The Effects of Monetary Adjustment on the Swedish Stock Market

An Event Study Analyzing the Effects of Monetary Changes in the Repo Rate Set by The Swedish Central Bank on the Stock Market.
Abstract

Between the years 2007 and 2019 Riksbanken, the Swedish central bank, have changed the repo rate 75 different times. This thesis will answer if these changes have an effect on the Swedish stock market for two specific sectors, the bank- and the real estate sector. With the use of the event study method to calculate the average abnormal return and cumulative average abnormal return. The objective of this paper is to find out whether a change has or has not had an effect on the Swedish stock market for the sectors. The results are significant for both sectors, when Riksbanken decides to decrease the repo rate, which says that there is an effect on our sectors’ stock prices. However, the results are only significant for the bank sector when it comes to increases in the repo rate.

Keywords: Swedish central bank, Riksbanken, Repo Rate, Swedish Stock Market, Real Estate sector, Bank sector, Event study, Average Abnormal Return and Cumulative Average Abnormal Return.
## Table of content

1 INTRODUCTION .................................................................................................................. 1

2 PREVIOUS STUDIES ........................................................................................................ 2

3 THEORY ................................................................................................................................ 4

- 3.1 THE EFFICIENT MARKET HYPOTHESIS ........................................................................ 4
- 3.2 LEVERAGE EFFECT ......................................................................................................... 5
- 3.3 PROSPECT THEORY ....................................................................................................... 6
- 3.4 THEORY CRITICISM ....................................................................................................... 7
  - 3.4.1 Criticism on the Efficient Market Hypothesis .............................................................. 7
  - 3.4.2 Criticism on the Leverage effect .................................................................................. 8
  - 3.4.3 Criticism on the Prospect theory ................................................................................ 8

4 METHOD ................................................................................................................................ 9

- 4.1 RETRIEVING DATA ....................................................................................................... 9
  - 4.1.1 OMXS30 ................................................................................................................... 10
- 4.2 EVENT STUDY .............................................................................................................. 10
  - 4.2.1 Procedure of an event study ...................................................................................... 11
  - 4.2.2 The estimation window ............................................................................................. 11
  - 4.2.3 Market model estimation .......................................................................................... 12
- 4.3 RESTRICTIONS FOR THE EVENT STUDY ................................................................. 15
  - 4.3.1 Defining the event- and estimation window ............................................................... 15
  - 4.3.2 Market model and sector differentiation ..................................................................... 16
  - 4.3.3 Hypotheses ............................................................................................................... 16
  - 4.3.4 Criticism on Event studies ....................................................................................... 17

5 RESULTS .............................................................................................................................. 17

- 5.1 RESULTS OF THE EVENT STUDY ............................................................................... 18

6 ANALYSIS ............................................................................................................................ 21

- 6.1 REAL ESTATE SECTOR ................................................................................................ 22
- 6.2 BANK SECTOR ............................................................................................................. 23

7 FUTURE RESEARCH ......................................................................................................... 24

8 CONCLUSION ..................................................................................................................... 24

REFERENCES ......................................................................................................................... 26
1 Introduction

The Swedish central bank, Riksbanken, is a government agency with the primary purpose of keeping the inflation rate at a stable level. Even if Riksbanken is a government agency under the Swedish parliament, it is self-governing and can make monetary decisions without being influenced by political parties. The Swedish government handles the fiscal policies and Riksbanken handles the monetary policies. (Riksbanken.se, 2018) The targeted inflation rate is 2% and the inflation is the yearly change in the Consumer Price Index with fixed interest rate (CPIF). To maintain the 2% yearly increase of the inflation, the Swedish central bank uses the repo rate as their main monetary policy tool. (Riksbanken.se, 2019) The mechanics of the repo rate is that when the repo rate increases the lending rate for the banks will increase and this should consequently increase the interest rate in Sweden. When the interest rate increases the monthly payment for borrowers will grow, this should constrict the demand in the Swedish economy, since people have less to spend after the raise. An increase in the demand for the Swedish economy will lead to a lower inflation and the other way around when the repo rate decreases. In conclusion a rise in the repo rate should lower the inflation and a reduction of the repo rate should give us an increase in inflation. Does this really work in practice and does it work when looking at the stock market? That will be answered in this paper.

This thesis looks at two different sectors on the stock market. The first is the bank sector and the second is the real estate sector. The bank sector was chosen because of how much they are affected by a repo rate change. As mentioned before banks are the first to be influenced by the changes and hence one might suspect that their securities will be affected. The real estate sector are highly leverage and an increase in the repo rate should influence the interest rate on their mortgage’s. The firms profits decreases and their stocks should fall. There are four firm’s that are analyzed from each different sector. For the bank sector they are: Handelsbanken, Nordea, SEB and Swedbank. The real estate sector’s firms are: Castellum, Hufvudstaden, Kungsleden and Wallenstam. Why these were chosen will be further explained in chapter 4.1 Retrieving data.
Riksbanken announces the repo rate six times a year and usually it occurs two months after the previous report was released. However, in some cases the time between the announcements have been shorter. The shortest period between a change in the repo rate was in 2015. Where Riksbanken after only 28 days since the last decrease, decided to decrease the rate once again. Furthermore, the Swedish central bank decided in February 2015 to announce, for the first time since the introduction of the current Swedish monetary system, a negative repo rate. This was a new phenomenon for Swedish monetary history. With a negative interest rate the borrowers are paid to borrow and the savers are penalized for saving. Since 2015, until the end of 2019, the repo rate has remained negative, even going as low as -0.5% in 2016 and for almost three years the repo rate remained at that level. This has become the longest period with no adjustment on the repo rate since 2007. (Riksbanken.se 2019)

What this paper aims to analyze is whether a change in the repo rate has an effect on the stock market prices, and particularly for the bank- and real estate sectors. Focusing on sectors that are highly reliant on borrowing and lending money. Does an increase or decrease give significant results on our sectors’ stock prices? Or will it not have any effect on investors’ will to invest in these sectors? And what could the effects of the results be?

The thesis disposition will proceed as follows, the following chapter consists of previous studies with a similar aim as this paper. Afterward, explanations of the theories will be presented, the passage also displays criticism towards the theories. Following that, is the method part where methods are explained and restrictions are made. The sixth part is the results and after that is the analysis. Part seven talks about further research that can be made on the subject. Lastly, there is a conclusion summarizing the results.

2 Previous studies

In this chapter three different studies with a similar aim to this thesis will be discussed. The first from Andersson and Uhrenholt (2005), the second is from Wilson and Savor (2013) and lastly a thesis from Stjärnfält (2016).
A previous study that examined the Swedish central bank’s effect on the stock prices, is a Swedish master thesis by Andersson and Uhrenholt (2005). They performed an event study with 60 companies stock prices from six different industries and found that there generally is an abnormal return in the Swedish stock market after both raises or decreases in the prime lending rate. The authors also found that the difference between these raises and decreases are statistically significant. However, when the lending rate rose they did not observe any significant negative abnormal return on the day of the event. Although, where there was a negative abnormal return it showed up two days before the event and two days after the event. When it comes to lowering the lending rate it was discovered that there also where abnormal returns. However, in their results, the change in the prime lending rate only affected prices two days before the event and is absent after that. Andersson and Uhrenholt’s reasoning for this was due to expectations and speculations surrounding the announcement it would affect the stock market before the announcement takes place. Finally, the authors found that investors tend to overreact to new information and this due to them either being irrational or having an excessive self-image. (Andersson and Uhrenholt, 2005)

Savor and Wilson published 2013 a study about macroeconomic announcements effect on the stock market in the U.S. They found that there is a correlation, the average excess returns and Sharpe ratios in the USA are actually higher on days when macroeconomic announcements are announced. This correlation is even more distinct at times when the market is in periods characterized by high risk. They observed a clear connection between macroeconomic risk and the returns of financial assets and believed that investors want to be compensated with a higher return if the asset includes a macroeconomic risk. One conclusion was that since investors learn from previous events, they should take the announcements days into consideration and hence be less willing to hold stocks that have a positive covariance with these kinds of news. (Savor and Wilson, 2013)

These two previous studies have focused on the macroeconomic effects of the stock market in general. However, while searching for previous papers that have examined similar subjects as ours, a candidate thesis that examined the European
central bank’s (ECB) prime lending rate and its effect on the 24 biggest European bank stocks. Stjärnfält (2016) found a negative correlation between an increase of the ECB:s prime lending rate and the European bank stocks. The author also found a negative correlation between these two when the prime lending rate decreased. Although this correlation was not statistically significant. (Stjärnfält, 2016).

3 Theory

In this theory chapter, theories connected to the analysis and aim of the thesis, will be explained. Theories such as Efficient Market Hypothesis, Leverage Effect and Prospect theory. Additionally, a theory criticism on these theories will be included.

3.1 The Efficient Market Hypothesis

The Efficient Market Hypothesis, EMH, is a hypothesis that prices of securities fully reflect relevant available information about the securities. (Bodie, Kane & Marcus. 2011)

In EMH there are three types of efficiencies defined in the market, they are based on the amount and the type of information that is relevant. The three forms were developed by Eugene F. Fama and are

**Weak-form efficiency:** Stock prices reflects all information collected from the history of past trading. Such as the history of past trading volumes, prices or short interests. Previous data of stock prices are costless and accessible for all to collect. For the weak-form hypothesis, if such data gave reliable signals about future performance, investors would have known how to exploit the signals. Conclusively, signals lose their value as investors already know about a buy signal, thus prices would immediately increase.

**Semistrong-form efficiency:** Stock prices reflects all public available information of a firm. Information includes past prices, quality of management, data on the firm's production, accounting practices, earnings forecasts, patents, and balance sheet composition. If investors have access
to these types of information from publicly available sources, it would reflect in stock prices.

*Strong-form efficiency:* Stock prices do not only reflects all relevant information, it also includes inside information. Some would argue that with inside information investors could know information before public release and be able to profit from trading accordingly to the information they have. This would give them an unfair advantage and therefore there exists regulations to prevent profiting from situations that would lead to inside information.

All versions of EMH states that prices should reflect all the available information. However, it is not to believe that prices could never turn out to be unexpected, there is always more information about companies that could be available. Market prices could sometimes in retrospect have been valued too high or even too low. EMH says that given a specific time and using current information for that time, there is no way to be sure if today’s prices will be too high or too low in retrospect. Nonetheless, if the market is rational it is expected that it will be correct on average according to Bodie, Kane and Marcus (2011).

3.2 Leverage Effect

In the stock market there exists several asymmetry properties, one of these is the asymmetric impact of good or bad news on future volatility. (Hens & Steude, 2009) Bandi and Renò (2012) tells us that stocks to return and stocks to variance have been found to be negatively correlated. This negative correlation is the so-called “leverage effect” and was developed by Black (1976) and Christie (1982) and again by Ang and Chen (2002). They found that volatility tends to decrease when stock prices increases and volatility rises when stock prices decreases. This is explained by the stylized fact that stock’s volatility is linked to the firm’s capital structure.

Hens and Steude reference to Modigliani and Miller’s (1958) work. Where they say that a firm with bonds and stocks, their debt to equity ratio changes when, *ceteris paribus*, the stock price changes. When the leverage is affected, it is natural to
expect that the firm’s stock becomes more volatile. (Ait-Sahalia, Fan & Li, 2013) According to Bandi and Renò (2012) information that affects a firm’s equity negatively will increase the volatility. The reasoning for this is that the firm’s assets losses its value due to fall in profit and increases in leverage. Which increases the stocks volatility. Hens and Steude also refers to Figleski and Wang (2000) whom also found that a strong leverage effect on falling stock prices. However, for positive returns they found weak leverage effect. In theory the leverage effect should have the same logic for falling stock prices as for stock prices increasing in value.

3.3 Prospect theory

Kahneman and Tversky’s (1979) paper started as a critique to the Expected Utility Theory but later developed into an alternative model, the Prospect Theory. The Expected Utility Theory is a normative model of rational choice and is used as a descriptive model for economic behaviour among rational people. In other words, it describes the expected utility of an outcome. However Kahneman and Tversky does not fully agree that the utility theory is an adequate descriptive model and hence they present an alternative account of choice under risk. In Figure 1.1 we can see a graph explaining how the utility function looks for expected utility theory and the gain in utility is decreasing when wealth increases.

![Figure 1.1](source: Bodie, Kane and Marcus (2011))

The Prospect theory consists of two phases in the choice making process. The first is the editing phase and is a preliminary analysis of the offered prospects. The second phase, the subsequent phase, evaluates the edited prospects and the prospect
with the highest value is chosen. (Kahneman & Tversky, 1979) Bodie, Kane and Marcus (2011) definition of prospect theory is, a theory where investors utility depends on losses or gains from their starting position and not on their level of wealth. Hence it modifies the description of the rational risk-averse investor. The second graph from Figure 1.2 shows the risk-averse investor where higher wealth gives a higher utility but the rate is diminishing, just like the utility function shows. In this graph there is an opposite side of the utility graph, it has a sort of S shape and shows the utility for losses as well as profits. The risk-averse investor has a negative utility for when their wealth diminish. Kahneman and Tversky (1979) also states that after an investor suffers from losses they might start taking more risky decisions to break even. Thus the risk aversion might decrease after negative returns. In conclusion previous gains and losses may have asymmetric effects on the behaviour of the investor, as they might want to break even when coming from a loss. (Zhang and Semmler, 2009)

![Utility Function under Prospect Theory](image)

Figure 1.2 Source: Bodie, Kane and Marcus (2011)

3.4 Theory criticism

3.4.1 Criticism on the Efficient Market Hypothesis

The Efficient Market Hypothesis was constructed by Fama back in the early 1970s. During that time it was generally assumed that security markets were efficient in reflecting stock prices of the whole market. The consensus was that if a piece of new information emerges it would immediately be reflected on the stock prices. In other words, an investor could not systematically beat the market without taking a comparable risk (Malkiel, 2003). However, the market efficiency hypothesis is not
as widely accepted today, a big criticism of the theory is that there are examples in
the history of stock prices that cannot possibly be explained by the market
efficiency hypothesis. The economist Burton G. Malkiel claims that the theory is
disproved by events where the changes in stock prices could not be explained. He
uses the market crash in October 1987 and argues that the market cannot have been
efficient. Both at the beginning of October where the market was normal and in the
middle of October when the market dropped one-third of its value. There are also
similar examples supporting the argument that the market efficiency hypothesis is
an oversimplification of reality (Malkiel, 2003).

3.4.2 Criticism on the Leverage effect
A criticism against the Leverage Effect is that there is no real consensus on how
positive and negative economic shocks affect the volatility in the market. Some
economists argue that relative small positive shocks affect the volatility of more
than relatively small negative surprises. In other words, the surprises effect on the
volatility depends on both the magnitude of the economic shock and if it is positive
or negative. (Rabemananjara and Zakoïan, 1993). Other studies claim that negative
shocks always cause more volatility in the market than positive shocks. The
magnitude of it is irrelevant when comparing a positive and negative surprise and
its effect on the volatility in the market (Engle and Ng, 1993).

3.4.3 Criticism on the Prospect theory
Even though the Prospect Theory is not as criticized as the Expected Utility Theory,
it still has some flaws. One of the more common weaknesses to be pointed out by
critics is that the theory struggles with generalizability. The behavioral economist
Barberis (2013) argues that it is difficult to simplify the value of a profit or a loss
for all individuals for each specific outcome. This creates problems when it comes
to using the prospect theory to describe individuals in general (Barberis, 2013). It
is hard to generalize with the Prospect Theory since the individuals have their own
reference point. These reference points differ from other people, based on their
personal subjective preferences (Közegi and Rabin, 2006).
Another criticism of the Prospect Theory is that it has a problem with aggregation according to Levy (1997). Levy means that since Kahneman and Tversky (1979) only try the theory on the individual level it does not necessarily mean that theory is valid on a group level. Therefore Levy means that it could be problematic to use the Prospect Theory on companies and organizations since it may not be consistent.

4 Method

The method part consists of how data was retrieved and chosen. Which firms where selected and why, during what time period they were analyzed. Ensuing this, the event study method will be explained and further restrictions made in this thesis particularly surrounding the event study will be clarified.

4.1 Retrieving data

The following bank stocks were selected as research objects; Nordea Bank, SEB A, Svenska Handelsbanken A and Swedbank A. This restriction was made since these stocks are all part of the most traded bank stocks in the Swedish stock market. Furthermore, to examine how the repo rates affect the real estate sector the following companies were chosen to represent that sector; Castellum, Hufvudstaden, Kungsleden, and Wallenstam. According to Avanza’s website, these are some of the biggest real estate stocks on the Swedish stock market and hence they were chosen. (Avanza.se, 2019)

Moreover, this study uses a sizable amount of data containing stock-closing-prices for each company and the market index between the dates 2007-02-15 and 2019-10-28. Beforehand, data was collected regarding all announcements from Riksbanken’s increases, decreases and unchanged repo rates. It included 75 different announcements during the time period. Thereafter, data of all the closing prices from those years were gathered and they were retrieved from Nasdaq stock history. Altogether, we collected 3192 security prices for each company, so in total, there is approximately 30 000 stock prices for that period. There were also no missing values in the data set.
4.1.1 OMXS30

If there existed a share that was equivalent to every company on the stock market, its price would reflect the market value. However, no such share exists and therefore it is necessary to estimate a market model instead. To estimate the market model we used OMX Stockholm 30 index, OMXS30, this index includes the thirty most traded stocks in Nasdaq Stockholm. Determining which stocks should be included in OMXS30, it is based on the turnover during a six month period, when starting seven months before the appointed date. Accordingly, OMXS30 is an index of the market value and the stocks included effects the index value accordingly with the proportional amount of the stocks total stock value. (Nasdaqomxnordic.com, 2019)

The OMXS30 will therefore work as our market return, and since the index consists of the biggest and most traded stocks it was found fitting considering the thesis uses largely traded stocks as comparison. There are indexes such as OMXSPI that is an index of all traded stocks in the Swedish market. However, as previously stated the paper focuses on stocks that are largely traded, it will follow the OMXS30 index more closely than the OMXSPI.

4.2 Event Study

To measure the effects of an economic event on the value of a company might sounds like a difficult task but can be easily executed using the event study method. Applying data from the financial market, event studies measure the impact of a specific event on a firm's value. Given rationality in the market, the effect of an event should reflect the price of securities. Events that have an economic impact can thus be constructed with security prices during a relatively short time period. (MacKinlay, 1997)

Event studies can be used in accounting and finance research. However, it can also be applied in other fields, such as fields of law and economics. One of the first published studies where made by Dolley (1933) and contributes to the long history of event studies. During the late 1960s influential studies by Ball and Brown (1968), and also Fama et al.(1969) were made and introduced a methodology that is generally the same as what is used today. Fama et al. studied the effects of stock
when removing effects of simultaneous dividend increases, while Ball and Brown studied the information content of earnings. (MacKinlay, 1997)

4.2.1 Procedure of an event study
The procedure for an event study follows a general flow. Defining the event of interest is the initial task for the event study. Furthermore, it is necessary to establish the period of which security prices in the firm should be included in the examination of the effect when introducing an event. Deciding the event day and the prices which should be involved in the testing, this gives us the event window. The event could, for instance, be an announcement of revenue for a firm and the event window will become the surrounding dates to that event. It is customary to have an event window that is larger than only just the event announcement, this allows examination of the effect caused by the event on the dates surrounding it. It could be as large as multiple days but should at least include the day before the event, the day of the event and the day after the announcement. This is to capture the effect when announcements are publicized after the stock market is closed. Thereafter it is necessary to determine different restrictions in the data. It could be restrictions such as listing on different stock exchange platforms or which sectors will be examined. During this stage it is also essential to compile some sample characteristics like; distribution of events throughout time, firm market capitalization or industry representation. Important to acknowledge is if any possible bias that may occur from the restrictions made, according to MacKinlay (1997).

4.2.2 The estimation window
Another essential step is to select the estimation window, most common is to use the period prior to the event window. The estimation window should give the normal return of the stocks. Commonly the estimation window does not overlap with the event window, as it could interfere with the parameters that are estimated for the normal performance model. Figure 1.3 shows how the event window and estimation window follows each other.
Where $\tau = 0$ is the event day where the announcement takes place. When $\tau = T_1 + 1$ to $\tau = T_2$ we have our event window as shown in Figure 1.3. The estimation window is $\tau = T_0 + 1$ to $\tau = T_1$. This means that the estimation window length is $L_1 = T_1 - T_0$ and the event window length is $L_2 = T_2 - T_1$.

### 4.2.3 Market model estimation

For firm $i$ the market model for an estimation window of observations are

$$
\hat{\beta}_i = \frac{\sum_{\tau = T_0 + 1}^{T_1} (R_{i\tau} - \bar{y}_i)(R_{m\tau} - \bar{y}_m)}{\sum_{\tau = T_0 + 1}^{T_1} (R_{m\tau} - \bar{y}_m)^2},
$$

(1)

where

$$
\bar{y}_i = \frac{1}{L_1} \sum_{\tau = T_0 + 1}^{T_1} R_{i\tau},
$$

(2)

$$
\bar{y}_m = \frac{1}{L_1} \sum_{\tau = T_0 + 1}^{T_1} R_{m\tau},
$$

(3)

and

$$
\hat{\alpha}_i = \bar{y}_i - \hat{\beta}_i \bar{y}_m,
$$

(4)

where $R_{i\tau}$ is the return in event period $\tau$ for firm $i$ and $R_{m\tau}$ is the return for the market in event period $\tau$. Using the market model to measure the normal return, the sample abnormal return becomes
\[
\tilde{AR}_{i\tau} = R_{i\tau} - (\tilde{\alpha}_i + \tilde{\beta}_i R_{m\tau}),
\]

and the variance is

\[
\sigma^2(\tilde{AR}_{i\tau}) = \hat{\sigma}^2_{i\hat{\epsilon}} + \frac{1}{L_1} \left[ 1 + \frac{(R_{m\tau} - \bar{y}_m)^2}{\hat{\sigma}^2_m} \right],
\]

where

\[
\hat{\sigma}^2_{i\hat{\epsilon}} = \frac{1}{L_1 - 2} \sum_{\tau = \tau_0 + 1}^{\tau_1} (R_{i\tau} - \tilde{\alpha}_i - \tilde{\beta}_i R_{m\tau})^2.
\]

When the length of the estimation window, \(L_1\), becomes larger the second term of equation 7 will move towards zero. In other words, the estimation window can be chosen to be just big enough for the second term to be negligible.

To be able to draw an overall inference for the event, the observations of the abnormal return needs to be aggregated. The aggregation works along two dimensions, through time and across securities. Firstly, aggregation through time for an individual security is looked at and then both time and across securities will be considered. To accommodate for a multiple period event windows, it is necessary to use the concept cumulative abnormal return, CAR. CAR is defined as the sample cumulative abnormal return from \(\tau_1\) til \(\tau_2\). Where CAR is the sum of the abnormal returns

\[
\text{CAR}_i(\tau_1, \tau_2) = \sum_{\tau = \tau_1}^{\tau_2} \tilde{AR}_{i\tau},
\]

and the variance is

\[
\sigma^2_{(\tau_1, \tau_2)} = (\tau_2 - \tau_1 + 1)\hat{\sigma}^2_{i\hat{\epsilon}}.
\]

However, it is not likely to only use one event to base your results on, therefore it is necessary to average the abnormal return for the event window and across observations of the event. If there is no clustering, i.e. the event windows do not
overlap, and the distributional assumptions are maintained then the abnormal return and cumulative abnormal return will be independent across securities. (MacKinlay, 1997) Given N events, the sample average abnormal return for period τ becomes

$$\overline{AR}_\tau = \frac{1}{N} \sum_{i=1}^{N} \overline{AR}_{i\tau},$$

(10)

and the variance is

$$\text{var}(\overline{AR}_\tau) = \frac{1}{N^2} \sum_{i=1}^{N} \hat{\sigma}_{i}^2.$$  

(11)

To test a hypothesis for the average abnormal return for a given day, the test will look as follows

$$t = \frac{\overline{AR}_\tau}{\sqrt{\text{var}(\overline{AR}_\tau)}}.$$  

(12)

For the calculation of the cumulative average abnormal return for each security, it can be done in two ways. One approach is to sum the average abnormal returns

$$\overline{CAR}(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \overline{AR}_\tau,$$

(13)

and to calculate the variance

$$\text{var}(\overline{CAR}(\tau_1, \tau_2)) = \sum_{\tau=\tau_1}^{\tau_2} \text{var}(\overline{AR}_\tau).$$

(14)

To then test if the hypothesis will be rejected or not it can be done by using

$$t = \frac{\overline{CAR}(\tau_1, \tau_2)}{\sqrt{\text{var}(\overline{CAR}(\tau_1, \tau_2))}}.$$  

(15)
4.3 Restrictions for the Event Study

There are lots of different ways to formulate and define an event study. Choosing the length of the event period or the length of the estimation window, to defining the restrictions in the data. All of these specifications are crucial when analyzing the results. In this part specifications on the restrictions and deciding event characteristics will be concluded. Finally criticism regarding the event study method will be included.

4.3.1 Defining the event- and estimation window

Our event in this study is the day when the Swedish Central Bank announces the repo rate. There are three possible outcomes. One outcome is that the rate increases. Another is that the rate stays the same and the last outcome is that the rate decreases. For the event window, a four day period surrounding the event day was decided. The days being, one day before the event announcement, the day of the event and two days after the announcement. The reason for only including two days after the announcement for the event window and not more days, where a decision made because of the short time period between the announcements. A problem with a small estimation window, is that it can be hard to get a good estimate of the normal return. So when determining the estimation window, the same reason as stated formerly was considered when deciding on the event window. Since the announcements from Riksbanken have different lengths in the time intervals between them, the number of days are not the same for each estimation window. This was done to maximize the number of days possible to estimate a normal return as close to the actual normal return. However, there is one period in particular that can become a problem for our estimation window and that is the period between the announcement on the 12th of February 2015 and March 18th the same year. Between these announcements there are only 20 observed closing stock prices which can be a problem. So to not obtain clustering, i.e. overlap between estimation windows and event windows, the decision to have a short estimation window was made. Another effect a small estimation window could bring, is that the sample variance for our abnormal returns could be larger and give us insignificant results. In conclusion, our estimation window starts after an event window ends, and it stops the day before the event window starts. So after one event ends the
window is the period between that date and the next date an event starts, as shown in Figure 1.4.

![Timeline for the event widows and estimation windows](image)

Figure 1.4. Timeline for the event widows and estimation windows.

### 4.3.2 Market model and sector differentiation

In this study data from the OMXS30 index was used as the return for the market. Thereafter two different sectors were selected to analyze the effects of an announcement from Riksbanken. The first sector analyzed was the financial sector or more precisely banks. The second sector was the real estate sector, focusing on sectors that are heavily influenced by monetary adjustments. Where banks first and foremost borrow money from the Swedish central bank and then lend money to companies and private lenders. The real estate sector is highly leveraged and therefore reliant on interest rates. These two sectors should, therefore, be affected by a change in the repo rate because of these reasons.

### 4.3.3 Hypotheses

Throughout the thesis a 5% significance level will be applied. The null hypothesis in this study is that an announcement from Riksbanken regarding the repo rate will not have any effect on our stock markets for our sectors when looking at them individually. Our alternative hypothesis is that the announcement does affect the stock market for bank- and the real estate sector.

\[
\begin{align*}
H_0 & : \quad E(CAR(\tau_1, \tau_2)) = 0 \\
H_A & : \quad E(CAR(\tau_1, \tau_2)) \neq 0
\end{align*}
\]

So here the cumulative average abnormal return is tested to see if an event has an abnormal change in the market. The critical value for this t-test is |1.96| since the sample size is large, i.e. if the observed t-values are larger than the critical value the null hypotheses will be rejected.
To then test an individual event day, it will be tested in a similar way and here the formulation of the hypotheses will be as follows, for event day $x$ the announcement will have no effect on that day’s stock prices for a specific sector. And understandably the alternative hypothesis is that it will have an effect.

$$H_0: \ E(\bar{AR}_t) = 0$$
$$H_A: \ E(\bar{AR}_t) \neq 0$$

4.3.4 Criticism on Event studies

MacKinlay’s event study method for receiving abnormal returns in stock markets is both well-known and well used in the financial world. Although this does not mean that it is flawless, actually it has received a lot of criticism. For example, event studies do not include other information than the one that is the subject for the study. An example of information that often is overlooked is macroeconomic events. Even though this is a criticism of the method it can also be seen as a compliment if the researcher chooses to include this information in the model. It is also hard to calculate what a normal return is. It is possible to get an approximate estimator by analyzing historical prices with an estimation period. Nonetheless, this estimation can never fully predict how a stock should perform (Wells, 2004). Another type of apprehension to the event study has received is the fact that it uses an event window to isolate the incident the method tries to analyze. The downside with this is that it can be difficult to know if the event window is big enough to capture the whole magnitude of the event. This since the information about the event could have leaked a long time before the event actually occurred. This could be solved with a longer event window however a longer event window also increases the chances of other variables affecting the abnormal return in the event.

5 Results

This chapter gives the results of the tests and will give important numbers for analyzing the effects.
5.1 Results of the Event Study

As previously noted the total amount of announcements Riksbanken has released from May of 2007 until October 2019 are 75 different statements. Where 14 of the announcements reported an increase in the repo rate, 16 of them reported decreases and 45 of them were announcements where Riksbanken choose to not change the rate from the previous level, this can be seen from Table 1.1.

<table>
<thead>
<tr>
<th></th>
<th>Number of Announcements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increases</td>
<td>14</td>
</tr>
<tr>
<td>Decreases</td>
<td>16</td>
</tr>
<tr>
<td>Unchanged</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
</tr>
</tbody>
</table>

From all the data collected, we merged all the securities through time and combined the companies from each sector together to receive an average abnormal return, $\overline{AR}$, for our samples and a cumulative average abnormal return, $\overline{CAR}$. The following Table 1.2 shows the real estate sectors values for $\overline{AR}$ and $\overline{CAR}$.

<table>
<thead>
<tr>
<th>Event day</th>
<th>Increases</th>
<th>Decreases</th>
<th>Unchanged</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\overline{AR}$</td>
<td>$\overline{CAR}$</td>
<td>$\overline{AR}$</td>
</tr>
<tr>
<td>-1</td>
<td>0.29%</td>
<td>0.29%</td>
<td>0.58%</td>
</tr>
<tr>
<td>0</td>
<td>-0.15%</td>
<td>0.14%</td>
<td>1.41%</td>
</tr>
<tr>
<td>1</td>
<td>-0.02%</td>
<td>0.12%</td>
<td>0.43%</td>
</tr>
<tr>
<td>2</td>
<td>-0.04%</td>
<td>0.08%</td>
<td>0.02%</td>
</tr>
</tbody>
</table>

$\overline{AR}$ is the average abnormal return and is given for each event day. The same is for $\overline{CAR}$, the cumulative average abnormal return. They are categorized into three groups, increases, decreases and unchanged. Real Estate sector.

And from the Bank sector
\begin{table}[h]
\centering
\begin{tabular}{lcccccc}
\hline
Event day & \multicolumn{2}{c}{Increases} & \multicolumn{2}{c}{Decreases} & \multicolumn{2}{c}{Unchanged} \\
 & \(\bar{AR}\) & \(\bar{CAR}\) & \(\bar{AR}\) & \(\bar{CAR}\) & \(\bar{AR}\) & \(\bar{CAR}\) \\
-1 & 0.84\% & 0.84\% & 1.06\% & 1.06\% & -0.43\% & -0.43\% \\
0 & 0.09\% & 0.92\% & -0.40\% & 0.66\% & -0.14\% & -0.57\% \\
1 & 0.16\% & 1.08\% & 0.19\% & 0.85\% & -0.28\% & -0.84\% \\
2 & -0.23\% & 0.85\% & -0.09\% & 0.76\% & -0.14\% & -0.99\% \\
\hline
\end{tabular}
\caption{Increases Decreases Unchanged}
\end{table}

Superscript \(\bar{AR}\), \(\bar{CAR}\) is the average abnormal return and is given for each event day. The same is for \(\bar{CAR}\), the cumulative average abnormal return. They are categorized into three groups, increases, decreases and unchanged. Bank sector.

From Tables 1.2 and 1.3 we received the \(\bar{AR}\) and \(\bar{CAR}\) for the real estate sector and the bank sector respectively. They are quite small average abnormal returns, where the highest is only 1.41\% for day 0 in the real estate sector during a decrease. Most of the \(\bar{AR}\) are close to zero. So from this, we can test to see if the average abnormal return for each event day are significant. Here our hypothesis will be formulated as such, for event day \(x\) the announcement will have no effect on that day’s stock prices for a specific sector. To test this, we tested each event days abnormal return for both sectors the results from the real estate sector were as follows

\begin{table}[h]
\centering
\begin{tabular}{lcccccc}
\hline
Event day & \multicolumn{3}{c}{Increases} & \multicolumn{3}{c}{Decreases} \\
 & \(\bar{AR}\) & T-obs & p-value & \(\bar{AR}\) & T-obs & p-value \\
-1 & 0.29\% & 1.24 & 0.1075 & 0.58\% & 2.24 & 0.0125 \\
0 & -0.15\% & -0.65 & 0.2578 & 1.41\% & 5.45 & 0.0000 \\
1 & -0.02\% & -0.09 & 0.4641 & 0.43\% & 1.65 & 0.0495 \\
2 & -0.04\% & -0.16 & 0.4364 & 0.02\% & 0.06 & 0.4761 \\
\hline
\end{tabular}
\caption{Increases Decreases}
\end{table}

The table shows average abnormal returns, the observed t-value, and p-value for the real estate sector.

Where the significance level for the test is at 5\%. From the results on the real estate sector, there were only two significant results. One being the day before and the other being the day of the announcement, and this is for a decrease in the repo rate. When it comes to the average abnormal returns for Table 1.4 we can see that
when an increase is announced, the $\overline{AR}$’s becomes negative from the day of the announcement. However, what can be observed is that none of these $\overline{AR}$’s are significant. So it does not reject our hypothesis, which tells us that we cannot say that they are negative as a result of a change in repo rate. For decreases of the repo rate in Table 1.4, the average abnormal return is positive. Nevertheless, the further away from day 0, the smaller they are and insignificant they become. For event days, -1 and 0, we received significant results that show that we will reject the null hypothesis on a 5% significance level. This indicates when the Swedish Central Bank announces a decrease in the repo rate the average abnormal return is 1.41% and gives us an abnormal increase in the stocks for the real estate sector. The reason for the other significant result could be that investors expected a decrease in lending rate and therefore invested more in these sectors’ stocks.

<table>
<thead>
<tr>
<th>Event day</th>
<th>$\overline{AR}$</th>
<th>T-obs</th>
<th>p-value</th>
<th>$\overline{AR}$</th>
<th>T-obs</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>0.84%</td>
<td>3.90</td>
<td>0.0000</td>
<td>1.06%</td>
<td>3.82</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>0.09%</td>
<td>0.40</td>
<td>0.3446</td>
<td>-0.40%</td>
<td>-1.43</td>
<td>0.0764</td>
</tr>
<tr>
<td>1</td>
<td>0.16%</td>
<td>0.73</td>
<td>0.2327</td>
<td>0.19%</td>
<td>0.67</td>
<td>0.2514</td>
</tr>
<tr>
<td>2</td>
<td>-0.23%</td>
<td>-1.07</td>
<td>0.1423</td>
<td>-0.09%</td>
<td>-0.33</td>
<td>0.3707</td>
</tr>
</tbody>
</table>

The table shows average abnormal returns, the observed t-value and p-value for the bank sector.

For the bank sector, we can observe in Table 1.5 that the $\overline{AR}$’s does not react as it did for the real estate sector when observing the increases we only have one negative value that appears the second day after the announcement. Additionally when we have a decrease in repo rate the abnormal return is negative for the day of the change and on the second day. But since these results are not significant we cannot say that these are effects of a change in repo rate or other factors just as explained for the previous table. However, values the day prior to the announcement are significant and are a bit larger than the other abnormal returns for the event period.
Furthermore, to test if our hypothesis is correct, i.e. if the announcement of a change in the repo rate does not affect the stock markets prices, we performed the test from equation 15 to see if Riksbanken’s announcements has an effect on the sector’s stock prices. Testing both increases and decreases separately, we received these results for the bank sector

<table>
<thead>
<tr>
<th></th>
<th>( \bar{CAR} )</th>
<th>T-obs</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>decreases</td>
<td>0.0084</td>
<td>2.2359</td>
<td>0.0125</td>
</tr>
<tr>
<td>increases</td>
<td>0.0085</td>
<td>2.2522</td>
<td>0.0122</td>
</tr>
</tbody>
</table>

The table shows the cumulative average abnormal returns, the observed t-value and p-value for the bank sector.

And for the real estate sector

<table>
<thead>
<tr>
<th></th>
<th>( \bar{CAR} )</th>
<th>T-obs</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>decreases</td>
<td>0.0243</td>
<td>6.7206</td>
<td>0.0000</td>
</tr>
<tr>
<td>increases</td>
<td>0.0008</td>
<td>0.2234</td>
<td>0.4129</td>
</tr>
</tbody>
</table>

The table shows the cumulative average abnormal returns, the observed t-value, and p-value for the real estate sector.

From the results, we can see that decreases in both sectors and increases for only the bank sector will reject the null hypothesis, on a 5% significant level. So when Riksbanken announces a decrease in the repo rate it will have an effect on the stock market for the bank- and real estate sector. But will only be statistically significant for banks, and not for the real estate sector, when an increase is announced.

6 Analysis

In this section an analysis of the results will be formed with the help of the previous theories.
6.1 Real Estate Sector

From Table 1.4 of the real estate sector there are two days that have significant results. The two event days are for decreases in the repo rate, the first one being the day before the event and the second being on the day of the announcement. As for the event day -1, the results show an increase of the stock value with 0.58% and when testing the null hypothesis formed in 4.3.3 Hypotheses, the null hypothesis was rejected. When analysing the significant results for the average abnormal return a motivation for this could be the Efficient Market Hypothesis, EMH. Due to inside information investors might have foreseen a decrease in the repo rate and hence invested in the stocks and therefore increasing its value. This would indicate that there might exist a strong-form efficiency on the market. However, there are no significant average abnormal returns the days after the event announcement. Nether are the results for increases in the real estate sector. Nevertheless, the pattern of the abnormal returns follows for this sector are what previous predictions states and this ties into the second theory the Leverage Effect. When the repo rate increases, the lenders, in this case the real estate sector, will have a decrease in their turnover since they now have to pay more in interest. This results in less attractive stocks and hence the prices fall. This is the opposite for when a decrease happens. So when observing Table 1.4 it can be seen that after an announcement the $AR$’s are negative, however the results are not significant and hence we cannot reject the null. So the results are not due to an increase in the repo rate.

When analysing the subject of this thesis, whether a change in the repo rate has an effect on the stock market for these sectors, the test from equation 15 was performed. The results for the real estate sector can be seen in Table 1.7. For the real estate sector the only significant result received was for decreases. This tells us that when Riksbanken announces a decrease in the repo rate the stock market does have an abnormal change in these values. However the same cannot be said for the increases, here the announcement does not have an effect on the returns. For this the Leverage Effect is only present for decreases, and in most of the studies on leverage effect they have found a stronger impact when negative information surface. This would indicate the opposite that when a positive information surface the stock market reacts stronger in this sector at least. Could this be because the real
estate sector has an easier time increasing their prices without effecting their demand? Therefore their profit are not affected as much as other sectors. So when a decrease happens they will only profit from it and therefore the stock prices increases abnormally.

6.2 Bank Sector
Table 1.5 shows the bank sectors average abnormal returns for increases and decreases. For the bank sector there is only one significant average abnormal return for increases and decreases separately. Both of these are the average abnormal returns for event days -1. There might be a couple of reasons why there is only significant results the day before the announcement. One might be that investors have inside information regarding the change and hence buys stocks the day before to then sell at the optimal time. Another motivation might be from the Prospect Theory where investors makes trades due to previous losses or gains. The leverage effect might not be as prevalent since there are no significant $AR$'s during and after the announcement. However, in the movement of the average abnormal returns for decreases in the repo rate, the day of the announcement $AR$ is negative. This negative $AR$ might be an reaction to investors over evaluating the stocks the day before the announcement.

For Table 1.6 both increases and decreases are significant on a 5% significance level. The significant results tell us that there is an effect on the stock market when Riksbanken changes the repo rate. When it comes to decreases the cumulative abnormal return is positive which indicated that our expectation, decreases in repo rate leads to increased stock prices, are somewhat true. A lower repo rate would make it cheaper for companies to borrow money therefore their costs are lowered which potentially can generate higher profits. A higher potential profit could lead to more attractive stocks and investors will, therefore, invest in these stocks. However, the result also shows a significant positive $CAR$ for increases, this seems to contradict our initial beliefs. A rise in the repo rate therefore has a positive effect on the banks’ stock prices.

As mentioned there is a statistically significant positive cumulative average
abnormal return when Riksbanken lower the repo rate. Yet the average abnormal returns are only significant for day -1 and day 0 for the real estate companies and only for day -1 for the banks’ stock prices. This can be explained by the fact that the effect of the repo rate increase perhaps rather is distributed between the days rather than just being noticed on one day. This shows that the Swedish central bank repo rate changes actually making a difference in the stock market.

7 Future Research
In this section potential research for the future will be reviewed.

For future research there could be interesting to see if different sectors could be affected by the repo rate change. Other sectors that might be highly leverage or smaller companies that might be largely affected. Focusing on different event windows, such as looking at effects a couple of days before the announcement or effects happening after the announcement only.

8 Conclusion
In this part a conclusion of the entire thesis will be constructed, summarizing the key components.

In conclusion, this thesis aims to answer the question, does a change in the repo rate, set by Riksbanken, have an effect on the Swedish stock market? Three out of four tests were statistically significant. The significant results were decreases and increases for the bank sector and only decreases for the real estate sector. This means that for these sectors there are abnormal returns when Riksbanken changes the repo rate. For both sectors the cumulative average abnormal returns are positive for decreases in the repo rate. This indicates that when the repo rate decreases the stock prices goes up for these sectors. Moreover, when it comes to analyzing specific event days, there were only a few significant results. The significant results were often the days before or the day of the announcement. This could imply that there is a strong-form of efficiency in the market, where prices reflect all information available including inside information. The behavior of the $\overline{AR}$’s for
the real estate sector implies that there might be an leverage effect from the announcement happening.

Conclusively, from the results we can say that on a 5% significant level the change in the repo rate will, in three out of four cases, effect the stock market for our sectors. That suggests that a change in the repo rate does, in most times, affect the stock market.
References

Ait-Shalaia Y., Fan J. and Li Y. 2013. The Leverage Effect Puzzle: Disentangling Sources of Bias at High Frequency. Princeton University. 2-4


