INVESTIGATING THE IMPACT OF THE EUROPEAN CENTRAL BANK'S UNEXPECTED MONETARY POLICY CHANGES ON THE NORDIC STOCK MARKETS BETWEEN THE YEARS 1999-2024

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ABSTRACT

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Examiners: Professor Eero Pätäri, D.Sc. and Associate Professor Sheraz Ahmed, D.Sc.

Keywords: Monetary policy, European Central Bank, ECB, Nordic Stock Markets

This thesis studies how unanticipated monetary policy actions by the European Central Bank (ECB) influence stock market performance in the Nordic region. The primary objective of this thesis is to assess whether surprise changes in the ECB's policy rates generate abnormal returns in the equity markets of Finland, Sweden, and Denmark.

The empirical analysis covers the period from 1999 to 2024, and examines the OMX Helsinki, OMX Stockholm, and OMX Copenhagen indices. Information on ECB policy decisions is obtained directly from the ECB, while daily financial market data and Euribor futures are imported from LSEG Workspace. Immediate market reactions are analysed using an event study framework. Monetary policy surprises are derived from changes in three-month Euribor futures. Effects of both expected and unexpected policy changes are analysed through multiple linear regressions, while controlling for global market movements with the MSCI World ex Europe Index. Estimations are conducted using OLS and robust standard errors. Additional analyses compare actual rate changes with all ECB meetings, assess whether monetary easing has a similar effect as monetary tightening, and test the sensitivity of results to extreme observations.

The results indicate that ECB policy surprises do not lead to clear or stable abnormal returns in the Nordic stock markets. Instead, global market movements explain a substantial share of return variation, which highlights strong international integration. Consequently, the results of this thesis provide limited evidence of clear international spillover effects from the ECB's actions. The findings also indicate asymmetric reactions to monetary easing and tightening as well as sensitivity to model specifications.

TIIVISTELMÄ

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EUROOPAN KESKUSPANKIN ODOTTAMATTOMIEN RAHAPOLIITTISTEN PÄÄTÖSTEN VAIKUTUS POHJOISMAIDEN OSAKEMARKKINOIHIN VUOSINA 1999-2024

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Tässä tutkielmassa tarkastellaan miten Euroopan keskuspankin (EKP) odottamaton rahapolitiikka vaikuttaa Pohjoismaisten osakemarkkinoiden kehitykseen. Päätavoitteena on selvittää aiheuttavatko EKP:n ohjauskorkojen yllättävät muutokset epänormaaleja tuottoja Suomen, Ruotsin ja Tanskan osakemarkkinoilla.

Empiirinen analyysi kattaa vuodet 1999–2024 ja tarkastelee OMX Helsingin, OMX Tukholman ja OMX Kööpenhaminan osakeindeksejä. Päätökset EKP:n rahapoliittisista kokouksista on kerätty suoraan EKP:n sivuilta ja markkinadata sekä Euribor-futuurit LSEG Workspace:sta. Markkinareaktioita analysoidaan tapahtumatutkimusmenetelmällä ja rahapolitiikan yllätykset johdetaan kolmen kuukauden Euribor-futuurien muutoksista. Sekä odotettujen että odottamattomien päätösten vaikutuksia tarkastellaan usean selittäjän lineaarisilla regressiomalleilla, joissa globaalit markkinaliikkeet huomioidaan MSCI World ex Europe -indeksillä. Estimoinnit tehdään OLS-menetelmällä robusteilla keskivirheillä. Lisäksi analyyseissä verrataan korkomuutoksia kaikkiin EKP:n kokouksiin, arvioidaan keventämisen ja kiristämisen eroja sekä testataan tulosten herkkyyttä äärihavainnoille.

Tulokset osoittavat, että EKP:n rahapoliittiset yllätykset eivät johda selkeisiin tai pysyviin epänormaaleihin tuottoihin Pohjoismaiden osakemarkkinoilla. Sen sijaan globaalit markkinaliikkeet selittävät suuren osan tuottojen vaihtelusta, mikä korostaa markkinoiden vahvaa kansainvälistä integroitumista. Näin ollen tutkielman tulokset tarjoavat vain rajallista näyttöä EKP:n päätösten kansainvälisistä heijastusvaikutuksista (spillover effects). Tulokset viittaavat myös rahapolitiikan keventämisen ja kiristämisen epäsymmetrisiin vaikutuksiin sekä mallimääritysten herkkyyteen.

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Yours truly,

Rosa

SYMBOLS AND ABBREVIATIONS

ECB	European Central Bank
Nordic markets	Finland, Sweden and Denmark
MRO	Main Refinancing Operation
LTRO	Longer-Term Refinancing Operation
OMT	Outright Monetary Transactions
OMXHGI	OMX Helsinki General Index
OMXSPI	OMX Stockholm All-Share Index
OMXCPI	OMX Copenhagen All-Share Index
EMH	Efficient Market Hypothesis
FED	U.S. Federal Reserve
OLS	Ordinary Least Squares method

Table of contents

Abstract

Acknowledgements

Symbols and abbreviations

Declarations

1 Introduction 1
1.1 Background 2
1.2 Previous studies 3
1.3 Objectives and research questions 4
1.4 Limitations 5
1.5 Thesis structure 6
2 Theoretical framework 7
2.1 Nordic stock markets 7
2.1.1 OMX Helsinki 8
2.1.2 OMX Stockholm 9
2.1.3 OMX Copenhagen 9
2.2 European Central Bank 9
2.3 Efficient markets 11
2.3.1 Efficient Market Hypothesis 13
2.4 Literature review 14
2.4.1 Monetary policy decisions and financial markets 15
2.4.2 Market reactions to ECB monetary policy decisions 17
2.4.3 International and cross-market spillover effects 20
2.4.4 Conclusion of the literature review 21
3 Data and research methodology 23
3.1 Data 23
3.1.1 ECB Monetary Policy Meetings and key policy rates 23
3.1.2 Nordic stock markets 25

3.1.3 MSCI World Index ex Europe Index 27
3.1.4 Euribor futures 29
3.2 Methodology 31
3.2.1 Event study 31
3.2.2 Linear Regression Model 32
3.2.3 Statistical model 34
4 Results 36
4.1 Key statistics 37
4.2 OMX Helsinki 38
4.2.1 Changes in ECB policy rates and the OMXHGI 39
4.2.2 All ECB policy rate decisions and the OMXHGI 39
4.2.3 Monetary easing vs tightening and the OMXHGI 42
4.3 OMX Stockholm 43
4.3.1 Changes in ECB policy rates and the OMXSPI 44
4.3.2 All ECB policy rate decisions and the OMXSPI 45
4.3.3 Monetary easing vs tightening and the OMXSPI 47
4.4 OMX Copenhagen 48
4.4.1 Changes in ECB policy rates and the OMXCPI 49
4.4.2 All ECB policy rate decisions and the OMXCPI 50
4.4.3 Monetary easing vs tightening and the OMXCPI 51
4.5 Comparison with previous studies 53
4.6 Reliability of results 55
4.7 Use and significance of results 58
5 Conclusions 59
5.1 Answers to research questions 60
5.2 Suggestions for further research 62
References 63

Appendices

Appendix 1. Effect of only ECB monetary policy changes on the OMXHGI without robust standard errors.

Appendix 2. White's test in relation to abovementioned linear regression (justification to using robust standard errors)

Appendix 3. Effect of only ECB monetary policy changes on the OMXHGI.

Appendix 4. Effect of all ECB monetary policy decisions on the OMXHGI.

Appendix 5. Visual inspection of outliers in unexpected policy change variable.

Appendix 6. Detailed summary of the unexpected policy change variable.

Appendix 7. Effect of only ECB monetary policy changes on the OMXHGI after dropping extreme observations from the unexpected policy change variable.

Appendix 8. Effect of all ECB monetary policy decisions on the OMXHGI after dropping extreme observations from the unexpected policy change variable.

Appendix 9. Effect of only policy rate changes on the OMXHGI.

Appendix 10. Effect of all policy rate decisions on the OMXHGI.

Appendix 11. Effect of monetary tightening on the OMXHGI.

Appendix 12. Effect of monetary easing on the OMXHGI.

Appendix 13. Effect of monetary tightening on the OMXHGI (outliers included).

Appendix 14. Effect of monetary easing on the OMXHGI (outliers included).

Appendix 15. Effect of only ECB monetary policy changes on the OMXSPI.

Appendix 16. Effect of all ECB monetary policy decisions on the OMXSPI.

Appendix 17. Effect of only ECB monetary policy changes on the OMXSPI after dropping extreme observations from the unexpected policy change variable.

Appendix 18. Effect of all ECB monetary policy decisions on the OMXHGI after dropping extreme observations from the unexpected policy change variable.

Appendix 19. Effect of only policy rate changes on the OMXSPI.

Appendix 20. Effect of all policy rate decisions on the OMXSPI.

Appendix 21. Effect of monetary tightening on the OMXSPI.

Appendix 22. Effect of monetary easing on the OMXSPI.

Appendix 23. Effect of monetary tightening on the OMXSPI (outliers included).

Appendix 24. Effect of monetary easing on the OMXSPI (outliers included).

Appendix 25. Effect of only ECB monetary policy changes on the OMXCPI.

Appendix 26. Effect of all ECB monetary policy decisions on the OMXCPI.

Appendix 27. Effect of only ECB monetary policy changes on the OMXCPI after dropping extreme observations from the unexpected policy change variable.

Appendix 28. Effect of all ECB monetary policy decisions on the OMXCPI after dropping extreme observations from the unexpected policy change variable.

Appendix 29. Effect of only policy rate changes on the OMXCPI.

Appendix 30. Effect of all policy rate decisions on the OMXCPI.

Appendix 31. Effect of monetary tightening on the OMXCPI.

Appendix 32. Effect of monetary easing on the OMXCPI.

Appendix 33. Effect of monetary tightening on the OMXCPI (outliers included).

Appendix 34. Effect of monetary easing on the OMXCPI (outliers included).

DECLARATIONS

Turnitin

The originality of this thesis has been reviewed with the Turnitin similarity checking service.

AI usage

The author of the thesis, Rosa Saario, used the following AI-tools during the preparation of the thesis:

1. ChatGPT (OpenAI)
    a. Purpose of use: brainstorming, translations and visual representation
    b. Explanation of the use of the tool:
        - Used to help come up with a thesis idea that was related to my interests
        - Used to find synonyms and translations to some words (mostly translating Finnish words into English as this is quicker than using an ordinary dictionary or googling the words)
        - Used to help with the visuals of some tables (asking would it be better to have words/number on the X-axis or Y-axis for clearer interpretation)

Responsibility

The author, Rosa Saario, takes full responsibility for the content of this thesis and has reviewed and edited the content generated by the possible use of AI tools.

1 Introduction

"The trade war initiated by the United States of America has increased instability in global trade. Therefore, financial markets are already anticipating that the (European) central bank will remain in a wait-and-see position on Thursday" read in an article posted by Helsingin Sanomat on 24.7.2025 before the European Central Bank was supposed to conclude a 2- day monetary policy meeting (Sajari 2025). Can the financial markets actually anticipate the next actions of a central bank? If they can, do the announcements of central banks lead to any changes or abnormal returns in the financial markets? These are exactly the questions this thesis aims to study and provide answers to. Because one simply cannot study all possible financial markets in one research paper, this thesis will be focusing on the Nordic markets: Finland, Sweden and Denmark. Consequently, the central bank this thesis focuses on will therefore be the European Central Bank (ECB).

The European Central Bank carries out monetary policy through various structured set of instruments with the target of maintaining price stability and ensuring smooth functioning of the financial markets. According to the ECB's official framework, the main instruments in use are open market operations, standing facilities and minimum reserve requirements, as can be seen in figure 1. (European Central Bank 2024)

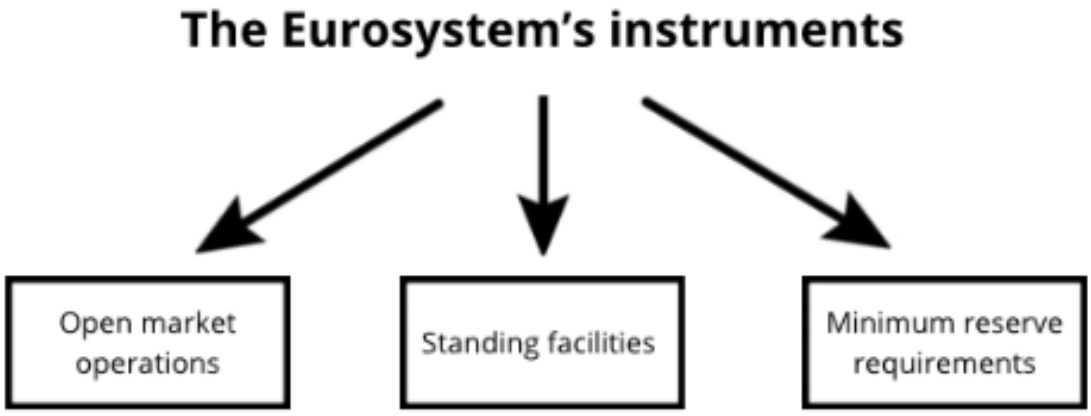

Figure 1. The Eurosystem's instruments. (European Central Bank 2024)

The ECB's policy rate changes are made through its open market operations – specifically through the Main Refinancing Operations (MROs), which serve as the central policy instrument guiding short-term interest rates. (European Central Bank 2024) This thesis will focus on examining how the changes, and more specifically unexpected changes, in the ECB's policy rates effect the Nordic stock markets. To examine the changes in the Nordic markets, this thesis will be studying changes in the Helsinki Stock Exchange (OMXHGI), Stockholm Stock Exchange (OMXSPI) and Copenhagen Stock Exchange (OMXCPI).

1.1 Background

Central banks play a fundamental role in in shaping the behaviour and dynamics of the financial markets through their monetary policy actions, regulatory oversight and communication. By setting key policy interest rates and managing liquidity conditions, central banks directly and indirectly influence short-term money markets and long-term yields as well as asset prices and foreign exchange rates. The decisions of central banks also alter the cost of capital for companies, households' rates of returns and the valuation of future cash flows for various investors. All the abovementioned contribute to changes in the equity and bond markets.

According to Mishkin (2019), monetary policy operates through a so-called transmission mechanism in which policy rate changes affect the market interest rates, asset prices, credit conditions and in short, the overall aggregate demand. This transmission mechanism implies that even the most modest shifts in policy expectations can lead to significant revaluations across the financial markets, making central banks the key drivers of market sentiment and volatility.

In addition to setting interest rates, central banks exert influence through communication and expectations management. Traditional (conventional) monetary policy refers to the use of short-term nominal interest rates as the primary tool for central banks to influence economic

activity, inflation and other financial conditions (Mishkin 2019; Green 2005). On the other hand, modern monetary policy increasingly relies on forward guidance, press conferences and publications of forecasts to shape market expectations. These communication tools allow central banks to steer financial conditions even without immediate policy changes. Furthermore, clear communication enhances policy effectiveness by aligning the market's expectations with the intentions of central banks, reducing uncertainty and speculation. In the modern world, central banks have been transformed into powerful market communicators that can move asset prices with not only their actions but also solely their words. (Blinder, Ehrmann, Fratzscher, de Haan & Jansen 2008)

1.2 Previous studies

Literature has consistently shown that monetary policy decisions, for instance those by the ECB, have significant effects on financial markets. Foundational research, such as Ehrmann and Fratzscher (2004) and Rigobon and Sack (2004) has demonstrated that stock markets react immediately to unexpected monetary policy changes, with monetary tightening often leading to negative market reactions. Conversely, monetary easing has often led to overall positive market reactions.

Later studies (Mishkin 2019; Filbien and Labondance 2013) have also emphasized the role of communication and managing expectations as financial markets tend to not only react the policy actions but also to how the changes are communicated. These findings have aligned with the overall Efficient Market Hypothesis (EMH), suggesting that only the unanticipated component of monetary policy announcements should cause abnormal market movements.

Further research (Haitsma, Unalmis and de Haan 2016; Jäger and Grigoriadis 2017) have also shown that the strength and duration of market reactions depend on the type of policy measure as well as the overall economic context. Markets have tended to react most strongly to monetary policy changes during crisis periods, when investor uncertainty has been high.

Several studies (Kim and Nguyen 2009; Fratzscher, Duca and Straub 2016; Camara 2023; Berend and Prüser 2024) have also confirmed that ECB's monetary policy creates international spillovers as the effects extend beyond just the eurozone. These key findings suggest that economies closely linked to the eurozone are also affected by the ECB's policy signals, despite not adopting the euro as their currency.

Overall, the past studies provide a clear foundation for this thesis. Despite the extensive amount of research on the effects of the ECB's monetary policy, a clear research gap remains in understanding how these announcements influence specifically the Nordic markets, including those which are not within the eurozone.

1.3 Objectives and research questions

Based on the previous findings of various studies as well as the clear research gap, this thesis will address that gap by investigating whether ECB's monetary policy announcements, specifically unexpected changes in the policy rates, lead to abnormal returns in the Nordic stock markets and whether these effects differ between the eurozone and the non-eurozone economies. The examined Nordic stock markets are Finland, Sweden and Denmark, as previous research has shown that ECB policy announcements often cause spillover effects across the eurozone and onto other European financial markets. By analysing these 3 closely integrated yet structurally different economies, this study aims to provide a comprehensive understanding of how the monetary policy decisions of the ECB affect investor behaviour.

The main research question of this thesis is:

Q1: "Do the ECB's unexpected monetary policy announcements lead to abnormal returns in the Nordic stock markets?"

The working hypothesis is that the announcements would lead to abnormal returns, as the financial markets typically react to new information that alters expectations about interest rates and overall economic growth.

The 2 sub-research questions to aid in answering the main research question are:

Q2: "Does monetary tightening cause the same effect as monetary easing?"

Q3: "Do the Nordic stock markets outside of the eurozone respond differently compared to Finland, which is part of the eurozone?"

1.4 Limitations

This thesis will be limited to the period of 1999-2024, as the euro was introduced as Finland's official currency on January 1, 1999, and 2024 represents the most recent full year for which complete financial data is available. This study focuses on examining the impact of the ECB's monetary policy announcements on the financial markets of Finland, Sweden and Denmark. While Finland is the only member of the eurozone, studies have shown that the ECB's monetary policy announcements often generate spillover effects on the other non-eurozone European markets, influencing stock prices, interest rates and capital flows. Therefore, including Sweden and Denmark is also justified. (Fausch & Sutter 2024) This broader geographical scope allows for a more comprehensive understanding of how the ECB's monetary policy actions transmit beyond the eurozone's borders and aids in answering both the main and sub-research questions of this thesis.

It is important to note that this thesis will only be investigating the traditional monetary policy instruments, which are adjustments to the ECB's monetary policy rates. Although the

ECB has several other policy instruments, such as asset purchase programs and targeted refinancing operations, these are excluded from this study due to their limited comparability with conventional rate changes. The effects of policy rate adjustments can be quantitatively adjusted using various statistical models that capture the market's reaction, whereas the influence of unconventional tools is more complex to assess. Therefore, in order to keep this study as clear as possible, only conventional policy rate adjustments and their effects will be studied. This provides more easily measurable insights into how monetary policy announcements by the ECB affect both the eurozone and the non-eurozone Nordic stock markets.

1.5 Thesis structure

After this introduction chapter, this thesis will continue with a chapter dedicated to theoretical framework and an extensive literature review of previous studies. After this, the data and methods used in this thesis will be explained thoroughly. The empirical findings of this study will be reported in chapter 4, followed by conclusions and answers to research questions in chapter 5. Lastly, ideas for further research will be presented.

2 Theoretical framework

This chapter of the thesis is divided into 2 sections. The first section establishes the grounds for this study by analysing the Nordic stock markets and the ECB better as well as introducing the concept of market efficiency and the efficient market hypothesis (EMH). The second section is the literature review, where previous studies and their findings are reported. Based on the literature review and the findings from other studies, we can later compare the results of this thesis against them.

2.1 Nordic stock markets

This study is limited to the financial markets of Finland, Sweden and Denmark. Though Norway is a Nordic market, all indexes examined in this thesis are a part of the Nasdaq Nordic which Oslo Børs is not a part of (Nasdaq 2025a). Moreover, all Nordic markets examined in this thesis are members of the European Union. Both Sweden and Denmark are also member states despite them having their own currencies. Norway, as a non-member state, would not be directly influenced by the ECB's monetary policy decisions and consequently, has been left out of this study.

The three indexes examined in this thesis are the OMX Helsinki General Index (OMXHGI), OMX Stockholm All-Share Index (OMXSPI) and the OMX Copenhagen All-Share Index (OMXCPI). All these indexes are part of the broader Nasdaq All-Share family and are total return indexes, meaning that they consider not only the changes in share prices but also the reinvested dividends paid by the listed companies (Nasdaq 2025b). This makes them good indicators of the overall return investors would receive. The market cap and number of listed companies in each country's Nasdaq exchange can be seen in table 1.

Table 1. Market cap and number of companies listed on the main Nasdaq markets of Helsinki, Stockholm and Copenhagen as of April 2025. (Nasdaq 2025c; Nasdaq 2025d; Nasdaq 2025e)

	Listed Companies	Market Cap
Nasdaq Helsinki	134	> 270 BEUR
Nasdaq Stockholm	366	> 1000 BEUR
Nasdaq Copenhagen	117	> 530 BEUR

Regarding this thesis, it is also important to note that Sweden and Denmark, though part of the European Union, have not adapted euro as their official currency. While the Swedish krona (SEK) operates under a floating exchange rate system, meaning that the value fluctuates freely according to market forces, the Danish krone (DKK) is pegged to the euro through the European Exchange Rate Mechanism II (ERM II). This simply means, that the Danish krone is kept close to 7,46 DKK per euro and therefore, that the Danish monetary policy is essentially constrained by the ECB monetary policy. (Danmarks Nationalbank 2025) In other words, Sweden has greater monetary policy independence as its markets are less directly constrained by the ECB's actions.

2.1.1 OMX Helsinki

The OMX Helsinki General Index (OMXHGI) is the broad stock market index for Finland. It represents the overall performance of all the shares listed in the Nasdaq Helsinki exchange and shows how the entire Finnish stock market is developing. The index includes both ordinary shares and depositary receipts. However, it excludes certain types of securities, such as investment funds or companies with almost single-shareholder- ownership (90% or more) as these would not reflect normal market trading activity. Each company's weight in the index depends on its own market value. As of April 2025, there are 134 companies listed on the main Nasdaq Helsinki market. (Nasdaq 2025b)

2.1.2 OMX Stockholm

The OMX Stockholm All-Share Index (OMXSPI) is the broad market index for Sweden. It represents the overall performance of all the shares listed in the Nasdaq Stockholm exchange and shoes how the entire Swedish stock market is developing. Each company's weight in the index depends on its own market value. As of April 2025, there are 366 companies listed on the main Nasdaq Stockholm market. (Nasdaq 2025b)

2.1.3 OMX Copenhagen

The OMX Copenhagen All-Share Index (OMXCPI) is the broad market index for Denmark. It represents the overall performance of all the shares listed in the Nasdaq Copenhagen exchange and shoes how the entire Danish stock market is developing. Each company's weight in the index depends on its own market value. As of April 2025, there are 117 companies listed on the main Nasdaq Copenhagen market. (Nasdaq 2025b)

2.2 European Central Bank

The ECB plays a central role in in shaping the banking and financial markets of the European Union. Its functions extend beyond simply setting interest rates and include defining and implementing monetary policy, supervising banks, overseeing the functioning of payment systems and promoting financial stability. (European Central Bank 2025a) Central banks are key players in monetary policy transmissions through lending and depositing money as well as risk management. Banking supervision means that the ECB contributes not only to price stability but also to safeguarding the entire financial system's infrastructure and promoting resilience in banks under its supervision. (European Central Bank 2025b)

The ECB's primary aim is price stability as its strategy is aiming for an inflation rate of 2% over the medium term as measured by the Harmonised Index Consumer Price (HICP). This inflation target rate is symmetric as inflation both above and below 2% are considered undesirable. By maintaining price stability, the ECB seeks to preserve the purchasing power of the euro, support sustainable economic growth, foster employment rates and provide favourable conditions for the financial markets to operate within. (European Central Bank 2025c) As seen in figure 1, the ECB has 3 primary ways of practising monetary policy: open market operations, standing facilities, and the minimum reserve system.

Open market operations are the ECB's primary tool for implementing monetary policy as it allows it to influence short-term interest rates, control liquidity in the whole banking system as well as signal and communicate its policy direction to the financial markets. These open market operations are often conducted as reverse transactions, meaning that the ECB provides liquidity to banks in return for eligible security collateral, or repurchase agreements. The ECB uses four categories of open market operations that all serve different functions as can be seen in table 2. Through these open market operations, the ECB maintains effective control over short-term interest rates and communicates its monetary policy stance across the euro area financial system. (European Central Bank 2024)

Table 2. Open market operations of the ECB. (European Central Bank 2024)

Type of operation	Frequency	Typical maturity	Function
Main Refinancing Operations (MROs)	Weekly	1 week	Provide regular liquidity and steer short-term interest rates, key policy signal
Longer-Term Refinancing Operations (LTROs)	Monthly	3+ months	Supply longer-term funding to banks and improve liquidity conditions
Fine-Tuning Operations	Ad hoc	Varies	Manage short-term liquidity shocks or interest rate volatility
Structural Operations	Occasional	Long-term	Adjust the structural liquidity position of the bankin sector

Standing facilities are another main way for the ECB to practise its monetary policy. Standing facilities provide banks with overnight liquidity management options and set both lower and upper limits for the overnight interest rates. Furthermore, they help signal the ECB's monetary policy stance and support the money markets by ensuring that short-term rates remain close to the policy target. Marginal lending facility allows counterparties to obtain overnight liquidity at a predetermined interest rate against eligible collateral and the rate on the marginal lending facility usually serves as the ceiling for overnight market rates. On the other hand, deposit facilities allow counterparties to make overnight deposits and the rate on these provides the floor for overnight market rates. In other words, banks should not be borrowing money from other banks with a higher rate than it could obtain from the ECB, nor should they be lending money at lower rates than they can earn by simply depositing them to the ECB. Therefore, by adjusting these facility rates, the ECB can influence liquidity conditions and markets expectations in the short run. (European Central Bank 2024)

Moreover, the third key component of the ECB's operational framework is the minimum reserve system, which obliges the euro area credit institutions to hold a specified proportion of their short-term liabilities, such as customer deposits, as reserves on accounts with their respective national central banks. The ECB calculates these reserve requirements individually based on the balance sheet of each credit institution with the objective of stabilising money market interest rates and creating demand for central bank liquidity. (European Central Bank 2024)

2.3 Efficient markets

The concept of market efficiency is at the core of modern financial economics and provides a foundation for understanding how information affects asset prices. Efficient markets are those in which all available, and relevant, information is rapidly and accurately reflected into asset prices. When markets are efficient, it becomes virtually impossible for investors to consistently earn above average returns without taking additional risks. This is due to any new public information being immediately incorporated into prices. However, in efficient

markets, higher risk investments are expected to yield higher returns, but excess returns, which are returns beyond justified risk, should not exist in the long run. The whole concept of market efficiency is based on the presence of rational investors, free and fast information as well as the ability to trade assets quickly at fair prices. (Knüpfer & Puttonen 2024, 163-180)

In efficient markets, price changes occur primarily when new information enters the market. As this new information ought to be unpredictable, price movements follow so called random walks, meaning that yesterday's price changes will not give any clue about today's price changes. This randomness reflects how investors continuously reassess expectations in response to new available data and information, such as macroeconomic indicators, earnings reports or central bank announcements. (Knüpfer & Puttonen 2024, 163-180) Consequently, the principle of market efficiency is particularly relevant to this thesis, as according to this theory, the announcements of the ECB should cause movement also in the Nordic stock markets. If markets are efficient, the reaction to the ECB's policy rate changes should occur immediately after the announcements as investors incorporate the new information into their expectations and asset valuations.

Moreover, the concept of efficiency helps distinguish between expected and unexpected policy actions as only the unexpected component, the surprise element, should trigger a market reaction in efficient markets. This means that abnormal returns should be concentrated in very short time windows surrounding the announcements. In other words, at any given time, the price of an asset can be either above or below its fundamental value, but these deviations are unpredictable and not systematic. (Knüpfer & Puttonen 2024, 163-180)

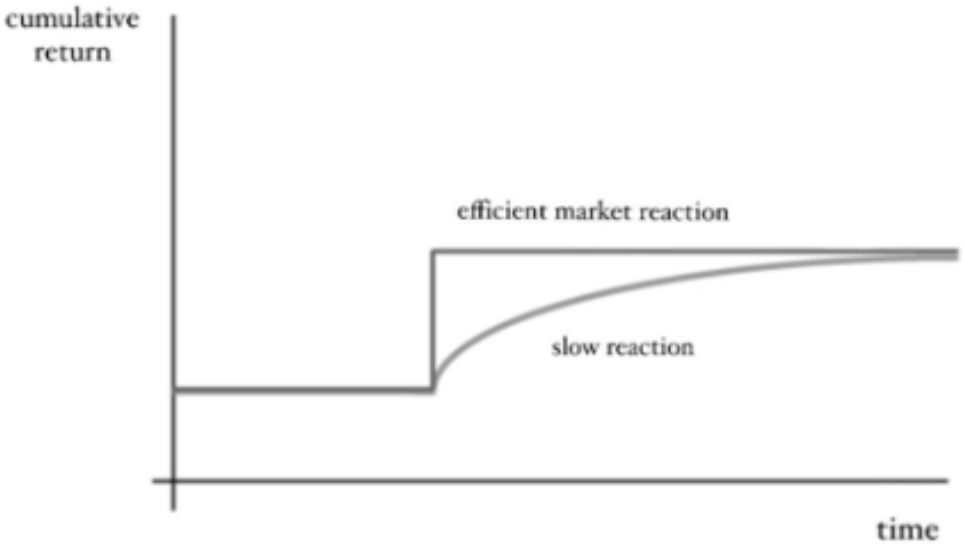

Figure 2. Reactions of efficient and inefficient markets to new available information. (translated from Knüpfer & Puttonen 2024)

2.3.1 Efficient Market Hypothesis

The efficient market hypothesis (EMH), Eugene Fama's (1970) framework, proposes that capital markets are efficient when asset prices fully reflect all available information at any point in time. In such markets, price changes occur only in response to new available information, which by nature is unpredictable and asymmetric. Consequently, it should be impossible for investors to consistently earn excess returns above the market average by leveraging any information that is already publicly known. (Fama 1970)

Eugene Fama (1970) identified three levels of market efficiency. These three levels are the weak, semi-strong and strong forms, and are displayed in table 3. The weak form efficiency proposes that investment strategies based on patterns in past performances cannot consistently yield abnormal returns as such information is already embedded in current asset prices. The semi-strong form efficiency extends this idea to all publicly available information as according to this form, stock prices adjust rapidly to new publicly available information, leaving no opportunity for investors to outperform the market by reacting to

new news. Moreover, the strong form efficiency represents the highest level of market efficiency and suggests that stock prices already reflect all information, both public information as well as private information, or insider information. Under this highest form of efficiency, even investors with privileged knowledge cannot consistently achieve abnormal profits as they are already incorporated into asset prices.

Table 3. Definitions of the three different levels of market efficiency. (Fama 1970)

Form	Definition
Weak	Current stock prices fully incorporate all information contained in past trading data. such as historical prices, returns and trading volumes.
Semi-strong	Current stock prices include everything above as well as all publicly available information.
Strong	Current stock prices include everything above as well as all insider information.

2.4 Literature review

The purpose of this literature review is to examine and present key findings from previous similar studies related to the impact of monetary policy on financial markets. Reviewing earlier research is essential for establishing a theoretical and empirical foundation for this thesis as well as enabling comparison between this study and previous work. The literature reviewed in this chapter is organized into 3 main sections, each addressing an important relationship between monetary policy and financial markets.

The first section examines the fundamental channels through which monetary policy is transmitted to the financial markets, including the roles of interest rates, expectations and information in shaping asset price movements. The second section focuses specifically on the ECB's monetary policy announcements, both conventional and unconventional, and the

markets' reactions to it. The third section examines the international and cross-market spillover effects of central banks' monetary policy decisions, which is a necessary part of this thesis as the effects of ECB's monetary policy are being analysed on the non-eurozone markets too.

2.4.1 Monetary policy decisions and financial markets

According to Mishkin (2019, 355-466), the interest rate channel represents the most direct mechanism of monetary policy transmission. When a central bank changes its policy rate, it influences the entire structure of market interest rates, and thereby, affects the borrowing costs of households and companies. Monetary tightening raises interest rates, making credit more expensive and reducing spending and investments, which then again can cause stock prices to fluctuate as investors anticipate slower future growth. Conversely, monetary easing lowers interest rates, making borrowing cheaper and increasing asset demand, which usually leads to higher stock valuations.

However, the expectations and information channels amplify or moderate the impact of interest rate decisions. Mishkin (2019, 355-466) explains, that financial markets are forward-looking as investors form expectations about the future of monetary policy, inflation and other economic activities. Therefore, central bank communication and credibility become powerful tools in shaping market behaviour even prior to any actual policy changes. When central banks issue policy statements, the markets typically immediately reprice assets to reflect the new information and altered expectations. However, the speed and accuracy of these reactions depend on how clearly and credibly the central banks convey their future actions. Due to this, monetary policy operates not only through adjustments to policy rates but also through information and signalling effect of central banks.

An important study regarding this thesis was conducted by Ehrmann and Fratzscher in 2004. The two examined how monetary policy decisions were transmitted to equity markets with

the particular focus on the ECB and the U.S. Federal Reserve (FED). The main objective of the study was to determine how stock markets reacted to unexpected monetary policy actions and to identify if these reactions differed across various markets. This has been one of the earlier studies comprehensively linking the actions of central banks, market expectations and stock price movements in the early years of the eurozone. A high-frequency event study was conducted, and the results demonstrated a clear and consistent negative relationship between monetary policy tightening and stock market performances. Unexpected increases in policy rates lead to significant declines in stock prices whereas unexpected easings generated positive market reactions. The effects did vary across markets, with the U.S. markets generally reacting more strongly to policy shocks compared to European markets.

Also in 2004, Rigobon and Sack conducted research where they studied how unexpected monetary policy changes affected various financial assets. Their main goal was to identify the causal effect of policy decisions on markets, overcoming the problem that both asset prices and monetary policy often actually react to the same economic news. Using a structural econometric model with an identification-through-heteroskedasticity approach, they also found that unanticipated interest rate increases lead to declines in stock and bond prices but also appreciation of the currency. The strongest and fastest reactions were recorded in the equity markets. The findings of this study further highlight the importance of central bank communication and market expectations.

Building on the foundations of previous research, Ferrer, Bolós and Benítez (2016) conducted a study investigating how interest rate changes affected stock market returns across several European countries, including Finland. The main objective of their study was to determine whether the effect of interest rate movements on stock returns differed across countries, frequencies and time horizons, which would reflect both the short-term reactions and longer-term adjustments to monetary news and investor expectations. A time-frequency analysis was conducted to examine how the correlation between interest rates and stock returns evolved over time. Similarly to previous studies (Ehrmann and Fratzscher 2004; Rigobon and Sack 2004), the results of this study indicated that the relationship is both negative and time-dependant, meaning, that periods of monetary tightening are typically

associated with declining stock returns and monetary easing on the other hand, tends to support higher equity valuations. Importantly, Ferret et al. (2016), found that this relationship is stronger in the short-term and varied across countries, suggesting that national markets exhibit asymmetric sensitivities, depending on their financial structures and degrees of integration.

Moreover, already in 2005, Evans and Honkapohja investigated how monetary and fiscal policies interact during liquidity traps, periods when nominal interest rates approach zero and conventional policy rate adjustments cannot stimulate the economy anymore. The main objective of their research was to understand how expectations and policy coordination affect economic stability and possible recovery. The results of this study demonstrated that expectations management is central in escaping a liquidity trap. When policymakers successfully communicated their credible commitment to higher future inflation or fiscal expansion, this led to higher spending and investments even when interest rates remained near zero. Evans and Honkapohja's study clearly highlight that monetary policy affects the economy not only through direct changes in interest rates but also through expectations as the market is always anticipating future policy actions.

2.4.2 Market reactions to ECB monetary policy decisions

The ECB emphasizes that market prices, especially equity and bond prices, respond almost immediately to monetary policy news, reflecting changes in expectations about future interest rates, growth and inflation. When the ECB adjusts its policy stance, either through interest rates changes or communicating future policy intentions, these actions alter investors' risk assessments, leading to changes in asset prices. (Ehrmann and Fratzscher 2004)

Bohl, Siklos and Sondermann (2008) investigated how various European stock markets responded to the ECB's unexpected monetary policy decisions. The markets studied were

Germany, France, Spain, Italy, and the Netherlands as these markets represented the largest and most liquid equity markets in the euro area and therefore, offered a clearer view of how deviations of actual ECB's rate changes from market expectations would affect euro area markets. The study assessed the immediate market reactions by using event- study methodology (1 day window) surrounding the meeting days of the ECB Governing Council. Monetary policy surprises were calculated by comparing the actual rate changes to Euribor futures, which reflect normal market expectations of future interest rates. By conducting this comparison, the study managed to isolate the unexpected component of monetary policy decisions, which is the element that introduces genuinely new information to the financial markets. Bohl et al. then analysed the stock market reactions using regression analysis. The key findings were in line with other studies and revealed that the European stock markets reacted strongly and negatively to unexpected increases in interest rates. Conversely, cuts in interest rates tended to have a positive effect on equity prices. The study also found that the markets reacted most sharply on announcement days, suggesting that the financial markets adjusted their expectations almost immediately after receiving new information. This again is in line with the EMH.

Building on the research of Bohl et al. (2008), Kholodilin, Montagnoli, Napolitano and Siliverstovs (2009) studied how the European stock markets reacted to ECB monetary policy decisions but with the focus on sectoral differences. The main objective of their study was to determine whether certain industries were more sensitive to unexpected policy rate changes compared to other sectors. The euro zone countries studied were the same as in Bohl et al.'s (2008) study: Germany, France, Spain, Italy, and the Netherlands. A similar event study methodology was conducted, and the results revealed that sectoral responses to ECB policy surprises varied a lot. Unexpected interest rate hikes decreased stock returns particularly in interest rate sensitive sectors, such as construction, real estate and banking. Conversely, traditionally defensive sectors, such as utilities or consumer staples, showed weaker reactions to changes in interest rates. The key findings of Kholodilin et al. (2009) confirmed that the magnitude and financial market reactions to ECB monetary policy changes depend both on the nature of the policy surprise as well as the characteristics of the sector involved.

In 2013, Filbien and Labondance conducted a study titled "Do financial markets learn from ECB monetary policy?". As the name suggests, the two were investigating if the financial markets actually adjusted their reactions to the ECB's monetary policy decisions over time by "learning" from the ECB's communication and policy patterns. The study was conducted as an event study between the years 1999-2011 and the unexpected monetary policy change effects on the financial markets were estimated using time-varying regression models. The key findings of this study were that the financial markets did, in fact, learn from ECB monetary policy. In the early years of the study, in the whole euro area, asset prices reacted strongly to unexpected policy changes. In the later years of the study, as the ECB's communication improved, the same markets' sensitivity to policy surprises declined. However, it is important to note, that even with the decline of sensitivity, the markets continued to produce immediate and significant price movements. This finding is in line with previous research (Ehrmann and Fratzscher 2004; Rigobon and Sack 2004; Bohl et al. 2008) and confirms that markets do react to genuinely new information, even over time.

More recent studies such as Haitsma, Unalmis and de Haan (2016) or Jäger and Grigoriadis (2017) have introduced new perspectives to research. While earlier studies have primarily focused on short-term market reactions to interest rate changes (Ehrmann and Fratzscher 2004; Bohl et al. 2008), Haitsma et al. (2016) analysed the effect of both traditional rate changes as well as unconventional measures. These unconventional measures included for example, asset purchase programmes and long-term refinancing operations. An event study was conducted over the period of 1999-2015 and results indicated that unconventional monetary policy surprises had a stronger and more persistent influence on stock market prices, compared to just rate adjustments. Moreover, the study conducted by Haitsma et al. (2016) confirmed that firm-specific factors also mattered as value stocks and previously underperforming stocks tended to respond more strongly to policy surprises.

Similarly, Jäger and Grigoriadis (2017) compared the effectiveness of ECB unconventional monetary policy across countries that were categorised into crisis and non-crisis countries based on their exposure to the European sovereign debt crisis (2009-2012). Crisis countries included Greece, Ireland, Italy, Portugal, and Spain. Non-crisis countries included Austria,

Belgium, Finland, France, Germany, and the Netherlands. The objective of the study was to compare how ECB's unconventional monetary policy affected markets under varying economic conditions. Results showed that crisis countries reacted more strongly to ECB announcements.

2.4.3 International and cross-market spillover effects

In 2009, Kim and Nguyen investigated how monetary policy announcements from major central banks, the (FED) and the ECB, affected stock markets in the Asia-Pacific region. Their main objective was to measure the degree of international spillover effects, assessing whether changes in advanced economies influenced financial conditions in geographically different, but economically similar, markets. An event study was conducted on the markets of Japan, Australia, Hong Kong, Singapore and South Korea. The results showed significant international transmission of monetary policy shocks. Both FED and ECB policy surprises generated measurable reactions in the Asia-Pacific stock markets. Though the magnitude and timing differed across countries, Kim and Nguyen (2009) found that specifically the ECB's announcements produced notable spillover effects especially in financially open economies that had linkages to Europe. Furthermore, the results indicated that monetary tightening surprises caused a negative correlation in stock prices and conversely, monetary easing caused a positive correlation. This result, again, is in line with other studies (Ehrmann and Fratzscher 2004; Rigobon and Sack 2004; Bohl et al. 2008; Ferrer et al. 2016).

Building on Kim and Nguyen (2009) and Jäger and Grigoriadis (2017), Fratzscher, Duca and Straub (2016) further explored the international spillovers, focusing on the market impact of unconventional measures implemented during and after the euro crisis. Their study examined how long-term refinancing operations (LTROs), and outright monetary transactions (OMT) announcements influenced asset prices both within as well as beyond the euro area. An event study was conducted, and key findings of the study included identifying substantial international spillovers as markets outside of the eurozone also

responded to monetary policy actions of the ECB. These results demonstrated that the ECB's actions could influence global financial market conditions beyond just the eurozone markets.

Berend and Prüser (2024) examined how monetary policy transmission operates through common business and financial cycles within the euro area. With various econometric modelling, they found that shared cyclical patterns link national economies, showing that changes in ECB's monetary policy spread across countries through these common trends. The impact of the ECB's policy decisions depended on how closely each country's economies were linked to the overall eurozone cycles. In short, this study highlights that the effects of monetary policy changes quickly spillover to other countries through connected financial markets and shared investor expectations.

Prior to Berend and Prüser's (2024) study, Camara's (2023) findings also support the idea that ECB's monetary policy decisions create international spillovers. Camara, with an event study, examined how ECB interest rate decisions affected international markets both inside and outside the eurozone. Findings were aligned with prior research (Fratzscher et al. 2016; Kim and Nguyen 2009), demonstrating that the information signals in ECB announcements influenced financial markets beyond just the eurozone.

2.4.4 Conclusion of the literature review

The reviewed literature consistently shows that monetary policy decisions, especially those by the ECB, have significant effects on financial markets, both within and beyond the eurozone. Studies have consistently found that policy announcements influence the stock market through interest rates, expectations and information channels. Tightening monetary policy systematically causes overall negative market reactions, while monetary easing causes overall positive market reactions. More recent research emphasizes that not only the monetary policy actions themselves, but also how the ECB communicates them, affects

market behaviour. Throughout the studies reviewed in this chapter, investors have quickly incorporated new and unexpected information into prices, which is consistent with the EMH.

Furthermore, several studies have demonstrated that the ECB's influence extends internationally across various financial markets. Research (Kim and Nguyen 2009; Fratzscher et al. 2016; Camara 2023; Berend and Prüser 2024) has highlighted cross-market spillovers, showing that policy signals from the ECB affects also non-eurozone markets through shared expectations and capital flows.

3 Data and research methodology

This section of the thesis will present the data and methods used to conduct the actual empirical research. The data-section will provide information and overview of the data, and the methods-section will present the methods and statistical models used. All data has been collected in November 2025 and the criterion for choosing each data is explained in this chapter. All the data has been collected from the ECB's official website as well as from LSEG Workspace (formerly Refinitiv Workspace). Used research methods include an event study and linear regressions, which are also thoroughly explained in this chapter of the thesis.

3.1 Data

To conduct the empirical study, this research requires data from the ECB's monetary policy meetings, specifically the changes made to the main refinancing operations rate (RMO). Furthermore, daily stock market data, daily benchmark index data and Euribor futures rates are also needed. Daily market data was gathered from LSEG Workspace, and data related to the ECB's monetary policy meetings was gathered from the ECB itself. All data will now be introduced in more detail.

3.1.1 ECB Monetary Policy Meetings and key policy rates

Data from the ECB's monetary policy meetings has been collected directly from the ECB's official website. A total of 305 monetary policy meetings were held between January 1, 1999, and December 31, 2024. The dataset includes all meetings and the corresponding changes in the MRO rates. Rate adjustments are expressed in basis points, where 1 percent change equals to 100 basis points. The most common rate adjustment were 25 basis points (33 times), 50 basis points (15 times) and 75 basis points (3 times). All together during the period of 1999-2024, the ECB has implemented 55 key policy rate changes. The key interest

rate has been increased a total of 28 times and decreased a total of 27 times. This leaves the key interest rate unchanged 250 times. (European Central Bank 2025d; European Central Bank 2025e) As the key interest rate has been changed only 55 times, this results in a relatively small sample size. Therefore, the analysis also includes meetings where no rate change occurred as periods of unchanged policy can also represents unexpected outcomes from a market expectations perspective.

Figure 3. ECB key policy rates 1999-2024. (European Central Bank 2025d)

During the period of 1999-2024, the ECB's key policy rate started at 3% in 1999. The rate gradually increased to a peak of 4,75% by late 2000 as a response to strong economic growth and inflationary pressures in the early years of the euro. The policy rate was reduced to 2% in 2003 and remained quite stable for a few years. Before the financial crisis, the key policy rate had been increased up to 4,25% but in response to the crisis itself, the rate was decreased to 1% by mid-2009. From there, the ECB mainly decreased the key policy rate that finally reached 0% by 2016. A 0% key policy rate remained for more than six years, reflecting the low-inflation environment and the ECB's reliance on unconventional monetary policy measures, such as asset purchases. A major change happened mid-2022, when the ECB started tightening the key policy rate again. In just 14 months, the rate was raised from 0%

to 4,5%. By late 2024, the rate was gradually lowered and the last monetary policy meeting, on December 12, 2024, decided to further decrease the key policy rate to 3,15%.

3.1.2 Nordic stock markets

Data of the Nordic stock markets has been collected as daily time series data from LSEG Workspace with the codes OMXHGI (OMX Helsinki General Index), OMXSPI (OMX Stockholm All-Share Index), and OMXCPI (OMX Copenhagen All-Share index). The stock market data represents the daily closing values of the indexes. Figures 4-6 present the overall development of the indexes.

Figure 4. OMX Helsinki development 1999-2024.

Figure 5. OMX Stockholm development 1999-2024.

Figure 6. OMX Copenhagen development 1999-2024.

After retrieving the daily data, the dataset was then filtered to remove any unnecessary days, meaning that only the dates of the ECB monetary policy meetings and the index values from the days preceding them were left. In the case of national holidays, where daily index data was not available, the first possible previous or next trading day was used. Altogether, there was 14 of these dates (3 for OMXHGI, 5 for OMXSPI and 6 for OMXCPI). These dates as well as their next possible trading dates used can be seen in table 4. After removing

unnecessary dates, daily percentage changes were calculated and logarithmically transformed. In the final tests, the unit of measurement was expressed in decimals, meaning that, for example a 3% change corresponds to 0,03.

Table 4. Trading dates not used, and trading dates used instead.

trading date not used	trading date used instead
OMXHGI	
6.12.2001	7.12.2012
6.12.2007	7.12.2012
6.12.2012	7.12.2012
OMXSPI	
6.6.2007	7.6.2007
6.6.2012	7.6.2012
6.6.2013	7.6.2013
6.6.2019	7.6.2019
6.6.2024	7.6.2024
OMXCPI	
5.6.2003	6.6.2003
5.6.2008	6.6.2008
5.6.2014	6.6.2014
5.6.2019	6.6.2019
14.4.2022	19.4.2022
5.6.2024	6.6.2024

3.1.3 MSCI World Index ex Europe Index

As global economic developments are also likely to influence the Nordic stock markets, a control variable was included in this study to capture the performance of the global stock market, excluding Europe. This control variable plays an important role in maintaining statistical significance as by incorporating this control variable, the size of error terms can be reduced.

The MSCI World ex Europe Index was chosen as the control variable because it effectively represents the performance of major global equity markets outside of Europe (MSCI 2025).

By excluding European markets, the index isolates external global influences without overlapping with the European, and specifically Nordic, stock markets. This isolating is important as it prevents double-counting regional effects while still accounting for international financial shocks. Including the MSCI World ex Europe index helps ensure that the estimated effects of the ECB's monetary policy on the Nordic stock markets are not influenced by any unrelated global events. Figure 7 displays the sector weights within the MSCI World ex Europe index.

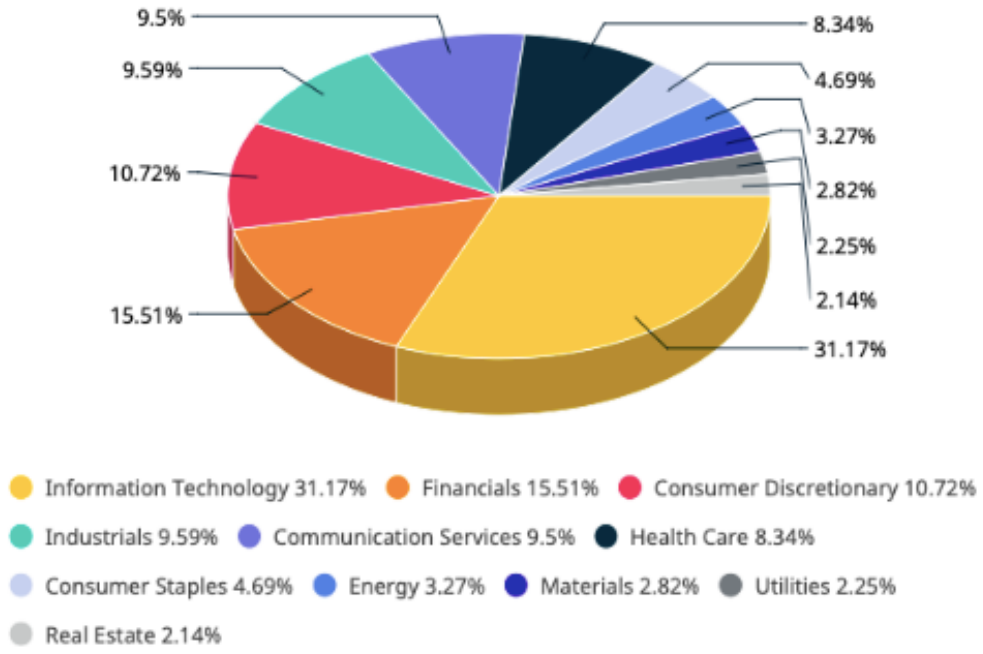

Figure 7. Sector weights of the MSCI World ex Europe Index. (MSCI 2025)

The data for the MSCI World ex Europe Index has been retrieved as daily time series data from LSEG Workspace with the code dMIWOE0000PUS. The data was collected from January 1, 1999, to December 31, 2024. Figure 8 presents how the index has developed between 1999-2024. The data represents the daily closing values of the index.

Figure 8. MSCI World ex Europe Index development 1999-2024.

As with the Nordic stock market data, after retrieving the daily data, the dataset was then filtered to remove any unnecessary days, meaning that only the dates of the ECB monetary policy meetings and the index values from the days preceding them were left. Then the daily percentage changes were calculated and in the final tests, the unit of measurement was expressed in decimals, meaning that, for example a 3% change corresponds to 0,03.

3.1.4 Euribor futures

Monetary policy surprises are derived from Euribor futures, which represent market expectations of future interest rates. By comparing actual policy rate decisions to these future expectations, one can isolate the unanticipated component of monetary policy. Only the new information should be the information that the financial markets have not already priced in. (Filbien and Labondance 2013) This thesis will be using the 3-month Euribor future rates to calculate the unanticipated component of the ECB's monetary policy actions.

The 3-month Euribor futures quotations were also collected from LSEG Workspace with the code FEU3c1. The futures data represents the daily closing values. The futures price for each is determined as follows (CME Group, 2011):

$$\textit{Daily futures price} = 100 - \textit{daily futures contract price} \quad (1)$$

To process the futures data, the daily expected interest rates were obtained by subtracting the quoted price from 100 as this reflects the markets' expectation of the futures rates development. These daily values were then compared with the rates preceding each ECB meeting to determine the change in the expected interest rate. Using this information, the expected and unexpected components of monetary policy changes were calculated as follows:

$$\Delta r_t^u = F_{s,t} - F_{s,t-1} \quad (2)$$

F_s = daily futures spot price (subtracted from 100)

t = monetary policy meeting date

t-1 = day before monetary policy meeting

Finally, these interest rate changes were expressed in similar basis points as the ECB key policy rates, meaning, that for example a 0,5% change corresponds to 50 basis points. The development of the 3-month Euribor futures rates 1999-2024 before any changes can be seen in figure 9.

Figure 9. 3-month Euribor futures rates 1999-2024.

3.2 Methodology

When studying the effects of central bank monetary policy, the two main approaches commonly used are the event study methodology and the vector autoregression analysis. The empirical part of this thesis is conducted as a quantitative event study as prior research, presented in chapter 2, has proven it to be an efficient methodology in this type of research. Studies such as Ehrmann and Fratzscher (2004) and Haitsma et al. (2016) demonstrate that this methodology is particularly suitable for evaluating how financial markets react to changes in policy rates.

3.2.1 Event study

Event studies are widely used in quantitative research in finance to analyse how specific events, such as monetary policy announcements, affect asset prices. The methodology assumes that financial markets are efficient and therefore, that any new and relevant information will be quickly reflected in asset prices. By isolating the event window, or the period immediately preceding the event date, one can measure the abnormal returns or the portion of price movement which cannot be explained by general market trends. This makes

event studies a valuable tool for examining how markets react to the ECB's monetary policy. (MacKinlay 1997)

An event study methodology typically involves identifying the event date, defining the event window, estimating normal returns and calculating abnormal returns. Normal returns represent the expected price movement in the absence of the event in question. Abnormal returns are calculated as the difference between the actual and expected return during the event window. (MacKinlay 2017) As per the EMH, the surprise element, in this case the monetary policy announcement, should trigger a market reaction quickly. This means that abnormal returns should be concentrated in very short time windows surrounding the announcements. Therefore, this study will be using a 1-day window. Figure 10 presents the event window for this study, where t represents the ECB's monetary policy meeting.

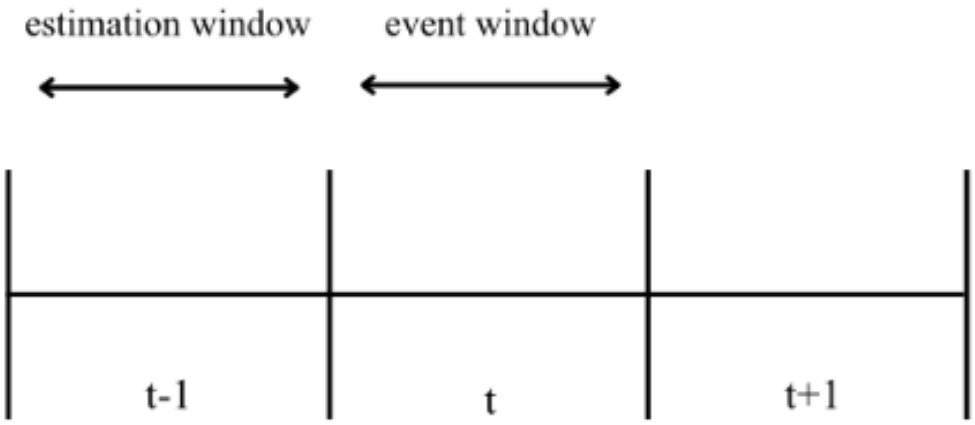

Figure 10. Event window where t represents the ECB's monetary policy meeting.

3.2.2 Linear Regression Model

Linear regression analysis is a tool in finance and econometrics used to examine the relationship between a dependent variable and one or more independent variables. A linear regression models how changes in explanatory variables influence the dependent variable while holding other factors constant. Linear regression is widely used to measure the effects of specific events or economic variables, such as monetary policy decisions, on market

outcomes like stock returns or interest rates. The most common method used to estimate this linear relationship is the Ordinary Least Squares (OLS) method. OLS minimizes the sum of squared residuals, which is the difference between the observed and predicted values of the dependent variable. This then produces unbiased estimates of the regression coefficients, provided that the classical linear regression assumptions are satisfied. (Hill, Griffith and Liam 2018)

Hill et al. (2018) also highlight the importance of validating the regression model through diagnostic tests. These include assessing for heteroskedasticity, autocorrelation, and multicollinearity. Violation of these assumptions can distort coefficient estimates and statistical significance.

A simple linear regression model can be mathematically expressed in the form:

$$y = \beta_1 + x\,\beta_1 + e \qquad (3)$$

y = response variable
β_1 = constant
β_2 = regression effect of the predictor variable x
e = error term

The linear regression assumptions in this study are as follows:

1) The dependant variable y is determined by a linear relationship with the independent variable x, plus an error term e
2) The expected value of the error term is zero, (E(e) = 0) meaning, that the model correctly captures the average relationship between x and y.
3) The variance of the error term is constant across all observations ($Var(e_i) = \sigma^2$).
4) The error terms are independent of each other, meaning that there is no correlation between e_i and e_j for $i \neq j$.
5) The independent variable x is not a random linear combination of other explanatory variables.
6) The error term e follows a normal distribution.

The regression coefficients refer to the slope of the regression line, which reflects the change in the explained variable when the explanatory variables increase by +/- 1(unit). Therefore, the regression coefficients can be both negative and positive. However, the regression coefficient cannot be 0 as this would indicate that there is no linear correlation. The error term, or residuals, represents all factors not already considered in the linear regression model. Due to the presence of the residual term, the linear regression model can never be used to explain variations in variables perfectly but simply just estimating them. (Hill et al. 2018)

The coefficient of determination, R^2, measures how well the regression model explains the variation in the dependent variable. It represents the amount of the total variation in the response variable that can be caused by the explanatory variables in the regression model. In other words, R^2 indicates the goodness of fit of the model. The value of R^2 ranges between 0 and 1, with 1 implying that the model explains the variation perfectly and 0 implying that the model completely fails to explain the observed variation. A high R^2 value alone does not necessarily mean the linear model is perfect and it should be interpreted together with other statistical measures, such as significance tests and diagnostic checks. (Hill et al. 2018)

3.2.3 Statistical model

A properly specified regression model allows one to isolate the marginal effect of one explanatory variable. In event studies, linear regression can be applied to estimate abnormal returns by regressing actual asset returns against expected market returns or relevant control variables. (Hill et al. 2018) This study requires a multiple linear regression. As this thesis focuses particularly on the impact of surprises on stock prices, the effect is estimated using the following model:

$$R^i_t = \alpha + \beta \Delta r^u_t + \gamma \Delta r^e_t + \delta X_t + e_t \quad (4)$$

R^i_t = daily stock return of index i on day t

Δr^u_t = unexpected component of the monetary policy announcement

Δr^u_t = expected component of the monetary policy announcement

X_t = control variable to account for global market movements

e_t = residual term to capture unexplained variation

To make the daily returns more normally distributed, R_i^t has been calculated as the daily log return and can mathematically be presented as follows:

$$R^i_t = \ln * (P^i_t / P^i_{t-1}) \quad (5)$$

P = price of index on day t

t = day of monetary policy meeting

t-1 = day before monetary policy meeting

The surprise element Δr^u_t has been calculated as follows and as already presented in chapter 3.1.4:

$$\Delta r^u_t = F_{s,t} - F_{s,t-1} \quad (2)$$

F_s = daily futures spot price (subtracted from 100)

t = monetary policy meeting date

t-1 = day before monetary policy meeting

F_s represents the 3-month Euribor futures spot price. Once the magnitude of the surprise element is known, the expected component of the monetary policy change can be calculated from the total change by using the following mathematical formula:

$$\Delta r^e_t = \Delta r_t - \Delta r^u_t \quad (6)$$

Δr_t = change in key policy rate

Δr^u_t = surprise (unexpected) element

4 Results

This chapter will present the findings of this thesis. Based on these findings, the research questions of this thesis will then be answered in the next chapter. All tests have been conducted in Stata using the OLS estimation method (linear regression) and White's heteroskedasticity-consistent standard errors. As the White's test indicated the presence of heteroskedasticity, all regressions were estimated using robust standard errors (appendices 1 and 2). In relation to this thesis, all the linear regression assumptions could not be met. This is because the expected change is calculated with the help of the unexpected change, meaning, that the two are inevitably in a linear relationship with each other. However, it is impossible to leave the expected change from the thesis as this is needed to tie all the tests to previous studies as well as financial theories.

First, the key statistics of all variables are presented. Then the findings of this study will be presented one market at a time, starting from the Finnish stock market and ending with the Danish stock market. To begin with, the impact of only the ECB's monetary policy changes and its effect on the stock markets was examined. After this, all the ECB's monetary policy decisions, including those where no changes were made, were considered. Finally, the difference between the ECB's monetary policy easing and monetary policy tightening on the stock markets was studied. In the very end, this chapter will critically examine the reliability of these findings.

4.1 Key statistics

Table 5. Key statistics of variables.

VARIABLE	OBS.	MEAN	VOLATILITY	MIN	MAX
OMX Helsinki	305	0,16%	2,41%	−10,76%	14,56%
OMX Stockholm	305	−0,01%	1,66%	−11,81%	5,73%
OMX Copenhagen	305	0,05%	1,30%	−8,50%	4,68%
Control variable	305	−0,05%	1,23%	−9,10%	3,95%
Unexpected change (bp)	305	0,13	4,03	-23.5	15,50
Expected change (bp)	305	−0,83	16,21	−80,50	79,00
Total change (bp)	305	0,49	16,10	−75,00	75,00

Table 5 presents the key statistics of the variables used in this study. OMX Helsinki, OMX Stockholm and OMX Copenhagen are the OMXHGI, OMXSPI and OMXCPI indices, respectively. The stock market indices exhibited slightly different levels of average daily returns and volatility, reflecting variations in market dynamics across the Nordics. The average daily return for the OMXHGI was 0,16%, which was the highest among all the indices. OMXSPI displayed a negative average return of –0,01% and the OMXCPI a positive average return of 0,05%. In terms of volatility, or standard deviations of the daily returns, OMXHGI appeared to have the highest volatility readings at 2,41%. OMXSPI had a volatility of 1,66% and the OMXCPI 1,30%. Based on the volatility readings, the Finnish stock market seems to have experienced the largest fluctuations in daily returns.

The control variable, MSCI World ex Europe Index, represents the global market movements and had an average return of –0,05% and a volatility of 1,23%. This alone indicates that global market movements were relatively stable compared to the Nordic markets. Even though the average daily return was slightly negative, this control variable serves as an important control factor and captures how external financial influences may affect the Nordic stock markets.

Regarding the monetary policy variables, the unexpected change in policy rates averaged 0,13 basis points, while the expected change averaged -0,83 basis points. The total change in rates averaged 0,49 basis points, indicating that during the studied period (1999-2024), policy rate changes were small and close to zero. Altogether, there were 305 monetary policy meetings, in which changes to policy rates was done 55 times. Out of the 55 times, the ECB tightened its monetary policy 28 times and eased it 27 times. This leaves 250 meetings with no policy rate changes. However, the unexpected policy rate changes ranging from –23,5 basis points to 15,5 basis points and expected policy rate changes ranging from –80,5 basis points to 79 basis points means that there was significant variability and at least some meetings involved large rate adjustments. Based on these numbers, it seems that monetary policy actions were largely expected by the financial markets, which does align with the ECB's announced practises of providing forward guidance and reducing financial surprises.

Table 6. How many times policy rates were or were not changed.

policy_change	Freq.	Percent	Cum.
0	250	81.97	81.97
1	55	18.03	100.00
Total	305	100.00	

*1=change, 0=no change

4.2 OMX Helsinki

This part of the thesis aims to study how the OMXHGI reacts to ECB monetary policy. The results are organised into three parts: market reaction to actual ECB policy rate changes, response to all ECB monetary policy meetings, including those where rates remained unchanged, and lastly, comparison of how the index behaves during times of monetary policy tightening and monetary policy easing.

4.2.1 Changes in ECB policy rates and the OMXHGI

First, a linear regression was used to examine the effect of only the ECB's monetary policy changes on the Finnish stock market. This means that a total of only 55 changes were considered. The model captures some variation in OMXHGI returns but was not statistically significant neither overall nor per any of the variables with even 10% accuracy.

The explanatory power (R^2) was only 0,18, meaning that the model explains only 18% of the variation in the OMXHGI. As the quite small sample size may explain some of the lack of statistical significance, the next step was to examine the effect of all the ECB's monetary policy decisions, including the decisions to not alter the key policy rates, on the stock market.

Table 7. Effects of the ECB's monetary policy changes on the OMXHGI.

VARIABLE	COEFFICIENT	t-value
Constant	0,0020472	0,69
Unexpected change	0,0006964	1,34
Expected change	−0,0000216	−0,33
Control variable	0,610623	1,62

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

4.2.2 All ECB policy rate decisions and the OMXHGI

In this model, all monetary policy meeting days were included, meaning, that also the days when no monetary policy changes were made were considered. The regression therefore captures the potential market response to both rate changes as well as unchanged policy decisions and so, reflects how the Finnish stock market reacts to overall ECB expectations.

This model had an R^2 of 25% and was statistically significant even on a 1% accuracy. In other words, this model manages to explain 25% of the variation in the OMX Helsinki's daily returns on ECB meeting dates.

Table 8. Effects of all ECB monetary policy decisions on the OMXHGI.

VARIABLE	COEFFICIENT	t-value
Constant *	0,0020835	1,71
Unexpected change	0,0002746	0,71
Expected change	−0,0000671	−0,89
Control variable ***	0,9748943	6,35

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

Neither the expected nor the unexpected components of monetary policy changes had a statistically significant effect on the Finnish stock market. The findings of this model therefore suggest that neither surprise nor the anticipated rate adjustments are, at least systematically, associated with abnormal returns in the Finnish markets. Furthermore, the small coefficients (0,0002746 and -0,0000671) imply that investors on the Finnish market may already price in the ECB's policy expectations and that because of this, unexpected announcements do not trigger significant short-term adjustments in the stock prices.

However, the control variable (MSCI World ex Europe Index) was highly significant, even on a 1% scale, and with a coefficient of approximately 0,97. This suggests that there is a strong correlation between the Finnish stock market and the global stock market. In other words, when the MSCI World ex Europe Index increases, the OMX Helsinki Index increases almost the same amount.

The constant term (0,0021) is marginally significant at the 10% level. This implies that there is a small positive average return (0,2%) on the ECB's meeting days. Overall, these

regression results suggest that the OMXHGI does not react strongly or systematically to ECB monetary policy changes, when considering also the broader global market movements.

After visually inspecting the outliers in the unexpected policy change (appendices 5 and 6), one could clearly see that there were some extreme observations that could potentially tamper with the reliability of the test. Therefore, as a robustness step, a decision was made to remove all observations above or below 15 basis points in the unexpected policy change variable. This led to dropping 5 observations. By doing so, even the model with only ECB policy changes was made statistically significant at the 10% level and with an R^2 of approximately 22% (appendix 7). The model with all ECB monetary policy decisions was still significant even at the 1% level but had a slight increase in the R^2, being 26% (appendix 8).

Table 9. Effects of the ECB policy rate decisions on the OMXHGI after removing outliers.

VARIABLE	ONLY CHANGES COEFFICIENT	t-value	ALL DECISIONS COEFFICIENT	t-value
Constant	0,0008256	0,27	0,0019447	1,59
Unexpected change	0,0009948	1,43	0,0001406	0,32
Expected change	−0,0000208	−0,31	−0,0000944***	−1,31
Control variable	0,6140186	1,56	1,005055	6,53

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

Appendices 9 and 10 present the calculations illustrating the impact of the ECB's unexpected monetary policy changes on the OMXHGI. If examining only the actual policy rate changes made, a 0,25% unexpected increase in the policy rate should cause a 2,35% change in the OMXHGI. When examining all policy rate decisions, the corresponding effect should only be 0,35%.

4.2.3 Monetary easing vs tightening and the OMXHGI

To answer the other sub-research question, it is also important to examine whether the ECB easing or tightening its monetary policy had the same effect on the stock market. This was done by first estimating separate regression models for monetary tightening and monetary easing. For these regressions, the dataset used was the one were the extreme values (5) had been removed as this dataset had provided better results in the earlier models. After excluding the outliers, 27 tightening and 25 easing observations remained in the final sample.

Table 10. Effects of monetary tightening and monetary easing on the OMXHGI.

VARIABLE	TIGHTENING COEFFICIENT	t-value	EASING COEFFICIENT	t-value
Constant	0,0070554	0,93	−0,0054192	−0,68
Unexpected change	0,0009657	1,21	0,0008619	0,83
Expected change	−0,0001185	−0,78	−0,0002487	−1,06
Control variable	−0,0195996	−0,04	0,9271048 *	1,82

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

In the case of monetary policy tightening, the model explains only around 7% of the variation in the OMXHGI (appendix 11). However, the model was not statistically significant even at the 10% level as were none of the coefficients either. Therefore, the model alone suggests that unexpected tightening policy rate changes do not have a significant or at least a systematic effect on the Finnish stock market. However, the positive coefficient acts against theoretical expectations as one could expect there to be a negative relationship between unexpected monetary policy tightening and stock market returns. Overall, the results for the tightening period imply that the OMXHGI would not respond strongly to ECB policy rate hikes.

However, the results did differ during periods of monetary policy easing. The monetary policy easing model received an R^2 of approximately 37% and was statistically significant

at the 10% level (appendix 12). These results suggest that monetary policy easing has a more systematic relationship with market movements compared to tightening monetary policy. The coefficient for unexpected monetary policy change was yet positive again, but still statistically insignificant. The only statistically significant coefficient was of the control variable at the 10% level. This alone suggests that OMXHGI tends to move closely with the global equity market.

However, if the extreme observations were added back into the dataset, the results for monetary tightening changed notably (appendix 13). The coefficient for unexpected policy change became statistically significant at the 5% level, with a positive sign indicating that unexpected rate hikes were associated with higher OMXH returns. This finding is yet again counterintuitive, and the results therefore suggest that the extreme observations do distort the relationship between the ECB policy changes and the OMXH returns. Furthermore, the whole model remained statistically insignificant and had only a 13% explanatory power. For monetary policy easing, adding the outliers back did not really change the results (appendix 14) as both the expected and unexpected policy change coefficients remained statistically insignificant.

As a whole, these findings implied that expected monetary policy change actions are already incorporated into asset prices, which supports the EMH. However, out of the two options, monetary easing seems to have a larger impact on the OMXHGI.

4.3 OMX Stockholm

This part of the thesis aims to study how the OMXSPI reacts to ECB monetary policy. The results are organised into three parts: market reaction to actual ECB's policy rate changes, response to all ECB's monetary policy meetings, including those where rates remained unchanged, and lastly, comparison of how the index behaves during times of monetary policy tightening and monetary policy easing.

4.3.1 Changes in ECB policy rates and the OMXSPI

As with the OMXHGI, a linear regression was first used to examine the effects of only the ECB's monetary policy changes on the OMXSPI. In total, there were 55 changes made between the years 1999-2024. The estimated model was significant at the 1% level and had an explanatory power of 41% meaning, that the model explains 41% of the variation in the OMXSPI.

Table 11. Effects of the ECB's monetary policy changes on the OMXSPI.

VARIABLE	COEFFICIENT	t-value
Constant	0,0006116	0,3
Unexpected change	0,0005526 **	2,19
Expected change	−0,0000108	−0,21
Control variable	0,8277893 ***	3,32

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

The coefficient for the unexpected monetary policy changes was positive and statistically significant at the 5% level, suggesting that unanticipated ECB monetary policy changes are associated with higher Swedish stock market returns. However, this finding is also counterintuitive compared to previous studies, which have suggested that there is usually a negative relationship with the two. Furthermore, this could still be interpreted as non-eurozone investors viewing ECB policy rate hikes as indication of stronger macroeconomic conditions within the eurozone, which in turn could boost economic conditions outside of the eurozone too.

4.3.2 All ECB policy rate decisions and the OMXSPI

When looking at how all the EBC's policy rate decisions affected the OMXSPI, regardless of whether policy rate changes were made, the model captures the market's reaction to not only the policy rate changes but also the reaction to the unchanged policy decisions. Therefore, it ought to reflect relatively well how the Swedish stock market reacts to overall ECB expectations.

Table 12. Effects of all ECB monetary policy decisions on the OMXSPI.

VARIABLE	COEFFICIENT	t-value
Constant	0,0003688	0,51
Unexpected change	−0,0000747	−0,31
Expected change	−3,97E−06	−0,07
Control variable	0,8861428***	7,69

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

The model had a slightly higher explanatory power than the previous model, it being 43% and meaning, that the model could explain approximately 43% of the variation in the OMXSPI. The model was also statistically significant as a whole, even at the 1% level, indicating that, taken together, the explanatory variables provide a significant explanation of stock market movements during these ECB monetary policy meetings.

However, the coefficients for both the unexpected and expected components were statistically insignificant with extremely high p-values (0,757 and 0,948 respectively). This suggests that neither the surprise nor the anticipated element had significant effects on the OMXSPI when considering all policy meetings. By contrast, the control variable was statistically significant at the 1% level and had a coefficient value of approximately 0,89. Therefore, this indicates that the Swedish stock market has a strong correlation with the

global equity markets. This highlights Sweden's high degree of financial integration with the global financial markets outside of Europe.

Overall, the results indicated that the ECB's policy meetings, including those with no policy rate changes, did not have a significant impact on the Swedish stock market. Rather, the OMXSPI appears to be primarily influenced by broader global market developments.

Next, the outliers (5) were again removed from the dataset to examine if the correlations changed in any way. After doing so and rerunning the regressions, the overall results remained largely unchanged, but the statistical significances and explanatory powers improved slightly (appendices 17 and 18). The model with only the ECB's policy rate changes had a small increase in its R^2 from 0,41 to 0,43, indicating a small improvement in model fit. The coefficient of the unexpected monetary policy component remained positive but lost some of its significance (from being significant at the 5% level to being significant only at the 10% level). In the regression including all monetary policy meetings, the R^2 increased a tiny bit from 0,428 to 0,434. However, both the unexpected and expected components remained statistically insignificant, while the control variable on the other hand, remained strongly positive and statistically significant at the 1% level.

These results indicate that this time the removal of the extreme observations did not alter the core interpretation of the OMXSPI being primarily driven by other global factors than the ECB rate surprises. Results remain quite similar than before removing the outliers.

Table 13. Effects of the ECB policy rate decisions on the OMXSPI after removing outliers.

VARIABLE	ONLY CHANGES COEFFICIENT	t-value	ALL DECISIONS COEFFICIENT	t-value
Constant	0,0001538	0,07	0,0004295	0,59
Unexpected change	0,0008508*	1,96	−0,0001055	−0,32
Expected change	1,23E−06	0,02	−0,0000208	−0,34
Control variable	0,8078427***	3,14	0,9012387***	7,75

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

Appendices 19 and 20 present the calculations illustrating the impact of the ECB's unexpected monetary policy changes on the OMXSPI. If examining only the actual policy rate changes made, a 0,25% unexpected increase in the policy rate should cause a 2,15% change in the OMXSPI. When examining all policy rate decisions, the corresponding effect should be -0,264%.

4.3.3 Monetary easing vs tightening and the OMXSPI

Regressions estimating the effects of monetary policy tightening and monetary policy easing on the OMXSPI were conducted separately (appendices 21 and 22). For these regressions, the dataset used was the one where outliers had been removed. After removing the outliers, 27 tightening and 25 easing observations remained in the sample.

Table 14. Effects of monetary tightening and monetary easing on the OMXSPI.

VARIABLE	TIGHTENING COEFFICIENT	t-value	EASING COEFFICIENT	t-value
Constant	−0,0029547	−0,43	−0,0045315	−1,02
Unexpected change	0,0007937	1,16	0,0007241	1,08
Expected change	0,0001043	0,66	−0,0001498	−0,99
Control variable	0,7372495	1,53	0,8965684**	2,76

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

The results of the regression analysis showed that there was a noticeable asymmetry in how the OMXSPI responded to monetary tightening and monetary easing. The monetary tightening regression, as a whole, was statistically significant at the 10% level and received an R^2 of 0,278. In other words, the variables explain less than 30% of the OMXSPI's movements during monetary tightening periods. The coefficient for the unexpected policy change was slightly positive, but statistically insignificant. Moreover, none of the coefficients were statistically significant, suggesting that the OMXSPI may reflect limited spillover effects or has already been able to anticipate tightening monetary policy changes.

In contrast, the monetary easing regression was statistically significant at the 1% level and received an explanatory power of approximately 50%. In other words, the variables explain approximately 50% of the OMXSPI's movements during monetary easing periods. As with the tightening regression, the unexpected policy change coefficient was statistically insignificant, yet slightly positive. However, the control variable was statistically significant at the 5% level and received a high coefficient value of almost 0,9. This implies that during times of monetary easing, the Swedish stock market movements can be heavily influenced by global factors.

Reintroducing the removed outliers did not produce any major differences in regression results (appendices 23 and 24). This again indicates that the extreme observations do not significantly distort the outcomes or interpreting the effects of monetary tightening or easing on the OMXSPI.

4.4 OMX Copenhagen

This part of the thesis aims to study how the OMXCPI reacts to the ECB's monetary policy. The results are organised into three parts: market reaction to actual ECB's policy rate changes, response to all the ECB's monetary policy meetings, including those where rates

remained unchanged, and lastly, comparison of how the index behaves during times of monetary policy tightening and monetary policy easing.

4.4.1 Changes in ECB policy rates and the OMXCPI

First, a linear regression was used to examine the effects of only the ECB's monetary policy changes on the Danish stock market. This means that only the effects of 55 changes in policy rates were considered. The model, as a whole, was statistically significant at the 5% level but received an R^2 of only 14% (appendix 25). This means, that the model would be able to explain only approximately 14% of the variation in the OMXCPI.

Table 15. Effects of the ECB's monetary policy changes on the OMXCPI.

VARIABLE	COEFFICIENT	t-value
Constant	−0,0037076	−1,59
Unexpected change***	−0,0009547	−2,99
Expected change	6,22E−05	1,03
Control variable	−0,0932323	−1,1

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

The unexpected change in ECB policy rates had a statistically significant (at the 1% level) and negative effect on the OMXCPI returns. This finding aligns with many previous studies and means that when the ECB unexpectedly tightens its monetary policy, this would lead to a decline in the Danish stock market. Conversely, easing the policy rates would lead to an increase in the Danish stock market. On the other hand, the expected change in policy rates did not have a statistically significant reaction, which further suggests that the financial markets have been able to incorporate anticipated policy expectations into their asset pricings. The control variable also received a statistically insignificant p-value, indicating that the Danish stock market was driven by something other than global international

financial trends. Overall, this regression alone demonstrates that the OMXCPI is sensitive to unexpected changes in the ECB's monetary policy.

4.4.2 All ECB policy rate decisions and the OMXCPI

In the next model, all monetary policy meetings were included in the dataset, regardless of whether any changes were made. However, surprisingly this made the whole model statistically insignificant, and it received an explanatory power of only 1,2% (appendix 26).

Table 16. Effects of all ECB monetary policy decisions on the OMXCPI.

VARIABLE	COEFFICIENT	t-value
Constant	0,0004873	0,66
Unexpected change	−0,0002406	−1,08
Expected change	3,78E−05	0,64
Control variable	−0,0563711	−0,9

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

Both the unexpected and expected variables showed statistically insignificant coefficients. The unexpected variable's coefficient was slightly negative, implying that there could potentially be a slight decrease in stock prices when unexpected tightening occurs, but the simultaneous lack of significance also implies that this effect is not consistent. Conversely, the expected component had a slightly positive effect, which indicates that the financial markets have potentially already anticipated changes and priced these into the asset prices.

Overall, the results suggest that the Danish stock market remains largely unresponsive to the information released on the ECB monetary policy meeting dates (when no new policy

measures are introduced). This does again align with the EMH, which suggests that financial markets usually only react to unexpected monetary policy shifts and new information.

When the dataset was trimmed to remove extreme observations (5), the results show a clearer relationship between the ECB's policy rate changes and the OMXCPI (appendix 27). The coefficient for the unexpected policy change becomes slightly stronger and is still statistically significant at the 10% level. However, when examining all ECB meetings, the coefficients for both expected and unexpected rate components are statistically insignificant and the R^2 of the whole model remains very low at 0,9%.

Table 17. Effects of the ECB policy rate decisions on the OMXCPI after removing outliers.

VARIABLE	ONLY CHANGES COEFFICIENT	t-value	ALL DECISIONS COEFFICIENT	t-value
Constant	−0,004138	−1,79	0,0003535	0,48
Unexpected change	−0,0010575*	−1,94	−0,0000832	−0,29
Expected change	5,33E−05	0,83	0,0000542	0,89
Control variable	0,0842317*	−0,89	−0,069941	−1,15

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

Calculations illustrating the impact of the ECB's unexpected monetary policy changes are presented in appendices 29 and 30. If examining only the actual policy rate changes made, a 0,25% unexpected increase in the policy rate should cause a –2,68% change in the OMXCPI. When examining all policy rate decisions, the corresponding effect should be –0,21%.

4.4.3 Monetary easing vs tightening and the OMXCPI

Next, the effects of monetary policy easing and monetary policy tightening on the OMXCPI were examined. This was first done by estimating separate regressions for both using the dataset where outliers had been removed. After this, the same regressions were run on the

original data including the outliers too. After excluding the outliers, 27 tightening and 25 easing observations remained in the sample.

Table 18. Effects of monetary tightening and monetary easing on the OMXCPI.

VARIABLE	TIGHTENING COEFFICIENT	t-value	EASING COEFFICIENT	t-value
Constant	−0,0163183	−1,59	−0,0008124	−0,14
Unexpected change	−0,0007542	−0,96	−0,0012459*	−1,73
Expected change	0,0003666*	1,88	0,0001102	0,53
Control variable	0,0362601	0,17	−0,0980051	−0,71

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

When it comes to monetary tightening, the only statistically significant coefficient is the expected change at the 10% level. This implies that when the Danish markets are expecting a rate hike, the actual implementation will most likely cause a rather small (positive) market response as there is not much uncertainty. On the other hand, the coefficient for unexpected change was not statistically significant even at the 10% level. Nevertheless, the slight negative coefficient suggests that unexpected tightening may have a minor decreasing effect in the Danish stock market. However, as with all the Nordic indices, one must be careful at interpreting the results from such a small sample size (27 samples). Overall, the model was not statistically significant and received an R^2 of 12,8% (appendix 31).

Monetary easing, on the other hand, manages to produce opposite values. The unexpected change coefficient is negative and statistically significant at the 10% level. This finding alone suggests that during unexpected monetary easing periods, the Danish stock market tends to experience some decline. No other variables received any statistically significant coefficients. Furthermore, the model, as a whole, was not statistically significant and received an R^2 of 23,2%.

When the outliers were added back into the dataset, this notably changed how the Danish stock market reacted to especially monetary easing. The coefficient for unexpected change was statistically highly significant at the 1% level and yet again, had a negative value suggesting, that monetary easing would have a slightly negative effect on the Danish stock market. Furthermore, this shift implies that the most extreme monetary easing actions, which often happen during periods of financial stress, trigger more adverse reactions from the financial market. On the other hand, results relating to monetary tightening remained largely similar, suggesting that adding the outliers back did not significantly make any change.

Overall, the OMXCPI did not show strong or statistically significant reactions to the EBC's monetary easing or tightening once the outliers had been removed, although the direction of the coefficients hinted at small underlying dynamics. Tightening tended to generate mildly positive reactions and vice versa. These asymmetries may imply that the OMXCPI would react more strongly to broader context surrounding monetary policy (rather than solely to the rate changes themselves). Once the outliers were added back in, the effects of monetary easing became notably stronger and clearly negatively correlated. The monetary tightening effect remained roughly similar.

4.5 Comparison with previous studies

The findings of this study partially align with earlier research on the effects of monetary policy announcements on stock markets. Consistent with foundational research such as Ehrmann and Fratzscher (2004) and Rigobon and Sack (2004), the findings of this study support the analysis that financial markets primarily react to the unexpected component of monetary policy decisions, rather than to anticipated changes. The generally weak or insignificant effects of expected policy changes across all the examined markets also support the Efficient Market Hypothesis and confirm, that policy expectations are largely incorporated into asset prices even before official announcements.

However, unlike much of the prior research (Ehrmann and Fratzscher 2004; Rigobon and Sack 2004; Bohl et al. 2008; Ferrer et al. 2016), this study does not find strong or consistently negative stock market reactions to unexpected monetary tightening. Earlier studies have typically reported that unexpected monetary policy changes have led to immediate and negative equity market responses, especially within the euro area. In contrast, the results of this study indicate that tightening effects in the Nordic markets are often statistically insignificant, unstable across specifications, or even counterintuitive when extreme observations are included. This may be explained by differences in the sample composition as the sample size used in this study was relatively small and included an even smaller number of actual rate changes (55).

The findings of this study are more closely aligned with studies emphasizing international spillovers and global financial integrations, such as Kim and Nguyen (2009), Fratzscher et al. (2009), and Camara (2023). The consistently strong explanatory power of the control variables across all models suggests, that the Nordic stock markets are heavily influenced by global equity movements. Moreover, the stronger and more frequent responses observed especially in the Swedish markets are consistent with previous research (Kim and Nguyen 2009; Fratzscher et al. 2009; Camara 2023), suggesting that market structure and openness can matter more than formal eurozone membership.

Finally, the results obtained from studies such as Haitsma et al. (2016) and Jäger and Grigoriadis (2017) are similar to this study, arguing that monetary policy effects vary across economic regimes and policy environments. While previous studies have distinguished crisis periods and unconventional measures, this thesis, on the other hand, shows that failing to separate such periods may obscure some underlying relationships. The limited and unstable significances suggest that the ECB's monetary policy effects on the Nordic stock markets can be more context-specific rather than constant over time. Overall, this study extends the existing literature by demonstrating that while the ECB's monetary policy does generate some cross-border signals, their translation into abnormal stock market returns in the Nordics is weaker, less stable, and more conditional than previously documented for larger euro area markets.

4.6 Reliability of results

The reliability of this study's empirical findings is supported by the decision to remove the extreme observations in the unexpected policy rate variable. This strengthened both the robustness and internal consistency of many models. Including these outliers led to some statistically significant but theoretically inconsistent results, most notably, a positive relationship between monetary tightening surprises and stock market reactions. The removal of the outliers aligned the findings more closely with already established monetary policy theory and improved the stability of some coefficients. However, the findings must also be evaluated with some considerable caution. Although trimming the extreme values (5) improved the consistency of some regression results, this decision also shows how sensitive models are to individual observations. The fact that 5 extreme values could reverse coefficient signs and significance demonstrated that the estimated relationships are potentially not particularly stable. Rather than indicating a clear and underlying economic mechanism, this sensitivity suggests that the data, especially the surprise variable, may be too imprecise to capture the actual theoretical effects of monetary policy with high confidence.

A further complication arose from the limited number of genuine policy rate changes. With only 55 tightening or easing events across the whole period of 1999-2024, the sample size for the core phenomenon under investigation is simply too small. This then again can sharply restrict the statistical power, especially when the sample was divided further into monetary policy tightening and easing actions. Some of the statistically significant results obtained in the Finnish and Swedish markets must therefore be interpreted with scepticism, as they may reflect coincidental correlations – correlations, which do not actually represent stable monetary policy transmission mechanisms. These coincidental correlations could include, but would not be limited to, stock prices rising on the same dates as the ECB meetings even if the meeting would not be the root cause of the increase. Instead, even a seasonal trend might result in stock prices, and indices, increasing. Therefore, the relationship between the ECB's monetary policy meetings and stock prices could potentially not be causal, but coincidental. Furthermore, the inclusion of 250 "no-change" meetings did expand the

dataset, but these observations do not necessarily contain meaningful monetary policy information and therefore, may dilute the true effect of actual policy surprises.

Moreover, as this study lacks the addition of other macroeconomic controls, such as for example inflation dynamics, this can undermine the reliability of some estimates. This thesis aimed to study the sole effect of the ECB's monetary policy announcements, but looking back at the results, the addition of other macroeconomic controls may have added confidence and statistical significance of results. Though monetary policy announcements often do trigger inflation, by excluding the actual inflation variables, this could potentially tamper with some otherwise clearer results. This kind of omission could be especially problematic during periods of increased inflation, such as post-Covid, when inflation shocks and monetary tightening were tightly intertwined.

As a whole, this study did benefit from the long observation period of 1999-2024. The observation period included multiple economic cycles and therefore may have increased reliability as the results are less likely to be driven by short-term anomalies and more likely to be driven by structural relationships. However, prior research (Haitsma et al. 2016; Jäger and Grigoriadis 2017) has demonstrated that the financial markets can respond differently to monetary policy actions in crisis periods, compared to normal times. The observation period of this study also includes some significant crisis periods, such as the global financial crisis, the European sovereign debt crisis, and the post-Covid pandemic inflation spike. A further research suggestion could be to examine how differentiating these periods would affect the results otherwise obtained from this study.

Table 19. Conclusion of statistical significances.

STATISTICAL SIGNIFICANCE			
	OMXHGI	OMXSPI	OMXCPI
WITH ALL VALUES			
only changes	NO	YES***	YES**
all decisions	YES***	YES***	NO
tightening	NO	YES*	NO
easing	NO	YES**	YES**
WITHOUT OUTLIERS			
only changes	YES*	YES***	YES*
all decisions	YES***	YES***	NO
tightening	NO	YES*	NO
easing	YES*	YES***	NO

****significant at the 1% level, **significant at the 5% level, *significant at the 10% level*

As can be seen in table 19, the empirical results of this study were not consistently stable. Statistical significance varied depending on whether the analysis included all observations or whether the outliers were excluded. As the presence or absence of statistical significance depended on these choices, this suggests that the results were at least, to some extent, sensitive to modelling assumptions rather than reflecting a persistent relationship. In short, this sensitivity reduces the reliability of the results.

Moreover, notable cross-market inconsistency was observed, which further complicates the reliability of the findings. While the Swedish market exhibited statistical significance in most cases, the Finnish and Danish markets showed more inconsistent and unstable patterns. This of course may reflect structural differences between the markets but can also indicate that some statistically significant results were driven by coincidental correlation. The lack of consistent significance during monetary tightening periods across all the markets is particularly important as it suggests that the results are not aligned with theoretical expectations of tightening monetary policy transmissions.

Furthermore, the comparison between results obtained with and without the outliers highlights yet again another reliability concern as trimming the extreme values improved theoretical coherence and consequently, demonstrated that the results of this study were influenced by a very small number of observations. The fact that only removing 5 extreme values altered the statistical significance multiple time implies limited robustness of the estimates.

4.7 Use and significance of results

Beyond academic contribution, this thesis provides valuable insights for investors, businesses as well as policymakers. By examining how unexpected ECB monetary policy decisions transmit into the Finnish, Swedish, and Danish equity markets, these results can help investors better understand the degree to which Nordic stock market returns are driven by European monetary signals. This knowledge supports more informed risk management, investment strategies, and portfolio diversification. For businesses, especially those dependent on financing conditions or with substantial European market exposure, the findings of this study help clarify how shifts in policy expectations may affect their cost of capital, demand, and investment planning. This includes shifts in policy expectations beyond their own national borders.

Moreover, for Nordic central banks and other policymakers, this study further emphasizes the cross-border nature of monetary transmission, highlighting how the ECB's decisions may influence financial conditions beyond just the eurozone. Although the ECB's policy surprises did not appear to be the primary driver of Nordic stock market movements, they still contribute to the broader set of signals shaping financial conditions. This has direct implications for national monetary authorities needing to account for external policy shocks when designing domestic interest rate policies or other financial stability measures.

5 Conclusions

This study examined the impact of the European Central Bank's unexpected monetary policy rate changes on the Nordic stock markets between 1999 and 2024, focusing on Finland, Sweden, and Denmark. By combining an event study framework with regression analysis and controlling for global market movements, this thesis aimed to isolate the surprise element of the ECB's monetary policy decisions and assess whether these shocks translated into abnormal market returns in both the eurozone and non-eurozone Nordic economies.

The results of this study were obtained through a quantitative event study combined with linear regression analysis. Daily log returns of the Nordic stock indices were examined around the ECB's monetary policy meeting dates by using a 1-day event window to capture immediate market reactions. Monetary policy surprises were derived from changes in 3-month Euribor futures, allowing the unexpected component of policy rate decisions to be isolated from market expectations. The regression models included both expected and unexpected policy changes as explanatory variables, alongside a global control variable (MSCI World ex Europe Index) to account for international market movements. All estimations were conducted using OLS with heteroskedasticity-robust standard errors. Testing was first done by analysing how only actual rate changes versus all policy meetings affected the stock market returns. Then, further analysis was conducted by trimming extreme observations as well as analysing the effects of monetary tightening and monetary easing alone.

Overall, the findings of this study suggested that the relationship between the ECB's monetary policy surprises and the Nordic stock markets is complex and highly sensitive to model specifications. The results indicated that global equity movements, captured through the MSCI World ex Europe Index, explained a substantial share of stock market variation on the ECB's meeting dates. This highlights the strong international integration of Nordic equity markets and suggests, that the ECB policy signals operate alongside, rather than independent from, broader financial dynamics.

The analysis also revealed that monetary easing and tightening did not produce symmetric market reactions, and that extreme observations can distort estimated relationships. Although excluding the outliers improved theoretical consistency, it simultaneously also exposed the sensitivity of the results to only a small number of influential events. Furthermore, the absence of explicit controls for other macroeconomic variables, such as inflation, and the lack of separation between crisis and non-crisis periods limited the ability to draw definitive causal conclusions. These constraints highlighted the challenge of identifying clean monetary policy effects in small, open economies that are yet still deeply embedded in global financial cycles.

In conclusion, this study contributed to a deeper understanding of cross-border monetary policy transmission by demonstrating that the ECB's policy surprises did not translate into clear or stable abnormal returns across the Nordic stock markets. Instead, the results suggest that market expectations, global conditions, and structural differences between countries play a central role in shaping observed outcomes. While the findings provided valuable insights into the interaction between European monetary policy and the Nordic equity markets, they also emphasized the importance of cautious interpretation and the need for more refined approaches in possible future research.

5.1 Answers to research questions

To answer the main research question of this thesis, let's first answer the sub-research questions. The first sub-research question examined whether monetary tightening and monetary easing had similar effects on the Nordic stock markets. The empirical results simply and clearly indicated that they do not. Across all three markets, monetary easing periods tended to exhibit more frequent and stable associations with stock market returns than during monetary tightening periods. The effects of monetary tightening were generally weak, statistically insignificant or highly sensitive to a few extreme values. In some cases, monetary tightening was even associated with positive stock market reactions, which is highly contradictive to established monetary policy theory. These counterintuitive results

largely disappeared once the few extreme values were removed, suggesting, that tightening effects are therefore neither robust, nor systematic. Overall, the findings imply that the Nordic equity markets reacted asymmetrically to the ECB's policy actions, with monetary easing having a limited but still more detectable impact compared to monetary tightening.

The second sub-research question examined whether Nordic stock markets outside the eurozone responded differently to the ECB's monetary policy announcements compared to Finland, which is part of the eurozone. The results did provide partial support for this question. Among the examined markets, Sweden showed the strongest and most frequent statistical significance in response to the ECB's monetary policy surprises. Finland and Denmark, on the other hand, displayed weaker and less consistent reactions. This suggests that the eurozone membership alone does not determine the strength of monetary policy transmissions. Instead, differences in financial market structure, international exposure, and integration with the global equity markets appeared to play a more important role. The strong explanatory power of the global control variables in all the studied markets further supports the conclusion that the Nordic stock markets, regardless of their eurozone status, are heavily influenced by global developments rather than the ECB's monetary policy alone.

The main research question of this thesis was: "Do the ECB's unexpected monetary policy announcements lead to abnormal returns in the Nordic stock markets?". Based on the findings of the two sub-research questions, the main research question can be answered with caution. The results of this thesis suggest that the ECB's monetary policy surprises do not lead to consistent abnormal returns across the Nordic markets. While certain statistically significant effects were observed in specific markets and model specifications, these effects were not stable across time or methodological choices. Consequently, the evidence did not support a strong or generalizable causal relationship between the ECB's monetary policy surprises and abnormal stock market returns in the Nordic region. Rather, the findings of this study imply that the ECB's announcements operate within a broader global environment, where market expectations and international financial conditions play a dominant role in shaping short-term equity market movements.

5.2 Suggestions for further research

Building on analysing the reliability of this study, there are several ways one could continue this study. Firstly, the strong possibility of coincidental correlations in the small samples suggest that future studies could examine broader sets of financial markets, both within and beyond Europe and the eurozone. Analysing additional EU-member states and non-eurozone countries could help determine whether the patterns observed in the Nordic region represent genuine monetary policy transmission or simply sample-specific observations. Secondly, as this study did not differentiate between crisis periods and normal market conditions, future studies could build on this study too, by isolating these periods and examining whether this would provide more reliable and context-specific findings. Prior literature (Haitsma et al. 2016; Jäger and Grigoriadis 2017) strongly suggests that monetary policy shocks have substantially different effects during crisis times, such as the financial crisis, European sovereign debt crisis and post-Covid pandemic – all crises' that were within the time frame of this study's dataset.

Thirdly, extending this study to a sector-specific level could offer deeper understanding of how monetary policy shocks affect different industries. Previous studies (Kholodilin et al. 2009) have demonstrated that interest-sensitive sectors, such as banking and construction, respond very differently compared to defensive sectors. Finally, future research could also incorporate additional macroeconomic variables, such as inflation expectations, to reduce omitted variable bias and obtain findings from the broader macroeconomic environment.

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Appendices

Appendix 1. Effect of only ECB monetary policy changes on the OMXHGI without robust standard errors.

Source	SS	df	MS	Number of obs	=	55
				F(3, 51)	=	3.77
Model	.005669694	3	.001889898	Prob > F	=	0.0161
Residual	.025560749	51	.000501191	R-squared	=	0.1815
				Adj R-squared	=	0.1334
Total	.031230443	54	.000578342	Root MSE	=	.02239

ret_omxh	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0006964	.0004729	1.47	0.147	-.0002531	.0016458
dRE_bp	-.0000216	.0000869	-0.25	0.804	-.000196	.0001528
ret_msci	.610623	.209333	2.92	0.005	.1903694	1.030877
_cons	.0020472	.0030474	0.67	0.505	-.0040707	.0081652

Appendix 2. White's test in relation to abovementioned linear regression (justification to using robust standard errors)

White's test
H0: Homoskedasticity
Ha: Unrestricted heteroskedasticity

chi2(9) = 28.31
Prob > chi2 = 0.0008

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	28.31	9	0.0008
Skewness	15.74	3	0.0013
Kurtosis	4.43	1	0.0353
Total	48.48	13	0.0000

Appendix 3. Effect of only ECB monetary policy changes on the OMXHGI.

Linear regression

Number of obs	= 55
F(3, 51)	= 1.53
Prob > F	= 0.2167
R-squared	= 0.1815
Root MSE	= .02239

ret_omxh	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0006964	.00052	1.34	0.186	-.0003475	.0017402
dRE_bp	-.0000216	.0000662	-0.33	0.745	-.0001546	.0001113
ret_msci	.610623	.3774721	1.62	0.112	-.1471838	1.36843
_cons	.0020472	.0029874	0.69	0.496	-.0039502	.0080447

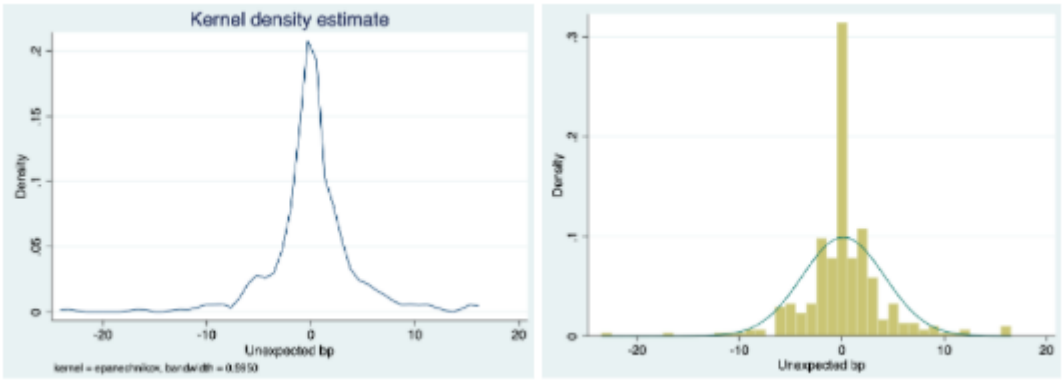
Appendix 4. Effect of all ECB monetary policy decisions on the OMXHGI.

Linear regression

Number of obs	= 305
F(3, 301)	= 16.20
Prob > F	= 0.0000
R-squared	= 0.2505
Root MSE	= .02099

ret_omxh	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0002746	.0003877	0.71	0.479	-.0004883	.0010375
dRE_bp	-.0000671	.0000749	-0.89	0.372	-.0002145	.0000804
ret_msci	.9748943	.1536377	6.35	0.000	.6725542	1.277234
_cons	.0020835	.0012156	1.71	0.088	-.0003086	.0044757

Appendix 5. Visual inspection of outliers in unexpected policy change variable.



Appendix 6. Detailed summary of the unexpected policy change variable.

Unexpected bp

	Percentiles	Smallest		
1%	-10.5	-23.5		
5%	-6	-16.5		
10%	-4	-12.5	Obs	305
25%	-1.3	-10.5	Sum of wgt.	305
50%	0		Mean	.1318033
		Largest	Std. dev.	4.025062
75%	1.5	12		
90%	4	15.5	Variance	16.20112
95%	6.5	15.5	Skewness	-.3166752
99%	12	15.5	Kurtosis	9.567431

Appendix 7. Effect of only ECB monetary policy changes on the OMXHGI after dropping extreme observations from the unexpected policy change variable.

Linear regression

Number of obs	=	52
F(3, 48)	=	2.44
Prob > F	=	0.0761
R-squared	=	0.2161
Root MSE	=	.02173

ret_omxh	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0009948	.0006967	1.43	0.160	-.0004059	.0023956
dRE_bp	-.0000208	.0000674	-0.31	0.759	-.0001563	.0001147
ret_msci	.6140186	.393225	1.56	0.125	-.1766132	1.40465
_cons	.0008256	.0030123	0.27	0.785	-.005231	.0068823

Appendix 8. Effect of all ECB monetary policy decisions on the OMXHGI after dropping extreme observations from the unexpected policy change variable.

Linear regression

				Number of obs	=	300
				F(3, 296)	=	17.79
				Prob > F	=	0.0000
				R-squared	=	0.2632
				Root MSE	=	.02076

ret_omxh	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0001406	.0004358	0.32	0.747	-.000717	.0009982
dRE_bp	-.0000944	.0000721	-1.31	0.191	-.0002362	.0000475
ret_msci	1.005055	.1538497	6.53	0.000	.7022772	1.307833
_cons	.0019447	.0012201	1.59	0.112	-.0004565	.0043459

Appendix 9. Effect of only policy rate changes on the OMXHGI.

$$\ln(R) = 0{,}0009948 r_u \text{ ---> } R = e^{0{,}0009948 ru} - 1$$

$$\text{if } r_u = 25, \text{ then } R = 0{,}02518... \approx 2{,}52\%$$

Appendix 10. Effect of all policy rate decisions on the OMXHGI.

$$\ln(R) = 0{,}0001406 r_u \text{ ---> } R = e^{0{,}0001406 ru} - 1$$

$$\text{if } r_u = 25, \text{ then } R = 0{,}00352... \approx 0{,}35\%$$

Appendix 11. Effect of monetary tightening on the OMXHGI.

Linear regression

Number of obs	= 27
F(3, 23)	= 0.97
Prob > F	= 0.4258
R-squared	= 0.0728
Root MSE	= .0187

ret_omxh	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0009657	.000795	1.21	0.237	-.0006788	.0026102
dRE_bp	-.0001185	.0001514	-0.78	0.442	-.0004316	.0001946
ret_msci	-.0195996	.5409279	-0.04	0.971	-1.138594	1.099395
_cons	.0070554	.0075506	0.93	0.360	-.0085642	.0226751

Appendix 12. Effect of monetary easing on the OMXHGI.

Linear regression

Number of obs	= 25
F(3, 21)	= 2.76
Prob > F	= 0.0674
R-squared	= 0.3664
Root MSE	= .02441

ret_omxh	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0008619	.001035	0.83	0.414	-.0012905	.0030143
dRE_bp	-.0002487	.0002355	-1.06	0.303	-.0007383	.000241
ret_msci	.9271048	.5095094	1.82	0.083	-.1324779	1.986688
_cons	-.0054192	.0079415	-0.68	0.502	-.0219345	.011096

Appendix 13. Effect of monetary tightening on the OMXHGI (outliers included).

Linear regression

Number of obs	= 28
F(3, 24)	= 1.91
Prob > F	= 0.1548
R-squared	= 0.1339
Root MSE	= .01841

ret_omxh	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0011973	.0005633	2.13	0.044	.0000347	.0023599
dRE_bp	-.0001136	.0001568	-0.72	0.476	-.0004371	.00021
ret_msci	-.058105	.4824857	-0.12	0.905	-1.053907	.9376966
_cons	.0073913	.0075336	0.98	0.336	-.0081573	.0229399

Appendix 14. Effect of monetary easing on the OMXHGI (outliers included).

Linear regression

Number of obs	= 27
F(3, 23)	= 1.30
Prob > F	= 0.2997
R-squared	= 0.2945
Root MSE	= .02561

ret_omxh	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0003835	.0007192	0.53	0.599	-.0011043	.0018712
dRE_bp	-.0001636	.0002193	-0.75	0.463	-.0006173	.0002902
ret_msci	.8945152	.4805998	1.86	0.076	-.0996811	1.888712
_cons	-.0014071	.0079454	-0.18	0.861	-.0178434	.0150293

Appendix 15. Effect of only ECB monetary policy changes on the OMXSPI.

Linear regression

Number of obs	= 55
F(3, 51)	= 5.88
Prob > F	= 0.0016
R-squared	= 0.4132
Root MSE	= .01625

ret_omxs	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0005526	.0002518	2.19	0.033	.0000472	.0010581
dRE_bp	-.0000108	.000051	-0.21	0.834	-.0001132	.0000916
ret_msci	.8277893	.249211	3.32	0.002	.3274773	1.328101
_cons	.0006116	.002069	0.30	0.769	-.003542	.0047652

Appendix 16. Effect of all ECB monetary policy decisions on the OMXSPI.

Linear regression

Number of obs	305
F(3, 301)	21.59
Prob > F	0.0000
R-squared	0.4277
Root MSE	.01264

ret_omxs	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0000747	.0002415	-0.31	0.757	-.0005499	.0004005
dRE_bp	-3.97e-06	.0000605	-0.07	0.948	-.0001231	.0001152
ret_msci	.8861428	.1152044	7.69	0.000	.6594347	1.112851
_cons	.0003688	.0007209	0.51	0.609	-.0010499	.0017874

Appendix 17. Effect of only ECB monetary policy changes on the OMXSPI after dropping extreme observations from the unexpected policy change variable.

Linear regression

Number of obs	52
F(3, 48)	7.56
Prob > F	0.0003
R-squared	0.4307
Root MSE	.01644

ret_omxs	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0008508	.0004351	1.96	0.056	-.0000241	.0017256
dRE_bp	1.23e-06	.0000527	0.02	0.981	-.0001048	.0001072
ret_msci	.8078427	.2572309	3.14	0.003	.2906454	1.32504
_cons	.0001538	.0021744	0.07	0.944	-.0042182	.0045258

Appendix 18. Effect of all ECB monetary policy decisions on the OMXHGI after dropping extreme observations from the unexpected policy change variable.

Linear regression

Number of obs	= 300
F(3, 296)	= 22.94
Prob > F	= 0.0000
R-squared	= 0.4344
Root MSE	= .01265

ret_omxs	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0001055	.0003315	-0.32	0.751	-.0007578	.0005469
dRE_bp	-.0000208	.000062	-0.34	0.738	-.0001428	.0001013
ret_msci	.9012387	.1163157	7.75	0.000	.6723282	1.130149
_cons	.0004295	.0007316	0.59	0.558	-.0010103	.0018693

Appendix 19. Effect of only policy rate changes on the OMXSPI.

$$\ln(R) = 0{,}0008508 r_u \text{ ---> } R = e^{0{,}0008508 ru} - 1$$

$$\text{if } r_u = 25, \text{ then } R = 0{,}021498... \approx 2{,}15\%$$

Appendix 20. Effect of all policy rate decisions on the OMXSPI.

$$\ln(R) = -0{,}0001055 r_u \text{ ---> } R = e^{-0{,}0001055 ru} - 1$$

$$\text{if } r_u = 25, \text{ then } R = -0{,}002641... \approx -0{,}26\%$$

Appendix 21. Effect of monetary tightening on the OMXSPI.

Linear regression

Number of obs	= 27
F(3, 23)	= 2.40
Prob > F	= 0.0937
R-squared	= 0.2779
Root MSE	= .01644

ret_omxs	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0007937	.0006855	1.16	0.259	-.0006245	.0022118
dRE_bp	.0001043	.0001587	0.66	0.517	-.000224	.0004327
ret_msci	.7372495	.4809407	1.53	0.139	-.2576522	1.732151
_cons	-.0029547	.0067978	-0.43	0.668	-.017017	.0111076

Appendix 22. Effect of monetary easing on the OMXSPI.

Linear regression

Number of obs	= 25
F(3, 21)	= 6.36
Prob > F	= 0.0031
R-squared	= 0.5059
Root MSE	= .01761

ret_omxs	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0007241	.0006708	1.08	0.293	-.000671	.0021192
dRE_bp	-.0001498	.0001518	-0.99	0.335	-.0004654	.0001658
ret_msci	.8965684	.3249992	2.76	0.012	.2206956	1.572441
_cons	-.0045315	.0044343	-1.02	0.318	-.0137532	.0046902

Appendix 23. Effect of monetary tightening on the OMXSPI (outliers included).

Linear regression

Number of obs	28
F(3, 24)	2.43
Prob > F	0.0900
R-squared	0.2777
Root MSE	.0161

ret_omxs	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.000732	.0004699	1.56	0.132	-.0002377	.0017018
dRE_bp	.000103	.0001567	0.66	0.517	-.0002204	.0004264
ret_msci	.7474939	.4554916	1.64	0.114	-.1925946	1.687582
_cons	-.003044	.0067161	-0.45	0.654	-.0169054	.0108174

Appendix 24. Effect of monetary easing on the OMXSPI (outliers included).

Linear regression

Number of obs	27
F(3, 23)	3.81
Prob > F	0.0236
R-squared	0.4795
Root MSE	.01745

ret_omxs	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	.0003651	.0003439	1.06	0.299	-.0003463	.0010764
dRE_bp	-.0001329	.0001355	-0.98	0.337	-.0004132	.0001474
ret_msci	.9014183	.3089092	2.92	0.008	.2623909	1.540446
_cons	-.0031782	.0042031	-0.76	0.457	-.0118729	.0055166

Appendix 25. Effect of only ECB monetary policy changes on the OMXCPI.

Linear regression

Number of obs	55
F(3, 51)	3.68
Prob > F	0.0178
R-squared	0.1444
Root MSE	.01647

ret_omxc	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0009547	.0003195	-2.99	0.004	-.0015961	-.0003132
dRE_bp	.0000622	.0000603	1.03	0.307	-.0000588	.0001832
ret_msci	-.0932323	.084899	-1.10	0.277	-.2636741	.0772095
_cons	-.0037076	.0023373	-1.59	0.119	-.0084	.0009847

Appendix 26. Effect of all ECB monetary policy decisions on the OMXCPI.

Linear regression

Number of obs	305
F(3, 301)	0.73
Prob > F	0.5332
R-squared	0.0119
Root MSE	.01296

ret_omxc	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0002406	.0002218	-1.08	0.279	-.0006771	.000196
dRE_bp	.0000378	.0000587	0.64	0.520	-.0000777	.0001534
ret_msci	-.0563711	.0628726	-0.90	0.371	-.1800965	.0673544
_cons	.0004873	.0007373	0.66	0.509	-.0009636	.0019381

Appendix 27. Effect of only ECB monetary policy changes on the OMXCPI after dropping extreme observations from the unexpected policy change variable.

Linear regression

Number of obs	52
F(3, 48)	2.59
Prob > F	0.0634
R-squared	0.1156
Root MSE	.01677

ret_omxc	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0010575	.0005459	-1.94	0.059	-.0021551	.0000401
dRE_bp	.0000533	.0000642	0.83	0.410	-.0000757	.0001824
ret_msci	-.0842317	.0948523	-0.89	0.379	-.2749451	.1064816
_cons	-.004138	.0023134	-1.79	0.080	-.0087895	.0005134

Appendix 28. Effect of all ECB monetary policy decisions on the OMXCPI after dropping extreme observations from the unexpected policy change variable.

Linear regression

Number of obs	300
F(3, 296)	0.64
Prob > F	0.5905
R-squared	0.0090
Root MSE	.01296

ret_omxc	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0000832	.0002837	-0.29	0.769	-.0006415	.0004751
dRE_bp	.0000542	.000061	0.89	0.375	-.0000658	.0001741
ret_msci	-.069941	.0607593	-1.15	0.251	-.1895159	.0496339
_cons	.0003535	.0007413	0.48	0.634	-.0011053	.0018123

Appendix 29. Effect of only policy rate changes on the OMXCPI.

$$\ln(R) = -0{,}0010575 r_u \dashrightarrow R = e^{-0{,}0010575 ru} - 1$$

$$\text{if } r_u = 25, \text{ then } R = -0{,}02679... \approx -2{,}68\%$$

Appendix 30. Effect of all policy rate decisions on the OMXCPI.

$$\ln(R) = -0{,}0000832 r_u \dashrightarrow R = e^{-0{,}0000832 ru} - 1$$

$$\text{if } r_u = 25, \text{ then } R = -0{,}00208... \approx -0{,}21\%$$

Appendix 31. Effect of monetary tightening on the OMXCPI.

Linear regression

Number of obs	= 27
F(3, 23)	= 1.81
Prob > F	= 0.1734
R-squared	= 0.1280
Root MSE	= .01882

ret_omxc	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0007542	.0007821	-0.96	0.345	-.0023721	.0008637
dRE_bp	.0003666	.0001953	1.88	0.073	-.0000374	.0007705
ret_msci	.0362601	.2172033	0.17	0.869	-.4130591	.4855793
_cons	-.0163183	.0102488	-1.59	0.125	-.0375196	.004883

Appendix 32. Effect of monetary easing on the OMXCPI.

Linear regression

Number of obs	= 25
F(3, 21)	= 2.16
Prob > F	= 0.1236
R-squared	= 0.2320
Root MSE	= .01471

ret_omxc	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0012459	.0007183	-1.73	0.097	-.0027396	.0002478
dRE_bp	.0001102	.000207	0.53	0.600	-.0003203	.0005407
ret_msci	-.0980051	.1385286	-0.71	0.487	-.3860911	.1900809
_cons	-.0008124	.0057714	-0.14	0.889	-.0128147	.0111898

Appendix 33. Effect of monetary tightening on the OMXCPI (outliers included).

Linear regression

Number of obs	= 28
F(3, 24)	= 1.59
Prob > F	= 0.2186
R-squared	= 0.1117
Root MSE	= .01861

ret_omxc	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0004352	.0005019	-0.87	0.395	-.0014711	.0006007
dRE_bp	.0003734	.0002	1.87	0.074	-.0000395	.0007862
ret_msci	-.0167792	.200015	-0.08	0.934	-.4295898	.3960314
_cons	-.0158557	.0099194	-1.60	0.123	-.0363282	.0046169

Appendix 34. Effect of monetary easing on the OMXCPI (outliers included).

Linear regression

Number of obs	= 27
F(3, 23)	= 4.70
Prob > F	= 0.0106
R-squared	= 0.3277
Root MSE	= .0141

ret_omxc	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
dRU_bp	-.0011381	.0003238	-3.51	0.002	-.001808	-.0004682
dRE_bp	.0001098	.0001904	0.58	0.570	-.0002841	.0005037
ret_msci	-.1023795	.1165272	-0.88	0.389	-.3434344	.1386754
_cons	-.0010538	.0052001	-0.20	0.841	-.0118111	.0097035