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The European Central Bank's announcement effect on stock returns in Europe

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Abstract

This study investigates how the European Central Bank has influenced European stock markets on the scheduled announcement of monetary policy decisions. Our findings conclude that the European Central Bank does not have a significant influence on major stock indices in Europe on scheduled announcement days. These findings are in sharp contrast to the documented influence the Federal Reserve has on their announcement days in Europe. However, the four investigated stock indices give significant and negative results four days before the scheduled announcement day for the European Central Bank. Furthermore, we do not find support for the following hypothesis: The European Central Bank's announcement effect increase in periods of financial distress and the European Central Bank's announcement effect is increasing over time.

1.0 Introduction

Investors in the United States and numerous other countries worldwide have experienced substantial excess returns on stocks they are holding on days when the Federal Reserve (Fed) has scheduled monetary policy meetings (Savor & Wilson, 2013). This market behavior is referred to as “the Fed’s announcement effect.” So far, it has been conducted little research on the relationship between the European Central Bank’s (ECB) monetary policy announcements and its influence on stock markets in Europe.

Monetary policy’s primary objectives are often expressed as macroeconomic variables such as inflation, employment, output, and price stability (Friedman, 1995). Nevertheless, monetary policy instruments affect inflation, employment, and output indirect at best. The most immediate and direct effects of monetary policy decisions are on the financial markets and its stability. Therefore, policymakers try to adjust the economic behavior by influencing returns and asset prices to reach their primary objectives (Issing, 2003). Hence, it is critical for investors to understand the relationship between monetary policy and equity prices.

The ECB was established in 1998 to build an Economic and Monetary Union. Members of the European Union would have free capital movements, a common monetary authority and a single monetary policy (ECB, 2018a). On January 1st, 1999, the ECB became the common monetary authority in the eurozone. The ECB has regular scheduled meetings to make and apply monetary policy decisions. These meetings gradually been held less frequent, and since 2015, there have only been eight scheduled meetings per year. From January 1st, 1999 to May 30th, 2018 they have announced their monetary policy decision 249 times at approximately 2:00 p.m.

This study will empirically examine the relationship between the ECB’s monetary policy announcements and stock markets in Europe on announcement days. More

specifically, we will measure ECB's announcement effect on FTSE 100, DAX, CAC 40, and EuroStoxx 50, with a particular emphasis on FTSE 100.

The primary analysis is based on the natural logarithm excess return. We measure the performance from closing time (t_{-1}) to closing time (t) on the scheduled announcement day. Investors receive more accurate signals about what decision the ECB will announce in the few hours leading up to the announcement (Lucca and Moench, 2015). Therefore, we measure the performance of the whole day.

Flannery and Protopapadakis (2012), and Savor and Wilson (2013), argues that stock markets are positively and significantly influenced on days of scheduled Federal Open Market Committee (FOMC) announcements of monetary policy decisions. Moreover, Lucca and Moench (2015) find evidence of increased excess return in the hours leading up to the announcement of the monetary policy decision, referred to as the pre-FOMC announcement drift.

Until now it has been conducted little research on the relationship between the ECB's monetary policy announcements and its influence on stock markets in Europe. Therefore, the following hypothesis is investigated:

H1: The ECB has a significant announcement effect in Europe

One of Savor and Wilson (2013) findings is that FOMC announcements of monetary policy decisions have increased influence during times of financial distress. Erkens, Hung and Matos (2012) define the financial crisis as the period from January 2007 through August 2008. Therefore, we will examine the following hypothesis:

H2: The ECB's announcement effect is increasing in times of financial distress

Savor and Wilson (2013) and Lucca and Moench (2015) argues that the FOMC's announcement effect on financial markets is increasing over time, and approximately doubling in the recent years. Hence, the following hypothesis is examined:

H3: The ECB's announcement effect is increasing over time

In the end, to put our findings for the ECB in perspective, we have conducted a brief analysis on how the Fed influence the same stock indices over the same period.

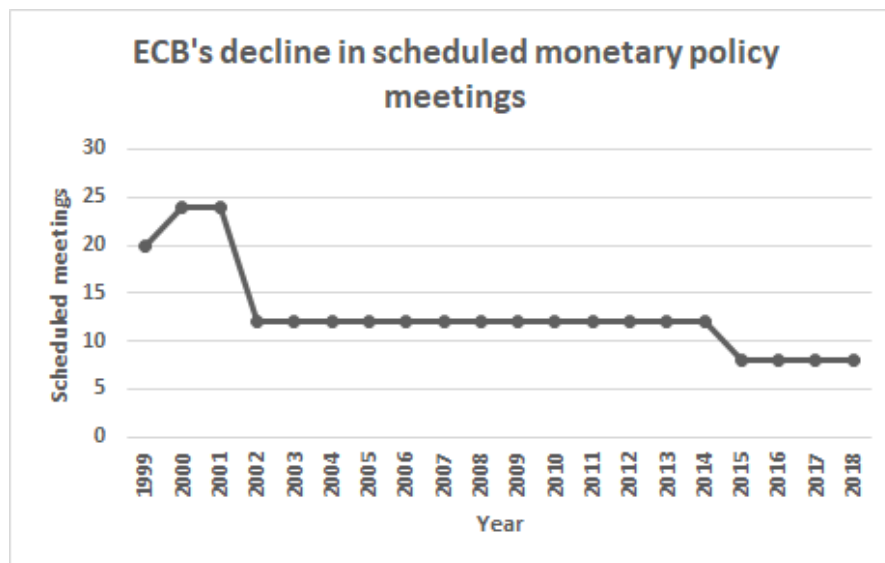
The rest of the paper is structured as follows; section 2.0 provides a brief overview of the ECB's monetary policy decision-making process. Section 3.0 address the theoretical background, while section 4.0 explain our methodology and data. Subsequently, in section 5.0 we present our main empirical findings, before we in section 6.0 discuss our findings with the theoretical background. Lastly, in section 7.0 we give our concluding remarks.

2.0 European Central Bank Policy and Monetary Policy Meetings

The European Central Bank was established on June 1st, 1998 (ECB, 2018b), in order to provide the member states with free capital movements, a common monetary authority and a single monetary policy (ECB, 2018a). ECB became the common monetary authority on January 1st, 1999, but did not have their first monetary policy announcement before April 1st, 1999.

The Governing Council is the main decision-making body of the ECB. The Governing Council consist of six members of the Executive Board, and the governors representing the 19-member states national central banks (ECB, 2018e). The council evaluates monetary and economic developments, and enforce monetary policy decisions every six weeks. Less frequently, the Governing Council apply monetary policy decisions at unscheduled meetings. Investors are only aware of scheduled meetings, and since the goal of this study is to investigate the announcement effect on days of scheduled meetings, we solely consider scheduled meetings in this study.

In figure 1, we see that the frequency of monetary policy meetings has gradually declined since the establishment of the ECB. In 1999 the ECB had 20 meetings and from 2000 to 2018 meetings decreased from 24 to eight meetings annually (Appendix 1).

Figure 1: Number of yearly scheduled monetary policy meetings

The decision is usually presented in a press release 2.00 p.m. Following the announcement, the President of the ECB holds a press conference that starts about 2.30. p.m. where comments on the considerations underlying the monetary policy decision are discussed.

"The primary objective of the European System of Central Banks [...] shall be to maintain price stability." (The Lisbon treaty, 2018; ECB, 2018g). Financial stability is the state where a build-up of systemic risk is prevented (ECB, 2018c). ECB has two primary responsibilities concerning financial stability in the Eurozone; to identify and assess risk (ECB, 2018d). Furthermore, it is stated in the Treaty on the Functioning of the European Union, Article 127 (1): *Without prejudice to the objective of price stability, the Eurosystem shall also support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union.* These include among other things full employment and balanced economic growth.

In 1998, the Governing Council embraced a quantitative definition of price stability: "A year-on-year increase in the Harmonized Index of Consumer Prices for the euro area of below 2%" (ECB, 2018h). However, in 2003 the Governing Council clarified that in the pursuit of price stability the ECB aims to maintain inflation rates close to, but below 2% over the medium term. In the price stability definition, the ECB states that the monetary policy focuses on the euro area as a

whole. Hence, price stability is evaluated from price developments for the whole euro area economy.

In order to keep inflation rates just below 2%, the ECB monitors cyclical and structural developments in the banking sector and other financial industries in the euro area to identify threats. The ECB's resilience and financial systems are assessed by applying quantitative instruments, where the Governing Council primarily relies on open market operations. Open market operations have a critical role in steering interest rates, managing the liquidity in the market, and signaling the monetary policy stance (ECB, 2018f). Other central instruments are minimum reserve requirement for credit institutions standing facilities, more specifically marginal lending facility and deposit facility (ECB, 2018f).

Members of the Governing Council communicate with the public between the official monetary policy announcements through speeches, interviews, and other means to convey the most likely path of the monetary policy. Transparency is vital, and the Governing Council must explain the rationale for their policy (ECB, 2018i).

The public market is sensitive to this interaction with the Governing Council and with the intention to reduce volatility and avoid unnecessary speculation, it exists a so-called *quiet period* or *purdah* which means that all the members of the Governing Council are on hold from communicating with the public market. Consequently, interactions are restricted in the run-up to monetary policy meetings (ECB, 2018i).

3.0 Theoretical background

Great quantities of macroeconomic news are announced randomly over time. However, some critical macroeconomic news are published at pre-scheduled dates. One of the most critical macroeconomic news is monetary policy decisions made by central banks. Scholars propose conflicting views on whether monetary policy affects equity markets. Ioannidis and Kontonikas (2006) and Jensen, Mercer and Johnson (1996), argue that monetary policy affects equity markets. On the other hand, Bordo and Jeanne (2002) and Fair (2005), argues that monetary

policy has a minor or no influence on equity markets. At these pre-scheduled dates of monetary policy announcements, investors do not know what the news will be, but they know long in advance that there will be news.

According to Savor and Wilson (2013), pre-scheduled dates of announcements are dates of higher risk, and thus the rationale investor should require a premium in expected return. Moreover, Nikkinen and Sahlström (2003) argue that financial asset prices fluctuate more around announcements of scheduled macroeconomic news. Macroeconomic news contains information that may be incorporated into the security prices once published, and thus, volatility is higher (Nikkinen and Sahlström 2003).

Following this increased volatility, Bernanke and Kuttner (2005) argue that FOMC key rate decisions positively and significantly affect equity prices on scheduled announcement days. Based on the discounted cash flow model, equity prices are equivalent to the present value of expected future net cash flow (Ioannidis & Kontonikas 2006; Jensen et al., 1996). Hence, central bank's may either influence the market players expectation of future economic activity or by altering the discount rate applied in the market.

A study based on research by Bernanke and Kuttner (2005) identified that on pre-scheduled dates, when the FOMC announce their monetary policy decision, the average U.S stock market return has been significantly higher on announcement day versus non-announcement days, more precisely 11.4 bps versus 1.1 bps over the sample period 1958 to 2009 (Savor & Wilson, 2013). These findings propose that some 60% of cumulative annual equity risk premium is realized on announcement days in the U.S. Furthermore, they found that the Sharpe ratio was ten times higher, and that the risk-free rate is comparatively lower on announcement days. Henceforth, investors in the U.S are compensated for bearing the increased volatility at scheduled FOMC announcements (Savor & Wilson, 2013).

A similar study carried out by Lucca and Moench (2015) investigated the 24-hour window in the run-up to the FOMC announcement. They documented a substantial mean excess return on U.S equities in anticipation of monetary policy

decisions taken by the FOMC in the last few decades. These documented pre-FOMC returns account for a substantial portion of the total annual realized stock return and are referred to as the “pre-FOMC announcement drift” (Lucca & Moench, 2015).

Brusa, Savor and Wilson (2017), argue that FOMC announcements have a significant effect on a considerable number of international stock markets. The FOMC’s announcement effect is on average stronger in various international markets than in the U.S itself. The combined global average market excess return is 43.4 bps over a two-day FOMC window, while it is only 3.4 bps on non-announcement days (Brusa et al., 2017). This difference is significant (and positive) in 29 (37) out of 38 countries included in their study. Further, the researchers claim that the Bank of England, the Bank of Japan, and the ECB has virtually no announcement effect in either the U.S market or in their home markets. Investors from the United Kingdom, Japan, and Europe accordingly demand lower risk premium associated with their own central bank’s decisions than they do by FOMC announcements (Brusa et al., 2017).

Bohl, Siklos and Sondermann (2008), measure the ECB’s influence on major stocks in Europe when their monetary policy announcement surprise investors. Monetary policy surprise is defined as an unanticipated interest rate change of 25-basis points (Bohl et al., 2008). Following this definition, the ECB did not surprise investors in more than 90% of their announcements (Bohl et al., 2008). These findings are further supported by Perez-Quiros and Sicilia (2002), that concludes that ECB successfully communicates their monetary policy intentions and that the market views the ECB as credible.

Although, on the few occasions investors was surprised, the European stock markets reacted negative and significant between -1.42% and -2.30% (Bohl et al., 2008). However, these significant results averaged out to zero. Blinder, Ehrmann, Fratzscher, De Haan, and Jansen (2008) firmly argues that in order for Central Banks to reach their primary objectives, communication is considered a vital requirement. Hence, it is essential for investors to capture the information communicated by the ECB, in addition to the information provided in the key rate decisions.

Another interesting study conducted by Mishkin (2009), finds that monetary policy has increased influence during times of financial distress. Moreover, this is further verified by Savor and Wilson (2013), that also finds evidence of an increase in the FOMC's announcement effect during times of financial distress.

Lastly, Brusa et al., (2017), argues that the FOMC's announcement effect has been gradually stronger in the last decades, both domestically and internationally. In fact, the announcement effect has almost doubled in the past few years. This statement is also supported by Lucca & Moench (2015), which identify an increased pre- FOMC announcement drift over time. Interestingly, countries that have recently experienced financial distress especially witness an increased influence by FOMC announcements.

4.0 Methodology and Data

4.1 Methodology

This study applies an event study methodology first introduced by Fama, Fisher, Jensen, and Roll (1969), in order to scrutinize the ECB's announcement effect. An event study measures the impact of a specific event, and its influence on security prices or other financial assets, by applying financial market data (MacKinlay, 1997). To measure the impact of the event, one simply applies a simple dummy variable regression, where the dummy variable takes the value one at the specific event (announcement day) and zero otherwise (Suits, 1957). According to the efficient market hypothesis, share prices reflect all available information (Clarke, Jandik, & Mandelker, 2001). Thus, given rationality in the market, the effects of a specific event will instantly be reflected in the security prices. Therefore, by applying security prices observed over a particular period, the event's economic magnitude can be measured. Any positive or negative reactions to the scheduled monetary policy announcement will be reflected in the abnormal return – its return in excess of what is expected – of stock indices in the period around the scheduled announcement day.

4.2 Data

This study targets financial asset returns, more specifically the natural log excess stock return (excess return) in Europe before, on, and after scheduled ECB monetary policy meetings in the period January 1st, 1999 to May 30th, 2018.

Furthermore, all findings for FTSE 100, DAX, CAC 40 and EuroStoxx 50 are based on daily data, and the primary focus will be on excess return from closing time ($t-1$) to closing time (t) announcement day, with a particular emphasis on FTSE 100. Hence, by construction, returns are reckoned through the specified time interval to include anticipatory behavior, response, as well as the behavior for the indices after the ECB's monetary policy announcement. Throughout the sample, we apply the daily rate of one-month London Interbank Offered Rate (LIBOR) locked to the beginning of each month as the risk-free rate for all the indices we investigate. This risk-free rate is also defined as expected return in this paper.

To conduct the empirical research, daily stock returns and the 1-month LIBOR rate was downloaded from Bloomberg. The specific dates of every scheduled ECB monetary policy meeting are collected from the ECB's homepage. Every monetary policy meeting that does not follow the traditional pattern is left out from the study, for example conference calls and extra ordinary meetings. Furthermore, we briefly analyze the Fed, and the dates of their monetary policy announcements are collected from the Fed's homepage. Because utmost of this analysis is rooted in average excess returns, we discard a detailed discussion and instead refer keen readers to the tables. See Appendix 1 and 2 for the dates of the monetary policy meetings.

5.0 Empirical results

This part of the paper will present the empirical findings identified in this study. First, we report summary statistics for FTSE 100, DAX, CAC 40, EuroStoxx 50 on scheduled ECB announcement days and non-announcement days. Summary

statistics for scheduled announcement days contains 249 observations, while summary statistics for non-announcement days consist of 4691 observations for FTSE 100, 4680 observations for DAX, 4711 observations for CAC 40, and 4731 observations for EuroStoxx 50. The four indices have a different number of observations because the indices are traded on various stock exchanges with varied opening times.

Second, this paper presents coefficient estimates and total annual realized stock return for both announcement days and non-announcement days. Third, we scrutinize FTSE 100 and investigate the sensitivity to outliers for the initial findings, and fourth, the robustness of its statistical evidence. Fifth, we present the average excess return before, on and after the announcement day for FTSE 100. All four indices are examined in the same way and tables for DAX, CAC 40 and EuroStoxx 50 are placed in the appendix.

Lastly, we will document the FOMC's announcement effect in Europe with summary statistics, coefficient estimates and total annual realized stock return. We will investigate how the performance of the indices on scheduled FOMC announcements are affected by outliers.

5.1.1 Summary Statistics

In Table 1, we immediately observe that the sample window was a challenging period for investors in Europe. All the indices behave very similarly, and without exception, the four indices have on average yielded negative excess return on the 249 observations for scheduled ECB announcement days. Thus, a simple trading strategy of holding stocks on announcement days and cash on non-announcement days would destroy value for investors compared to investing in the risk-free rate over the sample window.

We further observe that FTSE 100 is the least negative index on announcement days yielding an average excess return of -3.24 bps. On the other hand, FTSE 100 on average perform worse on non-announcement days with an excess return of -5.96 bps. As a matter of fact, FTSE 100 is the only index included in this study that on average perform better on scheduled ECB announcement days compared

to non-announcement days. Additionally, FTSE 100 is the least volatile index on announcement day verified by both the lowest standard deviation and the least extreme outliers.

Table 1
Summary Statistics

This table presents summary statistics of the natural log average excess return on ECB's announcement days and non-announcement days for FTSE 100, DAX, CAC 40 and EuroStoxx 50. The sample period is January 1st, 1999 to May 30th, 2018. FTSE 100, DAX, and CAC 40 denotes the close-to-close excess return on the British, German and French benchmark indices, and EuroStoxx 50 denotes the close-to-close excess return for the supersector leaders (blue-chip) in the Eurozone.

	Announcement Days					All Other Days				
	Mean	St. Dev.	Max	Min	No. Obs	Mean	St. Dev.	Max	Min	No. Obs
FTSE 100	-0,032362	1,384372	4,389134	-5,840591	249	-0,059581	1,28564	9,452533	-9,393754	4691
DAX	-0,116252	1,654651	5,857803	-7,230224	249	-0,037841	1,478809	10,62938	-9,018527	4680
CAC 40	-0,09835	1,603327	5,192289	-6,740757	249	-0,051937	1,427122	10,42651	-9,36962	4711
EuroStoxx 50	-0,074774	1,630933	5,477283	-6,569572	249	-0,059588	1,445974	10,26957	-8,999224	4731

The four indices experience an increase in volatility on scheduled ECB announcement days, documented by higher standard deviation. However, the difference is minor, and the most extreme outliers regarding excess return came on non-announcement days for the four indices, with a maximum and minimum value that easily triumphs announcement days.

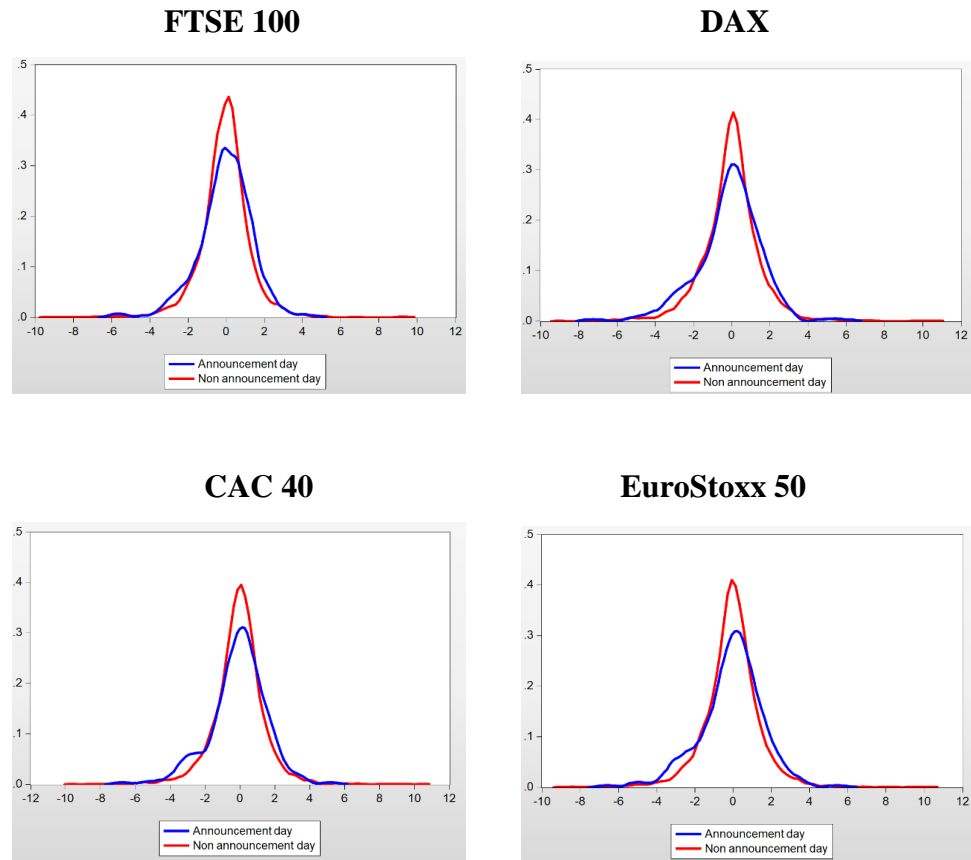
In contrast to FTSE 100, the German DAX index have the greatest outliers and is the most volatile index on both announcement days and non-announcement days. Henceforth, the 30 major German companies included in the DAX index are the most affected, while the 100 UK companies included in FTSE 100 is the least affected by monetary policy decisions taken and applied by the ECB.

5.1.2 Density figures

In order to put the initial findings from table 1 in perspective, we present figure 2, which is a density figure displaying the distribution of excess return for each index.

Figure 2**Density Figures**

This figure plots the density of the natural log excess return for FTSE 100, DAX, CAC 40, and EuroStoxx 50 on both announcement days (blue) and non-announcement days (red).



The similarity in the distribution of excess return between the indices regarding scheduled ECB announcement days and non-announcement days is remarkable. We graphically observe that the distribution for announcement days has a more mesokurtic form, while non-announcement days has a more leptokurtic form. The skewness is negative for all indices, however, announcement days are more negatively skewed, while non-announcement day has longer legs. This visualizes that the most extreme outcomes occur on non-announcement days, while negative results are the most likely scenario on scheduled ECB announcement days regarding excess return. Furthermore, a total of 131 observations on announcement day were positive, while the remaining 118 observations were negative for FTSE 100. On the other hand, a total of 2326 observations on non-announcement day were positive, and 2365 observations were negative.

5.1.3 Returns on all four indices

To more formally determine the magnitude of the excess return for the indices on the scheduled ECB announcement days, we applied the following simple dummy variable regression:

$$r_{xt} = \beta_0 + \beta_1(\text{announcement day}) + \varepsilon_t$$

The dependent variable r_{xt} represent the excess return in percent. The explanatory dummy variable takes the value of one on scheduled ECB announcement days and the value of zero on non-announcement days. The coefficient β_1 is the average excess return when the constant β_0 is excluded. β_0 is the average excess return differential on scheduled ECB announcement days versus non-announcement days when the constant is present. Lastly, the constant β_0 assess the mean excess return earned on all periods outside the window for scheduled ECB announcement days.

Table 2 presents coefficient estimates for the parameters on scheduled ECB announcement days on the four indices. The dependent variable is excess return, and the independent variable is a dummy variable. The dummy variable takes the value one on announcement days and zero otherwise. With the intention to include the effects of the build-up to the scheduled ECB announcement, the realized policy decision, and the wake of the decision.

Table 2
Returns on FTSE 100, DAX, CAC 40 and EuroStoxx 50

This table presents results for the ECB dummy variable regression based on excess returns for the FTSE 100, DAX, CAC 40 and EuroStoxx 50. The dependent variable is the natural log excess return on close-to-close time window. The “ECB dummy” is equal to one on the scheduled announcement day, and zero on non-announcement days. “Annual excess return AD” is the cumulative annual excess return earned on announcement day, and “Annual excess return NAD” is the cumulative return earned on non-announcement days. “Sharpe Ratio AD” is the annualized Sharpe ratio on ECB announcement day returns. Sharpe ratio are computed as $\sqrt{18,4166}$ (average annual monetary policy announcements) the per-meeting Sharpe ratio (sample mean of announcement day return divided by its standard deviation). The sample period is January 1st, 1999 to May 30th, 2018. ***Significant at 1%, **significant at 5%, *significant at 10%. Robust standard errors are displayed in brackets.

	Index							
	FTSE 100		DAX		CAC 40		EuroStoxx 50	
Coefficient AD	-0,032362	0,027219	-0,116252	-0,078411	-0,09835	-0,046414	-0,074774	-0,015186
St. Error.	[0,087731]	[0,089452]	[0,104859]	[0,106080]	[0,101607]	[0,102817]	[0,103356]	[0,104572]
Coefficient Constant		-0,059581		-0,037841		-0,051937		-0,059588
St. Error.		[0,016781]		[0,020561]		[0,018561]		[0,018918]
Annual excess return AD		-0,45		-1,61		-1,36		-1,03
Annual excess return NAD		-15,53		-9,84		-13,59		-15,67
Sharpe Ratio AD	-0,09	-0,09	-0,26	-0,26	-0,23	-0,23	-0,17	-0,17
Obs.	249	4940	249	4929	249	4960	249	4980
No. of announcements	249	249	249	249	249	249	249	249

Displayed in the leftmost column, the coefficient for FTSE 100 is on average -3.2 bps on announcement days with a corresponding t-statistic of -0,37 based on Newey-West standard errors, which is statistically insignificant. Furthermore, the annual excess return on announcement days is on average -0.45%, and on non-announcement days -15.53%. Thus, the negative realized excess return on announcement days counts for approximately 3% of the total negative realized annual excess return. If one were to follow a simple trading strategy and hold FTSE 100 only on the scheduled ECB announcement day and hold cash on non-announcement days, one would have lost a yearly Sharpe ratio of -0.09.

As can be seen in the third column, the coefficient for DAX is on average -11.6 bps on announcement day with a corresponding t-statistic of -1.11 based on Newey-West standard errors, which is also statistically insignificant. Moreover, DAX yields an annual excess return of -1.61% on announcement days which is the most disadvantageous excess return of the indices in this study. On the other hand, the annual excess return on non-announcement days is -9.84% which is the least negative of the indices. Henceforth, the DAX index is more influenced by the ECB's monetary policy decisions than the other three indices. Negative realized excess return on announcement days counts for approximately 14% of total realized excess return.

5.1.4 Sensitivity Test

In order to address the potential sensitivity of our findings to outliers, we will exclude top 1% and bottom 1% of daily excess return to further investigate if this affects the ECB's announcement effect.

Table 3 presents summary statistics for mean excess return and compare announcement days versus non-announcement days, as well as excluding top 1% and bottom 1% outliers. The observant reader notes that for all observations in the left column the average excess return (and the standard errors) are identical as in table 2. From this point on, FTSE 100 will be the focal point of our study regarding the ECB announcement days, the findings for the other three indices are placed in the appendix.

The standard deviation of excess return for all observations is 1.38 on announcement days, and 1.28 on non-announcement days, which implies that the FTSE 100 is more volatile on announcement days. Excluding top 1% and bottom 1% announcement day is still more volatile, more specifically a standard deviation at 1.22 versus 1.08. Even though scheduled ECB announcement days is more volatile than non-announcement days, only 5 of the total 95 excluded observations occurred on scheduled ECB announcement day.

Table 3
Summary Statistics on FTSE 100 Excess Returns

This table presents summary statistics for FTSE 100. The right panel excludes the top 1% and bottom 1% outliers. Standard errors for the means are reported in square brackets. "Obs." is the number of observations in each subset of days. The sample period is January 1st, 1999 to May 30th, 2018.

	All Observations		Excl. Top/Bottom 1%	
	Announcementdays	All other days	Announcementdays	All other days
Mean	-0,032362 [0,087731]	-0,059581 [0,016781]	-0,002976 [0,078113]	-0,054161 [0,015241]
St. Dev.	1,384372	1,28564	1,220157	1,083027
Skew	-0,597681	-0,213188	-0,315088	-0,143188
Kurtosis	4,958936	9,342766	3,085978	3,774921
Max	4,389134	9,452533	3,044301	3,779661
Min	-5,840591	-9,393754	-3,260387	-4,042403
Obs.	249	4691	244	4601

As graphically displayed earlier in figure 2, the skewness of the excess return distribution highlights another notable difference. Scheduled ECB announcement days have a negative skewness of -0.60, but excluding top 1% and bottom 1%, it shrinks to -0.32, while non-announcement days have a negative skewness on -0.21 that drops to -0.14 excluding top 1% and bottom 1%.

For scheduled ECB announcement days, the maximum value including all observations is 4.39%, and this drops to 3.04% excluding the top 1% and bottom 1%. The minimum value for announcement days is -5.84% for all observations, and this shrinks to -3.26% excluding top 1% and bottom 1%. We argue that our findings don't lose validity. Excluding top 1% and bottom 1%, the coefficient of FTSE 100 becomes -0.29 bps with a corresponding t-statistic that goes from -0.037 to -0,038. Hence, our findings are not affected by outliers. See Appendix 3 for the other three indices.

5.1.5 Robust test

Until now we have been presenting our findings for the whole sample. In order to investigate the robustness of the findings, the sample is divided into five new subsamples. Table 4 presents estimates of the simple dummy variable regression over different return windows.

Table 4
Robust test, FTSE 100 excess return alternative samples

This table presents the ECB dummy variable regression results for different return windows. The dependent variable is the natural log excess return for FTSE 100. The "ECB dummy" is equal to one on the scheduled announcement day, and zero on non-announcement days. "Annual excess return AD" is the cumulative annual excess return earned on announcement day, and "Annual excess return NAD" is the cumulative return earned on non-announcement days. "Sharpe Ratio AD" is the annualized Sharpe ratio on ECB announcement day returns. ***Significant at 1%, **significant at 5%, *significant at 10%. Robust standard errors are displayed in brackets.

Sample Period	1999.01 - 2018.05	1999.01 - 2008.12	2009.01 - 2018.05	2009.01 - 2013.12	2014.01 - 2018.05	2007.01 - 2008.08
Coefficient AD	0,027219	-0,006137	0,112894	0,107455	0,119353	-0,097246
St. Error.	[0,089452]	[0,118178]	[0,138297]	[0,181782]	[0,213104]	[0,255151]
Coefficient Constant	-0,059581	-0,131461	0,014192	0,018757	0,00908	-0,200552
St. Error.	[0,016781]	[0,025120]	[0,021466]	[0,030874]	[0,030867]	[0,057125]
Annual excess return AD	-0,45	-2,06	1,4	1,51	1,25	-3,57
Annual excess return NAD	-15,53	-31,24	3,65	4,59	2,48	-48,25
Sharpe ratio	-0,09	-0,39	0,30	0,31	0,30	-0,53
Obs.	4940	2526	2414	1283	1131	421
No. of announcements	249	150	99	60	39	20

In column 1, findings for the whole sample are shown and the results are identical as in table 2.

In column 2, the first ten years of the sample is presented and includes a total of 150 scheduled monetary policy meetings. In contrast to column 1, the annual

excess return yields an even lower result, the annual excess return for FTSE 100 was -2.06% in this period and remained insignificant with a corresponding t-value of -0.052. In this period, it was beneficial for investors to invest in the risk-free rate, rather than in FTSE 100. Furthermore, annual excess return on non-announcement day is at a substantial -31.24%. FTSE 100 closing price to might reflect some of these findings. On January 4th, 1999 to December 31th, 2008 the closing price went from 8245.88 EUR to 4631.84 EUR.

Column 3 presents approximately the second half of our sample containing daily data for more than nine years and 99 scheduled monetary policy meetings. In sharp contrast to both column 1 and 2, it yields a positive annual excess return. The annual excess return on announcement day is 1.4% with a corresponding insignificant t-statistic of 0.82. Annual excess return excluding announcement days is 3.65%. Thus, in the approximately second half of our sample, the stock markets yield a positive excess return on announcement days and non-announcement days. This highlight the fact that it was more beneficial for investors to hold the FTSE 100 compared to the risk-free rate in the second half of our sample.

Column 4 investigate the aftermath of the financial crises. This period lasts five years and contains 60 monetary policy announcements. This return window includes the most positive annual excess returns identified in this study, with a yearly excess return on announcement day on 1.51% with a corresponding t-statistic of 0.59. The annual excess return excluding announcement days was 4,59%. Even though markets were recovering from the financial crises and market participants had renewed interest in monetary policy, the ECB's influence on announcement days in this period remained insignificant.

Lucca and Moench (2015) and Brusa et al., (2017) stated that the influence of the Fed is positively increasing over time, roughly doubling in the past few years. That's why, in column 5, we investigate the last four years of our sample containing 39 monetary policy announcements to see if this also holds for the ECB. The last four years of our sample gave a corresponding t-value of 0.56, which remains insignificant. Further, in addition to this return window, we have

conducted an annually robust test to see if the ECB's influence is indeed increasing. We find that the ECB's influence shifts randomly. Nevertheless, the ECB's influence is increasing a little over the long term but remains insignificant.

Column 6 investigates the ECB's influence during the financial crises. We follow Erkens, Hung, and Matos (2012), that argue that the financial crisis lasted from January 2007 to August 2008 as a return window. Further, Savor and Wilson (2013) explain that monetary policy decisions have more impact during times of economic distress. This does not hold for the ECB. The annual excess return on announcement days is -3.57% with a corresponding t-value of -0.38. Even though this is the return window were FTSE 100 gives the most extreme excess return on announcement day, the ECB's influence remains statistically insignificant. Findings for the other three indices are placed in appendix 4.

5.1.6 Index Return

Table 5 presents a summary of excess returns for FTSE 100 around scheduled monetary policy meetings and their cumulative excess return. More specifically, we estimate the average excess return for each of the five days before announcement day, announcement day, and each of the five days after.

In sharp contrast to our previous findings, Table 5 presents statistically significant results. Four days before announcement day yields an average excess return of -33.28 bps with a corresponding t- statistic of -3.79 which is negative and significant at the 1% level. Every other day around the scheduled ECB announcement is statistically insignificant. Furthermore, the cumulative excess return for the coefficients regarding five days before announcement day is negative, profoundly influenced by t_{+4} and t_{+2} , while the cumulative excess return for coefficients regarding five days after is positive. This suggest that in the run-up to scheduled monetary policy announcement by ECB markets in Europe normally decreases.

Table 5**FTSE 100 index Returns before, on, and after ECB announcement**

This table presents results for the dummy variable regression for average excess returns on the FTSE 100 index on days before, on, and after scheduled ECB announcements. The sample period is January 1st, 1999 to May 30th, 2018. Refer to Table 4 for the dependent variable definition. ECB announcements on t_{-i} (t_{+i}) denotes a dummy that is equal to one for the i th trading day before (after) the scheduled ECB announcement. $\sum_{i=1}^5$ Announcements denotes the sum of the coefficients on the dummy variable for the five days before, while $\sum_{i=1}^{-5}$ Announcements denotes the sum of coefficients on the dummy variable for the five days after the ECB announcement. ***Significant at 1%, **significant at 5%, *significant at 10%. Robust standard errors are displayed in brackets.

	Mean	Std. Error
+5	0,088766	[0,082229]
+4	-0,332812	[0,076241]***
+3	-0,042142	[0,080302]
+2	-0,182586	[0,081877]
+1	0,008281	[0,083608]
AD	-0,032362	[0,089452]
-1	-0,010654	[0,080419]
-2	-0,089414	[0,087852]
-3	0,007673	[0,093643]
-4	-0,002816	[0,074511]
-5	0,036672	[0,081133]
$\sum_{i=1}^5$ Announcements	-0,365397	
$\sum_{i=1}^{-5}$ Announcements	0,244849	

5.1.7 The Federal Reserve

In the following section, we will quickly summarize some critical findings for the Fed's influence in the European stock market on scheduled FOMC announcements days. FOMC is the main decision-making body of the Fed and is responsible for the open market operations (the Federal Reserve, 2018). During the sample period, FOMC had eight scheduled monetary policy meetings annually (the Federal Reserve, 2018). The dates of the announcements have changed, and the total number of announcements is now 155, everything else is identical.

Table 6
Summary Statistics

This table presents summary statistics of the natural log average excess return on FOMC's announcement days and non-announcement days for FTSE 100, DAX, CAC 40 and EuroStoxx 50. The sample period is from January 1st, 1999 to May 30th, 2018. FTSE 100, DAX, and CAC 40 denotes the close-to-close excess return on the British, German and French benchmark indices, and EuroStoxx 50 denotes the close-to-close excess return for the supersector leaders (blue-chip) in the Eurozone.

	Announcement Days					All Other Days				
	Mean	St. Dev.	Max	Min	No. Obs	Mean	St. Dev.	Max	Min	No. Obs
FTSE 100	0,156443	1,304401	9,452533	-3,436466	155	-0,065163	1,289754	9,361329	-9,393754	4785
DAX	0,283045	1,169762	4,331910	-3,268291	155	-0,052349	1,496222	10,62938	-9,018527	4774
CAC 40	0,261821	1,317129	8,664673	-2,623501	155	-0,064463	1,438992	10,42651	-9,639620	4805
EuroStoxx 50	0,235930	1,195857	5,288127	-2,855650	155	-0,069865	1,462290	10,26957	-8,999224	4825

In contrast to the summary statistics in table 1, table 6 presents evidence of positive influence on announcement day for all four indices. The average excess return for FTSE 100 on announcement days is 15.64 bps, with a standard deviation of 1.30. Average excess return on non-announcement days is -6.52 bps. Another notable observation is that the maximum value on announcement days is 9.45% for FTSE 100. Hence, the most beneficial trading day in this study for FTSE 100 investors came on a FOMC announcement day. Overall, the three other indices are more positively influenced by the Fed on announcement days. Furthermore, FTSE 100 is still the index that has the least beneficial excess return on announcement days, while on the other hand, DAX still has the most beneficial excess return. DAX yields an average excess return on announcement days of 28.31 bps with a standard deviation of 1.17.

Table 7

This table presents results for the Fed dummy variable regression based on excess returns for the FTSE 100, DAX, CAC 40 and EuroStoxx 50. The dependent variable is the natural log excess return on the close-to-close time window. The "Fed dummy" is equal to one on the scheduled announcement days, and zero on non-announcement days. "Annual excess return AD" is the cumulative annual excess return earned on announcement days, and "Annual excess return NAD" is the cumulative return earned on non-announcement days. "Sharpe Ratio AD" is the annualized Sharpe ratio on FOMC announcement day returns. Sharpe ratio are computed as $\sqrt{8}$ (average annual monetary policy announcements) the per-meeting Sharpe ratio (sample mean of announcement day return divided by its standard deviation). The sample period is January 1st, 1999 to May 30th, 2018. ***Significant at 1%, **significant at 5%, *significant at 10%. Robust standard errors are displayed in brackets.

	Index							
	FTSE 100		DAX		CAC 40		EuroStoxx 50	
Coefficient AD	0,156443	0,221606	0,283045	0,335394	0,261821	0,326384	0,235930	0,305795
St. Error.	[0,104772]	[0,107189]	[0,093958]***	[0,096855]***	[0,105794]**	[0,108509]**	[0,096054]**	[0,099004]**
Coefficient Constant		-0,065163		-0,052349		-0,064463		-0,069865
St. Error.		[0,016932]		[0,020983]		[0,018951]		[0,019356]
Annual excess return AD		1,35		2,44		2,25		2,03
Annual excess return NAD		-17,32		-13,88		-17,21		-18,73
Sharpe Ratio AD	0,34	0,34	0,68	0,68	0,56	0,56	0,56	0,56
Obs.	155	4940	155	4929	155	4960	155	4980
No. of announcements	155	155	155	155	155	155	155	155

In the leftmost column in table 7, the coefficient for FTSE 100 is 15.64 bps on announcement days with a corresponding t-statistic of 1.49, which is not statistically significant based on Newey-West standard errors. The annual excess return on announcement day is on average 1.35%, and on non-announcement days -17.32% over the sample period. On the other hand, the DAX (t-value 3.01) is statistically significant at 1% level, while CAC 40 (t-value 2.47) and EuroStoxx 50 (t-value 2.46) is statistically significant at the 5% level. Hence, FTSE 100 is the only index in our study which is not significantly affected by the FOMC on their scheduled announcement days.

To further investigate the FOMC's announcement effect, we will examine if these findings are sensitive to outliers.

Table 8
Summary Statistics on FTSE 100 Excess Returns

This table presents summary statistics for FTSE 100. The right panel excludes the top 1% and bottom 1% outliers. Standard errors for the means are reported in square brackets. "Obs." is the number of observations in each subset of days. The sample period is January 1st, 1999 to May 30th, 2018.

	All Observations		Excl. Top/Bottom 1%	
	Announcementdays	All other days	Announcementdays	All other days
Mean	0,156443 [0,104772]	-0,065163 [0,016932]	0,070698 [0,082911]	-0,055571 [0,015258]
St. Dev.	1,304401	1,289754	1,025556	1,092181
Skew	2,139554	-0,316203	-0,545151	-0,141924
Kurtosis	19,01192	8,684651	4,203469	3,722216
Max	9,452533	9,361329	2,694116	3,779661
Min	-3,436466	-9,393754	-3,436466	-4,042403
Obs.	155	4785	153	4692

In table 8, the average excess return on announcement days drops from 15.64 bps to 7.07 bps excluding top 1% and bottom 1% for FTSE 100. The coefficient on announcement day was 15,64 bps, but when we exclude top 1% and bottom 1% it shrinks to 7,07 bps with a t- statistic at 0,85 which is further away from being statistically significant. Only two positive outliers were excluded from announcement days, and the maximum value drops from 9.45% to 2.69%. Lastly, the skewness decreases notably in value excluding top 1% and bottom 1%. Hence, the FOMC's insignificant influence on FTSE 100 on announcement days is highly dictated by two extreme outliers. At the same time, the other three indices remain

statistically significant excluding top 1% and bottom 1% outliers. More specifically, the DAX index is still significant at the 1% level, while CAC 40 and EuroStoxx 50 remains significant at the 5% level. Hence, the FOMC's significant announcement effect is not influenced by extreme outliers. See appendix 5 for the other indices.

6.0 Discussion of findings

In this section, we will discuss our findings from section 5 with the ECB policy and monetary policy from section 2 and the theoretical framework from section 3. Our findings indicate that the ECB does not have an announcement effect on stock markets in Europe. These findings are in sharp contrast to previous studies concerning the FOMC's announcement effect in Europe.

We find that the ECB, over the period January 1st, 1999 to May 30th, 2018, does not have an announcement effect on stock markets in Europe on scheduled announcements days. Each investigated index gives statistically insignificant results on announcement days. Therefore, we support the statement by Brusa et al., (2017) that says the ECB has no significant influence on stock markets in Europe on scheduled announcement days. Furthermore, these findings are not sensitive to outliers, and the ECB's announcement effect remains insignificant.

According to the Lisbon treaty (2018), the primary objective for the ECB shall be to maintain price stability. The Governing Council communicates the most likely path for the market with the market participants up to the "quiet period" with the intention to avoid substantial increases or decreases in stock prices in the days circling around the scheduled announcement day. However, our study identified significant results and results of economic magnitude in the run up to scheduled ECB announcement days. Four days before the scheduled announcement day FTSE 100 performs negatively significant. Furthermore, two days before announcement day yields results of economic magnitude and, hence, we observe a decreasing trend in the days leading up to scheduled ECB announcement days. These findings are in line with several central bank committees that argue that

markets tend to be more sensitive around policy decisions (Ehrmann and Fratzscher, 2009).

Nikkinen and Sahlström (2003) argues that security prices have increased volatility around the release of macroeconomic news. They argue that new information needs to be incorporated into the equity prices and, thus, volatility is higher. We observe that this to some extent holds for the ECB on announcement days. All four indices have a small increase in volatility on announcement days compared to non-announcement days. However, this increased volatility is minimal and insignificant.

As documented by Bohl et al. (2008), the ECB's monetary policy decisions are generally easy to predict. Less than 10% of their decisions surprised the market participants, and the surprises averaged out to zero. The efficient market hypothesis states that prices already reflect all relevant information. Hence, the ECB's announcement effect should be insignificant since investors rarely obtain new information after an announcement and the prices already reflect the information that is to be published. Similar to Bohl et al., (2008), our results show that extreme fluctuations seldom occur on the ECB announcement days.

Nevertheless, an interesting observation is that the four indices are on average more volatile on ECB announcement days than they are on the FOMC announcement days, even though the FOMC has a significant (and positive) influence for three (four) of the indices on the scheduled announcement days.

Furthermore, in order to address the robustness of our findings, we investigated different return windows. We found that the ECB's influence fluctuates randomly over time and remains insignificant for the various return windows. Firstly, this confirms the robustness of our findings. Secondly, Brusa et al., (2017) and Lucca and Moench (2015), argues that the FOMC's announcement effect is increasing over time and roughly doubling in the recent years. The Fed's increasing influence over time does not translate to the ECB. Hence, ECB's influence does not grow enough over time to achieve a significant impact on stock markets in Europe. However, even though the ECB's influence shifts quite randomly and remains insignificant, we observe a weak trend of increased impact on stock markets in Europe.

According to Mishkin (2009) and Savor and Wilson (2013), investors are more affected by monetary policy decisions in periods of financial distress. Therefore, we investigated the ECB's announcement effect during the financial crises, more specifically from January 2007 through August 2008 (Erkens et al., 2012), in order to see if this holds for the ECB. In this return window, we identified that the FTSE 100 had the most negative annually excess return at -3.57% with an insignificant t-value of -0.3811. Hence, the ECB's influence during the financial crises did not increase.

However, when only considering the year 2008, the ECB has a negative and significant influence at the 10% level for FTSE 100 on announcement days with a corresponding t-value of 1.73 (Appendix 6). From the beginning of 2008, the stock markets were decreasing rapidly, and this decreasing trend got further momentum after the crash of the Lehman Brothers on September 15th, 2008. As a result, indices collapsed, and the ECB's announcement effect became negatively significant. Hence, we cannot state that the ECB's influence did increase during the financial crises. Nevertheless, during times of financial distress the ECB's announcement effect has increased.

Lastly, we extended the sample on previous studies regarding the Fed's influence on scheduled announcement days in Europe with the newest possible data. We can confirm that earlier conclusions by Savor and Wilson (2013) and Lucca and Moench (2015) concerning the Fed's significant announcement effect in Europe still holds. Our findings are statistically significant for every index in this study, except for FTSE 100. Thus, we conclude that the Fed mainly has a significant announcement effect in Europe. These findings are not sensitive to outliers. Two plausible explanations of these results can be that European multinational corporations are heavily exposed to the U.S economy or that the Fed has more frequently announced good news than the ECB (Brusa et al., 2017).

7.0 Concluding remarks

This study concludes that the ECB's announcement effect on stock markets in Europe is not statistically significant and that these findings are robust and not sensitive to outliers. Henceforth, H1: The ECB has a significant announcement effect in Europe, does not hold. However, four days before scheduled announcement days stock markets in Europe yields statistically negative results for the investigated indices. The underlying reasons for this effect are not investigated further in this paper due to the scope of our thesis. However, we encourage future researchers to further look into this finding.

The ECB's scheduled announcement effect during the financial crises does not become more influential for markets in Europe. The ECB's announcement effect in the financial crises is very similar to every return window in this study. On the other hand, stock markets in Europe were significantly affected by the FOMC's announcement effect during the same return window. Hence, H2: The ECB's announcement effect is increasing in times of financial distress, does not hold according to this return window.

Nevertheless, in 2008, the ECB's announcement effect was negative and significant at the 10% level. Therefore, during times of recession for financial markets, the ECB's announcement effect must be considered by investors.

Furthermore, the ECB's insignificant announcement effect does not become significant over time. Many scholars have concluded that the FOMC's announcement effect is increasing rapidly over time. Be that as it may, this does not hold for the ECB, their announcement effect shifts very randomly over the years and always remains insignificant, except in 2008. Thus, H3: The ECB's announcement effect is increasing over time, does not hold.

We argue that the Fed still has a great impact in Europe on scheduled announcement days. The FOMC's announcement effect significantly affects three out of four indices, and outliers do not influence these findings. In the end, we conclude that the FOMC's announcement effect is unique for stock markets in

Europe and that the ECB's influence is not comparable. Hence, we support Brusa et al., (2017) statement regarding the Fed: "One central bank to rule them all."

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Appendix

Appendix 1

ECB announcement days

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04.03.1999	05.01.2000	04.01.2001	03.01.2002	09.01.2003	08.01.2004	13.01.2005	12.01.2006	11.01.2007	10.01.2008	05.01.2009	14.01.2010	13.01.2011	12.01.2012	10.01.2013	09.01.2014	22.01.2015	21.01.2016	19.01.2017	25.01.2018
18.03.1999	20.01.2000	18.01.2001	07.02.2002	06.02.2003	05.02.2004	03.02.2005	02.02.2006	08.02.2007	07.02.2008	05.02.2009	04.02.2010	03.02.2011	09.02.2012	07.02.2013	06.02.2014	05.03.2015	10.03.2016	09.03.2017	08.03.2018
08.04.1999	03.02.2000	01.02.2001	07.03.2002	06.03.2003	04.03.2004	03.03.2005	02.03.2006	08.03.2007	06.03.2008	05.03.2009	04.03.2010	03.03.2011	08.03.2012	07.03.2013	06.03.2014	15.04.2015	21.04.2016	27.04.2017	26.04.2018
22.04.1999	17.01.2000	15.02.2001	04.04.2002	03.04.2003	01.04.2004	07.04.2005	06.04.2006	12.04.2007	10.04.2008	02.04.2009	08.04.2010	07.04.2011	04.04.2012	04.04.2013	03.04.2014	03.06.2015	02.06.2016	08.06.2017	
06.05.1999	02.03.2000	01.03.2001	02.05.2002	08.05.2003	06.05.2004	04.05.2005	04.05.2006	10.05.2007	08.05.2008	07.05.2009	06.05.2010	05.05.2011	03.05.2012	03.05.2013	08.05.2014	16.07.2015	11.07.2016	20.07.2017	
20.05.1999	16.03.2000	15.03.2001	06.06.2002	05.06.2003	03.06.2004	02.06.2005	08.06.2006	06.06.2007	05.06.2008	04.06.2009	10.06.2010	09.06.2011	06.06.2012	06.06.2013	05.06.2014	03.09.2015	08.09.2016	07.09.2017	
02.06.1999	30.03.2000	29.03.2001	04.07.2002	10.07.2003	01.07.2004	07.07.2005	06.07.2006	05.07.2007	03.07.2008	02.07.2009	08.07.2010	07.07.2011	05.07.2012	04.07.2013	03.07.2014	22.10.2015	21.10.2016	26.10.2017	
17.06.1999	13.04.2000	11.04.2001	01.08.2002	31.07.2003	05.08.2004	04.08.2005	03.08.2006	02.08.2007	07.08.2008	06.08.2009	05.08.2010	04.08.2011	02.08.2012	01.08.2013	07.08.2014	03.12.2015	08.12.2016	14.12.2017	
01.07.1999	27.04.2000	26.04.2001	12.09.2002	04.09.2003	02.09.2004	01.09.2005	31.08.2006	06.09.2007	04.09.2008	03.09.2009	02.09.2010	08.09.2011	06.09.2012	05.09.2013	04.09.2014				
15.07.1999	11.05.2000	10.05.2001	10.10.2002	02.10.2003	07.10.2004	06.10.2005	05.10.2006	04.10.2007	02.10.2008	08.10.2009	07.10.2010	06.10.2011	04.10.2012	02.10.2013	02.10.2014				
29.07.1999	25.05.2000	23.05.2001	07.11.2002	06.11.2003	04.11.2004	03.11.2005	02.11.2006	08.11.2007	08.10.2008	05.11.2009	04.11.2010	03.11.2011	08.11.2012	07.11.2013	06.11.2014				
26.08.1999	08.06.2000	07.06.2001	05.12.2002	04.12.2003	02.12.2004	01.12.2005	07.12.2006	06.12.2007	06.11.2008	03.12.2009	02.12.2010	08.12.2011	06.12.2012	05.12.2013	04.12.2014				
09.09.1999	21.06.2000	21.06.2001			Teleconference			04.12.2008											
23.09.1999	06.07.2000	05.07.2001																	
07.10.1999	20.07.2000	19.07.2001																	
21.10.1999	03.08.2000	02.08.2001																	
04.11.1999	31.08.2000	30.08.2001																	
18.11.1999	14.09.2000	13.09.2001																	
02.12.1999	05.10.2000	17.09.2001																	
15.12.1999	19.10.2000	27.09.2001																	
		02.11.2001	11.10.2001																
		16.11.2000	25.10.2001																
		30.11.2000	08.11.2001																
		14.12.2000	06.12.2001																
			Terror																

Appendix 2

The FED announcement days

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
03.02.1999	02.02.2000	31.01.2001	30.01.2002	29.01.2003	28.01.2004	02.02.2005	31.01.2006	31.01.2007	30.01.2008	28.01.2009	27.01.2010	26.01.2011	25.01.2012	30.01.2013	29.01.2014	28.01.2015	27.01.2016	01.02.2017	31.01.2018
30.03.1999	21.03.2000	20.03.2001	19.03.2002	18.03.2003	15.03.2004	22.03.2005	28.03.2006	21.03.2007	18.03.2008	18.03.2009	16.03.2010	15.03.2011	13.03.2012	20.03.2013	19.03.2014	18.03.2015	16.03.2016	15.03.2017	21.03.2018
18.05.1999	16.05.2000	15.05.2001	07.05.2002	06.05.2003	04.05.2004	03.05.2005	10.05.2006	09.05.2007	30.04.2008	29.04.2009	28.04.2010	27.04.2011	25.04.2012	01.05.2013	30.04.2014	29.04.2015	27.04.2016	03.05.2017	02.05.2018
30.06.1999	28.06.2000	27.06.2001	26.06.2002	25.06.2003	30.06.2004	30.06.2005	29.06.2006	28.06.2007	25.06.2008	24.06.2009	23.06.2010	22.06.2011	20.06.2012	19.06.2013	18.06.2014	17.06.2015	15.06.2016	14.06.2017	
24.08.1999	22.08.2000	21.08.2001	13.08.2002	12.08.2003	10.08.2004	09.08.2005	08.08.2006	07.08.2007	05.08.2008	12.08.2009	10.08.2010	09.08.2011	01.08.2012	31.07.2013	30.07.2014	29.07.2015	27.07.2016	26.07.2017	
05.10.1999	03.10.2000	01.10.2001	24.09.2002	16.09.2003	21.09.2004	20.09.2005	20.09.2006	18.09.2007	16.09.2008	23.09.2009	21.09.2010	21.09.2011	13.09.2012	18.09.2013	17.09.2014	17.09.2015	21.09.2016	20.09.2017	
16.11.1999	15.11.2000	06.11.2001	06.11.2002	28.10.2003	10.11.2004	01.11.2005	25.10.2006	31.10.2007	29.10.2008	04.11.2009	03.11.2010	02.11.2011	24.10.2012	30.10.2013	29.10.2014	28.10.2015	02.11.2016	01.11.2017	
21.12.1999	19.12.2000	11.12.2001	10.12.2002	09.12.2003	14.12.2004	13.12.2005	12.12.2006	11.12.2007	17.12.2008	16.12.2009	14.12.2010	13.12.2011	12.12.2012	18.12.2013	17.12.2014	16.12.2015	14.12.2016	13.12.2017	

Appendix 3

Sensitivity test with ECB announcement days

DAX

	All Observations		Excl. Top/Bottom 1%	
	Announcementdays	All other days	Announcementdays	All other days
Mean	-0,116252 [0,104859]	-0,037841 [0,020561]	-0,092528 [0,093583]	-0,037409 [0,018092]
St. Dev.	1,654651	1,478809	1,461815	1,257021
Skew	-0,529309	-0,06357	-0,505732	-0,224273
Kurtosis	4,914301	7,491659	3,163408	3,659413
Max	5,857803	10,62938	3,054917	3,756583
Min	-7,230224	-9,018527	-4,547185	-4,51523
Obs.	249	4680	244	4587

CAC 40

	All Observations		Excl. Top/Bottom 1%	
	Announcementdays	All other days	Announcementdays	All other days
Mean	-0,09835 [0,101607]	-0,051937 [0,018561]	-0,06743 [0,091956]	-0,051628 [0,016877]
St. Dev.	1,603327	1,427122	1,436405	1,209112
Skew	-0,571571	-0,049184	-0,401929	-0,199519
Kurtosis	4,575393	8,170407	3,22365	3,704074
Max	5,192289	10,42651	3,359978	3,574374
Min	-6,740757	-9,63962	-4,094955	-4,207514
Obs.	249	4711	244	4616

EuroStoxx 50

	All Observations		Excl. Top/Bottom 1%	
	Announcementdays	All other days	Announcementdays	All other days
Mean	-0,074774 [0,103356]	-0,059588 [0,018918]	-0,025914 [0,092123]	-0,059129 [0,017042]
St. Dev.	1,630933	1,445974	1,436061	1,228863
Skew	-0,507561	-0,074071	-0,299543	-0,1718
Kurtosis	4,458528	7,803093	3,0553	3,785299
Max	5,477283	10,26957	3,590128	3,715152
Min	-6,569572	-8,999224	-3,76536	-4,385155
Obs.	249	4731	243	4633

Appendix 4

Robust test.

DAX

Sample Period	1999.01 - 2018.05	1999.01 - 2008.12	2009.01 - 2018.05	2009.01 - 2013.12	2014.01 - 2018.05	2007.01 - 2008.08
Coefficient AD	-0,078411	-0,186188	0,114848	0,026054	0,249735	-0,234698
St. Error.	[0,106080]	[0,141693]	[0,157337]	[0,225432]	[0,199321]	[0,234324]
Coefficient Constant	-0,037841	-0,101385	0,028478	0,03267	0,023749	-0,134569
St. Error.	[0,020561]	[0,031407]	[0,025819]	[0,038964]	[0,033771]	[0,060385]
Annual excess return AD	-1,6081497	-4,3135999	1,57658946	0,70468504	2,42406362	-4,42
Annual excess return NAD	-9,838691	-24,231129	7,24609431	7,93224597	5,80764067	-32,39
Sharpe ratio	-0,26	-0,66	0,30	0,12	0,69	-1,25
Obs.	4929	2540	2389	1274	1115	422
No. of announcements	249	150	99	60	39	20

CAC 40

Sample Period	1999.01 - 2018.05	1999.01 - 2008.12	2009.01 - 2018.05	2009.01 - 2013.12	2014.01 - 2018.05	2007.01 - 2008.08
Coefficient AD	-0,046414	-0,11963	0,09299	-0,010744	0,255539	-0,158838
St. Error.	[0,102817]	[0,132869]	[0,162865]	[0,233276]	[0,204650]	[0,225026]
Coefficient Constant	-0,051937	-0,111779	0,010263	0,003141	0,018262	-0,181801
St. Error.	[0,018561]	[0,027401]	[0,024807]	[0,038232]	[0,031556]	[0,059294]
Annual excess return AD	-1,288908	-3,4711322	1,13578565	-0,0912353	2,42687442	-4,08
Annual excess return NAD	-12,877599	-26,838187	2,63416557	0,76763331	4,51575536	-44,09
Sharpe ratio	-0,23	-0,57	0,21	-0,01	0,67	-1,20
Obs.	4960	2551	2409	1282	1127	425
No. of announcements	249	150	99	60	39	20

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Sample Period	1999.01 - 2018.05	1999.01 - 2008.12	2009.01 - 2018.05	2009.01 - 2013.12	2014.01 - 2018.05	2007.01 - 2008.08
Coefficient AD	-0,015186	-0,095295	0,13373	0,004733	0,33323	-0,168259
St. Error.	[0,104572]	[0,135286]	[0,165020]	[0,236830]	[0,205402]	[0,235621]
Coefficient Constant	-0,059588	-0,117772	0,001032	-0,001473	0,003843	-0,178837
St. Error.	[0,018918]	[0,027772]	[0,025426]	[0,039132]	[0,032362]	[0,057235]
Annual excess return AD	-1,03	-3,2	1,48	0,04	2,99	-4,16
Annual excess return NAD	-15,66	-28,43	0,27	-0,36	0,95	-43,58
Sharpe ratio AD	-0,17	-0,51	0,27	0,01	0,82	-1,17
Obs.	4980	2564	2416	1285	1131	427
No. of announcements	249	150	99	60	39	20

Appendix 5

Sensitivity test with the Fed announcement days

DAX

	All Observations		Excl. Top/Bottom 1%	
	Announcementdays	All other days	Announcementdays	All other days
Mean	0,283045 [0,093958]***	-0,052349 [0,020983]***	0,256754 [0,090792]***	-0,049971 [0,018502]***
St. Dev.	1,169762	1,496222	1,126697	1,271359
Skew	0,067542	-0,092246	-0,157972	-0,246428
Kurtosis	4,805039	7,329305	4,504444	3,617995
Max	4,33191	10,62938	3,756583	3,73951
Min	-3,268291	-9,018526	-3,268291	-4,547185
Obs.	155	4774	154	4677

CAC 40

	All Observations		Excl. Top/Bottom 1%	
	Announcementdays	All other days	Announcementdays	All other days
Mean	0,261821 [0,105794]**	-0,064463 [0,018951]**	0,18284 [0,088476]**	-0,060068 [0,017016]**
St. Dev.	1,317129	1,438992	1,094392	1,224619
Skew	1,617342	-0,125397	-0,164659	-0,215081
Kurtosis	12,75239	7,785468	3,167416	3,693685
Max	8,664673	10,42651	3,22296	3,574374
Min	-2,623501	-9,63962	-2,623501	-4,207514
Obs.	155	4805	153	4707

EuroStoxx 50

	All Observations		Excl. Top/Bottom 1%	
	Announcementdays	All other days	Announcementdays	All other days
Mean	0,23593 [0,096054]**	-0,069865 [0,019356]**	0,176793 [0,087538]**	-0,065062 [0,017336]**
St. Dev.	1,195857	1,46229	1,082779	1,243983
Skew	0,47933	-0,108817	-0,18338	-0,17646
Kurtosis	5,486429	7,576846	3,846044	3,734186
Max	5,288127	10,26957	3,489292	3,715152
Min	-2,85565	-8,999224	-2,85565	-4,385155
Obs.	155	4825	153	4723

Appendix 6.

Robust sample all years FTSE 100

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Coefficient AD	0,486316	-0,043381	0,436095	-0,135540	-0,457388	0,079814	0,014459	-0,251322	0,076415
St. Error.	[0,297343]	[0,295211]	[0,268802]	[0,656404]	[0,388217]	[0,164375]	[0,358611]	[0,257832]	[0,290601]
Coefficient Constant	-0,014257	-0,182767	-0,244766	-0,240995	-0,037753	-0,045859	0,000329	-0,035900	-0,158992
St. Error.	[0,082366]	[0,081012]	[0,098555]	[0,100077]	[0,084737]	[0,042358]	[0,036589]	[0,044699]	[0,066616]
Annual excess return AD	9,44	-5,43	4,40	-4,52	-5,94	0,37	0,18	-3,45	-0,99
Annual excess return NAD	-3,29	-41,67	-56,30	-57,84	-9,10	-11,14	0,08	-8,62	-38,32
Sharpe Ratio	0,02	-0,14	-0,14	-0,14	-0,04	-0,06	0,00	-0,06	-0,14
Obs.	251	252	253	252	253	254	252	252	253
No. Of announcements	20	24	24	12	12	12	12	12	12

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
-0,869586	0,093102	0,074556	0,220965	0,138495	0,010035	-0,130563	0,599725	0,092148	-0,047183	
[0,503788]*	[0,599278]	[0,334522]	[0,433464]	[0,268874]	[0,312247]	[0,300722]	[0,703699]	[0,539186]	[0,186153]	
-0,356015	0,071465	0,026453	-0,060032	0,015897	0,040121	0,018152	-0,015849	0,003406	0,027857	
[0,134728]	[0,09943]	[0,067592]	[0,081386]	[0,048216]	[0,046673]	[0,058375]	[0,083576]	[0,089991]	[0,032441]	
-14,71	1,97	1,21	1,93	1,85	0,60	-1,35	4,67	0,76	-0,15	
-86,16	17,37	6,48	-14,65	3,91	9,83	4,45	-3,95	0,85	6,94	
-0,16	0,05	0,03	-0,04	0,03	0,05	0,14	0,00	0,00	0,05	
254	255	257	256	258	257	257	257	257	257	
12	12	12	12	12	12	12	8	8	8	

Appendix 7

Returns before, on, and after ECB announcement

DAX

	Mean	Std. Error
+5	-0,086634	[0,095477]
+4	-0,277215	[0,089624]***
+3	-0,001241	[0,094356]
+2	-0,137846	[0,100403]
+1	0,008123	[0,101999]
AD	-0,116252	[0,106080]
-1	0,051155	[0,093676]
-2	-0,168585	[0,098757]
-3	0,022711	[0,106598]
-4	0,085485	[0,087481]
-5	0,023562	[0,097303]
$\sum_{t=1}^5$ Announcements	-0,301008	
$\sum_{t=1}^{-5}$ Announcements	0,235222	

CAC 40

	Mean	Std. Error
+5	-0,057621	[0,084806]
+4	-0,340177	[0,082737]***
+3	-0,036509	[0,091850]
+2	-0,166579	[0,100814]
+1	-0,016163	[0,094580]
AD	-0,09835	[0,102817]
-1	-0,015825	[0,087785]
-2	-0,153104	[0,098362]
-3	0,014242	[0,099526]
-4	0,026101	[0,083939]
-5	0,122797	[0,093809]**
$\sum_{i=1}^{+5} \text{Announcements}$	-0,363989	
$\sum_{i=1}^{-5} \text{Announcements}$	0,280579	

EuroStoxx 50

	Mean	Std. Error
+5	-0,127844	[0,089533]
+4	-0,33779	[0,086324]***
+3	-0,002017	[0,093101]
+2	-0,15413	[0,102455]
+1	-0,014162	[0,099265]
AD	-0,074774	[0,104572]
-1	0,021583	[0,085451]
-2	-0,150247	[0,096103]
-3	-0,023708	[0,102988]
-4	0,029034	[0,085925]
-5	0,041915	[0,093995]
$\sum_{i=1}^{+5} \text{Announcements}$	-0,351796	
$\sum_{i=1}^{-5} \text{Announcements}$	0,23191	