

UNRAVELING THE IMPACT

**AN EVENT STUDY OF THE SWEDISH STOCK MARKET
REACTIONS TO THE RIKSBANK'S MONETARY POLICY
ANNOUNCEMENTS**

JAKOB LINDER

JAKOB STRÖMHOLM SONTAGH

Bachelor Thesis

Stockholm School of Economics

2023



Unraveling the Impact: An Event Study of the Swedish Stock Market Reactions to the Riksbank's Monetary Policy Announcements

Abstract:

This study investigates the impact of the Riksbank's monetary policy announcements on Swedish equity returns. Using a methodology developed by Kuttner (2001) and Fransson and Tysklind (2016) we distinguish between expected and unexpected changes to the Riksbank rate and study how the components affect equity prices. Our findings suggest there is a significant negative relationship between unexpected changes to the Riksbank rate and OMX Stockholm 30 Index returns. This relationship is however not consistently robust when dividing into subsamples. We find that the presence of monetary policy announcements from the Federal Reserve and European Central Bank as well as Statistics Sweden inflation announcements affect both the magnitude and significance of Swedish equity returns to Riksbank monetary policy announcements. We also document that the introduction of alternative monetary policy measurements such as quantitative easing has reduced the impact Riksbank rate changes have on Swedish equity returns.

Keywords:

The Riksbank, Monetary Policy, Spillover Effects, Monetary Policy Announcements, Efficient Market Hypothesis, Event Study

Authors:

Jakob Linder (25407)

Jakob Strömholm Sontagh (25416)

Tutor:

Maíra Sontag González

Examiner:

Adrien d'Avernas, Assistant Professor, Department of Finance

Bachelor Thesis

Bachelor Program in Business and Economics

Stockholm School of Economics

© Jakob Linder and Jakob Strömholm Sontagh, 2023

The effect of interest rates is all-pervasive throughout the economy. From steering the cost of borrowing and lending to the cost of capital, as well as being an essential tool to combat inflation, its impact is significant. The role of central banks such as the Federal Reserve in the United States determining the Federal Funds rate or the Riksbank in Sweden setting the "styrränta", the Riksbank rate, is very powerful. Although the explicit goal of some central banks is to keep inflation at a certain level, the impact of monetary policy will undoubtedly be felt in other domains of the economy. One such area is stock markets and equity prices representing the collective beliefs and sentiments of the market and its investors. The relationship between these two opposing players is complex and continuously changing, especially in times of a turbulent economy. Since markets are often considered forward-looking, monetary policy announcements can range from being viewed by the market as highly predictable to very surprising. The relationship between Swedish equity prices and monetary policy announcements published by the Riksbank will be examined in this thesis. More specifically we study equity returns on days of monetary policy announcements made by the Riksbank. This is a replication of Bernanke and Kuttner (2005) with Swedish data, who found in an event study that monetary policy, more exactly unexpected changes to the Effective Federal Funds rate, had significant effects on equity prices. The main question in this thesis is:

What is the effect of monetary policy announcements made by the Swedish Riksbank on equity returns of the OMX Stockholm 30 Index?

Our main hypothesis is that the effect of a Riksbank monetary policy announcement is stronger when the change or non-change in the Riksbank rate is unanticipated by the market. This pertains to the Efficient Market Hypothesis (EMH) as outlined by Fama (1970) that asset prices should reflect all the available information to investors, and thus the expected change in monetary policy should already be reflected in the market prices. Deviations from the expected change, however, are likely to have a larger effect on the market prices once the policy changes are announced. A central part of our methodology, which will be described in the following section, is thus to differentiate between expected and unexpected changes in the Riksbank rate.

Additionally, we believe an increase (decrease) in the Riksbank rate, will yield a negative (positive) return on equity prices. More specifically, that this would result in a negative (positive) effect on the OMXS30. This is a key idea in the concept of how interest rates are used to control the development of the economy and to adjust inflation levels as well as market sentiment. Expected changes to the Riksbank rate, in line with the Efficient Markets Hypothesis should not significantly impact asset prices if assumed to already be priced in. Furthermore, we investigate how various conditions, or levels of information during monetary policy announcements, affect the responses of equity prices and whether they can be considered more or less

expected. Such conditions that are controlled for are spillover effects from monetary policy announcements by the Federal Reserve and the European Central Bank (ECB), and whether a monetary policy announcement is made closely ahead of the release of an inflation report. Finally, whether QE has impacted the responses of equity prices is studied. Thus, we focus on how equity prices respond based on investors' information and whether informative events have taken place in close proximity to the Riksbank announcement. Our hypothesis here is, in conjunction with EMH, that the less information investors have ahead of a Riksbank announcement, the stronger the unexpected component of changes in equity prices will be. We thus expect the presence of other pertinent announcements to dampen the unexpected aspects of a Riksbank announcement. The opposite is also anticipated, i.e., the lack of other sources of information should increase the magnitude of the unexpected component. With an insufficient amount of relevant information, the market's reaction would be expected to be stronger, in conjunction with EMH.

The first part (4A-D) of our paper studies the effect of the announcements of the Riksbank's possible changes in the Riksbank rate on the same day OMXS30 returns. It is related to specific events between 2009 and 2023 and could thus be considered as an event study. This is aligned with the method employed by Bernanke and Kuttner (2005). In addition to the specific event study, we also control for other kinds of information jointly affecting the stock market reactions. For the purpose of this thesis, the relevant sample events are the announcement dates of the Riksbank's possible changes in the Riksbank rate and not the actual implementation date of the monetary policy changes. This is because the financial markets are assumed to incorporate new information published by the Riksbank into the equity prices immediately, instead of waiting until the date when the economic monetary policy is being implemented, as suggested by EMH.

The second part (4E-F) of our paper studies the effects of other announcements potentially impacting expectations ahead of monetary policy announcements. The categories are spillover effects from monetary policy announcements by the Federal Reserve, spillover effects from monetary announcements by the European Central Bank, and Inflation Reports released by Statistics Sweden (SCB). In order to account for the effects we will divide our sample based on whether the Riksbank's monetary policy announcements occur in close temporal proximity to these pertinent announcements. Firstly, we divide our sample based on whether the Riksbank announcement occurred within one week after a monetary policy announcement by the ECB. We then run the same regression, however now with one dataset containing all Riksbank monetary policy announcements occurring within one week after ECB monetary policy announcements and the other dataset where this was not the case. The same is done to account for the spillover effects of Fed monetary policy announcements. To estimate the impact of inflation reports on equity returns we divide our sample once more. However, here we distinguish between monetary policy announcements by the

Riksbank occurring within one week ahead of the publishing of an inflation report by SCB.

We then employ the same method as described above to examine the effect Quantitative Easing (QE) has had on the reactions of equity prices to monetary policy announcements. We thus divide our sample into two datasets; one before and one after the Riksbank decided to implement QE.

The results related to the first part (4A-D) show that the OMXS30 does react to the Riksbank's monetary policy announcements and that the sign of the coefficient is negative, meaning the stock markets go down (up) for an interest rate hike (cut). This both at an aggregate level as well as when dividing the expectations into an expected and an unexpected component. This is in line with earlier studies such as the one by Bernanke and Kuttner (2005). The result shows that unexpected changes do imply a larger change in equity prices, but only slightly. Secondly, there are also indications that the direction of anticipation, i.e. whether the rate change is higher than market expectations does not significantly influence the movement of equity prices. The coefficient is always insignificant, which implies that the direction of anticipation cannot explain some of the great variety in equity responses based on whether they occur when changes to the Riksbank rate are greater than expected. The results also indicate that the market not only reacts to changes in the Riksbank rate but to non-changes as well. Thirdly, we have identified a strong timing effect, meaning a large portion of the unexpected changes are likely interpreted as a postponement or advancement of an unavoidable monetary policy path and that the surprise of the changes to the Riksbank rate is related to the timing rather than the level effect.

The second part (4E-F), which investigates other announcements potentially impacting expectations ahead of monetary policy announcements, is an extension of Bernanke and Kuttner (2005). It shows evidence of ECB spillover effects in terms of a muted effect when the Riksbank announcements are preceded by an ECB monetary announcement. The implication of Fed's monetary policy announcements and potential spillover effects seems to indicate an exaggerated response to the Riksbank's monetary policy announcement when preceded by a Fed announcement. However, this cannot be established with certainty. Secondly, we have also observed that inflation reports are a strong determinant of the stock market's reaction to monetary policy announcements made by the Riksbank. The publishing of an inflation report in close proximity after the Riksbank's monetary policy announcement results in a muted effect on equity prices. Thirdly, quantitative easing weakens the equity price drop as a result of the Riksbank's monetary policy announcement at the aggregate level, but we were not able to identify whether this is related to the expected or unexpected component.

1 Theoretical background

A Literature review

The literature on the impact of monetary policy announcements and interest rate changes on equity returns is vast. Thorbecke (1997) was one of the first to conduct an event study on changes in the Effective Federal Funds rate and equity prices. This yielded a statistically significant negative relationship between the two variables. He did however not account for whether the changes to the interest rate were expected or unexpected, which we will investigate.

The foundational theory in this thesis is the Efficient Market Hypothesis (EMH) by Fama (1970), which argues that asset prices reflect all the available information to investors, and thus the expected change in monetary policy should already be reflected in the market price of equities. This is a crucial theory in this thesis since monetary policy announcements are regressed on the same day stock market returns, implicitly assuming that equity prices directly incorporate the information published by the central banks. It also implies that monetary policy surprises should provoke much stronger equity price responses than expected ones.

Bohl, Siklos and Sondermann (2008) investigated the relationship between the European Central Bank's monetary policy decisions and reactions on European stock markets. They found a significant negative relationship between unanticipated ECB monetary policy decisions and European stock returns.

This thesis is a replication and extension of Bernanke and Kuttner (2005), which examines the stock market's reactions to Federal Reserve monetary policy by analyzing how monetary policy changes affect equity prices in the US. They quantify to what degree a monetary policy change was expected or unexpected by analyzing changes in Federal Funds futures rates using a methodology by Kuttner (2001). Some insight is also provided as to why the stock market reacts as it does, this part though will not be the focus of this thesis. The findings are that the market reacts fairly strongly to surprise changes in the interest rate, while the anticipated monetary policy changes result in a minor reaction. To account for the lack of uniformity in the stock market's responses, they also investigate a timing vs level effect. They find that many of the surprises have a muted effect since they may be interpreted as an advancement or postponement of a more or less inevitable change in policy, while others were viewed as altering the expected path of the Federal Funds rate for months to come. The first section of this study will be a direct replication with Swedish data of Bernanke and Kuttner (2005), however, we also extend the analysis. Sweden as a smaller economy is subject to spillover effects emanating from other countries' monetary policy which is something we will venture into. Furthermore, the study by Bernanke and Kuttner (2005) does not account for the consequences of inflation reports and was written before QE as a monetary policy instrument had been born.

Fransson and Tysklind (2016) conducted an event study to research the relation-

ship between changes in the Riksbank rate and other Swedish interest rates. Inspired by the method employed by Kuttner (2001), they used 1-month Overnight Index Swaps (OIS) with the Swedish reference rate STIBOR T/N as the underlying asset to calculate the expected and unexpected components of changes in monetary policy. They found a statistically significant relationship between surprise changes and multiple Swedish interest rates. We employed their methodology to account for unexpected and expected changes in the Riksbank rate, however, we differ in that we study the repercussions on equity prices instead of other interest rates in the Swedish economy.

The nature of Sweden’s characteristics as a small-scale open economy is also a relevant topic. Being a small country, the linkage to and the dependency on larger economies becomes more accentuated. Thomas (2023) finds that minor raises in the Federal Funds rate can significantly impede the Swedish economy. Furthermore, the study finds that 73 percent of variation in the Swedish economy can be attributed to international developments. The US, Euro area, UK, China and Norway influenced the Swedish economy the most. This is highly relevant to our study since it serves as a motivation for why we should include spillover effects from other countries when measuring stock returns to monetary policy. It underlines why Sweden must be regarded as distinctly different from the United States as a less independent monetary policy maker.

The concept of spillover effects is documented by Giovanni and Hale (2022) who research the propagation of US monetary policy shocks and their spillover throughout the world on country-sector-level stock returns. The network effects of global production linkages, they find, account for 70 percent of the reactions to monetary policy. The insight that US monetary policy affects asset prices globally is relevant to our research as a motivation for adding controls for Federal Reserve decisions to our regressions. Furthermore, Angeloni, Ehrmann, de Grauwe and Miles (2003) examines the euro area monetary policy transmission process, before and after the EMU, and its effect on the banking, interest-rate and asset-market channels. They find that the estimated impact of a monetary tightening on stock indices is negative and significant for all tested cases but one. The insight that ECB monetary policy affects asset prices in Europe is relevant to our research as a motivation for adding controls for ECB decisions to our regressions. These papers indicate that we cannot overlook global monetary policy shocks when studying the reactions of Swedish equity prices to monetary policy changes.

The effect of quantitative easing on the UK stock market is studied by Chortareas, Karanasos and Noikokyrus (2018). A crucial finding for this study is the effect of publishing inflation reports, in relation to how the stock market is affected by announcements of monetary policy changes by the central bank. They find that the strength of the market reaction depends among other things, on the bank’s information dissemination through inflation reports. Furthermore, monetary Policy Commit-

tee (MPC) meetings occurring within a week of the publishing of an inflation report, with smaller-than-expected asset purchases, lead to higher equity prices. They argue that smaller-than-expected asset purchases, less than a week before the inflation report, might be perceived as revealing private information about better-than-expected news from the forthcoming inflation report release. This would suggest that the MPC meetings take on the role of a predictor of the inflation report. They then find that equities respond in a manner intuitively expected only with regard to MPC announcement news that are unaccompanied by fresh inflation report news or when no inflation report is due in the following week. In this study, the findings by Chortareas, Karanasos and Noikokyrus (2018) are used to evaluate whether the same logic holds true for other actions taken by the central bank, such as changes in the Riksbank rate as part of the central bank's monetary policy toolbox. We thus differ in that we partially study the relationship between interest rates and inflation reports and do not profoundly research QE. This paper underlines why anticipation of inflation reports can influence equity returns on days of monetary policy announcements. In addition, it emphasizes that investors' monetary policy expectations are affected by other relevant announcements than the Riksbank's own.

Our study contributes to a well-documented section of the literature. The section in question has however not been updated much recently, in times of several monetary policy adjustments. The literature is additionally almost silent on the Swedish economy and market, and reactions to monetary policy are rarely combined with spillover effects. This paper's contribution to the literature is thus to analyze if the relationship between monetary policy and equity prices has the same characteristics in Sweden as in the US, as well as to document potential spillover effects in terms of both information and other markets that the Swedish economy is affected by.

B The Riksbank's Role and Objective

The Swedish Riksbank's role is explicitly outlined on its website: "The objective of monetary policy is to maintain a low and stable rate of inflation. More precisely the target is to hold CPIF inflation at around 2 per cent a year. Without neglecting the inflation target, the Riksbank shall moreover contribute to a balanced development of output and employment. Monetary policy is the measures the Riksbank takes to achieve this."¹ The Riksbank's main instrument for combating inflation is the "styrränta", or the Riksbank rate. It is determined by the Executive Board at monetary policy meetings, which since 2020 have been held five times a year. 2009-2019 they were held six times a year. At the monetary policy meeting, the Executive Board makes a majority decision on the policy rate level and other monetary policy measures. One day after the Executive Board has held a monetary policy meeting, a press announcement is made, announcing the possible change to the Riksbank rate

¹Monetary Policy, The Riksbank, 2023

and other monetary policy actions. This rate change is then implemented a couple of days after the press release has been made. Furthermore, the Riksbank also provides forward guidance in that they hint at where the Riksbank rate might be heading in the future, by publishing forecasts contained in the monetary policy announcements. Åhl (2017) found that the Riksbank managed the market's rate expectations through these forecasts, i.e., the Riksbank is a very important source for determining market expectations.

C The Riksbank Rate 2009-2023

During the 15-year time period we study, January 2009 to June 2023, the monetary policy of the Riksbank has been both expansionary and, recently in the wake of the pandemic and subsequent higher levels of inflation, contractionary. The final observation of our sample is a raise of the Riksbank rate by 0.25 percentage points to the 3.75 percentage level. Our sample includes the unusual and rather controversial period of negative interest rates in Sweden between 2015 and 2019, when the Executive Board was unsatisfied with meager inflation numbers and pursued a very expansionary monetary policy. The lowest Riksbank rate our sample contains is -0.50 percent in 2016-2018. The Riksbank implemented an expansionary monetary policy following the financial crisis in 2008 and 2009, which saw rate cuts from 1 to 0.25 percent in 2009 to rising interest rates in 2010-2011 to the 2.00 percent level. In December 2011, the Riksbank began to utilize rate cuts that would first be reversed in January 2019 when the Riksbank rate was raised from -0.50 percent to -0.25 percent. Since May 2022, when the Riksbank began its hike to repel increasing levels of inflation, the Riksbank rate has been raised 7 times.

D Quantitative Easing

A more novel monetary policy instrument used by the Riksbank is the method of Quantitative Easing (QE). It is a method where central banks purchase securities such as government bonds and other products in order to raise the prices and lower the yield of these assets. They thereby increase the money supply and stimulate economic activity, and thus QE can be considered a form of expansionary monetary policy. The Riksbank pursued QE for the first time in February 2015 when they purchased government bonds worth 10 billion SEK. The contractionary counterpart, where central banks sell assets, is called Quantitative Tightening (QT). The method of conducting asset purchases and sales is an alternative to using policy rates for monetary policy, but will not be investigated in-depth in this thesis. Its impact on the effect of interest rates on equity prices will however be accounted for.

E Transmission of Monetary Policy to Equity Prices

The monetary policy transmission mechanism has been studied to a high degree to understand the channels through which monetary policy actions move and impact different sectors of the economy. Mishkin (1996) provides an overview of the transmission mechanism of monetary policy and outlines three main channels. These are the traditional interest rate channels, channels operating through other asset prices and the credit channel. The equity price channel, and equities, are the focus of this thesis and build on the idea that other relative asset prices and real wealth transmit monetary effects onto the economy, where key assets are foreign exchange and equities. The idea is that "when money supply rises, the public finds it has more money than it wants and so tries to reduce the holdings of money by increasing their spending. One place the public can spend more is in the stock market, increasing demand for equities and consequently raising their prices." as explained by Mishkin (1996). An alternative channel for monetary policy transmission through equity prices is through wealth effects on consumption, which incorporates Modigliani's (1971) life cycle model of lifetime resources (human capital, real capital and financial wealth) determining consumption spending. The financial wealth component consists largely of common stocks and leads to that when stock prices rise, the value of financial wealth increases, thus increasing the lifetime resources of consumers, and consumption should rise.

F Identifying expected vs unexpected monetary policy changes

To differentiate between expected and unexpected changes, we will employ a methodology developed by Kuttner. Krueger and Kuttner (1996) found that the Federal Funds futures rates yielded efficient forecasts of funds rate changes by the Federal Reserve. Kuttner (2001) subsequently used Federal Funds futures to separate monetary policy changes into an expected and unexpected component. To do the same for the Swedish market, a Swedish equivalent to Federal Funds futures is required. A similar instrument for the Swedish market is RIBA-futures, a future that has the Riksbank's Riksbank rate as the underlying asset. A problem with this instrument, however, is that RIBA-futures do not have shorter contract periods than three months. For our purposes, we need shorter contract periods since monetary policy meetings sometimes occur within these three-month periods. Thus, we need to use another financial derivative to reflect the Swedish market's expectations of interest rate levels which are traded with contracts of 1 month. Fransson and Tysklind (2016) inspired by the method employed by Kuttner (2001) used Overnight Index Swaps (OIS) to calculate the expected and unexpected components of changes in monetary policy. It is a swap where one party exchanges a fixed interest rate for a floating rate, at the term of one month (the term extends from the first to the last day of every month). The underlying asset for the swaps is based on the Stockholm Interbank Offered Rate Tomorrow/Next (STIBOR T/N), which is a reference rate for financial contracts with

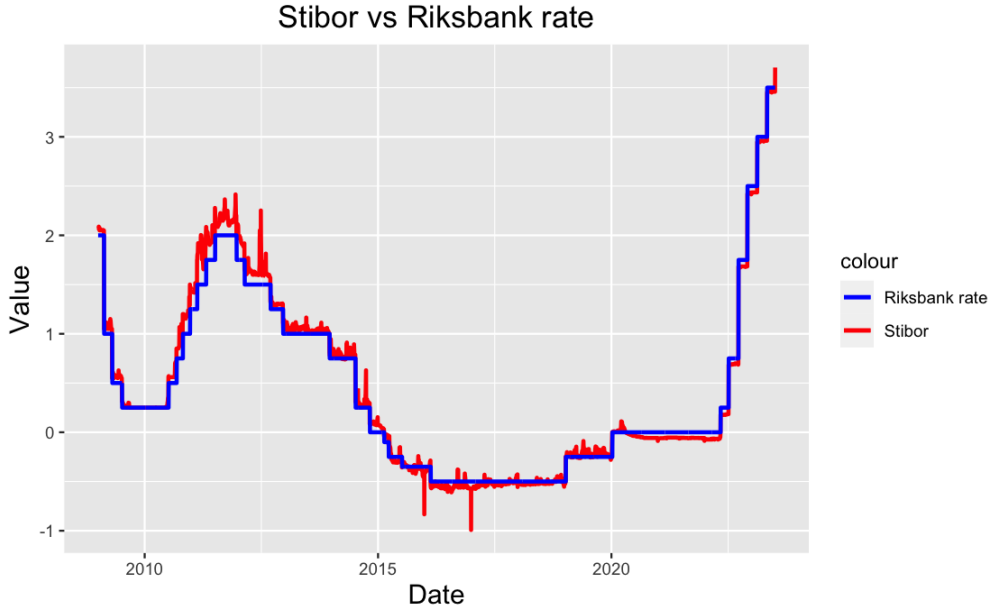


Figure 1: Time series of the Riksbank rate and Stockholm Interbank Offered Rate Tomorrow Next (STIBOR T/N) in the time period January 2, 2009 - July 5, 2023. Riksbank rate rates and STIBOR T/N rates between January 2, 2009 - July 3, 2020 were obtained from the Riksbank. STIBOR T/N rates July 4, 2020 - July 5, 2023 were retrieved from the Swedish Financial Benchmark Facility (SFBF). We can observe that the two rates follow each other very well.

floating interest rates denominated in Swedish Kronor. STIBOR was published by the Riksbank between 1987 and 2020. Since 2020, it has been published by the Swedish Financial Benchmark Facility (SFBF). A possible challenge with the STIBOR T/N swaps is that their underlying asset is not the actual interest rate, the Riksbank rate, i.e. the main monetary policy instrument of the Riksbank. Thus, the STIBOR T/N rate and the swaps do not exactly reflect the expected changes of the Riksbank rate and can at times have a risk premium over the Riksbank rate. We can however see in Figure 1, which depicts the rate levels during the time period January 2, 2009 - July 5, 2023, that the two rates follow each other very well. The correlation between the two rates is approximately 1, which further underlines STIBOR T/N's adequacy as a proxy for the Riksbank rate (see Appendix, Table 9).

Hence, the use of STIBOR T/N 1-month OIS as an indicator of future levels of the Riksbank rate is motivated. Although, it still has to be remembered that the underlying asset is not directly linked to the Riksbank rate. Even though STIBOR very closely follows the Riksbank rate, not being the actual Riksbank rate is a limitation of our study. One has to consider that during the observed time window there is a possibility that over the course of one day, the two rates could differ even though

they on the whole follow each other closely. Identifying the unexpected and expected components of the monetary policy changes is done using the methodology employed by Fransson and Tysklind (2016). The unexpected component of the interest rate change is defined as:

$$\Delta i_t^u = \frac{(r_t^{Stina} - r_{t-1}^{Stina})(\tau_1 + \tau_1) - \Delta i_t^{styr}}{\tau_2 - 1} \quad (1)$$

where r_t^{Stina} is the rate of the STIBOR T/N 1-month OIS on the day t the monetary policy change was announced, τ_1 is the number of days of the contract that have passed on the implementation date, τ_2 is the number of days left until the contract expires on the implementation date and Δi_t^{styr} is the actual change in the Riksbank rate on the day t of the monetary policy announcement.² After having calculated the unexpected component of the interest rate change, we can define the expected component as:

$$\Delta i_t^e = \Delta i_t^{styr} - \Delta i_t^u \quad (2)$$

Having done this we will then regress 1-day OMXS30 equity returns on the expected and unexpected components to determine whether they have significant effects and to examine which statistical relationship is stronger.

2 Data

A The Riksbank announcement dates

The monetary policy announcements for the Swedish economy are published by the Riksbank, 5 times a year since 2019 and 6 times a year between 2008 and 2019. The press release dates have been gathered from the Riksbank's website, during the event window between January 02, 2009 and September 18, 2023. The first monetary policy announcement in our sample is on February 11, 2009 and the last monetary policy announcement in our sample is June 29, 2023, resulting in a total sample size of 86 observations. The press releases supply the dates which our event study will focus on and also contain the necessary information regarding the level of the Riksbank rate and how much it is changed by. These include 16 rate hikes, 14 rate cuts and 56 instances of keeping the Riksbank rate at the same level as before. To study the effects in question we use the announcement dates of the press release announcing possible changes to the Riksbank rate as the dates when we wish to study the equity returns. The Riksbank publishes its monetary policy changes in a press release on its website, one day after the Executive Board has taken their decision at the monetary

²Observations occurring on the penultimate or last day of the month are treated as occurring on the first day of the following month.

policy meeting. We are thus looking at the dates when the monetary policy decision is announced and not the day the possible change to the Riksbank rate is implemented. As previously mentioned we assume that markets are efficient in accordance with the EMH, and thus the implementation date can be discarded for our purpose.

These announcements contain the monetary policy decisions that the Executive Board has arrived at, i.e. changes in the Riksbank rate. Since 2015, these press releases can also contain announcements regarding possible purchases or sales of securities such as treasury and government bonds. The announcements often elaborate on where the current and projected inflation levels are at and if they are in line with the Riksbank’s target of 2 percent. Furthermore, the Riksbank provides forward guidance where they indicate where policy rate levels could be in the future.

B Swap and stock index data

To investigate the unexpected and the expected component in the interest rate changes we utilize the STIBOR T/N 1-month Overnight Index Swaps (OIS) and STIBOR 3-month Overnight Index Swaps (OIS). The first STIBOR T/N OIS rate in our sample is February 10, 2009, i.e. one day before the first monetary policy announcement date since we measure the difference in STIBOR T/N 1M OIS rates between the two days. The last observation is June 29, 2023. For STIBOR 3-month swap dates the first and last dates are the same. The stock index used to reflect the responses of equity prices is OMX Stockholm 30 (OMXS30) with the first data point being January 05, 2009 and the last being September 18, 2023. The OMX Stockholm 30 is an index comprised of the 30 most traded stocks in Sweden, and it is considered to be Sweden’s benchmark index. A large index with a high volume of intraday trading is important when analyzing same-day effects and reactions of the stock markets to new information. The swaps data and OMXS30 returns are collected from Refinitiv Eikon, an open-technology solution for financial market professionals. Refinitiv is an LSEG (London Stock Exchange Group) business and one of the world’s largest providers of financial markets data and infrastructure. It is a widely used database by professionals in the industry, and should thus be a valid source for the purpose of this study.

C Monetary policy announcements

The European Central Bank (ECB) monetary policy announcements will be used as a control and robustness check in the main regression. The ECB meetings occur every 2 weeks, but monetary policy decisions are taken every 6 weeks since 2015 (8 meetings a year) and every month between 2009 and 2014. The press release dates have been gathered from ECB’s website, during the event window between January 02, 2009 and September 18, 2023. The first monetary policy announcement in our sample is on January 15, 2009, and the last monetary policy announcement in our

sample is on July 27, 2023, resulting in a total sample size of 141 observations. For the ECB data, we have only gathered the announcement dates and not the level of interest change, as the dates will only be used as a control variable.

The Federal Reserve (Fed) monetary policy announcements will also be used as a robustness check in the main regression. The Fed monetary policy announcements are published 8 times a year. In 2020 however, in times of Covid-19, they had 10 monetary policy announcements. The press release dates have been gathered from the Fed’s website, during the event window between January 2, 2009 and September 18, 2023. The first monetary policy announcement in our sample is January 15, 2009, and the last monetary policy announcement in our sample is September 20, 2023, resulting in a total sample size of 120 observations. For the Fed data, we have only gathered the announcement dates and not the level of interest change, as the dates will only be used as a control to examine the subsample stability.

D Inflation Reports

Data on the inflation reports in Sweden are published by the governmental body ”Statistics Sweden” (SCB). Statistics Sweden is responsible for developing, producing and disseminating official statistics and other government statistics. The overall goal is to produce official statistics of good quality that are easily available for the users. The press releases are published every month (12 times a year), referencing the inflation from the preceding month. The press release dates have been gathered from SCB’s website, during the event window between January 2, 2009 and September 18, 2023. The first inflation announcement in our sample is February 19, 2009, and the last inflation announcement in our sample is September 14, 2023, resulting in a total sample size of 176 observations. For the SCB data, we have only gathered the announcement dates and not the level or level changes of inflation, as the dates will only be used to conduct sanity checks on our main results.

3 Event Study Results

Table 1 presents a selection of descriptive statistics from our sample of the 86 times the Riksbank made a press release following a monetary policy meeting in the period January 2009 to September 2023. The Riksbank has not changed the Riksbank rate many times in our sample. 56 of the monetary policy decisions are non-changes, whereas there have been 16 rate hikes and 14 rate cuts. However, this lack of activity is not a problem since the market can also be surprised by the Riksbank retaining the previous Riksbank rate.

An interesting statistic is that the standard deviation on days when the Riksbank publishes their monetary policy decisions is 1.38 percent, higher than the 1.24 percent on non-event days. This indicates that the market is more volatile on event dates and that monetary policy announcements provoke equity market reactions in conjunction

Table 1:**Summary Statistics**

The table reports summary statistics for our sample of the 86 monetary policy announcements dates over the period from January 2009 through September 2023. It includes statistics on the number of Riksbank publication dates and daily OMXS30 equity returns on event dates, i.e., dates when the Riksbank published monetary policy announcements and the 3612 non-event dates from our sample, i.e. dates when no announcements were made.

	January 2009-September 2023
Number of publication dates	86
Number of interest rate raises	16
Number of interest rate cuts	14
Number of non changes	56
Number of non event days	3612
Standard deviation of surprise change, in percentage points	0.85
Standard deviation of equity returns on publication dates, %	1.38
Standard deviation of equity returns on non-event days, %	1.24

with the logic that the market moves when new information is released. However, it is important to consider that the amount of non-event days, 3612, is considerably larger than that of publication dates, 86, and that the smaller amount of observations can lead to a larger standard deviation.

A Equity Price Reactions

The estimates of equity market reactions to monetary policy announcements are contained in Table 2. The estimates from column (1) contain results from a regression of the OMXS30 index returns on changes in the Riksbank rate,

$$R_t = \alpha + \beta \Delta i_t^{styr} + \varepsilon_t \quad (3)$$

not differentiating between expected and unexpected monetary policy decisions. R represents the one-day OMXS30 returns and Δi_t^{styr} is the change to the Riksbank rate. The regression in column (2) is specified as

$$R_t = \alpha + \beta^e \Delta i_t^e + \beta^u \Delta i_t^u + \varepsilon_t \quad (4)$$

where the distinction between expected and unexpected Riksbank rate changes, Δi_t^e and Δi_t^u is made using the formula described in equations (1) and (2). The error term ε_t is defined as all factors other than monetary policy announcements that impact stock prices on event days and the assumption is that it is orthogonal to the right-hand side of the regression.

The response of the raw Riksbank rate change in column (1) is significant and negative. Based on economic theory as outlined earlier in the paper, a negative sign

Table 2:**The Response of Equity Prices to Changes in the Riksbank rate**

The table reports the results from regressing the 1-day OMXS30 equity returns on changes in the Riksbank rate in column (1), and on the unexpected and expected components of the Riksbank rate change, column (2). All variables are expressed in percentage terms. The full sample consists of the 30 Riksbank rate changes and the 86 monetary policy announcements dates over the period from January 2009 through September 2023. Parentheses contain heteroskedasticity-consistent estimates of the standard errors and dots indicate significance at different levels.

	<i>Dependent variable:</i>	
	OMXS30 returns	
	Raw Model	Surprise model
	(1)	(2)
Intercept	0.002 (0.002)	0.002 (0.002)
Interest rate change	-1.219** (0.557)	
Expected change		-1.155** (0.571)
Unexpected change		-1.294** (0.558)
Adjusted R ²	0.034	0.030
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01	

is to be expected as higher interest rates are associated with attempts to dampen economic activity. The negative significant coefficient of -1.219 implies that OMXS30 equity prices fall by 1.219 percent following a 1 percentage point increase in the Riksbank rate. This coefficient is in line with earlier research. Thorbecke (1997) had a statistically significant coefficient of -1.44 when regressing the Dow Jones Industrial Average Index on raw changes in the Federal Funds rate. Bernanke and Kuttner (2005) found a significant coefficient of -0.61. Our coefficient is thus in the middle of these two. It is evident that raw changes to the Riksbank rate have significant negative effects on equity prices.

When the effect is decomposed into an expected and unexpected change in column (2) we can see that both effects are negative and significant at the 5 percent level. In line with our hypothesis, the response of equity prices is stronger to surprise changes, not by much, however. The results from column (2) imply that equity prices drop by

1.294 percent as a reaction to a 1 percentage point unexpected Riksbank rate hike. This effect is much more modest than the -4.68 unexpected change coefficient found by Bernanke and Kuttner (2005). It is important to note though that we are using different formulas for our unexpected components, diminishing the direct comparability of our results. The adjusted R^2 states that 3 percent of the variance in equity prices on days of Riksbank monetary policy announcements are connected with monetary policy, compared to 17 percent found by Bernanke and Kuttner (2005) in relation to the Fed's monetary policy announcements. This would imply that even though the effect of expected and unexpected changes in the Riksbank rate significantly negatively affects equity prices, the magnitude of their effect is not substantial. A curious result of the regression is that the expected and unexpected components are quite similar in magnitude. According to the EMH, expected changes would already be incorporated into prices. The implication of this and the expectation for how it affects our regression analysis would be that the expected component should be insignificant. Bernanke and Kuttner (2005) generate a significant positive expected change coefficient in their regression. Their expected coefficient thus also fails to support EMH. None of the studies thus fall in line with the economic reasoning outlined in the EMH. The reason for the similarity in magnitude between the expected and unexpected coefficients can perhaps be comprehended from the definition of the expected component in equation (2). With 56 of our observations being non-changes to the Riksbank rate, in all these 56 cases, the expected component is going to be the same number as the unexpected with the opposite sign. This explains why their magnitude is very similar. However, it raises questions surrounding the sign of the expected component. Given that in 56 cases, the expected component is simply the opposite sign of the unexpected component, one would expect that the regression coefficient also would be of the opposite sign. We further investigate the peculiar similarity between the two components by running a regression where we exclude all 56 dates containing non-changes in order to account for the problem arising when the actual change in the Riksbank rate is zero (see Appendix, Table 8). This regression using 30 observations, however, yielded very similar results to those where we included all observations. The expected component coefficient was -1.090 and weakly significant at the 10 percent level, the unexpected component was -1.211 but insignificant. One does have to consider that the burden to prove significance increases with a decreasing sample size. However, since the two components are still very close in magnitude when removing all non-changes this proximity cannot solely be attributed to the high amount of non-changes, and the identical magnitude but opposite signs of the expected and unexpected components, non-changes imply. Their similarity is consistent throughout our study and a seemingly robust although peculiar and counterintuitive result.

Our first results thus both confirm and disprove the underlying economic framework and our expectations. The reaction of equity prices is stronger in response to unexpected changes in the Riksbank rate than to expected changes, confirming our first

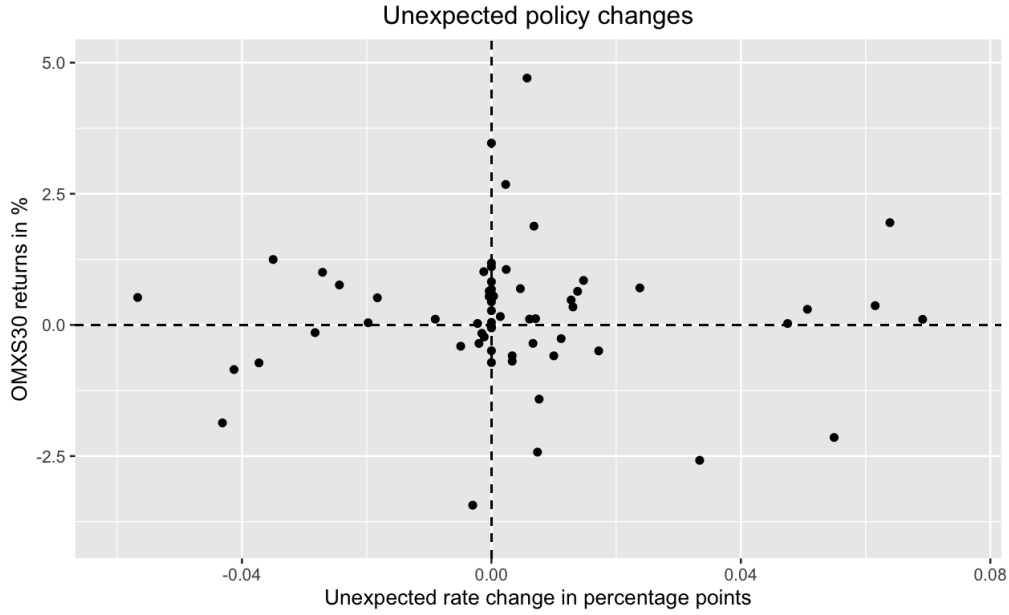


Figure 2: Riksbank rate surprises and OMXS30 returns, daily data. This figure is a scatter plot of 1-day OMXS30 returns against the unexpected component of changes to the Riksbank rate. Our sample includes the 86 monetary policy announcements made by the Riksbank between January 2009 and September 2023.

hypothesis. The significance of the expected component, however, and its similarity to the unexpected component rejects our hypothesis that expected changes should already be incorporated into equity prices. In our sample, this is evidently not the case. This raises doubts whether expected changes are actually accounted for in the equity prices. The relationship between equity returns and unexpected rate changes can be observed in Figure 2.

Figure 2 clearly displays the high fluctuations in equity prices on days of monetary policy announcements. Responses range from being very dramatic to being very muted. For instance, when the unexpected change is above zero we can observe multiple daily equity price returns both above and below zero. This spread and the substantial lack of uniformity in equity price responses hint that the surprise changes are interpreted differently. Furthermore, it could state that on days of monetary policy announcements, these announcements are not the only force driving equity price movements. Other information possibly affecting the relationship will be further examined in the following sections by controlling for more specific aspects of the Riksbank announcements and possible rate changes, as well as the circumstances when they were released.

B Possible Violations of Exogeneity

As previously mentioned, the regression model assumes that the error term is orthogonal to changes in the Riksbank rate. Should the Riksbank's changes to the policy rate be made in response to equity price movements, the orthogonality condition would be violated. The Riksbank's explicit target is, as stated earlier, to keep inflation levels at 2 percent CPIF. Additionally, they mention that balanced output and employment levels are another of their objectives. Thus, on a superficial level, this assumption seems to hold unless equity price fluctuations would significantly impact some of the Riksbank's target variables such as inflation. The literature on whether asset prices can be seen as a predictor of monetary policy varies. Bernanke and Gertler (1999) find that it is neither necessary nor desirable for central banks to respond to large fluctuations in asset prices. Their studied economies are however the United States and Japan and they note that it could be different for small open economies, such as Sweden. Fuhrer and Tootell (2004) find that the perception that asset price movements had impacted monetary policy decisions beyond the indirect effect on the Federal Reserve's target variable was not motivated. Their study indicated that the Federal Reserve did not overreact to fluctuations in asset prices by altering monetary policy. The Federal Reserve's reactions were deemed to be in proportion with the effect changes in asset prices had on their target variables. There exists however, studies indicating that central banks do respond to asset price fluctuations. Rigobon and Sack (2003) find that monetary policy is conducted following fluctuations in asset prices and that a 5 percent increase in the S&P 500 increases the likelihood of a 0.25 percentage point increase in the Federal Funds rate by a probability of 0.5. Although, they note that this response is in line with asset prices' impact on macroeconomic variables. A further study on the German Bundesbank by Bohl, Siklos and Werner (2007) found that the responses of German monetary policy to changes in asset prices were weak. Overall, there thus seems to be little support for the notion that there are contemporaneous reactions of monetary policy to movements in asset prices. Monetary policy can only be assumed to be affected by asset prices through their impact on the central banks' target variables.

The orthogonality condition could also be rejected if stock prices and monetary policy responded simultaneously to new information being released. This could be employment reports, inflation reports, or other types of announcements, such as those by other central banks. Since our sample only contains six instances of the Riksbank announcement coinciding with the release of an unemployment report, this should not give rise to contemporaneous responses in our model. Our sample also contains observations occurring during the Covid-19 pandemic 2020-2021. There is however little to suggest that the Riksbank reacted to news from the pandemic in terms of the Riksbank rate since the Riksbank rate remained unchanged at the 0 percent level during this time period. Pandemic-related announcements would hence not pose significant challenges to the orthogonality condition. The challenges posed by related

announcements such as those by other central banks will be addressed in later sections.

The methods used in the literature to tackle problems of endogeneity have yielded very similar results to those generated using event studies. The results from Rigobon and Sack (2002), where they introduced a new estimator based on heteroskedasticity in high-frequency data, did not diverge strongly from those using the event-study method. The same seems to be true for the method employed by Gürkaynak, Sack, and Swanson (2004) where they used intraday data to distinctively capture the event window. The findings were almost equivalent to those from daily data. Hence, based on results in earlier studies and our sample, we assume our study is not substantially hampered by a lack of orthogonality.

C Asymmetries

A possible explanation of the OMXS30's varying reactions to the Riksbank's monetary policy announcements could be the phenomenon of asymmetries, namely if the direction of a monetary policy decision induces varying reactions in equity prices. To examine this phenomenon we will employ interacting dummy variables in our regressions.

Firstly, we add a dummy variable that is equal to 1 in the 40 cases where the unexpected change component is greater than 0. An interactive term with this dummy variable and the unexpected change component was added to the regression reported in column (1) in Table 3. Here, we thus account for instances where the change in the Riksbank rate was greater than anticipated. The rationale for this is that in conjunction with EMH, a positive surprise, i.e. a change in the Riksbank rate greater than anticipated, should withdraw a stronger market reaction and could serve as a possible explanation for some of the equity prices' more drastic movement on days of monetary policy announcements.

A related kind of asymmetry concerns the sign of the Riksbank rate change. Perhaps market responses differ based on whether the monetary policy decision is a rate hike or if it is keeping the rate at the previous level. The effects of different directions of the monetary policy are studied using two dummy variables. The first equal to 1 for the 16 cases the Riksbank raised the Riksbank rate and the second equal to 1 for the 50 cases where the Riksbank announced that they would not be changing rates. The regression with this specification is reported in column (2) of Table 3. This allows us to account for the equity price response to non-changes in monetary policy.

The results from column (1) seem to suggest that whether the unexpected component is positive or negative does not result in different reactions in equity prices. The coefficient for the interaction term is as one would expect negative (-0.332), following the logic that rate changes higher than anticipated withdraw a drop in equity prices. However, the interaction term is insignificant and cannot be assumed to be different

Table 3:**Testing for Asymmetries**

The table reports the results from regressions of the 1-day OMXS30 equity returns on the unexpected and expected components of the Riksbank rate change. All variables are expressed in percentage terms. The full sample consists of the 30 Riksbank rate changes and the 86 monetary policy announcement dates over the period from January 2009 through September 2023. The positive surprise dummy in column (1) is set to 1 for the 40 instances when the unexpected change is greater than 0. The rate hike and no rate change dummies in column (2) are set to 1 when the Riksbank rate is increased or unchanged. Parentheses contain heteroskedasticity-consistent estimates of the standard errors and dots indicate significance at different levels.

	<i>Dependent variable:</i>	
	OMXS30 Returns	
	Direction of Anticipation (1)	Direction of Rate Change (2)
Intercept	0.002 (0.002)	0.002 (0.002)
Expected change	-1.207* (0.637)	-1.356** (0.640)
Unexpected change	-1.325 (0.812)	-1.403 (1.739)
Unexpected Change x Positive surprise	-0.332 (1.457)	
Unexpected Change x Rate Hike		-2.982 (2.783)
Unexpected change x No change		-1.767 (1.876)
Adjusted R ²	0.020	0.070
<i>Note:</i>		*p<0.1; **p<0.05; ***p<0.01

from zero. The results thus seem to suggest that the direction of anticipation, i.e., whether the rate change is higher than market expectations does not significantly influence the movement of equity prices. We can hence not explain some of the great variety in equity price responses based on whether they occur when changes to the Riksbank rate are greater than expected. This result is not what one would expect. The intuitive result would be that a positive surprise induces a much stronger reaction

from equity prices.

The coefficient for the interaction term between unexpected changes and rate hikes is strongly negative, as can be seen in column (2). This is in line with expectations and our previous results that increases in the Riksbank rate are related to falls in equity prices. It is although not statistically significant. One does have to consider that the burden to prove statistical significance becomes substantially greater with the small sample size of 16 rate hikes. The unexpected change component for non-changes is also negative, -1.767, and not statistically significant. This result could stipulate that the market does react to the Riksbank not changing the policy rate if this is unexpected. One does, however, have to consider the implication of the coefficient not being statistically significant. Thus, both coefficients concerning the direction of policy changes cannot be assumed to be different from zero.

Although the scant amount of rate hikes pose challenges to proving statistical significance and thus obtaining conclusive evidence, the results convey that the different directions of monetary policy decisions do not seem to substantially exert influence on equity returns.

The magnitude of the unexpected component remains stable in both of the specified regressions. It becomes slightly greater in both, compared to the original model in Table 2, when accounting for unexpected changes. This at least hints at the unexpected component displaying consistency in magnitude with varying specifications. The unexpected component in both regressions is however insignificant, raising concerns about the stability of the significant negative relationship between the unexpected component and equity returns. Furthermore, the expected and unexpected components remain very similar in magnitude, with the unexpected component coefficient still being moderately larger.

D Timing vs Level Surprises

As can be seen in Figure 2, equity price responses to monetary policy announcements in Sweden vary from being very strong to silent. Thus, even though they are significant, they are very far from being homogeneous. One possible explanation offered by Bernanke and Kuttner (2005) for this lack of uniformity in responses is that rate change surprises vary in their impact on short-term future interest rates. Some rate change surprises may be interpreted as a postponement or advancement of an unavoidable policy path, whereas others are construed as fundamental changes in monetary policy. The former example thus merely constitutes a surprise in terms of the timing of the rate change. The latter would have a much more significant impact by emphatically altering policy expectations for the months to come. Another argument elucidating why announcements affect expectations of future interest rates is that the Riksbank provides some forward guidance. Åhl (2017) found that forecasts of policy rates managed market expectations of future policy rates up to one and a half years in the future. This could imply that the market has an idea of where the

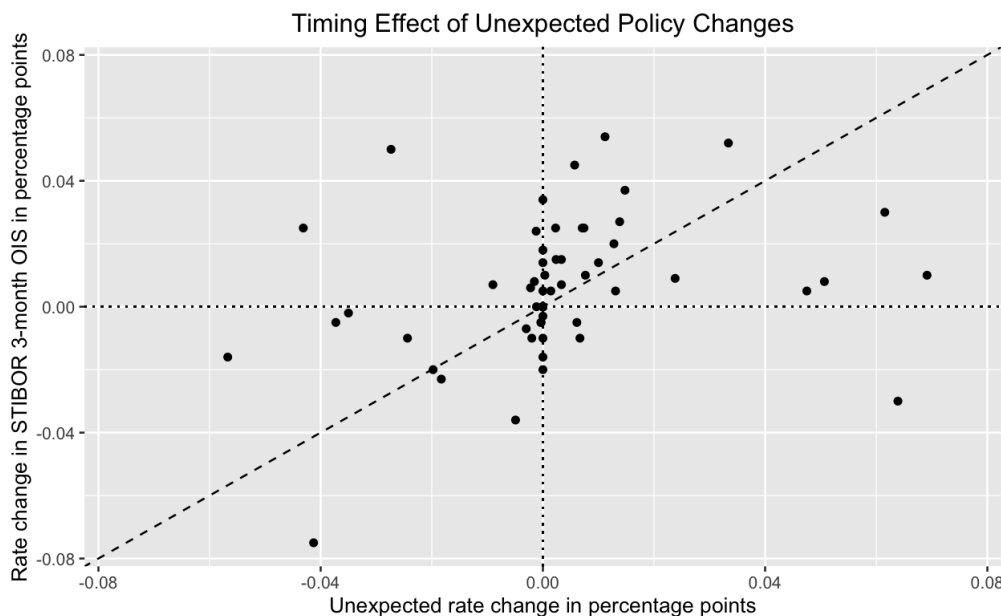


Figure 3: Riksbank rate surprises and 3-month expectations. This figure is a scatterplot of 1-day changes in the STIBOR 3-month OIS against the unexpected component of changes to the Riksbank rate. The 45-degree line indicates when there is a 1-for-1 effect. Our sample includes the 86 monetary policy announcements made by the Riksbank between January 2009 and September 2023.

Riksbank rate levels will be, the ambiguity concerns when they will reach the specified levels. Hence, one should try to comprehend whether the responses of equity prices to unexpected changes can be apportioned to surprises in terms of either the timing or the level of the monetary policy decision.

The method employed by Bernanke and Kuttner (2005) to determine the nature of the surprise response is to examine the relationship between unexpected changes and changes in 3-month Federal Funds futures rates. We will replicate this by regressing changes in prices of STIBOR 3-month OIS on the expected and unexpected components. This will provide an explanation as to whether an unexpected change to the Riksbank rate in one day also significantly changes the market's perception of where the Riksbank rate will be in 3 months. The relationship between changes in current and 3-month expectations following Riksbank announcements is portrayed in Figure 3.

Figure 3 clearly displays that there very rarely is a 1-for-1 effect in the changes of STIBOR 3-month OIS prices and unexpected changes to the Riksbank rate. The majority of observations are located above the 45-degree line which indicates when there is a uniform response in the unexpected change component and the expectations on the STIBOR rate in 3 months. The rate change in the STIBOR 3-month OIS is

usually much tinier than the unexpected change. We can however note that many observations are low in terms of the change in the unexpected component since most of the dots find themselves around the vertical line marking a non-change to current expectations. The wide spread both above and below the 45-degree line hints that the responses of the 3-month expectations vary a lot. Those observations in the upper right quadrant above the diagonal line imply that in many of the cases where a positive surprise occurred the response of the 3-month rate change was much stronger. The lack of uniformity is however palpable in Figure 3 and will be further enunciated in the regression in Table 4.

Table 4 displays the results from regressing 1-day changes in the STIBOR 3-month OIS on unexpected changes in the Riksbank rate. As noted earlier, the effect is much

Table 4:

The Response of Interest Rate Expectations to Unexpected Riksbank Rate Changes
The table reports the results from regressions of the STIBOR 3-month OIS price changes on days of monetary policy announcements on the unexpected and expected components of the Riksbank rate change. Column (2) contains a dummy variable equal to 1 in the 40 cases where the unexpected change component was greater than 0. All variables are expressed in percentage terms. The full sample consists of the 30 Riksbank rate changes and the 86 monetary announcement dates over the period from January 2009 through September 2023. Parentheses contain heteroskedasticity-consistent estimates of the standard errors and dots indicate significance at different levels.

	<i>Dependent variable:</i>	
	STIBOR 3M OIS	
	Normal model	Controlling for Positive Surprise
	(1)	(2)
Intercept	−0.00003 (0.0001)	−0.0001 (0.0001)
Expected change	0.120** (0.054)	0.140** (0.057)
Unexpected change	0.142 (0.127)	0.153 (0.134)
Unexpected change x Positive Surprise		0.129 (0.180)
Adjusted R ²	0.296	0.415
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01	

less than 1-for-1, as the insignificant unexpected coefficient of 0.142 suggests. Unexpected monetary policy decisions thus seem to influence 3-month expectations in a much weaker way, if at all. This could be interpreted as that unexpected changes to the Riksbank rate are solely construed as surprising in terms of their timing. They do not seem to substantially alter expectations of their level in the future. This relationship is much weaker than that found by Bernanke and Kuttner (2005), who found a coefficient of 0.65. Our unexpected coefficient here is also not significant, which indicates stronger evidence for timing effects. A reason for the insignificant effect we observed for the Swedish market, could potentially be an effect of the interest rate projections made by the Riksbank, which steer market expectations as suggested by Åhl (2017). These could possibly mitigate and even prevent monetary policy shocks. The forecasts communicated by the Riksbank in their monetary policy announcements reveal the possible future levels of the Riksbank rate. The ambiguity regarding Riksbank announcements could hence be argued to rather pertain to when they are implemented than to what they reveal. This is a possible explanation for the strong "timing" effect as indicated by the regression in Table 4. Although, the weak and insignificant coefficient hints at a low correlation, as was observed in Figure 3, many positive surprises resulted in stronger responses in the 3-month expectation. In Table 4 column (2) a dummy variable is included equal to 1 when there is a positive surprise that interacts with the unexpected change component. This coefficient is insignificant, and also quite small. The 1-for-1 effect when there are positive surprises is, however, evidently not present although the results establish that when there is a positive surprise there is an increase in the 3-month expectation as proxied by the STIBOR 3-month OIS. The effect of adding this interaction term raises the adjusted R^2 from 0.260 to 0.415, meaning that monetary policy, when accounting for the individual effect of positive surprises, explains 41.5 percent of the variations in the price of STIBOR 3-month OIS.

The fact that all unexpected coefficients are insignificant means that we cannot statistically prove the presence of a "level" effect through the unexpected component. The insignificance demonstrates that an unexpected change in the Riksbank rate does not significantly alter the prices of STIBOR 3-month OIS. This result is consistent throughout both regressions, which establishes the existence of a timing effect when it comes to interest rate surprises. A "level" effect only seems to exist through the expected component which in both regressions is significant but of a low magnitude (0.120 and 0.140). In the context of our other results, the strong indication of a timing effect could perhaps offer explanations as to why Swedish equity returns seem to react less dramatically to unexpected changes in monetary policy.

Our results from this section can thus be considered to state that most of the surprises of the changes to the Riksbank rate are in terms of their timing, they mostly seem to affect current expectations.

E Information Conditions and Spillover Effects

We will proceed by studying other information released in close temporal proximity to the 86 monetary policy announcements in our sample. This will include announcements regarding information that is often pertinent to interest rate expectations. These will include monetary policy announcements by central banks affecting bigger markets such as the European Central Bank and the Federal Reserve. Furthermore, we will include the effects of the market awaiting Swedish inflation reports. We can thus state that we are investigating varying conditions where investors have different degrees of information that may or may not provide insight into the monetary policy decision that is being taken. So, for instance, a Riksbank announcement of a monetary policy decision that is preceded by a monetary policy decision by another bigger central bank in the week before may be considered less surprising and provoke weaker reactions. The reverse logic applies to Riksbank monetary policy announcements made ahead of the release of an inflation report. Perhaps market participants await the inflation report, believing its revealed information will be more impactful. Hence their reaction to a Riksbank monetary policy announcement might be subdued in awaiting the inflation numbers. This section thus also serves to investigate some instances where the assumption of orthogonality could be violated and whether this could skew our results. The conditions under which a monetary policy report was released can further elucidate and offer explanations as to why some OMXS30 responses were more accentuated and others muted.

The spillover effects of central banks such as the ECB and the Fed were covered in the literature by Angeloni et al. (2003) and Giovanni and Hale (2022). These papers established that asset prices worldwide, or in the member states, reacted following monetary policy decisions by these two central banks. The fact that asset prices in foreign countries did react can be understood as that domestic investors interpret foreign monetary policy announcements, i.e. those by the ECB and the Fed, as significantly influencing the domestic economy. With this tenet as a starting point, we will investigate whether monetary policy decisions by the ECB and the Fed affect domestic investors' interpretation of a domestic, i.e. in this case the Riksbank, monetary policy decision. To determine whether the construing of Riksbank monetary policy announcements is affected by previous monetary policy announcements by the aforementioned central banks, we will construct subsamples and run the same specified regressions with expected and unexpected components as previously. This will aid in understanding when foreign monetary policy decisions impact Swedish investors' interpretations of Riksbank monetary policy announcements.

E.1 European Central Bank

Firstly, we will focus on the reactions of Swedish equity prices to the Riksbank's monetary policy announcements, made following monetary policy announcements by

the European Central Bank. The way we have divided our sample is that we have investigated which of the 86 Riksbank monetary policy announcements were made within a 1-week time window after a monetary policy announcement by the ECB was released. Note that we do not focus on the content of the ECB announcement or whether it contains information regarding interest rates or QE. Our focus is the unexpected component of the Swedish market with respect to Riksbank monetary policy announcements. This methodology thus yields two subsamples. The first one contains the 29 monetary policy observations made by the Riksbank within one week after a monetary policy announcement made by the ECB. The other subsample contains the 57 Riksbank monetary policy announcements in our sample that were not made after an announcement by the ECB. We then ran our surprise model as specified in equation (4) on these two subsamples. The results from these regressions are reported in Table 5.

As can be seen in Table 5, column (2), the statistically significant coefficients related to ECB spillover effects are regarding Riksbank announcements that have not been preceded by an ECB announcement. The expected change is significant at the 5 percent level, with a coefficient of -1.502, which indicates that an expected one percentage point increase in the Riksbank rate would transmit to the stock market by negative 1.502 percent if the announcement is not followed by an ECB report. The unexpected component is not significant and has a negative coefficient, meaning that the stock market would drop by 1.650 percent when the Riksbank rate is unexpectedly raised by 1 percentage point. The magnitude is greater and a negative sign is in line with our earlier regression coefficients. This indicates that the equity price response is stronger when no monetary policy announcement is released by the ECB the week before the Riksbank makes its own announcement. The magnitude can be considered to be in line with EMH since the equity price movement is greater when investors can be thought of as having less information. The reaction of OMXS30 prices hence seems to be stronger when the Riksbank is "undisturbed" within the release of their monetary policy decision. However, the lack of significance means we cannot reject the unexpected component being unequal to zero. It is thus another example proving the lack of subsample stability. The unexpected component that at first was significantly negative, is not so anymore.

Column (1) refers to the Riksbank announcements that have been preceded by an ECB announcement. These coefficients are negative for both the expected and the unexpected Riksbank rate change, however, they are not statistically significant. The unexpected change also indicates a weak effect of -0.227 between the unexpected Riksbank rate change and the OMXS30 change, but since not being statistically significant, it cannot be assumed to be unequal to zero. This can be interpreted as that investors are much less surprised by the Riksbank's monetary policy decisions when they are made within one week after an ECB monetary policy announcement. The effect of the unexpected component becomes muted. This could mean that

Table 5:**Spillover effects**

The table reports the results from regressing the 1-day OMXS30 equity returns on changes in the unexpected and expected components of the Riksbank rate change. Column (1) reports results from the 29 monetary policy announcements from the Riksbank that occurred within one week after a monetary policy announcement made by the European Central Bank. Column (2) reports results from those 57 Riksbank monetary policy announcements that were not preceded by a monetary announcement by the ECB the week before. Column (3) reports results from the 13 monetary policy announcements from the Riksbank that occurred within one week after a monetary policy announcement made by the Federal Reserve. Column (4) reports results from those 73 Riksbank monetary policy announcements that were not preceded by a monetary announcement by the Federal Reserve the week before. All variables are expressed in percentage terms. The full sample consists of the 30 Riksbank rate changes and the 86 monetary policy announcement dates over the period January 2009 through September 2023. Parentheses contain heteroskedasticity-consistent estimates of the standard errors and dots indicate significance at different levels.

	<i>Dependent variable:</i>			
	OMXS30 returns			
	One Week after ECB	No ECB	One Week after Fed	No Fed
	announcement	announcement	announcement	announcement
	(1)	(2)	(3)	(4)
Intercept	0.001 (0.002)	0.003 (0.002)	-0.004 (0.006)	0.002 (0.002)
Expected change	-1.843 (1.610)	-1.502** (0.654)	-5.193 (3.010)	-0.896 (0.568)
Unexpected change	-0.227 (1.607)	-1.650 (1.019)	-2.992 (5.378)	-1.054* (0.602)
Adjusted R ²	-0.013	0.037	0.168	0.022
N	29	57	13	73

Note:

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

the market anticipates that the Riksbank will take similar measures as the ECB, and the announcement can thus be seen as a forecast for the upcoming Riksbank announcement. The adjusted R^2 is even negative meaning that monetary policy announcements by the Riksbank explain none of the variation in OMXS30 equity returns. One could with caution, due to the small sample size and the subsequent difficulty of proving statistical significance, take this as an indication of ECB spillover effects. This in terms of a spillover in information which alters investors' perception of the Riksbank's monetary policy decisions. The presence of ECB monetary policy

decisions could hence be considered to explain some of the more phlegmatic equity price responses in our sample.

E.2 Federal Reserve

We apply the same methodology as employed in the previous section with respect to the response of OMXS30 equity prices to Riksbank monetary policy decisions made within a week after a monetary policy announcement by the Federal Reserve. As previously mentioned, we do not research the contents or directions of the Fed monetary policy decision. Our sole concern is whether or not the Riksbank monetary policy announcement is made within one week after that of the Federal Reserve. We thus divided the original 86 observations into two subsamples, one containing the 13 observations where the Riksbank decision was released within one week after an announcement by the Fed, the other where this was not the case. Table 5 contains the results from running the regression containing the expected and unexpected components on these two subsamples.

As can be seen in Table 5, only the unexpected change with no Fed announcement published within a week ahead of the Riksbank announcement, in column (4), is significant and negative at the 10 percent level. The effect however is approximately negatively 1-for-1 when the Riksbank unexpectedly raises rates by 1 percentage point and this announcement is not preceded by a Fed announcement. The effect in question is also smaller than in Table 2 column (2), which could be a consequence of the smaller sample size when excluding the Riksbank's announcements following a Fed announcement. The reaction of equity prices to unexpected changes in the Riksbank rate is however significantly negative in comparison to the ECB subsample where this is not the case. The behavior of equity prices, in response to surprises in the Riksbank rate unaffected by Fed announcements, can hence be viewed as somewhat more subdued than they were in the previous regression.

Table 5 column (3) shows the OMXS30 reaction when the Riksbank's announcements are preceded by a Fed announcement. The effect here is much larger than in column (4) for the unexpected change in the Riksbank rate. This could indicate that the market is negatively affected by and responds quite dramatically, with -2.992 percent for a 1 percentage point increase in the Riksbank rate, to the Riksbank announcement following the new information provided by Fed. The large unexpected coefficient implies that uncertainty and equity price volatility increase dramatically on days a Riksbank monetary policy announcement is released if it was preceded by an announcement by the Federal Reserve. Column (4) indicates that the opposite seems to be the case. These effects from column (3) are although not statistically significant, and thus the potential insight it provides must be taken with caution and cannot be assumed to be unequal to zero. One also has to consider that the burden to prove statistical significance becomes substantially more difficult with the small sample size of 13 observations. The very meager sample size of 13 means the

regression merely serves as a sanity check rather than an actual source of insight. However, the much larger volatility that becomes evident in both the expected and unexpected components seems to be correlated with the presence of Fed announcements. The more aggravated equity market responses of the OMXS30 in our sample seem to occur in close proximity to Federal Reserve monetary policy decisions and this is a relationship that requires further investigation.

The spillover effects from the ECB and the Federal Reserve on Swedish equity prices generate contrasting results. Volatility in the OMXS30 seems to increase in the presence of Federal Reserve monetary policy announcements even though we cannot say that these results are significant. This finding is in line with previous results, namely that monetary policy decisions by the Federal Reserve are often less anticipated and induce greater reactions. This statement is based on the results from Bernanke and Kuttner (2005) whose unexpected component was significantly greater than ours and who reported a substantially more pronounced "level effect". The Swedish equity market also exhibits greater fluctuations when these American monetary policy decisions are released. Our study has thus consistently indicated that both Swedish and American equity price reactions to Federal Reserve decisions are more enunciated than those of Swedish equity prices to Riksbank decisions in the absence of a Fed announcement. A potential explanation for this increased volatility can be the global spillover effects of US monetary policy shocks as documented by Giovanni and Hale (2022). The worldwide reverberations could be interpreted as augmenting uncertainty and hence induce more drastic investor reactions.

Whereas Federal Reserve monetary policy decisions seem to increase the movement of equity prices on days of Riksbank monetary policy announcements, the opposite seems to be the case with ECB announcements. Following ECB announcements, OMXS30 responses on days of Riksbank monetary policy decisions are ostensibly close to zero, and the fluctuations in prices seem to increase when the Riksbank announcement is "undisturbed" by the ECB. These contrasting dynamics, with the Fed seemingly increasing OMXS30 volatility and the ECB lowering it would be interesting to further investigate.

E.3 SCB Inflation Reports

The Statistiska Centralbyrån or Statistics Sweden releases inflation reports on a monthly basis and is a separate entity from the Riksbank. Since CPIF is the main target variable of the Riksbank, inflation announcements can be regarded as highly pertinent to the path of the Riksbank's monetary policy. As Chortareas, Karanasos and Noikokyris (2018) found that monetary policy announcements made by the Bank of England Monetary Policy Committee within one week ahead of an inflation report provided insight into that inflation report and hence withdrew a specific market reaction. This is an interesting relationship to examine. In England, it is the Bank of England that releases the inflation report whereas in Sweden monetary policy de-

cisions and inflation reports are released by different authorities. It is ambiguous whether one can say that a monetary policy decision provides insight into upcoming inflation numbers in Sweden in the same fashion as in England. The aspect of Swedish equity markets anticipating the results of an inflation report when a Riksbank monetary policy decision is announced will be examined in this section. Here we wish to determine the effects of the market awaiting the inflation report on the responses of equity prices to monetary policy announcements. Using the same methodology as before we divide our sample of 86 Riksbank announcements into two subsamples, one with the 27 announcement dates that occurred within one week ahead of the release of an inflation report and the other with the 59 observations unaffected by inflation reports. Regressions are then conducted on these two subsamples to compare the effects on equity prices that Riksbank announcements have when they occur within one week ahead of the release of an inflation report by Statistics Sweden. The results from the regressions are portrayed in Table 6.

Table 6 column (1) has a minor negative coefficient of -0.210, indicating that an unexpected 1 percentage point raise of the Riksbank rate results in the OMXS30 decreasing by -0.210 percent when the Riksbank announcement precedes an inflation report. The unexpected change to a Riksbank announcement is muted. This can be regarded as an indication that the equity markets are more focused on the inflation report than the monetary policy decision, hence why the reaction to the following monetary policy announcement by the Riksbank is relatively weak. Since inflation is the metric the Riksbank is most focused on, if there is an inflation announcement in close succession to a monetary policy announcement, the inflation announcement might be considered more important. The monetary policy announcement will be regarded as relatively less important since the upcoming inflation report will likely impact the course of monetary policy in the future. Another reason could be that the Riksbank provides a description of the future prospects for inflation, perhaps resulting in a larger component of expected inflation already priced into equity prices. In conclusion, however, the low sample size of 27 observations does make it harder to attain statistical significance for the relation between inflation reports and the Riksbank's announcements. Our sample can thus not be considered to provide conclusive evidence that the equity markets do not react to the release of inflation announcements. There are, as previously mentioned, other aspects of the sample that might hamper the ability to establish statistical significance. Furthermore, one has to consider that subsample significance in our unexpected coefficient has been elusive. The interpretation that the market anticipating an inflation decision results in a muted reaction must be taken with caution.

The unexpected change in column (2) is significant at the 10 percent level, indicating that a 1 percentage point raise of the Riksbank rate results in the OMXS30 decreasing by -1.229 percent when the Riksbank announcement is not published in the week before an inflation announcement. This result is in line with the results pre-

Table 6:

Inflation Announcement Effects

The table reports the results from regressions of the 1-day OMXS30 equity returns on changes in the unexpected and expected components of the Riksbank rate change. Column (1) reports results from the 27 monetary policy announcements from the Riksbank that occurred within one week before an inflation report was released by Statistics Sweden. Column (2) reports results from those 59 Riksbank monetary policy announcements that were not succeeded by an inflation report release by Statistics Sweden within the following week. All variables are expressed in percentage terms. The full sample consists of the 30 Riksbank rate changes and the 86 monetary policy announcement dates over the period January 2009 through September 2023. Parentheses contain heteroskedasticity-consistent estimates of the standard errors and dots indicate significance at different levels.

	<i>Dependent variable:</i>	
	OMXS30 returns	
	Within One Week before SCB Inflation Announcement	No SCB Inflation Announcement
	(1)	(2)
Intercept	0.003 (0.003)	0.001 (0.002)
Expected change	-3.034 (1.978)	-1.066* (0.601)
Unexpected change	-0.210 (2.978)	-1.229* (0.651)
Adjusted R ²	0.013	0.037
N	27	59
<i>Note:</i>		*p<0.1; **p<0.05; ***p<0.01

viously mentioned in Table 2 column (2). In the case of inflation reports there thus seem to be subsample stability in our results, although the coefficients are slightly weaker in this regression than with the full sample. This is in contrast with for instance the ECB case, where the non-presence of informative events close to the Riksbank announcement amplified the movement of equity prices. However, this result was not significant. The behavior of equity returns without a following inflation announcement can thus be regarded to be "normal". We can hence observe that the presence of an inflation report deviates our results strongly from the original full-sample regression, while the absence of inflation reports keeps them very much in line

with the original regression. Therefore, it seems that inflation reports are a strong determinant of the stock market's reaction to monetary policy announcements by the Riksbank. This could be argued as expected since inflation is the main target variable of the Riksbank. The upcoming inflation report might render the latest monetary policy decision less impactful since it will imply a different monetary policy path in the future.

F Quantitative Easing

With the Riksbank not only utilizing the Riksbank rate as the sole monetary policy instrument since February 2015, it is not clear that equity returns on monetary policy announcement dates can be attributed to revealed changes or non-changes to the Riksbank rate. Since the announcements beginning in February 2015 now also convey information on asset purchases/sales made by the Riksbank and whether and with what pace they will be conducted, quantitative easing measurements must also be accounted for. It is possible that for instance on dates where no rate changes were made, the Riksbank bought treasury bills or government bonds as an alternative method of conducting monetary policy. These alternative measures could induce reactions from the equity market that are not accounted for in our regressions. Since interest rates are no longer the exclusive tool for combating inflation, the role of QE ought to be accounted for. The presence of QE makes the relationship between interest rates and equity prices more ambiguous. We would thus continue by determining the effect of Riksbank rate changes during the time frame of our sample where the Riksbank also implemented asset purchases or sales to attain their monetary policy goals. This is to determine whether alternative monetary policy measures have affected the relationship between interest rates and equity price movements.

In order to ascertain this effect we will once again divide our original sample and now solely look at the 50 observations occurring between February 2015 and June 2023. This is the time frame where the Riksbank in addition to making use of the Riksbank rate used QE and its contractionary counterpart Quantitative Tightening (QT), i.e., selling assets to lower their prices and increasing their demand, to conduct monetary policy. One would now expect that a lesser degree of the variation in equity prices can be apportioned to changes in the Riksbank rate. After having divided the sample, we regress the OMXS30 1-day equity returns from the 50 monetary policy announcement dates in our sample that occurred when the Riksbank also pursued QE or QT on both the raw changes to the Riksbank rate as well as the expected and unexpected components of the rate change. The results from these regressions are reported in Table 7.

Column (1) in Table 7, the raw model, refers to the regression of the raw interest rate changes on the OMXS30 in the time period where the Riksbank pursued other forms of monetary policy than simply setting the Riksbank rate. The model has an adjusted R^2 of 0.023, compared to 0.034 of the raw model in Table 2. This indi-

Table 7:

Quantitative Easing

The table reports the results from regressions of the 1-day OMXS30 equity returns on changes in the Riksbank rate as well as the unexpected and expected components of the Riksbank rate change. Column (1) reports results from regressing the raw interest rate changes from the 50 monetary policy announcements from the Riksbank that occurred from February 12, 2015 when the Riksbank announced Quantitative Easing (QE) actions for the first time. Column (2) reports results from regressing the 1-day OMXS30 equity returns on the expected and unexpected components of the change to the Riksbank rate during the same time period. All variables are expressed in percentage terms. The sample consists of the 50 Riksbank monetary policy announcement dates over the period from February 2015 through September 2023. Parentheses contain heteroskedasticity-consistent estimates of the standard errors and dots indicate significance at different levels.

	<i>Dependent variable:</i>	
	OMXS30 returns	
	Raw Model	Surprise Model
	(1)	(2)
Intercept	0.001 (0.002)	0.001 (0.002)
Interest rate change	-1.203* (0.658)	
Expected change		-1.123 (0.788)
Unexpected change		0.392 (4.265)
Adjusted R ²	0.023	0.020
N	50	50
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01	

cates that interest rate changes occurring during the time period where the Riksbank pursued alternative monetary policy measures explain less of the variation in equity returns than they did in our full sample. The logic that adding another monetary policy instrument would suppress the effect of interest rate changes thus finds support in our results. The coefficient for interest rate changes is also slightly weaker than in Table 2 now at -1.203 meaning that equity prices respond a little bit less drastically than in the full sample. This coefficient is significantly negative at the 10 percent level. However, we cannot be certain that this difference is significant since the regres-

sions are made on different samples, and since the QE regression relies on a smaller sample size. Conclusively, one can state that the results from column (1) seem to tell that alternative monetary policy instruments have dampened the effect changes to the Riksbank rate have on equity returns, which is aligned with the purpose of QE as a monetary policy tool to stimulate the economy by increasing the money supply and indirectly facilitate increased investments.

Table 7 column (2) has a positive coefficient regarding the unexpected change in the Riksbank rate of 0.392, indicating that an unexpected 1 percentage point raise of the Riksbank rate results in the OMXS30 increasing by 0.392 percent in times where the Riksbank pursued quantitative easing. In this case, we thus do not have subsample stability, since the intuitive result would be that the coefficient would be slightly negative, but of a tinier magnitude than when the Riksbank did not pursue quantitative easing. The coefficient is however not statistically significant and cannot be assumed to be different from 0. The result thus has to be viewed with caution. This adds to the lack of subsample stability our results suffer from and increases doubt regarding their accuracy. The expected change variable is also not significant, and cannot be assumed to differ from 0. Furthermore, we have another curious instant here where the expected component is larger than the unexpected which could be considered to violate EMH. Because the raw model is the only one that generates a significant coefficient, and the decomposition does not, the decomposition does not seem to provide clarification as to whether the equity market response was mainly due to expected or unexpected changes. Attributing monetary policy announcements to the categories, expected or unexpected does thus not improve our comprehension of equity price movements here. This can also be said to constitute a violation of EMH.

4 Discussion and limitations

In our first regression with the full sample of 86 Riksbank announcements, where we are differentiating between expected and unexpected changes to the Riksbank rate, we obtained a significant negative coefficient for the unexpected component. This finding proved to be only sporadic when controlling for asymmetries and dividing our sample to control for other announcements. The magnitude of the unexpected component varied somewhat and even became positive in one instance. It is, however, statistical significance that has proven to be the most elusive throughout our regressions. Removing certain observations or adding interaction terms often deprives the unexpected component of its significance. In the case of inflation reports and Federal Reserve announcements, we found some subsample stability, where the unexpected coefficient is significantly negative at the 10 percent level when removing observations occurring in close temporal proximity to the Riksbank announcements. One has to consider that many of our subsample regressions are hampered by sample sizes below

60, many of them are even below 30, rendering the attainment of significance more challenging. The elusiveness of significance in many regressions, arising from removing observations, also hinders us from excluding the possibility that the significance in the first regression is caused by outliers, i.e. certain observations of large magnitude. Dividing our sample is as mentioned rather a sanity and robustness check of the first regression than results that should be viewed as particularly informative on their own. Due to the lack of subsample stability, particularly the lack of consistent significance in the unexpected coefficient, we can state that our results are not particularly robust. The unexpected coefficient is persistently negative. Only when controlling for timing effects and quantitative easing is this not the case. The domain of sign and magnitude can thus be stated to convey some robustness in contrast to that of significance. The lack of consistent subsample significance does however undoubtedly constitute a limitation of our study. Another consistent and peculiar finding in our study is the similarity in magnitude between the expected and unexpected coefficients.

Across all our regressions, the coefficient for expected changes to the Riksbank rate is negative. It is also in some regressions, such as those when removing all observations "undisturbed" by ECB announcements or adding interaction terms, the case that the expected component is significant while the unexpected is not. This, in addition to the fact that the unexpected and expected coefficients are often very similar in magnitude, poses questions regarding the value of the unexpected coefficient. As previously mentioned, the lack of interest rate changes makes the unexpected and expected components identical in magnitude. However, removing all non-changes from the sample did not result in significant changes to the coefficients in comparison to the full sample coefficients. The similarity between the two is a consistent finding of this study. This means we cannot state that unexpected changes to the Riksbank rate indicate larger equity price movements than expected changes. This violates EMH. Furthermore, the expected component in some cases can even be considered a superior explanation of equity price movement than the unexpected since it is the only significant coefficient. Even though the unexpected component is persistently slightly larger than the expected, the expected component being more robustly significant means we cannot categorically attribute equity price movements more to unexpected than expected changes to the Riksbank rate. Furthermore, in Bernanke and Kuttner (2005) the decomposed regression raised the adjusted R^2 substantially compared to regressing on raw interest rate changes, whereas in our case it barely changes at all. The decomposed regression is thus not able to explain a greater portion of equity price variance in this study.

We can also apportion a limitation and challenge of our study in the form of the STIBOR T/N 1-month OIS. Although we have established that the STIBOR T/N rate follows the Riksbank rate well, in comparison to Bernanke and Kuttner (2005) where the derivative product they employ to measure unexpected changes has the Federal Funds rate as the actual underlying asset, this is not the case in our study.

Firstly, one has to consider it is possible and more probable that the STIBOR T/N rate and Riksbank rate differ more in a small time window than in a larger one. Our time window for the change in rates of the STIBOR T/N 1-month OIS is one day and it is probable that the two rates differ compared to a much longer interval. This thus becomes a challenge to the validity and accuracy of the derivative instrument we use in providing a reflection of market expectations of the Riksbank rate. The literature does not cover Swedish instruments to the same extent as American, meaning these derivatives' accuracy is not as well documented and established as those of Federal Funds futures. This adds to the challenge faced by our measurements of expected and unexpected changes in all regressions, and they cannot fully be assumed to be as well suited for this purpose as the Federal Funds futures utilized by Bernanke and Kuttner (2005).

A further limitation of our study is the regressions controlling for spillover effects. Although we outline their purpose as simply investigating possible violations of orthogonality and conducting robustness checks, they are limited in their profundity. This is because we only investigate how our initial regression changes in the presence or non-presence of other announcements. Just as we control for a more detailed decomposition of our 86 observations by considering the directions of Riksbank rate changes, this could be done for our regressions covering spillover effects. It would perhaps be elucidating to study, e.g., how equity prices react when the Riksbank announces a monetary policy decision in line with the Federal Reserve or European Central Bank or when the Riksbank takes a measure in the opposite direction. The same applies to quantitative easing where we do not account for the amount of assets purchased or sold. The potential for insight would definitely be furthered by accounting for the content of the announcements rather than only their mere presence.

5 Conclusion

This study has established a significant link between raw as well as unexpected changes to the Riksbank rate and Swedish equity returns. The OMX Stockholm 30 index exhibits a drop of 1.294 percent following an unexpected Riksbank rate hike of 1 percentage point. It is however important to note that these variables explain a small part of the variance in equity prices. Our findings suggest responses are stronger when there is an interest hike, however, a significant relationship was not found. The monetary policy surprises are also deemed to be mostly unexpected with regards to their timing, rather than the direction of the change. Announcements from the Federal Reserve seem to amplify the response of Swedish equity prices to unexpected changes in the Riksbank rate, whereas those from the ECB seemingly dampen them. The hypothesis that the more information the market has, the weaker the reaction of securities' prices thus finds varying support. Furthermore, monetary policy announcements closely followed by an inflation announcement seem to elicit very weak

reactions from the Swedish stock markets. Finally, we find that quantitative easing and alternative instruments of monetary policy have also reduced the effect of both raw interest rate changes and unexpected changes in the Swedish Riksbank rate on Swedish stock returns.

Our results are however not robust and when removing observations occurring closely after the release of other relevant information, we rarely attain statistical significance. The same applies to the addition of interaction terms. Sample sizes are however often small making the attainment of statistical significance harder. We find a significant negative relationship between expected changes in the Riksbank rate and Swedish equity returns which exhibits more robustness than that of our unexpected coefficient. This is in clear violation of the Efficient Market Hypothesis. Our results do not consistently support the notion that unexpected changes to the Riksbank rate cause more movement in Swedish stock returns than expected changes.

Areas not covered in this thesis that require further research are related to a decomposition of stock market reactions. Looking at industry or even firm-level reactions would further the understanding of drivers of the stock market's response to announcements of monetary policy decisions. It would also highlight how the stock prices of different firms are affected by monetary policy announcements. Another area that would require further investigation is that of spillover effects from other relevant announcements. By specifying the decisions outlined in the monetary policy announcements of the Fed and ECB as well as potential asset purchases or sales by the Riksbank one could ameliorate the understanding of equity price movements. Accounting for this in the regressions would increase the understanding of the driving forces behind the reactions of equity prices on days of Riksbank monetary policy decisions.

6 References

- Angeloni, Ignazio, Ehrmann, Michael, de Grauwe, Paul and David Miles, 2003, Monetary Transmission in the Euro Area: Early Evidence, 18, EMU Assessment, 469-501.
- Bernanke, Ben S., and Mark Gertler, 1999, Monetary policy and asset price volatility, Federal Reserve Bank of Kansas City Economic Review 84, 17–51.
- Bernanke, Ben S. and Kenneth N. Kuttner, 2005, What Explains the Stock Market’s Reaction to Federal Reserve Policy?, Journal of Finance, 60, 1121-1257.
- Bohl, Martin T., Siklos, Pierre L. and David Sondermann, 2008, European stock markets and the ECB’s monetary policy surprises International Finance, 11 (2), 117-130.
- Bohl, Martin T., Siklos, Pierre L. and Thomas Werner, 2007, Do central banks react to the stock market? The case of the Bundesbank. Journal of Banking and Finance, 31(3), 719–733.
- Chortareas, Georgios, Karanasos, Menelaos and Emmanouil Noikokyris, 2018, QE and the UK Stock Market: Does the Bank of England Information Dissemination Strategy Matter?, Working paper No. 2018/2, Kings College London.
- Di Giovanni, Julian, and Galina Hales, 2022, Stock Market Spillovers via the Global Production Network: Transmission of U.S. Monetary Policy, Journal of Finance, 77, 3373 - 3421.
- Fama, Eugene, 1970, Efficient Capital Markets: A Review of Theory and Empirical Work, Journal of Finance, 25, 383–417.
- Fransson, Lina, and Oskar Tysklind, 2016, Penningpolitikens effekter på räntor, The Riksbank
- Fuhrer, Jeff, and Geoffrey Tootell, 2003, Eyes on the prize: How did the Fed respond to the stock market? Manuscript, Federal Reserve Bank of Boston.
- Gürkaynak, Refet S., Brian P. Sack, and Eric T. Swanson, 2004, The effects of monetary policy on asset prices: An intraday event–study analysis, Working paper, Board of Governors of the Federal Reserve System.
- Krueger, Joel T. and Kenneth N. Kuttner, 1996, The Fed funds futures rate as a predictor of federal reserve policy, Journal of Futures Markets, 16, 865-879.

Kuttner, Kenneth N., 2001, Monetary policy surprises and interest rates: Evidence from the Fed funds futures market, *Journal of Monetary Economics*, 47, 523-544.

Mishkin, Frederic S., 1996, The Channels of Monetary transmission: Lessons for monetary policy, NBER Working paper 5646.

Modigliani, Franco, 1971, Monetary Policy and Consumption in Consumer Spending and Monetary Policy: The linkages, Boston: Federal Reserve Bank of Boston, 9-84.

Rigobon, Roberto, and Brian Sack, 2002, The impact of monetary policy on asset prices, Finance and Economics Discussion Series 2002-4, Board of Governors of the Federal Reserve System.

Rigobon, Roberto, and Brian Sack, 2003, Measuring The Reaction of Monetary Policy to the Stock Market, *Quarterly Journal of Economics* 118, 639-670.

The Riksbank, Monetary Policy, 2023.

Retrieved Oktober 26 from the Riksbank: <https://www.riksbank.se/en-gb/monetary-policy>

Thomas, Lina, 2023, Global Currents, Local Waves: The Foreign Influences Shaping Sweden's Economy, The Riksbank Staff Memo.

Thorbecke, Willem, 1997, On Stock Market Returns and Monetary Policy, *Journal of Finance*, 52, 447-992.

Åhl, Magnus, 2017, How big is the toolbox of a central banker? Managing expectations with policy-rate forecasts: Evidence from Sweden, Working paper, Sveriges Riksbank Working Paper Series No. 339.

7 Appendix

Table 8:

Correlation between the Riksbank rate and Stockholm Interbank Offered Rate Tomorrow Next(STIBOR T/N) in the time period January 2, 2009 - July 5, 2023.
Riksbank rate rates and STIBOR T/N rates between January 2, 2009 - July 3, 2020 were obtained from the Riksbank. STIBOR T/N rates July 4, 2020 - July 5, 2023 were retrieved from the Swedish Financial Benchmark Facility(SFBBF)

	Correlation
Stibor/Riksbank rate	0.9954

Table 9:

The Response of Equity Prices to Changes in the Riksbank rate

The table reports the results from regressions of the 1-day OMXS30 equity returns on the unexpected and expected components of the Riksbank rate change. All variables are expressed in percentage terms. The full sample consists of the 30 Riksbank rate interest rate changes over the period from January 2009 through September 2023. Parentheses contain heteroskedasticity-consistent estimates of the standard errors and dots indicate significance at different levels.

	<i>Dependent variable:</i>
	OMXS30 returns Change Regression
Intercept	−0.0003 (0.003)
Expected change	−1.090* (0.601)
Unexpected change	−1.211 (1.013)
Adjusted R ²	0.038
N	30
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01