

	CAR -1 to 1	CAR -1 to 0	CAR 0 to 1
EV/EBITDA	– 0.0136	– 0.0175	-0.0140
	(-0.70)	(-1.31)	(-0.70)
P/BV	0.0182	0.0178	0.0107
	(0.85)	(1.01)	(0.44)
D/E	– 0.0990	– 0.0932	– 0.0614
	(-0.88)	(-0.90)	(-0.54)
LN Market Cap	0.116	0.0390	0.180
	(0.92)	(0.37)	(1.45)
UK exposure	– 1.61***	– 0.637	– 1.46***
	(-3.01)	(-1.32)	(-2.86)
Industrials	– 1.52***	– 0.822	– 1.63***
	(-2.85)	(-1.59)	(-3.13)
Constant	– 3.20	– 2.32	– 5.56**
	(-1.21)	(-1.03)	(-2.07)
Observations	167	167	167

t statistics in parentheses

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

Therefore, there is partial support to our last null hypothesis: **H3** *''Companies' UK exposure and firm-specific metrics do have an impact on companies' returns surrounding the Brexit Referendum''* as companies with UK exposure were affected more than their peers.

A summary of our findings can be found in table 8 below:

Table 8. Hypotheses outcome summary

H1	The outcome of the Brexit Referendum was unexpected and had a statistical effect on the returns of the Swedish Stock market AR≠0	Supported
H2	Some sectors will be more affected by the outcome of the Referendum in terms of abnormal returns than others	(Partially) supported
H3	Companies' UK exposure and firm-specific metrics do have an impact on companies' returns surrounding the Brexit Referendum	(Partially) supported

7. Conclusion

The UK's decision to leave the EU is one of the most recognized political events in modern time. The general consensus amongst previous researchers is that the Brexit referendum affected many financial market in a negative way (Burdekin et al., 2018; Oehler et al., 2017; Ramiah et al., 2017). This thesis aimed to investigate the effects on the Swedish stock markets by implementing an event study followed by a sector-specific study, as well as a cross-sectional regression. It stands out from previous research by (1) deeper examining a non-UK EU country's reaction to Brexit, (2) it also helps to understand how different industries are affected by the event of a withdrawal of an EU-member and (3), it provides an insight into how companies with a direct exposure, such as sales, to a leaving EU-member are affected by an event like Brexit.

The results from the event study indicated that the Swedish stock market did experience a negative abnormal return on the event date, however, this effect quickly reversed due to probable speculations regarding the consequences of a potential "hard" or "soft" Brexit as well as comments from several prominent business.

Initially, we could not conclude that any sector showed a lower abnormal return in the timespan -1 to 0. However, looking at the recovery timespan (0 to 1) we observe that the Industrial sector differ negatively from at least one other. This indicates that Industrials did not reverse like the rest of the sectors hence being the most affected. One can argue that a plausible reason behind this is the large UK sales exposure some Industrial companies have (Swedbank, 2019).

When the cross-sectional regression was conducted, we observed that UK exposure is the only variable showing significance. Therefore, in line with our hypothesis, companies with UK exposure were more affected than their peers as their performance expectations has to be adjusted to reflect the additional costs associated with Brexit.

Last, we included an additional variable for the Industrial sector in our cross-sectional regression. This parameter showed significance in the -1 to 1 and 0 to 1 timespan and further supports the ANOVA-results that the Industrials sector were more affected than the others by the Brexit referendum in those timespans.

As the actual exit date is yet to be decided, uncertainty of the long-term implications of Brexit still remains unclear. However, this study has provided a guidance to understand the initial Swedish stock market reaction to Brexit.

Limitations

The sample of companies was reduced due to various reasons presented in the data section. The most common reasons for excluding companies were limited trading data (or price gaps) due to low liquidity. This might skew the sample towards larger companies traded more frequently hence not giving an accurate picture of the market as a whole.

Further, the Swedish stock markets were closed on June 24th while the rest of the world was opened. This gave investors an additional three days to think through any investment decision before acting. This is especially interesting since the results indicate a quick recovery following the initial trading days. If the exchange would have been open the day following the event, would it have reacted more?

As we have included UK exposure as a dummy variable and not as a continuous variable, the size of the exposure is not measured. As some companies do not report their international sales by country but only state the presence, we had to exclude the usage of a continuous variable in this study.

Further research

As the limitation section describes, a continuous variable for UK exposure is desirable in order to measure the size effect of exposure. Including this would add to research and improve the accuracy of how sales exposure affects abnormal returns.

Also, there are different ways of measuring sectoral effects depending on what you want to achieve. In this study, an ANOVA-test is used followed by a Tukey-post hoc test in order to find out if any sectors' return differed from the others. One cannot exclude the possibility that results would have differed with a different hypothesis and if the usage of other methods was implied such as regressions. If this is applied in future research, a more complex analysis of the sectoral effects is possible.

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9. Appendix

Appendix 1: ANOVA statistics

Sector statistics

The table below presents the different sectors and the number of observations each sector have, mean returns for each sector in the event windows of interest and standard deviations.

		-1 to 1		-1 to 0		0 to 1	
Industry	Obs	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Communication Services	6	-2.2994	2.7976	-2.5008	1.8425	-2.3460	2.8864
Consumer Discretionary	27	-3.2578	4.6410	-2.6258	3.9204	-4.2346	4.5634
Consumer Staples	7	-0.3774	1.9464	-1.9075	2.1091	-1.2214	1.7110
Energy	2	-0.0307	0.3849	1.2913	3.5033	-1.1971	2.1487
Financials	12	-3.2701	2.8419	-2.4816	3.3438	-4.3442	2.3913
Health Care	17	-1.0286	2.7615	-1.4852	2.8009	-1.9289	2.7473
Industrials	48	-3.6973	2.8361	-3.0413	2.6626	-4.7057	2.8684
Information Technology	20	-2.2521	3.0257	-3.1669	2.9180	-3.5702	2.5450
Materials	8	-2.6470	2.3967	-1.6568	2.8732	-3.6786	3.5177
Real Estate	20	-0.6756	3.6768	-1.8100	1.8178	-1.4288	3.2904
Total	167	-2.5053	3.4027	-2.4579	2.9110	-3.4704	3.3535

Analysis of Variance

Source	SS			df			MS			F			Prob > F		
	-1 to 1	-1 to 0	0 to 1	-1 to 1	-1 to 0	0 to 1	-1 to 1	-1 to 0	0 to 1	-1 to 1	-1 to 0	0 to 1	-1 to 1	-1 to 0	0 to 1
Between groups	.02401794	.008702063	.02758168	9	9	9	.00266866	.000966896	.003064631	2.49	1.15	3.02	0.0109	0.3308	0.0023
Within groups	.168188086	.131961144	.159104701	157	157	157	.001071262	.000840517	.001013406	-	-	-	-	-	-
Total	.192206026	.140663207	.186686381	166	166	166	.001157868	.000847369	.001124617	-	-	-	-	-	-

Bartlett's test for equal variances:	-1 to 1	-1 to 0	- to 1
chi2(9) =	17.6801	14.8626	16.0602
Prob>chi2 =	0.039	0.095	0.066

Appendix 2: Kruskal-Wallice test

Rank sum statistics

Industry	Obs	-1 to 1 Rank Sum	-1 to 0 Rank Sum	0 to 1 Rank Sum
Communication Services	6	538	493	622
Consumer Discretionary	27	1946	2250	1991
Consumer Staples	7	853	654	883
Energy	2	277	283	250
Financials	12	860	965	809
Health Care	17	1864	1660	1861
Industrials	48	3124	3540	3042
Information Technology	20	1768	1478	1632
Materials	8	650	766	682
Real Estate	20	2148	1939	2256
Total	167	14028	14028	14028

The outcome of the Kruskal- Wallice Test

	-1 to 1	-1 to 0	0 to 1
chi-squared =	26.342 with 9 d.f.	9.465 with 9 d.f.	30.976 with 9 d.f.
probability =	0.0018	0.3955	0.0003
chi-squared with ties =	26.342 with 9 d.f.	9.465 with 9 d.f.	30.976 with 9 d.f.
probability =	0.0018	0.3955	0.0003

Appendix 3: Cross-sectional regression statistics and tests

VIF-test for multicollinearity

Variable	VIF	1/VIF
D/E	2.48	0.404007
P/BV	2.33	0.430007
EV/EBITDA	1.11	0.902494
UK Exposure	1.06	0.939647
Industrials	1.06	0.945432
LN Market Cap	1.02	0.978231
Mean VIF	1.51	

Appendix 4: Sample firms

Sample firms

The following table contains the firms that were publicly listed in Sweden during the event of interest after the removal of unsuitable candidates. The sample sums to 167 Swedish companies listed on Nasdaq OMX, First North and Spotlight.

Sample firms	
Byggmax Group AB	Getinge AB
MQ Holding AB	Axfood AB
Bulten AB	BE Group AB (publ)
Moberg Pharma AB (publ)	Fastighets AB Balder
Concentric AB	AAK AB (publ)
Xvivo Perfusion AB	Bergman & Beving AB
Hemfosa Fastigheter AB	Assa Abloy AB
Platzer Fastigheter Holding AB (publ)	CellaVision AB
Delarka Holding AB (publ)	Elekta AB (publ)
Bufab AB (publ)	Clas Ohlson AB
Oscar Properties Holding AB	Corem Property Group AB
Recipharm AB (publ)	Dios Fastigheter AB
Kalleback Property Invest AB	Duni AB
Besqab AB (publ)	Eastnine AB (publ)
Bactiguard Holding AB	Consilium AB
Scandi Standard AB (publ)	Concordia Maritime AB
Inwido AB (publ)	Haldex AB
Granges AB	Doro AB
Lifco AB (publ)	ICA Gruppen AB
Thule Group AB	Fingerprint Cards AB
NP3 Fastigheter AB	Firefly AB
Bravida Holding AB	JM AB
Eltel AB	Lindab International AB
Dustin Group AB	Betsson AB
Troax Group AB (publ)	Enea AB
Hoist Finance AB (publ)	FormPipe Software AB
Evolution Gaming Group AB (publ)	Havsfrun Investment AB
Tobii AB	HMS Networks AB
Collector AB	ITAB Shop Concept AB
Magnolia Bostad AB	Kungsleden AB
Alimak Group AB (publ)	Klovern AB
Nilorngruppen AB	Midsona AB

Coor Service Management Holding AB
Pandox AB
Atlas Copco AB
Acando AB
Swedish Orphan Biovitrum AB (publ)
Castellum AB
Addtech AB
Biogaia AB
Biotage AB
Beijer Ref AB (publ)
Avanza Bank Holding AB
Beijer Alma AB
Bjorn Borg AB
Beijer Electronics Group AB
HiQ International AB
Intrum AB
Atrium Ljungberg AB
Gunnebo AB
Fagerhult AB
G5 Entertainment AB (publ)
Husqvarna AB
KappAhl AB (publ)
H & M Hennes & Mauritz AB
KABE Group AB
Mekonomen AB
Nederman Holding AB
New Wave Group AB
Nibe Industrier AB
Holmen AB
Knowit AB (publ)
NetEnt AB (publ)
Medivir AB
Opus Group AB (publ)
SAS AB
Svenska Handelsbanken AB
Probi AB
Swedbank AB
Skanska AB
Odd Molly International AB
Nobia AB
Addnode Group AB (publ)
Bilia AB
BillerudKorsnas AB (publ)
Investment AB Latour
Indutrade AB
L E Lundbergforetagen AB (publ)
Modern Times Group MTG AB
Eniro AB
Fabege AB
Hexagon AB
Investor AB
Mycronic AB (publ)
NCC AB
Sweco AB (publ)
Swedish Match AB
Trelleborg AB
Telefonaktiebolaget LM Ericsson
Lagercrantz Group AB
Nolato AB
SkiStar AB
AF Poyry AB
Elos Medtech AB
Hexpol AB
Invisio Communications AB
Lammhults Design Group AB
GHP Specialty Care AB (publ)
Cloetta AB
Loomis AB
Sagax AB
Catella AB
Boliden AB
Alfa Laval AB
Skandinaviska Enskilda Banken AB
AB SKF
Telia Company AB
Electrolux AB
Svenska Cellulosa SCA AB
Sandvik AB

Peab AB	Volvo AB
Svedbergs i Dalstorp AB	Tele2 AB
Ratos AB	Tethys Oil AB
Vitrolife AB	Eolus Vind AB (publ)
Rottneros AB	Systemair AB
Sectra AB	Sensys Gatso Group AB
Securitas AB	Wallenstam AB
Semcon AB	Vitec Software Group AB (publ)
FastPartner AB	RaySearch Laboratories AB (publ)
Hufvudstaden AB	Saab AB
Wihlborgs Fastigheter AB	SSAB AB
Victoria Park AB	Bredband2 i Skandinavien AB
Rejlers AB (publ)	

Appendix 5: Tests of model assumptions including UK exposure

Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

Ho: Constant variance
Variables: EV/EBITDA, P/BV, D/E, LN Market Cap, UK Exposure

chi2(6) = 1.66
Prob > chi2 = 0.8942

White's test for Ho: homoscedasticity

against Ha: unrestricted heteroscedasticity

chi2(19) = 6.64
Prob > chi2 = 0.9959

Cameron & Trivedi's decomposition of IM-test

Source	Chi2	df	p
Heteroscedasticity	6.64	19	0.9959
Skewness	4.51	5	0.4791
Kurtosis	2.69	1	0.1008
Total	13.84	25	0.9831

Appendix 6: Tests of model assumptions including UK exposure and Industrials

Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

Ho: Constant variance

Variables: EV/EBITDA, P/BV, D/E, LN Market Cap, UK Exposure, Industrials

chi2(6) = 4.63

Prob > chi2 = 0.5920

White's test for Ho: homoscedasticity

against Ha: unrestricted heteroscedasticity

chi2(25) = 10.64

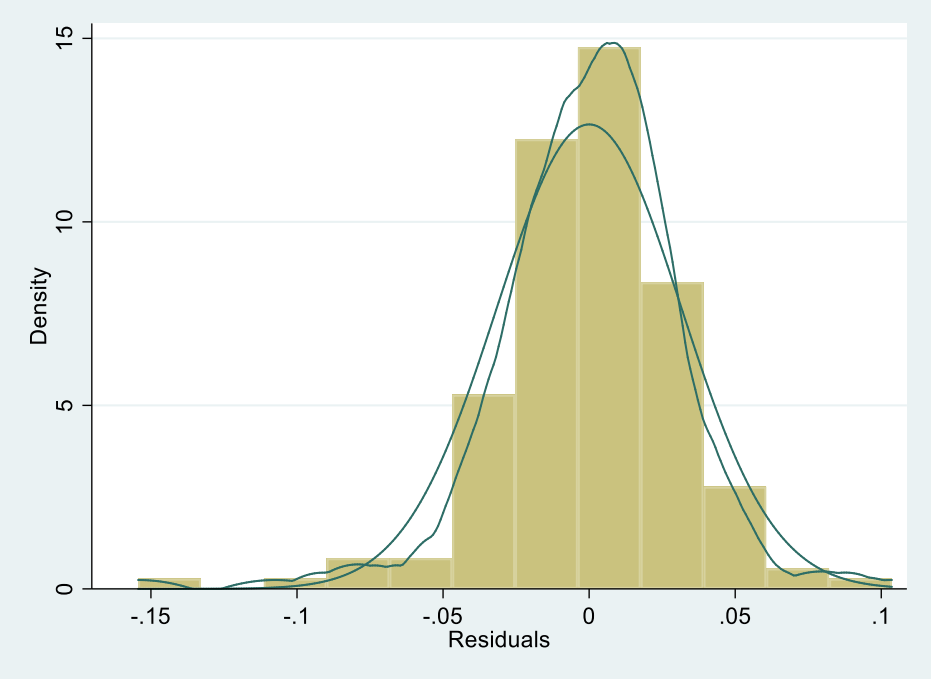
Prob > chi2 = 0.9945

Cameron & Trivedi's decomposition of IM-test

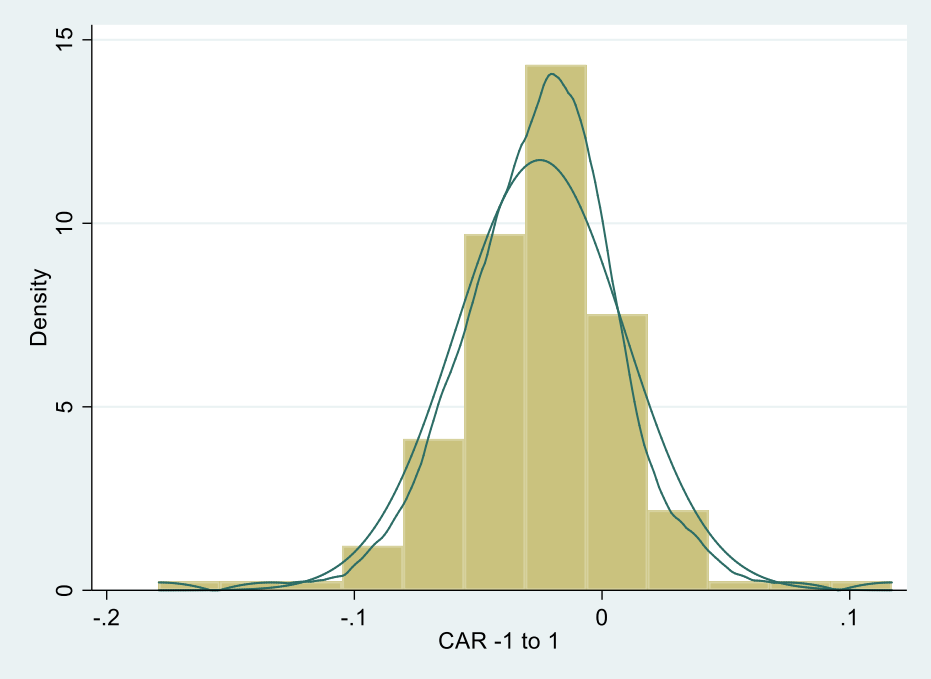
Source	Chi2	df	p
Heteroscedasticity	10.64	25	0.9945
Skewness	4.44	6	0.6172
Kurtosis	2.33	1	0.1266
Total	17.41	32	0.9831

Appendix 7:
Kernel Density tests

Resid, Kdensity Normal



CAR -1 to 1, Kdensity Normal



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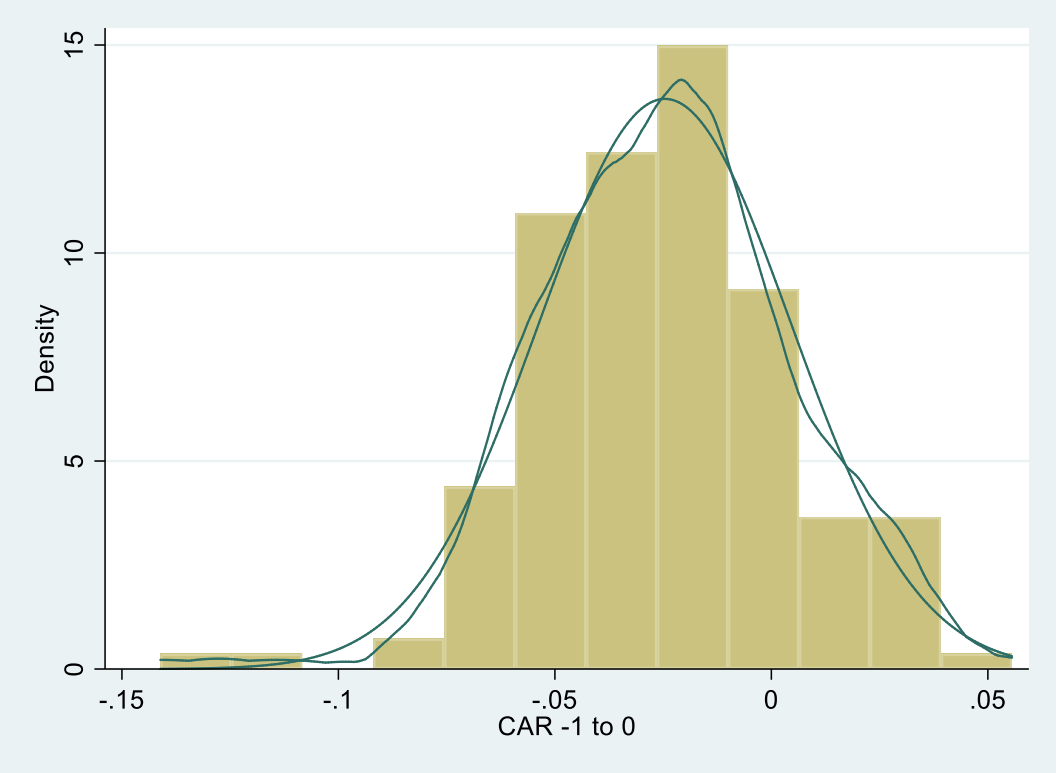
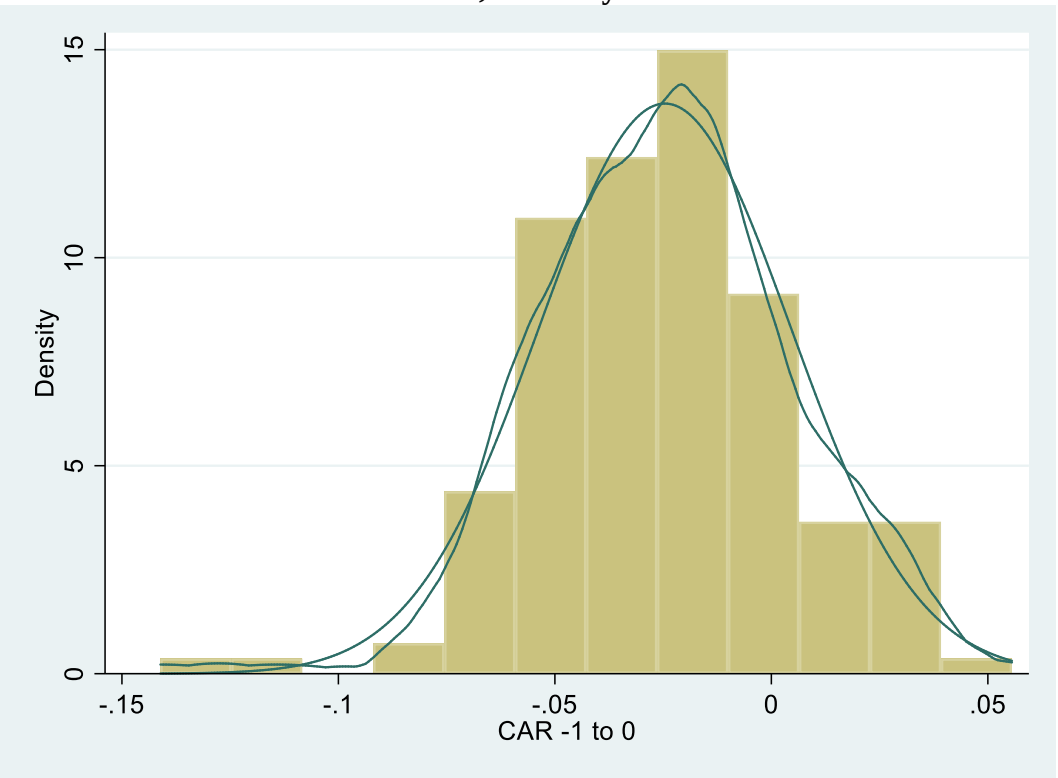


CAR 0 to 1, Kdensity Normal



Appendix 8: Correlation test

Correlation between regression variables

	EV/EBITDA	P/BV	D/E	LN Market Cap	UK Exposure	Industrials
EV/EBITDA	1.0000					
P/BV	0.0871	1.0000				
D/E	0.2294	0.7447	1.0000			
LN Market Cap	-0.0802	0.0922	0.0314	1.0000		
UK Exposure	0.0145	-0.0551	-0.1547	0.0220	1.0000	
Industrials	-0.1552	-0.0500	-0.0846	0.0727	0.1594	1.0000

Appendix 9: Tukey post-hoc test

CAR -1 to 1			Contrast	Std.Err.	t	P>t	[95%_Conf	Interval]
Consumer Discretionary	vs.	Communication Services	-.0095841	.0147723	-0.65	1.000	-.0569995	.0378314
Consumer Staples	vs.	Communication Services	.0192206	.0182094	1.06	0.988	-.0392271	.0776683
Energy	vs.	Communication Services	.0226869	.026724	0.85	0.998	-.0630909	.1084646
Financials	vs.	Communication Services	-.0097067	.0163651	-0.59	1.000	-.0622346	.0428213
Health Care	vs.	Communication Services	.012708	.0155422	0.82	0.998	-.0371786	.0625946
Industrials	vs.	Communication Services	-.0139791	.0141726	-0.99	0.993	-.0594696	.0315114
Information Technology	vs.	Communication Services	.0004736	.015235	0.03	1.000	-.0484272	.0493745
Materials	vs.	Communication Services	-.0034758	.0176763	-0.20	1.000	-.0602125	.0532608
Real Estate	vs.	Communication Services	.016238	.015235	1.07	0.987	-.0326629	.0651388
Consumer Staples	vs.	Consumer Discretionary	.0288047	.0138821	2.07	0.548	-.0157536	.073363
Energy	vs.	Consumer Discretionary	.032271	.0239856	1.35	0.941	-.0447169	.1092589
Financials	vs.	Consumer Discretionary	-.0001226	.0113555	-0.01	1.000	-.0365711	.036326
Health Care	vs.	Consumer Discretionary	.0222921	.0101337	2.20	0.461	-.0102346	.0548188
Industrials	vs.	Consumer Discretionary	-.004395	.0078736	-0.56	1.000	-.0296675	.0208775
Information Technology	vs.	Consumer Discretionary	.0100577	.0096561	1.04	0.989	-.0209359	.0410514
Materials	vs.	Consumer Discretionary	.0061083	.0131751	0.46	1.000	-.0361807	.0483973
Real Estate	vs.	Consumer Discretionary	.0258221	.0096561	2.67	0.194	-.0051716	.0568157
Energy	vs.	Consumer Staples	.0034663	.0262425	0.13	1.000	-.0807658	.0876984
Financials	vs.	Consumer Staples	-.0289273	.0155663	-1.86	0.697	-.0788913	.0210368
Health Care	vs.	Consumer Staples	-.0065126	.0146987	-0.44	1.000	-.053692	.0406668
Industrials	vs.	Consumer Staples	-.0331997	.0132422	-2.51	0.273	-.0757039	.0093045
Information Technology	vs.	Consumer Staples	-.018747	.0143736	-1.30	0.951	-.0648828	.0273889
Materials	vs.	Consumer Staples	-.0226964	.0169395	-1.34	0.943	-.077068	.0316752
Real Estate	vs.	Consumer Staples	-.0029826	.0143736	-0.21	1.000	-.0491184	.0431532
Financials	vs.	Energy	-.0323936	.0249981	-1.30	0.953	-.1126313	.0478442
Health Care	vs.	Energy	-.0099789	.0244672	-0.41	1.000	-.0885129	.0685551
Industrials	vs.	Energy	-.036666	.0236209	-1.55	0.868	-.1124835	.0391516
Information Technology	vs.	Energy	-.0222132	.0242733	-0.92	0.996	-.1001248	.0556983
Materials	vs.	Energy	-.0261627	.0258754	-1.01	0.991	-.1092167	.0568913
Real Estate	vs.	Energy	-.0064489	.0242733	-0.27	1.000	-.0843604	.0714626
Health Care	vs.	Financials	.0224147	.0123405	1.82	0.724	-.0171953	.0620246
Industrials	vs.	Financials	-.0042724	.0105636	-0.40	1.000	-.0381791	.0296342
Information Technology	vs.	Financials	.0101803	.0119514	0.85	0.998	-.0281807	.0485413
Materials	vs.	Financials	.0062308	.0149392	0.42	1.000	-.0417204	.0541821
Real Estate	vs.	Financials	.0259446	.0119514	2.17	0.481	-.0124163	.0643056
Industrials	vs.	Health Care	-.0266871	.0092376	-2.89	0.118	-.0563376	.0029634
Information Technology	vs.	Health Care	-.0122344	.0107972	-1.13	0.981	-.0468906	.0224219
Materials	vs.	Health Care	-.0161838	.0140329	-1.15	0.978	-.0612262	.0288585
Real Estate	vs.	Health Care	.00353	.0107972	0.33	1.000	-.0311263	.0381862
Information Technology	vs.	Industrials	.0144527	.008711	1.66	0.816	-.0135074	.0424129
Materials	vs.	Industrials	.0105033	.012499	0.84	0.998	-.0296156	.0506221
Real Estate	vs.	Industrials	.0302171	.008711	3.47	0.023	.0022569	.0581772
Materials	vs.	Information Technology	-.0039495	.013692	-0.29	1.000	-.0478975	.0399986
Real Estate	vs.	Information Technology	.0157643	.0103502	1.52	0.881	-.0174573	.0489859
Real Estate	vs.	Materials	.0197138	.013692	1.44	0.913	-.0242342	.0636618

CAR -1 to 0			Contrast	Std.Err.	t	P>t	[95%_Conf	Interval]
Consumer Discretionary	vs.	Communication Services	-.0012497	.013085	-0.10	1.000	-.0432493	.0407499
Consumer Staples	vs.	Communication Services	.0059332	.0161295	0.37	1.000	-.0458385	.0577049
Energy	vs.	Communication Services	.0379217	.0236716	1.60	0.845	-.0380585	.1139018
Financials	vs.	Communication Services	.000192	.0144958	0.01	1.000	-.0463362	.0467201
Health Care	vs.	Communication Services	.0101565	.0137669	0.74	0.999	-.0340321	.054345
Industrials	vs.	Communication Services	-.0054049	.0125538	-0.43	1.000	-.0456994	.0348897
Information Technology	vs.	Communication Services	-.0066606	.0134949	-0.49	1.000	-.0499759	.0366548
Materials	vs.	Communication Services	.0084408	.0156573	0.54	1.000	-.0418153	.0586969
Real Estate	vs.	Communication Services	.0069087	.0134949	0.51	1.000	-.0364066	.0502241
Consumer Staples	vs.	Consumer Discretionary	.0071829	.0122965	0.58	1.000	-.0322859	.0466518
Energy	vs.	Consumer Discretionary	.0391714	.0212459	1.84	0.706	-.0290229	.1073657
Financials	vs.	Consumer Discretionary	.0014417	.0100585	0.14	1.000	-.0308437	.033727
Health Care	vs.	Consumer Discretionary	.0114062	.0089762	1.27	0.959	-.0174053	.0402177
Industrials	vs.	Consumer Discretionary	-.0041551	.0069743	-0.60	1.000	-.026541	.0182307
Information Technology	vs.	Consumer Discretionary	-.0054109	.0085531	-0.63	1.000	-.0328644	.0220426
Materials	vs.	Consumer Discretionary	.0096905	.0116703	0.83	0.998	-.0277682	.0471492
Real Estate	vs.	Consumer Discretionary	.0081585	.0085531	0.95	0.994	-.0192951	.035612
Energy	vs.	Consumer Staples	.0319885	.023245	1.38	0.933	-.0426226	.1065995
Financials	vs.	Consumer Staples	-.0057412	.0137883	-0.42	1.000	-.0499983	.0385159
Health Care	vs.	Consumer Staples	.0042232	.0130198	0.32	1.000	-.0375673	.0460138
Industrials	vs.	Consumer Staples	-.0113381	.0117296	-0.97	0.994	-.0489874	.0263113
Information Technology	vs.	Consumer Staples	-.0125938	.0127318	-0.99	0.993	-.0534599	.0282723
Materials	vs.	Consumer Staples	.0025076	.0150046	0.17	1.000	-.0456536	.0506688
Real Estate	vs.	Consumer Staples	.0009755	.0127318	0.08	1.000	-.0398906	.0418417
Financials	vs.	Energy	-.0377297	.0221428	-1.70	0.792	-.1088026	.0333432
Health Care	vs.	Energy	-.0277652	.0216726	-1.28	0.956	-.097329	.0417986
Industrials	vs.	Energy	-.0433265	.0209229	-2.07	0.551	-.1104841	.0238311
Information Technology	vs.	Energy	-.0445823	.0215008	-2.07	0.549	-.1135947	.0244301
Materials	vs.	Energy	-.0294809	.0229199	-1.29	0.955	-.1030483	.0440866
Real Estate	vs.	Energy	-.0310129	.0215008	-1.44	0.912	-.1000253	.0379995
Health Care	vs.	Financials	.0099645	.0109309	0.91	0.996	-.0251212	.0450502
Industrials	vs.	Financials	-.0055968	.009357	-0.60	1.000	-.0356306	.024437
Information Technology	vs.	Financials	-.0068526	.0105863	-0.65	1.000	-.0408319	.0271268
Materials	vs.	Financials	.0082488	.0132328	0.62	1.000	-.0342253	.050723
Real Estate	vs.	Financials	.0067168	.0105863	0.63	1.000	-.0272626	.0406961
Industrials	vs.	Health Care	-.0155613	.0081825	-1.90	0.668	-.0418251	.0107025
Information Technology	vs.	Health Care	-.016817	.0095639	-1.76	0.760	-.0475148	.0138807
Materials	vs.	Health Care	-.0017156	.0124301	-0.14	1.000	-.0416132	.0381819
Real Estate	vs.	Health Care	-.0032477	.0095639	-0.34	1.000	-.0339455	.0274501
Information Technology	vs.	Industrials	-.0012557	.007716	-0.16	1.000	-.0260222	.0235108
Materials	vs.	Industrials	.0138457	.0110714	1.25	0.963	-.0216908	.0493821
Real Estate	vs.	Industrials	.0123136	.007716	1.60	0.848	-.0124529	.0370801
Materials	vs.	Information Technology	.0151014	.0121281	1.25	0.964	-.0238268	.0540296
Real Estate	vs.	Information Technology	.0135693	.009168	1.48	0.898	-.0158577	.0429963
Real Estate	vs.	Materials	-.0015321	.0121281	-0.13	1.000	-.0404603	.0373962

CAR 0 to 1			Contrast	Std.Err.	t	P>t	[95%_Conf	Interval]
Consumer Discretionary	vs.	Communication Services	-.0188856	.0143678	-1.31	0.949	-.0650029	.0272316
Consumer Staples	vs.	Communication Services	.0112468	.0177108	0.64	1.000	-.0456007	.0680943
Energy	vs.	Communication Services	.0114892	.0259924	0.44	1.000	-.0719401	.0949185
Financials	vs.	Communication Services	-.0199813	.015917	-1.26	0.962	-.0710711	.0311085
Health Care	vs.	Communication Services	.0041714	.0151166	0.28	1.000	-.0443495	.0526922
Industrials	vs.	Communication Services	-.0235969	.0137845	-1.71	0.787	-.067842	.0206482
Information Technology	vs.	Communication Services	-.012242	.0148179	-0.83	0.998	-.059804	.03532
Materials	vs.	Communication Services	-.0133257	.0171923	-0.78	0.999	-.068509	.0418576
Real Estate	vs.	Communication Services	.009173	.0148179	0.62	1.000	-.038389	.056735
Consumer Staples	vs.	Consumer Discretionary	.0301324	.0135021	2.23	0.440	-.013206	.0734708
Energy	vs.	Consumer Discretionary	.0303748	.0233289	1.30	0.952	-.0445053	.1052549
Financials	vs.	Consumer Discretionary	-.0010956	.0110446	-0.10	1.000	-.0365463	.034355
Health Care	vs.	Consumer Discretionary	.023057	.0098562	2.34	0.370	-.0085792	.0546932
Industrials	vs.	Consumer Discretionary	-.0047113	.0076581	-0.62	1.000	-.0292919	.0198693
Information Technology	vs.	Consumer Discretionary	.0066436	.0093917	0.71	0.999	-.0235014	.0367887
Materials	vs.	Consumer Discretionary	.0055599	.0128144	0.43	1.000	-.0355713	.0466911
Real Estate	vs.	Consumer Discretionary	.0280586	.0093917	2.99	0.092	-.0020865	.0582037
Energy	vs.	Consumer Staples	.0002424	.025524	0.01	1.000	-.0816835	.0821684
Financials	vs.	Consumer Staples	-.031228	.0151401	-2.06	0.557	-.0798241	.0173681
Health Care	vs.	Consumer Staples	-.0070754	.0142963	-0.49	1.000	-.0529631	.0388123
Industrials	vs.	Consumer Staples	-.0348437	.0128796	-2.71	0.181	-.0761842	.0064968
Information Technology	vs.	Consumer Staples	-.0234888	.0139801	-1.68	0.805	-.0683615	.0213839
Materials	vs.	Consumer Staples	-.0245725	.0164757	-1.49	0.894	-.0774555	.0283105
Real Estate	vs.	Consumer Staples	-.0020738	.0139801	-0.15	1.000	-.0469465	.0427989
Financials	vs.	Energy	-.0314704	.0243136	-1.29	0.954	-.1095114	.0465705
Health Care	vs.	Energy	-.0073178	.0237974	-0.31	1.000	-.0837017	.069066
Industrials	vs.	Energy	-.0350861	.0229742	-1.53	0.879	-.1088279	.0386557
Information Technology	vs.	Energy	-.0237312	.0236088	-1.01	0.992	-.0995096	.0520472
Materials	vs.	Energy	-.0248149	.025167	-0.99	0.993	-.105595	.0559652
Real Estate	vs.	Energy	-.0023162	.0236088	-0.10	1.000	-.0780946	.0734622
Health Care	vs.	Financials	.0241526	.0120026	2.01	0.592	-.0143729	.0626781
Industrials	vs.	Financials	-.0036157	.0102744	-0.35	1.000	-.036594	.0293627
Information Technology	vs.	Financials	.0077393	.0116241	0.67	1.000	-.0295715	.04505
Materials	vs.	Financials	.0066555	.0145302	0.46	1.000	-.0399829	.0532939
Real Estate	vs.	Financials	.0291542	.0116241	2.51	0.272	-.0081565	.0664649
Industrials	vs.	Health Care	-.0277683	.0089847	-3.09	0.070	-.056607	.0010704
Information Technology	vs.	Health Care	-.0164134	.0105015	-1.56	0.864	-.0501208	.0172941
Materials	vs.	Health Care	-.0174971	.0136487	-1.28	0.956	-.0613062	.0263121
Real Estate	vs.	Health Care	.0050016	.0105015	0.48	1.000	-.0287058	.038709
Information Technology	vs.	Industrials	.0113549	.0084725	1.34	0.943	-.0158397	.0385495
Materials	vs.	Industrials	.0102712	.0121568	0.84	0.998	-.0287493	.0492917
Real Estate	vs.	Industrials	.0327699	.0084725	3.87	0.006	.0055753	.0599645
Materials	vs.	Information Technology	-.0010837	.0133171	-0.08	1.000	-.0438285	.0416611
Real Estate	vs.	Information Technology	.021415	.0100668	2.13	0.511	-.010897	.053727
Real Estate	vs.	Materials	.0224987	.0133171	1.69	0.800	-.0202461	.0652435