THE EFFECTS OF MONETARY POLICY ON THE EURO STOCK MARKET

Jyväskylä University
School of Business and Economics

Master's Thesis

2022

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ABSTRACT

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Title
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Subject	**Type of work**
Banking and International Finance	Master's Thesis
Date	**Number of pages**
6/21/2022	56

Abstract
This paper analyses the level of impact that the European Central Bank's (ECB) policy rates decided on by the Governing Council affects the European Stock market. We use the Stoxx Europe 600 index's daily return data to represent in general, the aggregate European stocks. Our choice of daily frequency data is as a result of evidence of an endogeneity problem between the stock returns movement and the Central Bank's policy rate decisions because monetary policy can also react to stock market developments.
We adopt the event-study approach to address our hypotheses and use the Euro Overnight Index Average (EONIA) to measure the monetary policy rates in the conventional period which ends officially on the last conventional policy date before the first unconventional monetary policy announcement i.e. 22nd August 2007 and construct our proxy for conventional monetary policy surprises.
In the unconventional era, we utilize a different approach from previous studies like Bernanke & Kuttner (2005), by extracting the Portuguese, Italian, Greece and Spain government bond yield and using the spread between those four (cross sectional average) and the German 10 year bond as our proxy for unconventional surprise rate. We define the start of the unconventional period to be on the 22nd August 2007 based on the ECB's first unconventional monetary policy announcement. Furthermore, we identify governing council meeting dates in our paper as 'Eventdate' and outside those days are identified as 'Non-Eventdate'.
Our results indicate that the larger influence of the monetary policy on stock returns is during the unconventional period than the conventional period when unconventional policies were utilized. And that there is a higher response in equity returns to monetary policy announcements during Governing Council announcement days than those days when there is no Governing Council announcement. This emphasizes the point that the effect is greater on policy announcement days than outside those days. Our results further confirms the hypothesis that the effects of monetary policy on the stock market is predominantly dependent on shocks/unanticipated monetary policy.
Furthermore, our results also show that the policy impact is the same across the portfolios sorted based on sizes. The level of significance or lack thereof of the parameter estimates are fairly similar to each other across the different size panels.
Finally, our results show that there was no indication that internal economic activity specifically the exchange rates within the EU influenced the movement of stock prices significantly.

Key words
European Central Bank; Stoxx Europe 600 Index; Unconventional Era; Monetary Policy

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ACKNOWLEDGEMENT

I would like to express my gratitude to my supervisor, Heikki Lehkonen for his guidance throughout my thesis process. Also not forgetting my other lecturers in my core courses whose lectures stimulated my interests and enabled me to come up with this topic.

I would like to thank my parents, Nuha Kassama and Fatou Jallow Kassama for the solid foundation they've given me throughout my educational journey, without which I wouldn't reach this level. Also not forgetting my siblings Alagie, Amadou and Sedat for their morale support and sometimes very useful insight about the theme of my topic.

Furthermore, Covid-19 was a challenge during the period of my studies and going through this thesis would have been a lot harder if not for the support and experience of my friends Gibril Sanneh as well as Tijan and Susanna for making me feel comfortable and at home.
Finally, I'd like to thank the School of Business and Economics of the University of Jyvaskyla for this opportunity of achieving my objective.

1 INTRODUCTION

1.1 Research Background

Our paper attempts to analyse the effects that the European Central Bank's (ECB) monetary policy rates have on the Stoxx Europe 600 index which we've adopted to represent in general, the aggregate European stocks. It has a fixed number of 600 components representing small, mid and large capitalization companies among 17 European countries covering approximately 90% of the free float market capitalization of the European stock market (Chen, 2021). The Stoxx 600 index was created to offer a broader exposure to European companies and as a result, it is often compared with or serves as an alternative to Standard & Poor's 500 index (S&P 500).

Some of the questions we would try to answer from this research are the effects of monetary policy on stock markets time varying between the conventional period and unconventional period? The scope of our studies is under the governing council announcement days and outside of those, which we've termed as Eventdate and Non-Eventdate respectively. Secondly, we would further research on whether the effects significantly depend on shocks/unanticipated monetary policies. We also include a control variable in the form of exchange rate to factor the internal economic activities in the EU and find out if it has a significant influence to the EU stock prices. This and other questions we believe would make this research worthwhile.

There is substantial interest from academia, government sectors, and other stakeholders about the effects that monetary policy decisions have on the financial markets and the reactions of key economic variables such as output, employment or in our case, the stock market returns. However, the effects of the monetary policy on output, inflation and employment is indirect whilst there is an immediate and direct effect on the financial markets through stock returns, and asset prices (Bernanke & Kuttner, What Expalins the Stock Market's Reaction to Federal Reserve Policy?, 2005).

The theme for this research was even more prevalent during the global financial crisis of 2007. Such was the magnitude of the crisis that it was labelled the worst economic depression post World war two (WWII). The situation resulted in the Federal Reserve of America and major Central Banks across the world effectively setting their nominal interest rates to zero and adopting unconventional monetary policies. The intuition behind this move was to provide stimulus to the economy in the form of an expansionary monetary policy through the financial system. The low interest rate would give investors more liquidity to boost stocks and this is meant to reverse the negative shocks of the recession and help push the stock prices up.

The entire financial system is intertwined in such a manner that changes in any variable would have a rippling effect on the financial structure to a certain extent, depending on a culmination of circumstances. For instance, central bankers monitor asset prices when they are analysing the transmission mechanism of the policy interest rate decisions because of the high probability to affect the real economy through capital cost channels. Whereas, participants in the financial market make decisions based on the effects of monetary policy shocks on their asset price portfolios (Bohl, Siklos, & Sondermann, 2008).

It is therefore surprising to note that previous researches on this theme has been mostly focused on the Federal Reserve's interest rate settings and little noteworthy research has been undertaken regarding the European Central Bank and stock prices in the euro area. Perez-Quiros & Sicilia (2002) focused on the yield curve of the euro area. They were amongst the first researchers to find a significant impact of ECB's monetary policy decisions on the interest rates in the euro area (Bohl, Siklos, & Sondermann, 2008).

Previous noteworthy research that has focused on the Federal Reserve are many but to name a few; Thorbecke (1997) - Fed's interest rate setting behaviour and its effects on US financial asset prices, Rigobon & Sack (2004) - The impact of monetary policy on asset prices, Crowder (2006) - The interaction of monetary policy and stock returns, Bernanke & Kuttner (2005) - What explains the stock market reaction to federal reserve policy?.

Our research considers the monetary authority's interest rate movement to be the most important monetary policy tool to guide the major macroeconomic variables. The variables include consumer price index (inflation), employment, output, exchange rate etc. In conventional times, lowering the interest rate eases the market conditions and stimulates the economy. Meanwhile, raising the interest rate is a contractionary monetary policy on the economy and is used to halt the overheating of the economy.

1.2 Institutional Structure and Role of European Central Bank

Central banks are amongst the most important players in financial markets throughout the world. They are the authority mandated to govern the monetary policy activities in the economy as well as maintain price stability to enhance a smooth business and social environment. Their influence reaches to interest rates and the money supply, all of which have direct implications on aggregate output, consumer price index (inflation), the financial markets and the economy (Mishkin, 2019).

In this section, we will take a look at the institutional structure of the European Central Bank and also a little insight about the Federal Reserve Bank in order to understand the conduct of monetary policy. The European Central Bank (ECB) was formed on June 1, 1998, for the purpose of solving the transitional issues of the nations that comprise the Eurozone. The Eurozone is a monetary

union consisting of the member states of the European Union (EU) that have adopted the euro as their currency. This adoption process was initiated in January 1, 1999 then with 11 EU member countries. On this day, the conduct of monetary policy was transferred from the National Central Banks (NCBs) to the ECB. But not all member countries adopted the euro currency, as a result the European System of Central Banks (ESCB) was established alongside the Euro system to comprise the ECB and the NCBs of all EU member countries irrespective of being members of the Eurozone (Mishkin, 2019).

Our Figure 1 below illustrates the relationship between the ECB, the 19 NCBs as well as the three decision-making bodies of the ECB. The ECB's Governing Council consists of governors from the 19 Euro area NCBs and members of the Executive Board; the Executive Board consists of the president and the vice-president of the ECB along with four other members; and the General Council consists of the president and the vice-president of the ECB and the governors of the NCBs of the 28 EU member states. The purpose of the General Council is to foster cooperation between the NCBs of member countries of the EU. According to the Statute of the ESCB and the ECB, the General Council is a transitional body that will be dissolved after all EU member states adopt the euro (Mishkin, 2019).

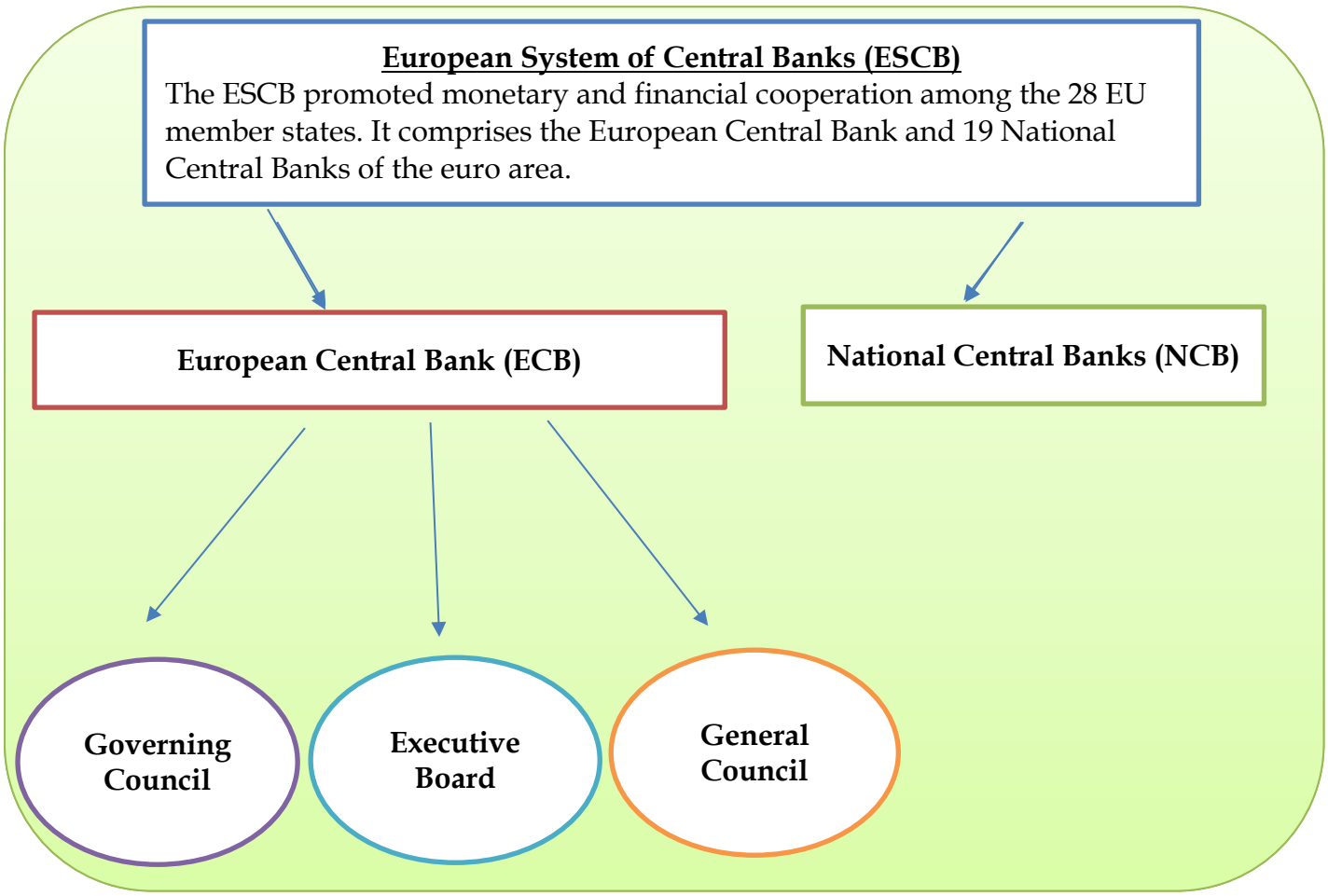


Figure 1 (Mishkin, 2019)

According to Mishkin (2019), the function of the ECB is to maintain price stability in the economies of the EU, and support the economic policies of the Eurozone nations to ensure an independent and open market economy. This statement is similar to what we explained regarding the functions of a central bank in general although there might be other responsibilities attached to those.

1.3 Main Monetary Policy Decision Makers

1.3.1. European Central Bank

The European Central Bank Governing Council is the main body given the mandate to make decisions based on monetary policies at the European Central Bank (ECB). It consists of the six members of the Executive Board, and the governors of the national central banks of the 19 euro area countries (ECB, Governing Council, 2021).

The Governing Council sets three key interest rates of the euro area – refinancing rate – guides the market interest rates of the euro area and is the rate on which banks of the Euro Area can borrow directly from the ECB. Other remaining rates include marginal lending facility and the rate of deposit facility. However, our focus for this research would be on the ECB marginal lending facility rate which determines the interest rate on overnight credit provided by the Euro system to banks. It is the rate which normally forms the "corridor" within which money market overnight rates fluctuate (ECB, Governing Council, 2021).

1.3.2. The Federal Reserve

The Federal Reserve System is the central bank of the United States and is responsible for the conduct of monetary policies by the Federal Reserve Act 1913. The Board of Governors of the Federal Reserve System are responsible for the discount rate and reserve requirements whilst the Federal Open Market Committee (FOMC) are responsible for open market operations. Utilizing the three tools influences the demand for, and supply of balances that depository institutions hold at Federal Reserve Banks and in this way alters the federal funds rate. The Federal funds rate is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight (FederalReserve, 2021).

Changes in the federal funds rate - the short term interest rate at which banks make loans to one another, triggers a chain of events that affect other short – term interest rates, foreign exchange rates, the amount of credit and money, and finally, a set of economic variables, including employment, output, and inflationary prices of goods and services (FederalReserve, 2021). A range of interest rates are dependent on the fed funds rate. As such, if the rate decreases consumer

loans become cheaper to service and vice versa. The chain effect here is that interest rates would influence the spending decisions and borrowing cost of households and investment in businesses. Higher interest rates would restrain borrowing by businesses and consumers.
Refer to the figure 2 illustration below for an ECB rate and Fed funds rate comparison.

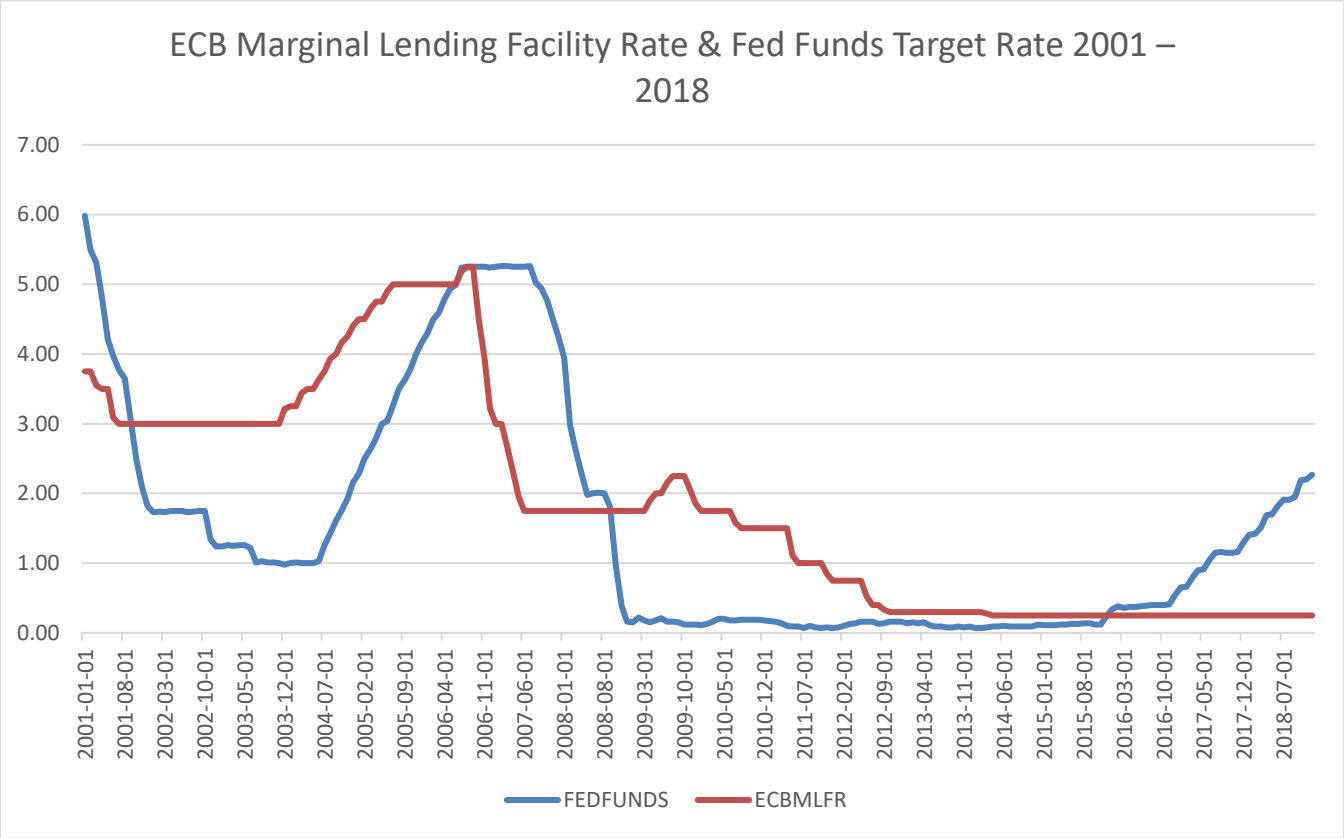


Figure 2: ECB Rate & Fed Funds Rate 2001 – 2018 (ECB F. , 2021)

In 2001 from the figure 2 above, the prospects of economic growth in the European Union deteriorated in the wake of severe shocks to the world economy and the global financial markets in no short terms due to the dot-com bubble collapse, the major corporate corruption scandals, the September 11 2001 terrorist attacks and ensuing geopolitical tensions related to Iraq. All this contributed to economic uncertainty (Hartmann, Philipp; Smets, Frank;, 2018). In this period, the Governing Council decided to adopt a position of 'wait and see' with regard to its monetary policy stance in the midst of the uncertainty. But by the end of the year 2001, cut interest rates by 50 basis points on 8th November in coordination with the Federal Reserve System. The meeting of 3rd April 2003 took place in the exceptional circumstance associated with the Iraqi conflict. The Governing Council decided to leave the interest rate on the marginal lending rate at 3.50%. At its meeting on 1 September 2005, the Governing Council of the ECB maintained interest rates on the marginal lending facility at 3.0%. The basis being that

given the current outlook for inflation rates over the medium term, the exceptionally low level of both nominal and real interest rates provides considerable support to economic activity in the euro area. At its meeting on 3rd August 2006, they decided to increase the rate by 25 basis points to 4.0%. This was meant to reflect the upside risks to price stability i.e. keeping inflation expectations firmly within targets consistent with price stability. The European Central Bank reduced its marginal lending rate to 3.0% with effect from 10 December 2008. Their systematic step follows the 50-basis points reductions in the key ECB interest rates announced on 8th October and 6th November, 2008. The reason being that, the outlook of the economy was extremely uncertainty to a high degree. The risks to economic growth were prevalent and they related mainly to the potential for the collapse in financial markets to have a more significant impact on the real economy, and there were concerns about protectionist pressures and possible surprisingly negative developments owing to global imbalances.

The Fed tends to keep the funds rate within a 2.0% to 5.0% range depending on the volatility of its key variables and immediate priorities at the time (inflation, price stability, employment etc.). The last cycle of rate increases was between June 2004 and June 2006 as the rates rose steadily from 1% to 5.25%. The lowering rates started in September 2007 and fell to the range of 0-0.25% in December 2008. From the end of December 2008 to December 2015 the rate remained the same as a reaction to the financial crisis.

As the global economy headed towards recession, the Fed swiftly reduced its primary policy i.e. the Fed's Funds Target Rate from 4.25% to 0.25% in 2008. (Wright, 2012) explains that the Fed hit its zero-lower bound of interest rate specific range of 0 – 0.25 and could not lower the Federal Funds Target Rate anymore without it becoming a negative one. Going below the zero – lower bound could have unintended consequences in terms of inflation. As the economic stance of the U.S. stabilized, and the market was already starting to show signs from overheating, the Fed began to gradually raise the Federal Funds Target Rate in 2016. Covid – 19 unexpectedly had a massive negative impact on the economy as the country was forced to shut down in order to contain the virus. The Fed Funds Target Rate was reduced ones again to zero – lower bound of 0 – 0.25 in order to provide monetary stimulus to the economy and enhance the effectiveness of asset purchases.

1.4 Transmission Mechanism of Monetary Policies

The Credit Channel:

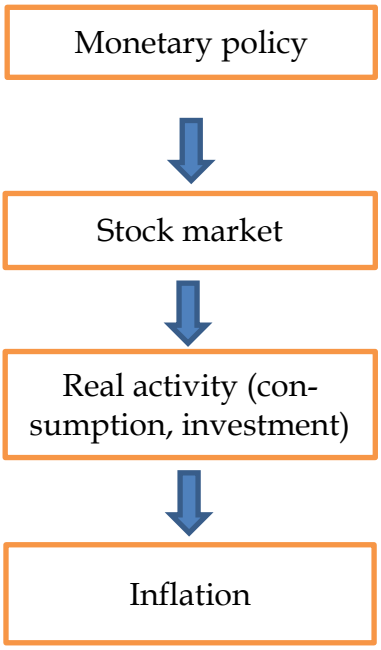
The credit channel of a monetary transmission operates in a way that a positive / negative monetary policy shock implies a/an increase/decrease in the availability of credit and a positive/negative effect on the balance sheets of financially constrained firms due to a/an decrease/increase in borrowing costs which matters particularly in recessions (Fausch & Sigonius, 2018).

Exchange Rate Channel:

The movement in exchange rate affects domestic price of imported goods i.e. final goods directly, or indirectly via input costs (Strasser, Georg, 2018). In open economies, if the domestic nominal interest rate rises above its foreign counterpart, the domestic currency tends to appreciate towards foreign exchange rates because of its increased attractiveness as an investment currency. When prices don't adjust quickly enough, the result is that domestically produced goods would be more expensive than foreign produced goods. Net exports fall, as do domestic output and employment, while inflation decreases (Beyer, Andreas; Nicoletti, Giulio; Papadopoulou, Niki; Papsdorf, Patrick; Runstler, Gerhard; Schwarz, Claudia; Sousa, Joao; Vergote, Olivier;, 2017).

Interest Rate and Asset Price Channel:

A change in money supply through open market operations by the central bank makes investors react by reassessing the stock market. The value of a stock is given by the sum of discounted future dividends and a change in monetary policy can affect stock prices through expected future earnings as well as through the rate at which they are discounted. Therefore, a change in monetary policy will lead to changes in investors' wealth and the companies' cost of capital for investment will also be affected. This will lead to changes in the overall value of the company and stock prices (Sellin, 2001). Change in official interest rates has subsequent effects on bank rates on loans and deposits. This affects returns on savings and costs of borrowing, and thus spending and investment decisions of firms and households, and in turn the consumer price level (Strasser, Georg, 2018). This is best described by the illustration in figure 2 below.



According to Beyer et. al (2017), a monetary policy that leads to an increase in the nominal interest rates, may raise the attractiveness of new debt instruments from an investor's point of view compared to equities and existing debt. This monetary contraction will lead to a fall in the asset prices which can lead to an impact on aggregate demand through changes in the value of collateral, affecting the amount that borrowers can borrow. On the other hand, an increase in asset prices may reduce the risk premium that lenders demand from borrowers. Furthermore, consumption and investment are affected by changes in asset prices through wealth effects and the corresponding effects on the value of collateral. E.g. as asset prices increases, the household income also increases, real estate companies and house owners become wealthier and might decide to increase their consumption or in the case of the companies, pay more money to their shareholders or reinvest the dividends (Beyer, Andreas; Nicoletti, Giulio; Papadopoulou, Niki; Papsdorf, Patrick; Runstler, Gerhard; Schwarz, Claudia; Sousa, Joao; Vergote, Olivier;, 2017).

The conventional transmission channel of monetary policies operate in order to have the desired effect through the stock market via changes in individual portfolios. It is important to also note that the stock market is viewed as an independent variable to gauge the macroeconomic movement and policy makers consider it when making their policy decisions (Bernanke & Kuttner, What Expalins the Stock Market's Reaction to Federal Reserve Policy?, 2005).

Another important transmission channel that can lead to changes in stock prices is a stimulus to the confidence of households and firms and a reduction in uncertainty about future economic conditions, which may increase consumption and investment (Fausch & Sigonius, 2018).

One of the key points from Tobin (1969) – A general equilibrium approach to monetary theory, and which later became known as Tobin's q, was that monetary policy contraction which might have occurred as a result of increased inflation, lowers the present value of future earnings, thereby depressing the equity markets. This work became relevant in the formation and understanding of the stock market channel of monetary policy transmission (Ehrmann & Fratzscher, 2004).

Tobin's q channel$=\frac{\text{MVF}/}{\text{RCC}}$ where MVF=market value of firms and RCC=replacement cost of capital. If q is high it means MVF is also high relative to RCC and the plant and equipment cost of capital is cheap relative to the market value of the firms. This means that the firm can issue stock and get a high price for it relative to the cost of the facilities they are buying. There will be an increase in investment because firms make a lot of money with only a small issue of stock. The transmission mechanism is as follows: $\boldsymbol{M^{\uparrow}, Pe^{\uparrow}, q^{\uparrow}, I^{\uparrow}, Y^{\uparrow}}$

However, the relationship between monetary policy and equity prices contained in Tobin's second part analysis has proven to be a bit difficult because of the endogenous nature of the elements being studied. It is difficult to identify monetary policy since it may be endogenous due in part because Central Banks might react to developments in stock markets (Ehrmann & Fratzscher, 2004). The

endogeneity problem was taken care of by researchers such as Rigobon & Sack (2002), (2003) whereby they developed a methodology which helped identify monetary policy shocks by exploiting the heteroscedasticity present in financial markets. Also on our list of researchers to have solved this problem was Kuttner (2001), and Bernanke & Kuttner (2003) whose research collected federal funds futures contracts to identify monetary policy shocks through measures of market expectations (Ehrmann & Fratzscher, 2004).

Further evidence of the endogeneity problem was highlighted in Haitsma, Unalmis & de Haan (2016), where they label it as an empirical research issue because monetary policy can also react to stock market developments. However, the problem can be resolved if daily data are used within an event study framework. Because monetary policy is unlikely to be affected by changes in asset returns on the same day, so that the probability that the final results are contaminated due to causality running from stock prices to changes in monetary policy is minimal (Haitsma, Unalmis, & de Haan, 2016). These methodologies and more would be discussed in detail in chapter three.

The Mechanism Involved in Changing the Monetary Base:

The Euro system is the monopoly supplier of the monetary base i.e. banknotes in circulation and bank reserves held by NCBs in the euro area. These items are liabilities in the Euro system's balance sheet and because of its monopoly status, the central bank is able to manage the liquidity situation in the money market and influence money market interest rates (Strasser, Georg, 2018).

The Federal Reserve controls the money supply (currency in the hands of the public and bank deposits) by indirectly using a variety of two groups of instruments: those that affect the monetary base and those that influence the reserve – deposit ratio and by extension, the money multiplier (Mankiw, 2016).

The Federal Reserve utilizes its open market operations tool to change the monetary base by trading government bonds to and from the public. When the Fed sells bonds to the public, the dollars it receives reduce the monetary base and therefore, decrease the money supply. When the Fed buys bonds from the public, the dollars it pays for the bonds increase the monetary base and thereby increase the money in circulation (Mankiw, 2016).

Another method of altering the monetary base is by borrowing to banks as *lender of last resort.* Banks borrow when they do not have enough reserve to either satisfy bank regulators or meet deposit withdrawals etc. The *discount window* is used to make such loans and there is a discount rate charged by the Fed on these loans. The lower the discount rate, the cheaper the borrowed reserves and the more banks utilize the Fed's *discount window.* Therefore, a reduction in the discount rate leads to an increase the money supply and the monetary base (Mankiw, 2016).

Hence, the money supply in an economy does not only depend on the Fed but is also determined by the reaction of households and banks as intermediary financial institutions.

1.5 Research Aim and Objectives

The aim of our research is to find out the effects of monetary policy on stock prices within the Euro Area. The range of our studies covers the periods from the easing periods, to the global financial crisis and into the unconventional monetary policy era – 2001 to 2018. We've decided to exclude the preceding years of Covid-19 because of the availability or lack thereof of small number of observations which might lead to an inconclusive work.
The following research questions will be explored in this paper:

1. Are the effects of monetary policy on stock markets time varying between the conventional period and unconventional period? When does it affect the most, when the least?
2. Are the effects significantly dependent on shocks/unanticipated monetary policies?
3. Which of the constituency i.e. large, medium and small capitalization, of the STOXX 600 return Index is most affected by monetary policy change?

1.6 Research Structure

To achieve our target, the study observes the following:

Examine the degree of impact the monetary policy has on the stock returns before the financial crisis and also during the crisis period which is in the era of unconventional monetary policy. We've decided to categorize those two periods of response of equity returns to monetary policy into Governing council meeting dates as 'Eventdate' and out of Governing council meeting dates as 'Non-Eventdate'. This will help to simplify our results and help differentiate the distinguishing factors between those two periods.

Our paper is organized into five chapters with the first chapter serving as an introduction and gives a general insight about the topic and its relevance. The first chapter also offers the main aim and objectives of the study stated in the form of questions that we hope to find answers to.

The second chapter is a literature review of previous research conducted on the same topic or similar. This chapter highlights some of the gaps in the research topic and how some of those gaps have been treated. Empirical literature based on the study of monetary policy impacts by the Federal Reserve and European Central Bank on the stock market price in their respective areas – There will

be more focus in the literature section on the Fed's policy effects due to the abundance of research in the area compared to the Euro Zone. With the intention of replicating such work to some extent on the European experience.

Afterwards, chapter three gives in detail the methodologies used to treat the gaps and the procedures used in conducting the research. Furthermore, chapter four is the empirical part of the work where data is being characterized and the variables described. Equally important is our dataset and we would be studying the STOXX Europe 600 index to represent the entire European stock market. It is also the closest European index to the American S&P 500.
Selecting suitable methodology to explore the effects of monetary policy on stock prices in the Euro Area. We also form our hypothesis for the work in this chapter.

Chapter five is the presentation and analysis of our results.

Finally, in Chapter six we form a conclusion of our research, present the limitations and offer some recommendations as precedence for further research.

2 LITERATURE REVIEW

2.1 Effects of Unanticipated Monetary Policy on Stock Returns

2.1.1. The Theory of Efficient Market Hypothesis

The assumption of an efficient market hypothesis is central to our research about the reaction of stock returns to monetary policy movements. The concept of market efficiency refers to current stock prices reflecting all the relevant and available information – this is referred to as information symmetry (Fama, 1970). Market efficiency is categorized into three forms. Firstly, the weak form of efficiency is based on the assumption that there are no patterns to stock prices and thus, the stock prices only move randomly. Secondly, the semi – strong form of market efficiency is based on the assumption that share prices reflect all publicly available information in an unbiased form and adjusts immediately to reflect any new relevant information. Finally, the strong form of market efficiency assumes that in addition to any public information, stock prices reflect private information and that eventually, no one gains excess returns on the stock market if only based on information (Fama, 1970). Our research will adopt the semi – strong form of market efficiency because the ECB's policy announcements represent public information.

The key point of our research on monetary policy is to measure the reaction of stock prices. The theory of the efficient market hypothesis by Fama, (1970) suggests that only unanticipated changes in monetary policy, often referred to as monetary policy shocks, should have an impact on stock prices. The intuition behind this is that the anticipated component of the stock price is already included in the investor' information set and therefore, priced into the value of the stock prior to the policy announcement (Fausch & Sigonius, 2018).

One main implication of the efficient market hypothesis is that the movement of stock prices should be random or that the volatility in stock prices should be impossible to predict from the available information. For example, a person using publicly available information, should not be able to predict the rise of a certain stock price by five percent at a certain date in the future. If that is the case, then the stock market is failing to incorporate that information today (Mankiw, 2016). According to this theory of assumption, the only thing that can move stock prices is news that changes the market's perception of the company's value. But such news must be unpredictable otherwise it wouldn't really be news (Mankiw, 2016).

2.1.2. Unanticipated Monetary Policy or Shocks

One of the main issues faced when trying to obtain quantitative estimates regarding the links between the monetary policy changes and stock prices is that there is a higher probability that the market will not respond to policy actions

that have already been anticipated. This makes it essential to separate between expected and unexpected policy actions (Bernanke & Kuttner, What Expalins the Stock Market's Reaction to Federal Reserve Policy?, 2005). The technique proposed by Kuttner (2001) was adopted by Bernanke & Kuttner (2005). This technique used Federal funds futures data to construct a measure of "surprise" rate changes[1] (Bernanke & Kuttner, What Expalins the Stock Market's Reaction to Federal Reserve Policy?, 2005). Before first explaining the reaction of the dependent variable to policy surprises, an investigation of how those policy surprises affect expectations of future interest rates, dividend, and excess returns was carried out (Bernanke & Kuttner, What Expalins the Stock Market's Reaction to Federal Reserve Policy?, 2005).

A slightly different approach was adopted by Bohl, Soklos, & Sondermann (2008) with regards to discerning the unexpected monetary policy by the European Central Bank (ECB). They extracted the surprise monetary policy decisions by using EURIBOR future and EONIA swap data as well as survey data containing the opinions of financial market experts (Bohl, Siklos, & Sondermann, 2008).

Cochrane & Piazzesi (2002) defined shocks more generally from interest rates without imposing the expectations hypothesis by following Piazzesi (2001). First they ran a regression of target rate changes on the interest rates prior to the target change. Secondly, they defined the shock as the change in the one–month Eurodollar rate from just before to just after the target change. This method relies on the fact that there has been a target rate change and they exclude from the shocks all dates whereby the funds rate might have been expected to change but did not. They explained that omitting shocks would not bias responses and suspect that the response to unexpected target changes is different from the response to target changes, expected by some (usually over parameterized) regressions, that did not happen (Cochrane & Piazzesi, 2002).

Ehrmann & Fratzscher (2004) further reiterated that returns react more strongly either when no change had been expected or when there is a directional change in the monetary policy position and during periods of high market volatility.

Gregoriou et al (2006), centered their research on evidence from the British market and generated the monetary policy shock from the change in the three-month sterling London Interbank Offered Rate (LIBOR) futures contract. A method similar to Kuttner (2001) whose research used data from interest rate futures contracts in order to derive the monetary policy shock. But because in the UK, there is no futures contract tracking the Monetary Policy Committee (MPC) – controlled policy instrument, the closest substitute that exists, is a futures contract based upon the three-month LIBOR rate, and this rate is widely accepted as

[1] Cochrane and Piazzesi (2002) proposed in their work, to utilizing the change in Eurodollar rates to calculate policy surprises, while Rigobon and Sack (2002) utilized the Eurodollar futures rate. While these methods provided an informative insight on interest rate expectations over a longer period, Gurkaynak, Sack and Swanson (2002) showed that Federal funds futures are the best predictors of target funds rate changes one to five months ahead.

a very good indicator of market expectations of future policy changes (Gregoriou, Kontonikas, MacDonald, & Montagnoli, 2006).

2.2 Unconventional Monetary Policy Era

The scope of this research also covers the unconventional monetary policy era and it would be interesting to analyze the effectiveness of unconventional policies in crisis period compared to conventional ones. The global financial crisis of 2007 is generally understood to have effectively led to the introduction of unconventional monetary policy. The crisis manifested itself in the collapse of the real estate industry which led to default in subprime mortgage loans and systemic dysfunction in the financial markets from United States to the European Union. The great recession ended by the third quarter of 2009 but left its mark and as a result, the interest rate policy was still on emergency setting between 0 and 0.25 percent (Mishkin, Frederic S., 2019). Furthermore, the monetary policy institutions had begun experimenting with unconventional policy tools such as – quantitative easing and forward guidance.

Forward guidance refers to a strategy of Central banks to be reliable in their actions by behaving systematically so that their policies are well understood by the public. It creates a sense of predictability about them and this is the whole point of forward guidance policy. A good example of its effectiveness as explained by Michael Woodford – with the nominal interest rate at zero, the Fed can make a promise to push interest rates even lower in the future and if such a promise is credible, will cause the market to react with people borrowing more and spend more today, expecting that inflation will be high (Federal Reserve Bank of St. Louise, 2015).

Quantitative Easing (QE) is another one of the unconventional monetary policy tools by central banks and involves purchases of long-term government assets to reduce long-term interest rates, inject money into the economy and expand economic activity. The resultant positive price effects on banks' security holdings scale asset purchase led to the recapitalization of banks (Federal Reserve Bank of St. Louise, 2015).

The use of conventional and unconventional policies is a situation the European Central Bank (ECB) has found itself since the sovereign debt crisis but lately experts have been questioning the effectiveness of the conventional policies. Buchholz M. (2020) made the point that conventional policies are less effective during unconventional periods. To drive home their point, they argue that the decline in the policy rate has seen a rise in banks' reserve holdings meanwhile for banks with a higher interest sensitive business model, a decline in policy rate can succeed in moving bank reserves into loans. But they further went on to

prove that this conventional policy is limited because it only applies to banks that are located in non-GIIPS[2] countries (Manuel Buchholz, 2020).

When conventional monetary policy reigned, expansion of money supply by reducing the interest rates was sufficient to stabilize the economy. However, the advent of the crisis reduced the degree of effectiveness of the monetary policy tools because the financial system collapsed to an extent that it was unable to allocate capital to productive users and as such investment spending dropped and the economy failed. This led to the zero-lower bound and the central banks were unable to lower the rate further because it hit a floor of zero (Mishkin, Frederic S., 2019).

2.2.1. Effects of the zero lower bound in introducing quantitative easing

In an effort to get past the limitations placed on conventional monetary policy by the lower bound on short-term interest rates and the liquidity trap, the Federal Reserve and other advanced economy such as the European Central Bank (ECB) have come up with new policy toolkit one of which is quantitative easing (QE). It has been effective at easing the financial conditions when the policy rate is constrained by the lower bound. As consistent with most estimates, the application of a combination of quantitative easing and forward guidance can provide approximately 3% of policy space, which is sufficient to offset the effects of the lower bound depending on the factors such as the fiscal policy, inflation target or economic stabilization (Bernanke, The New Tools of Monetary Policy, 2020).
In the last decades of the twentieth century, US monetary policy wrestled with the erratic inflation led by Federal Reserve chairs Paul Volcker and Alan Greenspan and the result was low inflation and manageable inflation expectations. However, the new century has seen major disruptions in technology, demographics etc. that has seen more people willing to save more than to invest and this has shown that low inflation is not an effective tool anymore. Low interest rates pose a challenge for the traditional approach to monetary policy in the presence of an effective lower bound on nominal interest rates and this puts a constraint on the amount of space available for conventional monetary policy to maneuver. The low inflation syndrome can be a self-perpetuating trap as we have seen from Japan in previous decades and low nominal interest rates make monetary policy less effective (Bernanke, The New Tools of Monetary Policy, 2020).
The critical turning point for the United States was the global financial crises of 2007 – 2009. The panic, the sovereign debt crises in Europe drove the global economies into deep recession which were well beyond the scope of the traditional monetary policies. The Feds and European Central Banks turned to alternative policies to stimulate the economy. This involved large scale purchases of financial assets (quantitative easing) and presently, it is becoming increasingly likely that in a twenty-first century context, the old methods would not work.

[2] Euro area countries but excluding Greece, Ireland, Italy, Portugal and Spain.

The developed economies of the EU and US are in a much better shape with the help of the new tools[3] of monetary policy granting the conventional policies ineffective at best and detrimental given how the economy has evolved recently. For example, simulations carried out of the Fed's macro econometric model suggests that the use of conventional policy would lead to constrain of short-term rates by zero with severe consequences for economic performance (Kiley & Roberts, 2017). For monetary policy to remain relevant, the new policy tools, framework and tactic would need to be adopted.

2.2.2. Impact of the ECB's Unconventional monetary policies

As already explained earlier, our sample period includes both pre-crisis and crisis period and this has two implications for our studies. According to (Haitsma, Unalmis, & de Haan, 2016), monetary easing under normal circumstances will increase stock prices, but in crisis period a decrease in the policy rate may alert investors that the future economic conditions might be worse than expected. Going by this narrative, then stock returns may decrease (Kontonikas et al., 2013; Hosono and Isobe, 2014).

Therefore, the most logical step is to examine whether the impact of ECB monetary policy surprises is different in non-crisis and crisis period. However, the use of unconventional monetary instruments led to complications in the identification of monetary policy surprises. Haitsma et al (2016) adopted the approach suggested by Kuttner (2001) to identify surprises or shocks in conventional monetary policy. The approach is based on the idea that futures prices reflect market expectations of future policy rates. Therefore, a monetary policy surprise can be represented by the difference in futures rate before the policy announcement and the announced policy rate. However, unconventional monetary policy seems to be more complicated in measuring the central bank's policy direction or policy expectations (Rogers, Scotti & Wright, 2014).

To solve this predicament, the approach suggested by Rogers et al. (2014), was adopted by (Haitsma, Unalmis, & de Haan, 2016). This approach focuses on changes in the yield spread between German and Italian 10-year government bonds at the day of a policy announcement. The reason was that the ECB's unconventional monetary policies were aimed at decreasing intra-euro area sovereign spreads to a certain degree (Haitsma, Unalmis, & de Haan, 2016).

An important issue to ascertain regarding this sub-topic, is how to measure unexpected unconventional monetary policies. There have been studies that utilize survey data from professional forecasters for example Ehrmann & Fratzscher (2004) for the US and Joyce et al. (2011) for the UK, while Rosa (2012) uses newspaper articles to measures shocks by analyzing whether the Federal reserve and Bank of England's quantitative easing policy were expansionary or restrictive compared to the expectations of prior articles.

Finally, previous studies that have studied the impact of the ECB's unconventional monetary policy surprises have had divergent views and results on the

[3] These tools are often referred to as "unconventional" or "nonstandard" policies.

topic. For example, Rogers et al. (2014) find that announcements made about the unconventional monetary policy of the ECB led to increases in stock prices during the crisis thereby easing financial conditions. They noted that several unconventional policies of the ECB during crisis were aimed at reducing intra-euro area sovereign spreads. The effect, especially in countries under stress (like Italy and Spain) tended to drive German yields up. That's why they didn't measure monetary policy using German yields alone but instead, the yield spread between Italian and German ten year government bonds on the day of an ECB policy announcement (Haitsma, Unalmis, & de Haan, 2016). Hosono & Isobe (2014) conclude that stock markets in the euro area reacted negatively to ECB unconventional monetary policy surprises. They utilize asset prices specifically the changes in the daily prices of 10-year German government bond futures traded on the Eurex Exchange to measure expected unconventional monetary policies (Haitsma, Unalmis, & de Haan, 2016).

3. THEORETICAL FRAMEWORK

3.1 Measuring the Surprise Element of Policy Actions

Our paper focuses on the impact of monetary policy on broad stock market indices as noted in the introductory section. However, this particular study has an inherent problem – asset markets are forward looking and tend to include any information about the anticipated component of policy changes (Bernanke & Kuttner, What Expalins the Stock Market's Reaction to Federal Reserve Policy?, 2005). Therefore, a quantitative analysis is required to separate the unexpected policy change from the expected change in order to identify clearly the stock market reaction to monetary policy.

A very effective and efficient method to identify surprise funds rate changes relies on the price of Federal funds futures contracts, and this contains expectations of the Federal funds rate, averaged over the settlement month[4]. According to Bernanke & Kuttner (2005) – "for an event happening on a specific day *d* of month *m*, the volatility in the surprise target funds rate is quantified by the change in the rate gathered from the current month's futures contract. The contract's settlement price is based on Federal funds rate's monthly average and as a result, the change in the given futures rate must be scaled up by a factor related to the number of days in the month affected by the change,"

$$\Delta \boldsymbol{i^u} = \frac{\boldsymbol{D}}{\boldsymbol{D-d}} \left(\boldsymbol{f^\circ_{m,d}} - \boldsymbol{f^\circ_{m,d-1}} \right),$$

Whereby $\Delta\, \boldsymbol{i^u}$ denotes the unexpected change in the target rate, $\boldsymbol{f^\circ_{m,d}}$ is the current month's futures rate, and $\boldsymbol{D}$ is the number of days in the month whilst $\boldsymbol{d}$ is the announcement day. The expected part of the change in rate is defined as the actual change minus the surprise, or

$$\Delta \boldsymbol{i^e} = \Delta \boldsymbol{i} - \Delta \boldsymbol{i^u}.$$

According to (Bernanke & Kuttner, What Expalins the Stock Market's Reaction to Federal Reserve Policy?, 2005), it is very important to get the timing right for an event study analysis. Before the advent of public announcement of Fed instituted policy changes, investors were on the day after the FOMC's decision, generally aware of policy actions only after it was implemented by the Open Market Desk.

[4] The contracts, referred to as "30 Day Federal Funds Futures," are traded on the Chicago Board of Trade and the implied futures rate is 100 minus the contract price.

3.2. Event-Study Methodology

Based on our earlier adoption of the efficient market hypothesis, theoretically a stock price already takes into account all available expectations and information. This assumption is the foundation which allows us to analyse the effect of a specific event which is in our case a monetary policy announcement, on a stock market index on the day, to gauge its impact on a macro level.

Our study takes interest in the works of Bernanke (2005) because they adopted this "event-study" style of analysis. They categorized their sample of as all the days corresponding to FOMC meetings, when the funds rate target was changed. The scope of their work covers the pre announcement and announcement periods i.e. June 1989 – December 2002. The September 17th, 2001 observation was excluded due to a peculiar reason. That was the first day of trading after the September 11 terrorist attacks. Altogether, their sample contained 131 observations.

Bernanke & Kuttner (2005) explains the response of equity prices to monetary policy by showing estimates. Their results are based on a regression of the Centre for Research in Security Prices (CRSP) value-weighted return on the change in the Federal funds rate target without any separation between the expected and unexpected changes.

$$\boldsymbol{H_t = a + b\Delta i_t + \varepsilon_t},$$

$\boldsymbol{H_t}$ Represents the stock return, whilst $\boldsymbol{i_t}$ represents the funds rate target. Another regression used for the results:

$$\boldsymbol{H_t = a + b^e \Delta i^e{}_t + b^u \Delta i^u{}_t + \varepsilon_t},$$

Separates the expected and unexpected funds rate changes, $\boldsymbol{\Delta i^e{}_t}$ and $\boldsymbol{\Delta i^u{}_t}$ using the decomposition they described in their research in section 2.3. In both equations, the error term $\boldsymbol{\varepsilon_t}$ represents other factors that affect stock prices and are not monetary policy.

Although there exists an inverse relationship, they found the response of the raw target rate change to be insignificant at -0.61. However, the estimated stock market response becomes inverse and highly significant ones the target rate change is separated into its expected and surprise components. The $\boldsymbol{R^2}$ translates into 17% of the volatility in equity prices on these "event" dates can be explained by monetary policy news or announcements. While Federal Reserve policy accounts for an insignificant portion of the variance of stock returns on event days (17%), clearly it is not the only piece of new information affecting the stock returns.

4. DATA AND METHODOLOGY

4.1. Dependent Variable

In this paper, we have decided to use a broad Euro stock index to represent the behaviour of stock returns in the Euro Area whenever the ECB changes its policy. To achieve this goal, the daily closing returns[5] of STOXX Europe 600 was obtained from Refinitiv Eikon Datastream (financial data platform) and consists of 17 countries[6] of the EU including the United Kingdom. The return index represents the aggregate growth in value of the constituents of the index. The index includes reinvested dividends as an incremental amount to the daily change in price index. Our time-series data ranges from year 2001 to 2018 to investigate the conventional and unconventional periods which we characterize as pre-crisis and crisis periods respectively. The pre-crisis period refers to the dates prior to the first unconventional monetary policy announcement which was 22nd August 2007. In the crisis period, we witnessed the European debt crisis. This crisis went through different phases from spreading through to containment 2012 by signing the treaty that would make the European Stability Mechanism (ESM) effective in July 2012. The European economy became even gloomier when the United Kingdom held a referendum considering the European Union membership. On 23rd June 2016, the UK voted to withdraw from the EU. We extend our dates to 2018 only to avoid the effects of the Covid-19 crisis because it is not an area of interest for us in this studies. However, future research could look into the effects of the pandemic during its two and half years of existence.

Haitsma, Unalmis & de Haan (2016) studied the relationship between stock portfolios and monetary policy surprises using EURO STOXX 50[7]. We will adopt their methodology to an extent but then differentiate our studies by comparing the ECB announcement effects on the Stoxx Returns' large, medium and small constituents to ascertain which are more susceptible to monetary policy changes.

[5] One-day windows are unlikely to be contaminated by other pieces of news (Haitsma, Unalmis, & de Haan, 2016)

[6] Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

[7] Note: Both EURO STOXX 50 and STOXX Euro 600 move in the same direction.

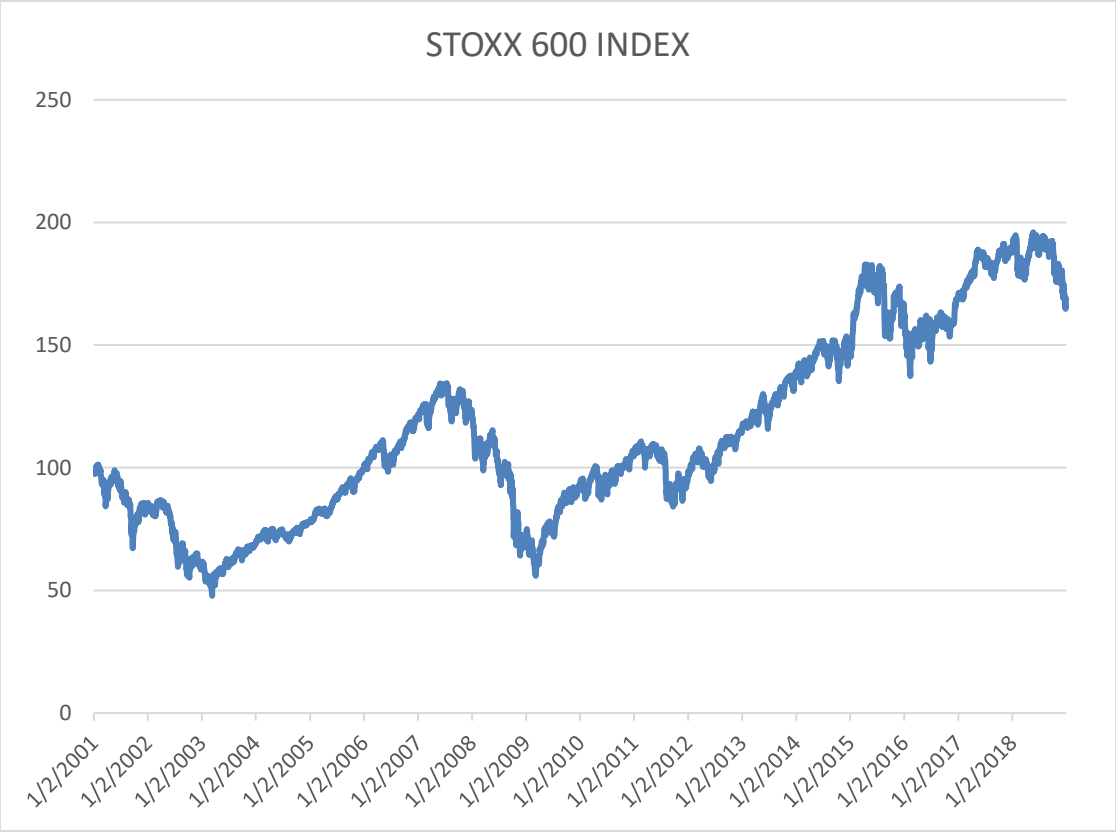


Figure 4 Stoxx 600 Total Return Index from 2001-2018

Figure 5 above represents the daily total return index of Stoxx Europe 600 during the periods from 2001 to 2018. It shows that the trend of the total Stoxx 600 total return index hasn't been completely straight forward. We notice that the early 2008 total return value was not surpassed until only 2013. This could be explained by the structural problems that overshadowed the European economy and sunk it into the sovereign debt crisis. Matters got even worse when in the year 2016, the United Kingdom decided to withdraw from the European Union membership. This event dropped the value of the Stock towards the 2008 value but then immediately recovered from that shock and went on to register one of its highest values in 2018. And looking at extended data, it went on to reach higher heights before the Covid-19 pandemic stopped it in its track.

4.2. Independent Variables

The explanatory variables used in our paper consists of time-series data regarding the ECB expected policy rate change, conventional monetary policy surprise, and the unconventional monetary policy surprise. Furthermore, we include a control variable of (MSCI) World Index excluding Europe in order to control for general economic movements in the rest of the world. We follow in the

works of Haitsma, Unalmis & de Haan (2016) estimation framework. In their research paper, they utilized the event study methodology to explain the impact of the ECB's unconventional and conventional policies on stock markets respectively. They further find evidence for the credit channel for unconventional monetary policy surprises. We also use the event study methodology but using different datasets for our analysis and on the other hand added a different dimension to our research by including an additional control variable for economic activities within the European Union in the form of the exchange rate.

We use Euro Overnight Index Average (EONIA) to measure the monetary policy rates in the conventional period which ends officially on the last conventional policy date before the first unconventional monetary policy announcement i.e. 22nd August 2007 and construct our proxy for conventional monetary policy surprises. A detailed description of our calculations can be found below in the methodology section 4.3.

In the unconventional era, we utilize a different approach from Haitsma et al. (2016) by extracting the Portuguese, Italian, Greece and Spain government bond yield and using the spread between those four (cross sectional average) and the German 10 year bond as our proxy for unconventional surprise rate. This measure is established in the works of Rogers, Scotti & Wright (2014) where they use intraday changes to German bond yields to measure Euro Area monetary policy surprise. We define the start of the crisis period to be on the 22nd August 2007 based on the ECB's first unconventional monetary policy announcement.

We selected governing council announcements after 22nd March 2015 from our own discretion whilst the previous announcements are from Haitsma et al. (2016) online appendix A. Our selection criteria was that the announcements of "Asset Purchases" or "Funding" had to reveal something new in comparison to previous announcements. This could be either the start, an expansion or a contraction of the size or length of a program, or an important announcement about its technical details. Regarding "Forward Guidance", an announcement is included in our study, only when a new wording was introduced. We examined all announcements in detail and included four dates to the original list from our search. The dates we included are: 23rd September 2015, 9th November 2015, 10th March 2016 and 8th December 2016 – this style was adopted from (Ferreira & Serra, 2019).

The Governing Council of the ECB usually announce their monetary policy decision at 13:45 CET right after concluding the Policy meeting. About 45 minutes later, the ECB President and Vice-President hold a press conference to read out an agreed upon statement by the council, outlining the intuition behind the policy decision and also answer questions from the press. We use Governing Council meeting dates to identify the conventional monetary policy decisions and for the unconventional period up to April 2014, we extract that data from Rogers et al (2014). These periods are then confirmed from the database of press release from the ECB (ECB, ECB Website, 2022) including up to December 2018. Note

also that we include all the press release dates when there was no change in monetary policy.

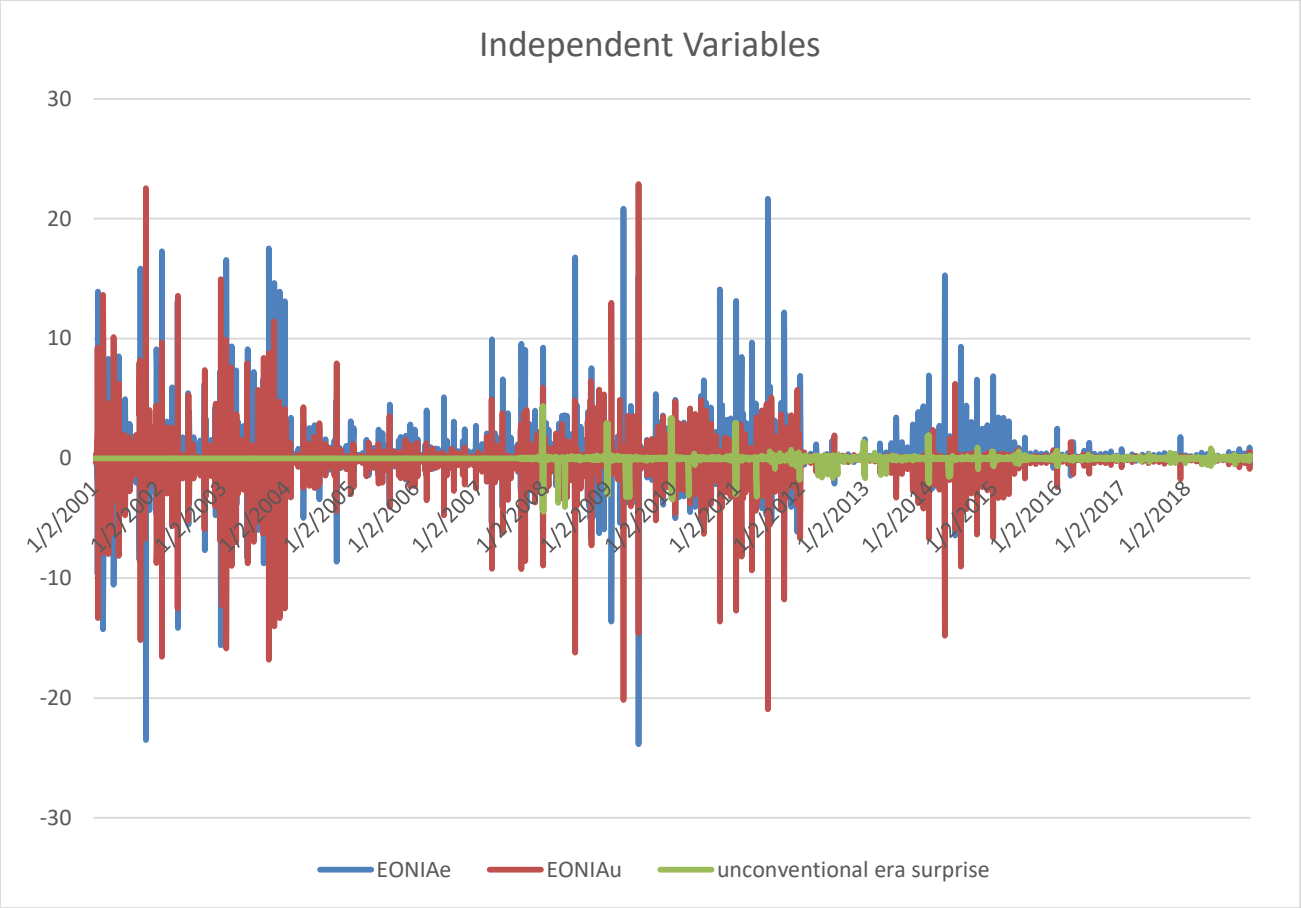


Figure 5 Expected & Surprise Change & Unconventional Era Policy from 2001-2018

4.3 Methodology

In the empirical part, we adopt the approach of Haitsma et al (2016) which is a similar approach applied by Kuttner (2001), Ehrmann & Fratzscher (2004) and Bernanke & Kuttner (2005). However, our approach is a bit different because our first two models contains two parts each; the first part contains the full sample of the variables and the second part has the dummy variables 'C' to capture the unconventional period of our study. We estimate our first (1) model to help explain the differences in the response of stock prices of expected and unexpected monetary policy decisions during conventional and unconventional periods using MSCI world index excluding Europe as a control variable. Our third model, includes the exchange rate variable as another control variable to help explain

the exchange rate economic activity that might affect the movement of stock returns:

$$\boldsymbol{R_t^i = \alpha + \beta_1 \Delta r_t^s + \beta_2 \Delta r_t^e + \beta_3 \Delta r_t^{s,u} + \delta_1 X_t + \varepsilon_t} \quad (1)$$

$$\boldsymbol{C R_t^i = \alpha + \beta_1 C + \beta_2 C \Delta r_t^s + \beta_3 C \Delta r_t^e + \beta_4 C \Delta r_t^{s,u} + \delta_1 C X_t + \varepsilon_t} \quad (2)$$

$$\boldsymbol{R_t^i = \alpha + \beta_1 \Delta r_t^s + \beta_2 \Delta r_t^e + \beta_3 \Delta r_t^{s,u} + \delta_1 X_t + \delta_2 E_t + \varepsilon_t} \quad (3)$$

$\boldsymbol{R_t^i}$ Represent the stock return on day t.
$\boldsymbol{\alpha}$ Is a constant.
$\boldsymbol{C}$ Dummy variable that takes a value of 0 before the unconventional period and 1 during the unconventional period which also includes the crisis period for our equation two above. The pre-crisis period refers to the dates prior to the first unconventional monetary policy announcement which was 22nd August 2007.
$\boldsymbol{\Delta r_t^s}$, $\boldsymbol{\Delta r_t^e}$ and $\boldsymbol{\Delta r_t^{s,u}}$ are conventional monetary policy surprise ($\boldsymbol{s}$ stands for surprise or unexpected rate change), the expected policy rate change ($\boldsymbol{e}$ represents the expected rate change) and the unconventional monetary policy surprise on day t respectively ($\boldsymbol{s, u}$ stands for the surprise or unexpected unconventional monetary policy rate change).
$\boldsymbol{X_t}$ Is a vector of control variable on day t and consists of two variables: the MSCI world index (excluding Europe) and the crisis dummy.
$\boldsymbol{E_t}$ Is a control variable on day t and consists of one variable: the Exchange rate for Euro and U.S. Dollar currency. It represents the economic activity within the EU.
$\boldsymbol{\varepsilon_t}$ Represents the Error term which contains all other variables that are not present in the model but have some degree of influence on our dependent variable.

All stock returns are calculated as:
$R_t^i = \ln \frac{P_t^i}{P_{t-1}^i}$, where P_t^i represents our broad index closing stock of i on day t.
Our calculation of surprises in conventional policy era is by constructing a proxy of EONIA rates we exported from ECB statistical data warehouse:

$$\boldsymbol{\Delta r_t^s = \frac{D}{D-d} (f^\circ_t - f^\circ_{t-1})}, \quad (4)$$

Whereby $\boldsymbol{\Delta r_t^u}$ denotes the conventional policy surprise at day t, $\boldsymbol{f^\circ_t}$ is the current month's futures rate, and $\boldsymbol{D}$ is the number of days in the month. The expected part of the change in rate is defined as the actual change minus the surprise:

$$\boldsymbol{\Delta r_t^e = \Delta r_t - \Delta r_t^s,} \quad (5)$$

Note: The equation four above is quite different from the notation we have under the theoretical framework section 3 because we try to adjust it to suit our research and data.
We measure the unconventional monetary policy surprise by following in the works of Haitsma et al. (2016) to proxy the surprise. However, their work was only limited to a few specific countries whilst our study covers the European

Union as a whole. Therefore, in order for our proxy to represent the European Union, we chose the countries based on a similar characteristics such as Gross Domestic Products (see Appendix 2) in those unconventional periods in order to diversify the country risk and calculate their cross-sectional average bond yields then find the spread against the German 10 year government bond yield. Those countries are Portugal, Greece, Italy and Spain. The intuition of Haitsma et al (2016) was, if the spread increases between those two after an unconventional policy announcement, then the policy is tighter than expected and vice versa:

$$\Delta \boldsymbol{r}_{\boldsymbol{t}}^{\boldsymbol{u,c}} = \left(\boldsymbol{y}_{\boldsymbol{t}}^{\boldsymbol{G}} - \boldsymbol{y}_{\boldsymbol{t}}^{\boldsymbol{PIGS}}\right) - \left(\boldsymbol{y}_{\boldsymbol{t-1}}^{\boldsymbol{G}} - \boldsymbol{y}_{\boldsymbol{t-1}}^{\boldsymbol{PIGS}}\right), \quad (6)$$

Where $y_{s,t}^{G}$ and $y_{s,t}^{PIGS}$ are the German and Portuguese, Italian, Greece and Spanish 10-year bonds at day t respectively.

5. RESULTS AND ANALYSIS

Our tables below consist of detailed descriptive statistics on our Equity Returns (Stoxx 600), Expected Change, Surprise Change, Unconventional Policy and the MSCIXEU for the full sample period from 2001 – 2018. Our sample was disintegrated into the conventional period and the unconventional period. The total observation for trading days are 4,606 which comprises of 1,698 trading days during the conventional policy era and 2,908 during unconventional era of our sample data. The standard deviation for policy surprises is higher during the unconventional period than conventional period at 135.8 compared to 128.1 respectively. The same pattern is also reflected on the expected EONIA rate changes of 163.1 compared to 151.2 for unconventional and conventional periods respectively. The standard deviation for equity returns in conventional era is 1.166 and during unconventional period rises to 1.242. This statistics results is consistent with our regression findings below, that the unconventional era induced a higher level of reaction from the equity market than the conventional period.

The skewness of our equity returns for the whole sample size is 0.5 which is fairly symmetrical. During the conventional period the skewness was moderately skewed at -0.16 and the same situation applies in the unconventional era at -0.18. Whilst the rest of our variables excluding unconventional policy are fairly symmetrical during the conventional era indicating our sample is robust, the unconventional era however, is a bit different. One of the contributing factors for the unconventional policy variable being negatively skewed at -41.01 is because its values only start from the 1,698th value and before that the values are zero. This is because the data for the unconventional monetary policy surprise only starts on the 22nd August 2007 but prior to that, there has been 1,698 daily values recorded for the total return variable from year 1st January 2001 to 22nd August 2007. The expected change and the surprise change are moderately skewed at -0.148, and at -0.219 respectively for their full sample size data. The result previously indicated possible outliers in our sample that might have affected our regression output in the past but we used the logged values of the variables excluding the unconventional policy variable.

Our kurtosis results has a similar pattern as the skewness of our variables. With results ranging from 2.1 and 0.88 for the equity returns and MSCIXEU. This is within the standard normal distribution of 3. Note that we used the logarithmic forms of those variables in our calculations hence their robustness.

In the same vein, our two other variables (Surprise and Expected Change) were converted to logarithmic forms and recalculated to remove for any affecting outliers. Their overall kurtosis are 3.7; and 4.4 respectively.

Table I Descriptive Statistics

	Variables	Obs.	Mean	Standard Deviation	Minimum	Maximum	Variance	Skewness	Kurtosis
Panel I Full Sample Period	Equity Returns	4,605	0.012	1.2	-7.92	9.42	1.47	-0.17	8.76
	Expected Change	662	39.58	160.5	-743.4	522.1	25,759	-0.148	4.457
	Surprise Change	887	5.278	134.6	-497.6	467	18,127	-0.219	3.715
	Unconventional Policy	2,908	-0.014	0.613	-8.587	8.578	0.375	-41.01	103.19
	MSCI (X) EU	4,605	0.02	1	-7.43	8.62	1	-0.35	11.48
Panel II Conventional Era	Equity Returns	1,697	0.012	1.166	-6.392	5.628	1.359	-0.164	6.411
	Expected Change	151	27.27	151.2	-414.9	323.1	22,874	-0.362	2.875
	Surprise Change	209	30.28	128.1	-403.5	348.1	16,398	-0.454	4.239
	MSCI (X) EU	1,697	0.018	0.902	-4.982	4.378	0.813	-0.00707	5.77
Panel III Unconventional Era	Equity Returns	2,908	0.011	1.242	-7.924	9.416	1.542	-0.175	9.778
	Expected Change	511	43.22	163.1	-743.4	522.1	26,600	-0.108	4.77
	Surprise Change	678	-2.429	135.8	-497.6	467	18,433	-0.146	3.654
	Unconventional Policy	2,908	-0.014	0.613	-8.587	8.578	0.375	-41.01	103.19
	MSCI (X) EU	2,908	0.023	1.053	-7.43	8.617	1.108	-0.477	12.98

Note: Equity Returns is the independent variable referring to the Euro Stoxx 600 Total Return Index. The Expected Change is an independent variable referring to the expected rate change during the conventional period. The Surprise Change is the independent variable that refers to the unexpected or shock rate change during the conventional period. The Unconventional Policy is an independent variable representing the shock or surprise rate change during the unconventional period and the MSCI (X) EU refers to the control variable of the Morgan Stanley Capital International excluding the European Union.

Our table II estimates below illustrates the response of stock returns on ECB rate changes for three different timeframes: the full sample period, the conventional period and the unconventional period.

At first glance the $R^2$of 45% for the unconventional period gives us further indication that the highest influence of the monetary policy on stock returns is during the unconventional period when unconventional policies were used. Our adopted Efficiency Market Hypothesis assumption from Fama (1970) still holds for Expected rate changes. The ECB surprise rate change shows a higher coefficient in the conventional period than in unconventional times. A part of that reason could be explained by the unconventional policies in the same crisis period perhaps restricting its influence and also being utilized less frequently by ECB. Our results show the Surprise in Unconventional Era policy rate variable is significant, implying 0.0755 responsibility for the 1% movement in stock returns with a 95% confidence interval, showing a positive relationship. While the ECB policy accounts for 29% of the variance of stock returns in conventional period, clearly it has more significant influence during the unconventional era with 45%.

Table II: The Response of Stoxx 600 Index Returns to ECB Rate Changes

	Full Sample Period	Conventional Period	Unconventional Period
Surprise Change	0.000601**	0.00165***	0.000308
	(2.54)	(3.18)	(1.18)
Expected Change	0.000151	0.0000878	0.000155
	(0.67)	(0.17)	(0.64)
Surprise in Unconventional Era	0.0784**		0.0755**
	(2.73)		(2.70)
MSCIXEU	0.758***	0.694***	0.785***
	(54.22)	(26.20)	(48.30)
_cons	-0.00490	-0.00612	-0.00694
	(-0.35)	(-0.26)	(-0.40)
N	4605	1697	2907
R-Square	**0.39**	**0.29**	**0.45**

Note: t statistics in parentheses; *p<0.1 **p<0.05 ***p<0.01

Note: The Surprise Change is the independent variable that refers to the unexpected or shock rate change during the conventional period. The Expected Change is an independent variable referring to the expected rate change during the conventional period. The Surprise in Unconventional Era is an independent variable representing the shock or surprise rate change during the unconventional period and the MSCIXEU refers to the control variable of the Morgan Stanley Capital International and excluding the European Union.

In our Table III estimates below, we illustrate the response of equity returns to monetary policy for Governing council meetings termed as 'Eventdate' and out of Governing council meeting dates as 'Non-Eventdate'. The entire sample including for both categories span 4,605 trading days and the model is picked from equations (1) and (2) in section 4.3. The results in the Eventdate and Non-Eventdate column are based on a regression of daily Stoxx Index returns on the changes in EONIA rate (surprise and expected component), Portuguese, Italian, Greece, Spain and German 10year bond for the unconventional policy measurement and the MSCI (Ex) Europe as a control variable.

Our conventional Era surprise change is significant at the 5% level outside the governing council announcement days. The results reported in the Eventdate column implies that a 1% one-day equity return is explained by 1.161 movement of Unconventional Era surprise rate movement during the governing council announcement dates, and is significant at 1% level. Unconventional Era policy surprise rate is also significant during the Non-Eventdate at 5% level. Furthermore, our regression results indicate that there is a higher response in equity returns to monetary policy announcements during Eventdates than Non-Eventdates. The coefficient figures for Surprise Changes shows 0.00355 during the conventional era Eventdate and 0.00137 for Non-Eventdate conventional era. Also, the unconventional era shows a higher degree of response with coefficient of -0.000474 in the announcement days despite being negative compared to a positive response of 0.000360. This same narrative is reflected in the results of the Expected Change variable for both Eventdate and Non-Eventdate. This helps to explain that the unconventional policies have an effect on the stock returns during days of scheduled Governing council meetings and outside those days but much more effective during the council meetings. The R^2 indicates that 48% of the variance in equity returns is associated with news about monetary policy during Eventdates and 39% of the variance in equity returns can be explained by Non-Eventdates. The difference between the R^2 is 9% which is the contribution of the monetary policy to the variance in stock returns. Considering the MSCIXEU is highly significant, it would be interesting to find out the extent other economic activities in the EU like exchange rate, oil prices etc.; do have on the stock returns.
Our Table VI estimates in the appendix 4 section, contains foreign exchange variable to find out the level of impact foreign exchange as an economic activity has on the stock market returns and the estimates show that the results for the foreign exchange are not significant to impact stock movements both during governing council announcement days and outside those days both in conventional and unconventional periods.

Table III: The Response of Stoxx 600 Index Returns to ECB Rate Changes

	Event-Date			Non-Eventdate		
	Full Sample	Conventional Era	Unconventional Era	Full Sample	Conventional Era	Unconventional Era
Surprise Change	0.00127	0.00355*	-0.000474	0.000568**	0.00137**	0.000360
	(1.17)	(1.96)	(-0.38)	(2.35)	(2.52)	(1.35)
Expected Change	0.00172	-0.00154	0.00309	0.000119	0.000143	0.000104
	(1.01)	(-0.45)	(1.71)	(0.53)	(0.27)	(0.42)
Surprise in Unconventional Era	1.351***		1.161***	0.0681**		0.0663**
	(3.68)		(3.47)	(2.38)		(2.37)
MSCIXEU	0.795***	0.524***	0.932***	0.753***	0.708***	0.772***
	(12.72)	(4.50)	(13.57)	(52.48)	(26.02)	(46.05)
_cons	0.0204	0.0311	0.0129	-0.00689	-0.00827	-0.00778
	(0.29)	(0.26)	(0.15)	(-0.48)	(-0.34)	(-0.44)
N	223	92	131	4382	1605	2777
R-Squared	**0.48**	**0.21**	**0.66**	**0.39**	**0.30**	**0.44**

Note: t statistics in parentheses; *p<0.1 **p<0.05 ***p<0.01

Note: The Surprise Change is the independent variable that refers to the unexpected or shock rate change during the conventional period. The Expected Change is an independent variable referring to the expected rate change during the conventional period. The Surprise in Unconventional Era is an independent variable representing the shock or surprise rate change during the unconventional period and the MSCIXEU refers to the control variable of the Morgan Stanley Capital International excluding the European Union.

5.1. Examining the Policy Impact on Large, Mid and Small Cap stocks

In our table IV below we combine the constituencies of the Stoxx Equity returns for large, mid or small capitalization and compare which one is the most affected by the ECB policy rate changes and which is the least affected. The large cap stocks estimates are represented in panel I, the medium cap stocks in panel II and the panel III represents the small cap stocks. This section is also part of our hypothesis to answer the question about which category of the Stock Index by size is more affected by the changing policy rates either through shocks or expected.

The coefficients of our proxy for unconventional monetary policy surprise are highly significant and positive in all the three scenarios. However, our results do not suggest that the impact differs across the portfolios sorted based on size. The parameter estimates are fairly close to each other, and the coefficient of the mid cap index is the smallest during the event date for unconventional period whilst the large cap index has the lowest parameter estimate for non-event date during the unconventional period.

Furthermore, the small cap index and mid cap index both have a significant estimate at 10% level for the surprise change variable during conventional periods outside the governing council announcement dates.

This analysis is an indication that despite there being little differences amongst the three stock indices, the small cap and mid cap portfolio has an R-square of 55% which is 4% higher than the large cap stocks in terms of responding to policy announcements.

Table IV: The Response of Large, Mid and Small Cap Stoxx 600 Index Returns to ECB Rate Changes

		Event-Date			Non-Eventdate		
		Full Sample	Conv Era	Unconv Era	Full Sample	Conv Era	Unconv Era
Panel I Large Cap Stocks	Surprise Change	0.00129	0.0038*	-0.000601	0.000599**	0.00146	0.000373
		(-1.14)	(-1.94)	(-0.47)	(-2.41)	(-2.55)	(-1.38)
	Expected Change	0.00184	-0.00144	0.00322	0.0000853	0.000163	0.0000607
		(-1.04)	(-0.39)	(-1.75)	(-0.37)	(-0.3)	(-0.24)
	Surprise in Unconv Era	1.379***		1.190***	0.0612**		0.0602**
		(-3.59)		(-3.48)	(-2.08)		(-2.12)
	MSCIXEU	0.793***	0.525***	0.929***	0.762***	0.736***	0.773***
		(-12.13)	(-4.19)	(-13.26)	(-51.66)	(-25.78)	(-45.46)
	_cons	0.0122	0.0235	0.00387	-0.00937	-0.0135	-0.00887
		(-0.16)	(-0.19)	(-0.05)	(-0.64)	(-0.52)	(-0.50)
	N	223	92	131	4382	1605	2777
	R-Squared	**0.46**	**0.19**	**0.65**	**0.38**	**0.3**	**0.43**
Panel II Medium Cap Stocks	Surprise Change	0.00111	0.00237	0.0000817	0.000416	0.000956**	0.000289
		(-1.18)	(-1.73)	(-0.07)	(-1.8)	(-2.07)	(-1.07)
	Expected Change	0.00113	-0.00211	0.0025	0.000274	0.0000997	0.000293
		(-0.76)	(-0.82)	(-1.42)	(-1.28)	(-0.22)	(-1.18)
	Unconventional Era	1.164***		0.979***	0.0921***		0.0866**
		(-3.62)		(-3.01)	(-3.37)		(-3.06)
	MSCIXEU	0.812***	0.539***	0.949***	0.713***	0.579***	0.770***
		(-14.85)	(-6.12)	(-14.21)	(-52.03)	(-25.1)	(-45.37)

	_cons	0.0514	0.0616	0.0462	0.00487	0.0163	-0.0026
		(-0.83)	(-0.69)	(-0.57)	(-0.36)	(-0.79)	(-0.15)
	N	223	92	131	4382	1605	2777
	R-Squared	**0.55**	**0.31**	**0.67**	**0.39**	**0.28**	**0.43**
Panel III Small Cap Stocks	Surprise Change	0.000737	0.00168	-0.0000934	0.000388	0.000842*	0.000293
		(-0.79)	(-1.3)	(-0.08)	(-1.67)	(-1.97)	(-1.05)
	Expected Change	0.00115	-0.00215	0.00255	0.000231	-0.0000956	0.000274
		(-0.79)	(-0.89)	(-1.44)	(-1.07)	(-0.23)	(-1.07)
	Unconventional Era	1.382***		1.183***	0.118***		0.111***
		(-4.35)		(-3.6)	(-4.32)		(-3.79)
	MSCIXEU	0.779***	0.478***	0.931***	0.686***	0.492***	0.769***
		(-14.4)	(-5.77)	(-13.81)	(-49.87)	(-23.02)	(-43.96)
	_cons	0.0809	0.0942	0.0735	0.00482	0.0206	-0.00481
		(-1.32)	(-1.12)	(-0.89)	(-0.35)	(-1.07)	(-0.26)
	N	223	92	131	4382	1605	2777
	R-Squared	**0.55**	**0.27**	**0.67**	**0.37**	**0.26**	**0.42**

Note: t statistics in parentheses; *p<0.1 **p<0.05 ***p<0.01

Note: The Surprise Change is the independent variable that refers to the unexpected or shock rate change during the conventional period. The Expected Change is an independent variable referring to the expected rate change during the conventional period. The Surprise in Unconventional Era is an independent variable representing the shock or surprise rate change during the unconventional period and the MSCIXEU refers to the control variable of the Morgan Stanley Capital International excluding the European Union.

The headings are self-explanatory except for Conv Era which refers to the Conventional Era and Unconv Era which means Unconventional Era.

6. CONCLUSIONS

This chapter contains our conclusions about the main themes of the thesis, the limitations we faced in our research and also to discuss what future researchers might want to lookout for when treating this subject matter. Our paper attempts to analyse the effects that the European Central Bank's (ECB) monetary policy rates have on the STOXX Europe 600 index which we've adopted to represent the aggregate European stocks in general. In trying to analyse this topic, we came up with relevant questions to try and find answers to those:

Our first question was; are the effects of monetary policy on stock markets time varying between the conventional period and unconventional period? When does it affect the most, when the least? According to our results analysis, we have series of evidence to suggest that the monetary policy effects on the stock market is time varying to different degrees. There may be different time variants such as business cycles etc. but the scope of our studies is under the governing council announcement days and outside of those, which we've termed as Eventdate and Non-Eventdate respectively. Furthermore, our time periods were categorized as either during the conventional period or unconventional period. Our table II results indicates at a glance the $R^2$of 45% for the unconventional period as opposed to 29% for the conventional period gives us further indication that the highest influence of the monetary policy on stock returns is during the unconventional period when unconventional policies were utilized. Further evidence to strengthen this claim can be found in Table III where our regression results indicate that there is a higher response in equity returns to monetary policy announcements during Eventdates (R^2 48%) than Non-Eventdates (R^2 39%) for both their full sample sizes. This emphasizes the point that the effect is greater on policy announcement days than outside those days. The same statement is also true for table IV.

Our second question is; are the effects significantly dependent on shocks/unanticipated monetary policies? In table III, our results show that the Expected Change variable does not have a significant impact on the movements of the stock market in any of the categorized timeframes. Meanwhile, the Surprise Change variable is significant at the full sample and conventional period under the Non-Eventdate. Furthermore, the Surprise in Unconventional Era is also significant in all of those timeframes (at 1% during policy announcement days and 5% outside those days). We therefore, fail to reject the hypothesis that the effects are significantly dependent on shocks/unanticipated monetary policies. Our concluding statement to this hypothesis is similar to previous studies such as Haitsma et al. (2016) and Bernanke & Kuttner (2005) that have been done on this topic.

Finally, the last question we posed for this studies is; which of the constituency i.e. large, medium and small capitalization, of the STOXX 600 return Index

is most affected by monetary policy change? What we found out for this hypothesis was that the coefficients of our proxy for unconventional monetary policy surprise are highly significant and positive in all the three scenarios in table IV. This is consistent with the results in the prior table III. However, our results further demonstrates that the impact is similar across the portfolios sorted based on size. The level of significance or lack thereof of the parameter estimates are fairly similar to each other across the different panels of table IV, and the coefficient of the mid cap index is the smallest during the event date for unconventional period whilst the large cap index has the lowest parameter estimate for non-event date during the unconventional period. Therefore, we can conclude from this hypothesis that there is no clear portfolio amongst the three caps that is significantly most affected by the monetary policy change. This result is also similar to the conclusions made in Bernanke & Kuttner (2005)

The main limitation of our research is that it explains only a limited amount of the ECB policy rate. The policy rate involves the management of both the money supply and interest rate. Our focus has been solely on the interest rate aspect of the policies.

Future research on this theme could expand the dataset to current affairs in the Euro Area to cover major events such as the Covid-19 pandemic and the current geopolitical crisis by Russia in Ukraine to observe how effective ECB policy rates can be during these crisis periods. (Bernanke, The New Tools of Monetary Policy, 2020)

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APPENDIX 1

Table V: SUMMARY OF PREVIOUS STUDY

Year	Author	Title	Abstract	Methodology	Results
1970	Eugene F. Fama	Efficient Capital Markets: A Review of Theory and Empirical Work	The paper reviews the theoretical and empirical literature on the efficient markets model and empirical work concerned with the adjustment of security prices to the three relevant information subsets i.e. weak form tests, semi-strong tests and strong form tests.	In the early treatments of the efficient markets model, Fama believed that the statement that the current price of a security "fully reflects" available information was assumed to imply the successive price changes are independent. In addition, it was usually assumed that successive changes (or returns) are identically distributed. Together the two hypotheses constitute the random walk model.	Fama's investment theory – which carries essentially the same implication for investors as the Random Walk Theory – is based on a number of assumptions about securities markets and how they function. The assumptions include the one idea critical to the validity of the efficient markets hypothesis: the belief that all information relevant to stock prices is freely and widely available, "universally shared" among all investors. As there are always a large number of both buyers and sellers in the market, price movements always occur efficiently (i.e.., in a timely, up-to-date manner). Thus, stocks are always trading at their current fair market value.

2018	Jürg Fauscha and Markus Sigoniusb	The impact of ECB monetary policy surprises on the German stock market	This paper examines the impact of ECB monetary policy surprises on German excess stock returns and the possible reasons for such a response.	They conducted an event study methodology to assess the impact of conventional and unconventional monetary policy on stock returns. Secondly, within the VAR framework of Campbell and Ammer (1993), they decomposed excess stock returns into news regarding expected excess returns, future dividends and future real interest rates. They measured conventional monetary policy shocks using futures markets data.	Their main findings are that the overall variation in German excess stock returns mainly reflects revisions in expectations about dividends and that the stock market response to monetary policy shocks is dependent on the prevailing interest rate regime. In the periods when the real interest rates are negative, an unexpected monetary tightening leads to a decrease in excess stock returns. The channels that leads to this response are news about higher expected excess returns and lower future dividends.
2005	Ben S. Bernanke and Kenneth N. Kuttner	What Explains the Stock Market's Reaction to Federal Reserve Policy?	This paper analyzes the impact of changes in monetary policy on equity prices, with the objectives of both measuring the average reaction of the stock market and understanding the economic sources of that reaction.	They used the methods developed by Campbell (1991) and Campbell and Ammer (1993), which utilized a vector autoregression (VAR) to calculate revisions in expectations of these key variables.	They found on average that, a hypothetical unexpected 25 basis point decrease in the Federal funds rate target is can explain a 1% increase in broad stock indexes.

2008	Martin T. Bohl, Pierre L. Siklos and David Sondermann	European Stock Markets and the ECB's Monetary Policy Surprises	This paper contributes to the literature that measures the response of stock markets to monetary policy actions. They study the reaction of the European stock market returns to unexpected policy rate decisions by the ECB.	The endogeneity between interest rate changes and stock returns is always factored in when using the identification through the heteroscedasticity approach to estimate the impact of monetary policy shocks on stock returns.	Depending on different methods to identify and isolate monetary policy shocks, they find an inverse and significant relationship between unexpected ECB decisions and the European stock market. Moreover, the monetary policy decisions of the ECB are well anticipated by the market, which implies that the central bank successfully communicates its monetary policy.
2006	A. Gregoriou, A. Kontonikas, R. MacDonald and A. Montagnoli	Monetary policy shocks and stock returns: evidence from the B ritish market	This paper examines the impact of anticipated and unanticipated interest rate changes on aggregate and sectoral stock returns in the United Kingdom. The monetary policy shock is generated from the change in the three months LIBOR futures contract.	They use a panel GMM estimator and find that both the expected and unexpected components of monetary changes are significant, but that only the surprise term is significant when they control for the impact of the sectors financial position.	Results from time-series and panel analysis indicate an important structural break in the relationship between stock returns and monetary policy shifts. Specifically, whereas before the credit crunch, the stock market response to both expected and unexpected interest rate changes is negative and significant; the relationship becomes positive during the credit crisis.
2020	Ben S. Bernanke	The New Tools of Monetary Policy	This paper reviews the available knowledge about the new monetary tools, especially on the quantitative easing (QE) and forward guidance, which are the principal new tools used by the Fed.	They employed stochastic simulations of FRB/US to compare expected economic performance under alternative monetary policy frameworks.	Simulations of the Fed's FRB/US model suggest that, if the nominal neutral interest rate is in the range of 2–3 percent, consistent with most estimates for the United States, then a combination of QE and forward guidance can provide the equivalent of roughly 3 percentage points of policy space,

					largely offsetting the effects of the lower bound.
2017	Michael T. Kiley and John M. Roberts	Monetary Policy in a Low Interest Rate World	The paper studies the persistently low nominal interest rates and observe that it can lead to frequent and costly scenarios on nominal interest rates at the effective lower bound (ELB).	They use the frequency and potential costs of scenarios in a world of low interest rates, using both a dynamic stochastic general equilibrium (DSGE) model and the Federal Reserve's large-scale econometric model, the FRB/US model.	Four main conclusions emerge. First, monetary policy strategies based on traditional rules lead to poor economic performance when the equilibrium interest rate is low, with economic activity and inflation more volatile and systematically falling short of desirable levels. Second, a risk adjustment to a simple rule—whereby monetary policymakers are more accommodative, on average, than prescribed by the rule—ensures that inflation averages its 2 percent objective, and requires that policymakers systematically seek inflation near 3 percent when the ELB is not binding. Third, commitment strategies, whereby monetary accommodation is not removed until either inflation or economic activity overshoots its long-run objective, are very effective in both the DSGE and FRB/US models. And fourth, their simulation results suggest

					that the adverse effects on economic and price stability associated with the ELB may be substantial at inflation targets near 2 percent if the equilibrium real interest rate is low and monetary policy follows a traditional approach.
2016	Reinder Haitsma, Deren Unalmis and Jakob de Haan	The impact of the ECB's conventional and unconventional monetary policies on stock markets	The authors try to examine how stock markets react to the policies of the European Central Bank between the dates of 1999 to 2015. By using market prices of futures (government bonds) to identify surprises in (un)conventional monetary policy.	Using an event study method	Their results suggest that especially unconventional monetary policy surprises affect the EURO STOXX 50 index. They analyze evidence for the credit channel, especially for unconventional monetary policy surprises. And their results also suggest that value stocks show a higher reaction to monetary policy surprises.

Appendix 2

Gross Domestic Product												
GEO	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Portugal	17230	17260	16710	16990	16720	16110	16050	16260	16620	17010	17650	18190
Greece	22500	22370	21350	20150	18130	16940	16630	16830	16900	16890	17110	17430
Spain	24380	24200	23100	23040	22770	22080	21840	22210	23080	23760	24430	24880
Italy	28740	28250	26600	26940	27030	26160	25620	25620	25860	26240	26730	27030

Source: Eurostat Data browser

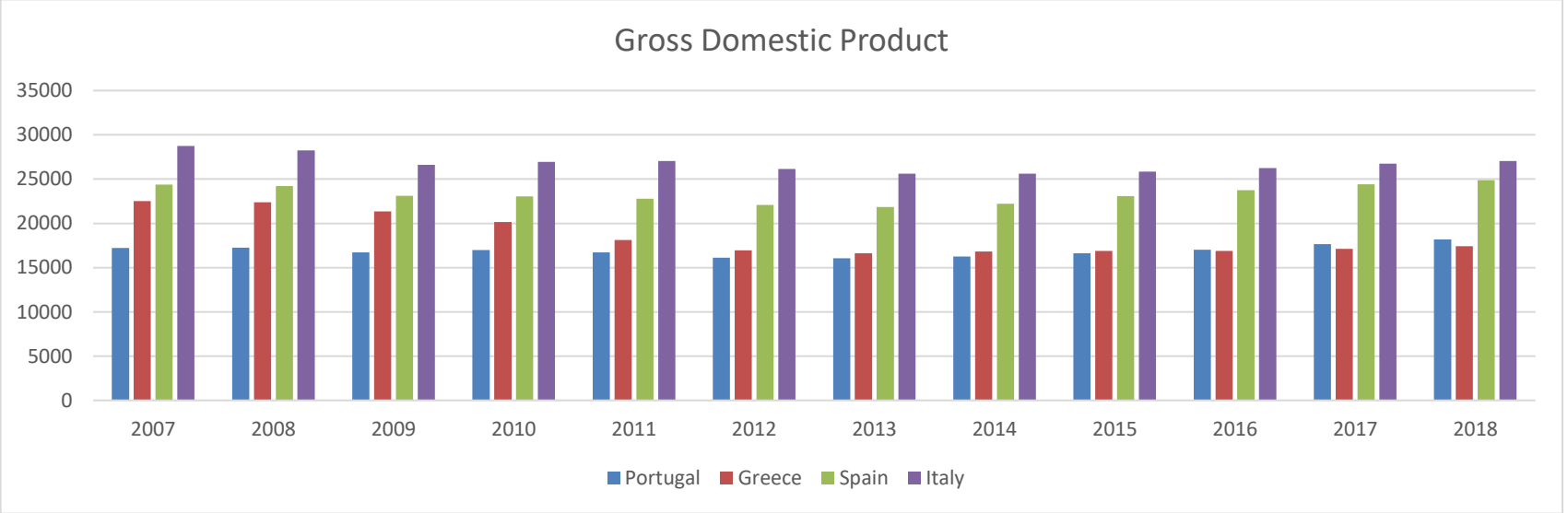

Figure 6 Gross Domestic Product

Appendix 3

Percentiles for Full Sample

VARIABLES	p1	p5	p10	p25	p50	p75	p90	p95	p99
Equity Returns	-3.600	-1.911	-1.308	-0.545	0.0518	0.597	1.281	1.821	3.199
Expected Change	-380.0	-197.9	-145.4	-59.78	32.85	132.2	243.0	307.7	437.9
Surprise Change	-384.9	-222.3	-156.5	-69.31	6.899	84.73	168.9	214.0	322.5
Unconventional Policy	-443.8	-309.3	-208.6	-101.4	-4.045	87.50	209.5	339.2	471.9
MSCI (X) EU	-2.851	-1.589	-1.054	-0.385	0.0680	0.488	1.015	1.410	2.638

Percentiles for Conventional Era

VARIABLES	p1	p5	p10	p25	p50	p75	p90	p95	p99
Equity Returns	-3.497	-1.864	-1.306	-0.565	0.0429	0.587	1.201	1.774	3.239
Expected Change	-402.0	-215.8	-174.9	-79.80	27.19	138.6	219.7	265.2	312.5
Surprise Change	-371.0	-187.2	-125.3	-35.67	27.72	98.08	179.2	228.4	322.5
MSCI (X) EU	-2.390	-1.477	-1.086	-0.469	0.0645	0.487	0.999	1.390	2.478

Percentiles for Unconventional Era

VARIABLES	p1	p5	p10	p25	p50	p75	p90	p95	p99
Equity Returns	-3.669	-1.940	-1.313	-0.528	0.0550	0.602	1.297	1.837	3.044
Expected Change	-368.9	-190.8	-138.3	-58.78	32.85	131.0	250.3	325.8	441.6
Surprise Change	-391.0	-229.3	-169.1	-87.55	4.082	78.02	167.4	214.0	322.3
Unconventional Policy	-443.8	-309.3	-208.6	-101.4	-4.045	87.50	209.5	339.2	471.9
MSCI (X) EU	-3.349	-1.636	-1.044	-0.354	0.0725	0.489	1.021	1.434	2.749

Full Sample Correlation

	Equity Returns	Surprise Change	Expected Change	Unconventional Policy	MSCI (X) EU
Equity Returns	1				
Surprise Change	0.0115	1			
Expected Change	0.003	-0.0016	1		
Unconventional Policy	0.062	-0.0019	0.0056	1	
MSCI (X) EU	0.6249	-0.0283	-0.0078	0.049	1

Conventional Period Correlation

	Equity Returns	Surprise Change	Expected Change	MSCI (X) EU
Equity Returns	1			
Surprise Change	0.057	1		
Expected Change	-0.0193	-0.0043	1	
MSCI (X) EU	0.5355	-0.0149	-0.0418	1

Unconventional Period Correlation

	Equity Returns	Surprise Change	Expected Change	Unconventional Policy	MSCI (X) EU
Equity Returns	1				
Surprise Change	-0.0059	1			
Expected Change	0.011	0.0009	1		
Unconventional Policy	0.0763	-0.0027	0.0068	1	
MSCI (X) EU	0.6677	-0.0331	0.003	0.0587	1

Appendix 4

Table VI: The Response of Stoxx 600 Index Returns to ECB Rate Changes

	Event-Date			Non-Eventdate		
	Full Sample	Conventional Era	Unconventional Era	Full Sample	Conventional Era	Unconventional Era
Surprise Change	0.00132	0.00407	-0.000597	-0.000570	0.00136*	0.000359
	(1.23)	(2.22)	(-0.47)	(2.36)	(2.49)	(1.35)
Expected Change	0.00159	-0.00105	0.00296	0.000110	0.000109	0.000106
	(0.94)	(-0.31)	(1.63)	(0.49)	(0.21)	(0.43)
Surprise in Unconventional Era	1.351***		1.139***	0.0681**		0.0663**
	(3.69)		(3.39)	(2.38)		(2.37)
MSCIXEU	0.796***	0.534***	0.929***	0.753***	0.706***	0.772***
	(12.78)	(4.62)	(13.51)	(52.45)	(25.93)	(46.04)
Forex	0.830	1.239	0.937	-0.0990	-0.244	0.0536
	(1.59)	(1.55)	(0.88)	(-0.81)	(-1.37)	(0.25)
_cons	-0.675	-1.117	-0.714	0.0750	0.210	-0.0500
	(-1.52)	(-1.49)	(-0.86)	(0.74)	(1.30)	(-0.30)
N	223	92	131	4382	1605	2777
R-Squared	**0.49**	**0.22**	**0.66**	**0.39**	**0.30**	**0.44**

Note: t statistics in parentheses; *p<0.1 **p<0.05 ***p<0.01

This figure 4 graph is an illustration of the influence that MSCI (ex) Europe and the Euro-Dollar Foreign exchange has on our dependent variable STOXX 600 Index during Governing council meeting dates.

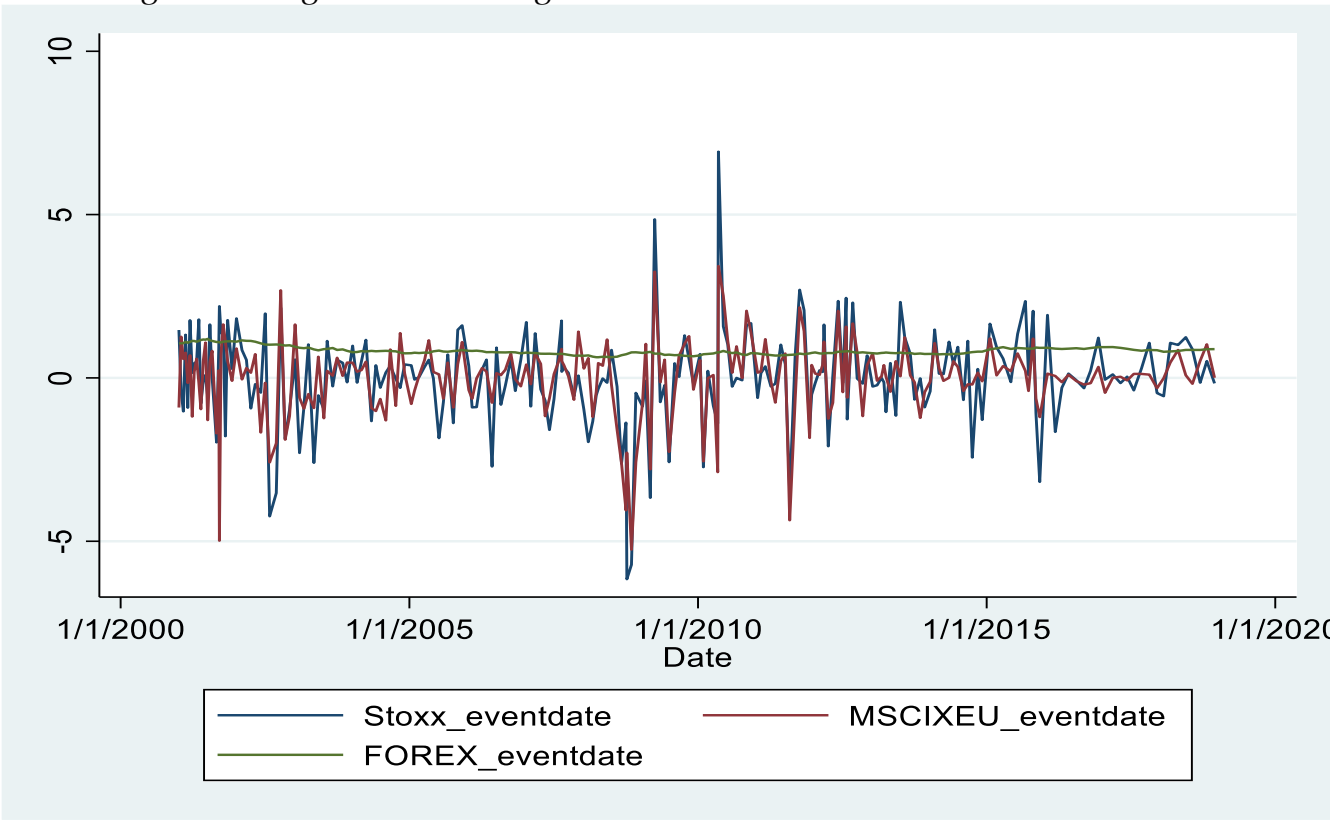

Figure 7 Stoxx 600 Return Index, MSCI (ex) Europe and Forex