



# Exploring the effects of ECBs Unconventional monetary policy announcements on European stock markets

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## Abstract

This paper conducts an event-study analysis to investigate the relationship between unconventional monetary policy announcements by the ECB and corresponding stock returns in the EMU, furthermore, it also postulates a second hypothesis to ascertain whether this relationship differs for firms listed amongst exchanges in Northern region of the EU name Germany, France and The Netherlands with their Southern Counterparts in the EMU, namely Italy, Portugal and Spain between 2006 and 2015. 10-year Government bond yields for Italy and Germany are used to calculate the surprise coefficient, while the returns are calculated from the return's indices of the firms on the CAC, PSI, IBEX, DAX, AEX, and MIB30. The significance of the variations of the Returns are tested with Wilcoxon and GRANK tests (Non-Parametric) for AARs and CAARs respectively. The results suggest that there is a relationship between an unconventional monetary policy announcement and stock returns. The results also indicate that this relationship differs for Northern and Southern European firms. The Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CAARs) indicate opposite movement of stock returns in most cases. Finally, an event study analysis is also conducted on 6 portfolios of Europe wide firms segregated through an intersection of firm size and market capitalisation, the results of which do not show enough evidence to claim substantive inference.

**Key Words:** Event-study, Unconventional monetary policy, Average Abnormal Returns, Cumulative Average Abnormal Return, Wilcoxon, GRANK, Non-Parametric test

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## Resumo

Este artigo conduz uma análise de estudo de evento para investigar a relação entre anúncios de política monetária não convencionais do BCE e retornos de ações correspondentes na UEM. Além disso, postula uma segunda hipótese para verificar se essa relação difere para as empresas listadas nas bolsas de valores. Região norte do nome da UE Alemanha, França e Países Baixos, com suas contrapartes do sul na UEM, nomeadamente Itália, Portugal e Espanha entre 2006 e 2015. Os rendimentos dos títulos do governo a 10 anos para Itália e Alemanha são usados para calcular o coeficiente de surpresa, enquanto os retornos são calculados a partir dos índices de retorno das empresas no CAC, PSI, IBEX, DAX, AEX e MIB30. A significância das variações dos retornos é testada com os testes Wilcoxon e GRANK (não paramétricos) para AARs e CAARs, respectivamente. Os resultados sugerem que existe uma relação entre um anúncio de política monetária não convencional e o retorno das ações. Os resultados também indicam que esse relacionamento difere para as empresas do Norte e do sul da Europa. Os retornos anormais médios (AARs) e os retornos anormais médios cumulativos (CAARs) indicam um movimento oposto dos retornos das ações na maioria dos casos. Por fim, também é realizada uma análise de estudo de eventos em 6 carteiras de empresas na Europa, segregadas por uma interseção entre tamanho da empresa e capitalização de mercado, cujos resultados não mostram evidências suficientes para reivindicar inferência substantiva.

**Palavras-chave:** Estudo de evento, Política monetária não convencional, Retornos anormais médios, Retorno anormal médio cumulativo, Financiamento, Método de pagamento

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## **List of Abbreviations**

ECB – European Central Bank

APP – Asset Purchase Program

OMT – Outright Monetary Transactions

GFC – Global Financial Crisis

ELB – Effective Lower Bound

AAR – Average Abnormal Returns

CAAR – Cumulative Average Abnormal Returns

EMU – Economic and Monetary Union

EU – European Union

GRANK – Generalised Rank Test

SMP – Securities Market Program

CSPP – Corporate Sector Purchase Program

PSPP – Public Sector Purchase Program

ABSPP – Asset-backed securities purchase Program

CBPP3 – Third covered bond purchase program

QE – Quantitative Easing

TLTRO – Targeted Long-Term Refinancing Operations

HMM – Historical Mean Model

SIM – Single Index model

MAM – Market adjusted model

# 1. Introduction

In May 2017, Mario Draghi, president of the European Central Bank received severe criticism in the Dutch Parliament for his monetary policies, which were allegedly responsible for, besides other factors, plummeting the savings of Dutch residents (Jonker, 2017). By applying such policies, the ECB not only affected the macro-economic environment, but also the financial environment as financial Intermediaries and other crucial members of the capital markets are highly responsive to changes in monetary policies. It comes as no surprise that the relationship between capital markets and monetary policies have been a topic of investigation since over a decade, amongst many scholars (Thorbecke, 1997, Patelis, 1997, Wang et al., 2015). Notwithstanding, areas of research with respect to the relationship between an unconventional monetary policy and the financial markets, especially stock returns, are under development. Over the course of the decade, the ECB has introduced a variety of UMPs to pull Europe out of their sovereign debt crisis, which had caused immense economic damage to several sub economies with the greater euro area. However, the agendas eventually shifted towards rectifying plummeting growth prospects and a consistently diminishing level of inflation. Ample research has been conducted over the past decade determining the effect of unconventional monetary policies (UMPs) on domestic markets and potential spill overs to global markets, of which opinions regarding UMPs vary significantly. Rogers et al, (2014) states that the euro had appreciated after the initial package of UMPs, while Georgiadis and Gräb (2015) contradict this statement, asserting that the Expanded Asset Purchase (EAP) Programme announced on 22 January 2015, in fact depreciated the Euro momentarily. Furthermore, due to these policies, that had as collateral effect the reduction of yields of the weaker economies within the union, many believe that the current yields of these countries undermine the country risk premium thereby not reflecting the true risk a country might pose with respect to future growth. Amidst this magnitude of pressure, it is of utmost concern to the ECB to ensure that they maintain their credibility as policy makers, with continuous efforts to pull inflation rates in a fairly recessive economic landscape. As we shall discuss the primary purpose of



this dissertation in the following paragraph, highlighting the expectations of banks the capital markets as a whole on the announcement of UMPs might create friction in the movements of such markets. Subsequently, in an environment of populist leadership, concise honest reflections of the EU economic health would only correct the mismatched dynamics of asset pricing. This thesis studies the implications of the monetary policy surprises of the European Central Bank and aims to infer the consequent effect of such activity on European stock markets. The stock markets will reflect both the investing sentiment of the citizens of Europe in terms of the volume of trade and the liquidity of funds available, which have a link to the supply of money that is being affected by such policies. The idea of this study is to see whether the plethora of monetary policies have an effect on economically stronger countries differently than economically weaker countries, and if so. Whether it is difficult to create monetary policies that affect all the sub economies in the union in a homogeneously beneficial way or whether the Economic vision of the European Union has a long way to go before it reaches complete economic stability and finally, if the it was all a big mistake.

This dissertation serves the purpose in making contribution to the literature by exploring the relationship between unconventional monetary policy as announced by the ECB and its effect thereof on stock returns in the Economic and Monetary Union of Europe (Euro area). It will additionally contribute to this research by examining whether an unconventional monetary policy announcement is different in terms of the impact that it has on Southern and Northern European firms. The methodology used in the paper is that of an event study. The results indicate that an unconventional monetary policy surprise announcement has a mixed effect on European stock markets. In addition, the results also offer evidence about the Southern European stock markets/firms responding in a manner that is different from the ones in Northern Europe. The unconventional monetary policy announcements have a strikingly positive influence on the southern EMU stock markets (Portugal, Spain, Italy),

The first section throws light upon the conceptual backdrop and literature review, the second examines the data and methodology, the third section describes the results, and the last section postulates the conclusion.

## 2. Literature Review

In this section the pertinent literature and theory will be discussed, consequently there are two hypotheses that will be formulated.

Unconventional monetary policy measures have been segregated into two distinct sides, that of quantitative easing and credit easing<sup>1</sup> both of which bring about a change in the balance sheet of the central bank. However, many strive to find a suitable definition to summarise such policies, as is claimed that unconventional monetary policies are explained more by what it is not rather than what it is (Joyce et al. 2012). For the purpose of this paper, the unconventional monetary policies identified by Haitsma et al. (2016)<sup>1</sup> have been used (Table 2). It has been argued by Joyce et al. (2012) that prior to and at the brink of the global financial crisis (GFC), monetary policy in major economies had a clear goal, viz. attaining a low and stable inflation by setting the interest rates as per the Taylor- rules. An instance of conventional policy used for overcoming a rapidly growing economy is that the central banks elevate the policy interest rates so as to limit asset price increases, stimulate savings and contain expenditure. However, banks have misused periods of low interest rates by taking on riskier investments (sub-prime lending) and companies have used the inflated value of their long term assets to obtain short term finances causing price instability for the future, The global financial crisis of 2008 is a good example of the above, wherein banks were defaulting and the government could neither restrict banks from increasing cash reserves nor bailout every distressed bank, at a time when interest rates lowered to zero and people were no longer incentivized to pick up new money into the economy. Such aforementioned limitations of conventional monetary policy were cited throughout the crisis and the need for new mechanisms was surging. Thus, the introduction of unorthodox policy measures for overcoming these problems, got coined as unconventional policies. The need for alternate tools for controlling mechanisms of asset pricing had arisen because their policy rates had plummeted to a record low known as the *effective lower bound* (ELB). Drawing from

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<sup>1</sup> See data section for further information

Smaghi's (2009) speech, a common example of an unconventional monetary policy is direct quantitative easing (QE), which essentially postulates that the central bank expands its balance sheet by purchasing financial assets. Often direct QE focuses on buying long-term government bonds anticipating that, along with bond yields, yields on privately issued securities decline and that long-term interest rates drop. The dropping rates in turn will stimulate long-term investments as well as aggregate demand. Amidst the conceptualization and rolling out of such unconventional monetary policy events, it had always been the intention of such measures to be temporary and a one-off introduction in the economy to limit financial stress and ensure price stability during extraordinary market conditions. However, the departure from these policies has still not been realized. Through temporary terminations and additions in new characteristics to these measures, one can question whether the effect of these unorthodox measures has been truly harmonious to the European Economy as a whole.

#### Primary Programs Launched Under ECBs Unconventional Monetary Policy.

1) Securities Markets Program (SMP): The Securities Markets Program was announced by the ECBs Governing council in May 2010. The SMP is the process of purchasing debt securities from specific sovereign issuers by the Euro system from its European counterparts. Unlike the Asset Purchase Program (APP), the purpose SMP was not of pushing in money supply into weaker European economies like Greece but in fact, it was a precursor to the QE programs. The idea was to help these distressed economies by ensuring depth and liquidity in these market segments that were not functioning properly. At a time when the ECB had plummeted rates to a record low, the government bonds of crisis-struck economies were being traded at 200 – 300 BPS above average yields at 4%, when Italian 10-year bonds rose to 6.63% in November 2011.

2) Outright Monetary Transactions (OMT): The ECBs Outright Monetary Transactions (OMT) or bond buying program was announced by Mario Draghi in September 2012. The Primary purpose of this program was for the ECB to buy short-term Government bonds of

countries within the Eurozone that were being speculated to leave the Euro. As a result of this speculation, interest rates on these bonds had shot up, and the ECB wanted to help stabilize this mismatch of risk that they believed was unfairly reflected in the yields demanded by the market on the short-term government securities of these countries. The famous ‘Whatever it takes speech’ by Mario Draghi was a prelude to the OMT program. The program was never activated.

3) Asset Purchase Program (APP): The APP launched by the ECB in mid-2014 was amongst the most popular unconventional monetary policy measure. Aimed at ensure price stability, the ECB bought an assortment of assets ranging from sovereign bonds, corporate bonds, asset backed securities and covered bonds. The APP net purchases terminated at the end of year 2018 but were resumed in November 2019. The different sub-programs launched under the APP (i) Corporate sector purchase program (CSPP), (ii) Public Sector Purchase Program (PSPP), (iii) Asset-backed securities purchase program (ABSPP), (iv) Third covered bond purchase program (CBPP3).

4) Targeted longer-term refinancing Operations (TLTROs): TLTRO’s was a program launched around the same time as the APP. It consisted in the provision of financing to credit institutions, incentivizing credit lending into the real economy by providing a “premia” in case lending exceeded a predefined benchmark, thereby further strengthening monetary policy transmissions. There were three different series of TLTRO measures launched as TLTRO I (2014), TLTRO II (2016) and TLTRO III (2019) respectively.

Table 1, Important Announcement days

ECB Monetary Policy Announcements		
Dates	Event	Program
22-08-2007	Supplementary Long-term Refinancing Operations	LTRO
04-06-2009	Details Covered Bond Purchase Program	CBPP
03-12-2009	Amendments to Long-term Refinancing Operations	LTRO
04-03-2010	Amendments to Long-term Refinancing Operations	LTRO
10-05-2010	Securities Markets Program	SMP
04-08-2011	Securities Markets Program	SMP
06-10-2011	Second Covered Bond Purchase Program	CBPP
08-12-2011	New Long-term Refinancing Operations; Reduced Reserve Ratio; Increased Collateral	LTRO
28-02-2012	Second Long-term Refinancing Operations Results	LTRO
26-07-2012	The 'London Whatever it takes' speech	OMT
02-08-2012	Outright Monetary Transactions	OMT
06-09-2012	Details Outright Monetary Transactions	OMT
22-03-2013	Amendments to Collateral Rules	CSPP
03-07-2014	Details Targeted Longer-term Refinancing Operations	LTRO
09-11-2015	Increase in PSPP issue share limit enlarges purchasable universe	PSPP
05-10-2016	Changes to collateral eligibility criteria and risk control measures for unsecured bonds	ABSPP
15-12-2016	Euro system adjusts purchase process in ABS purchase programme (ABSPP)	ABSPP

One of the primary effects of unconventional monetary policy is concerned with how the valuation of a firm is conducted. As per Ioannidis and Kontonikas (2008), monetary policy affects the stock price by changing components in the discounted cash flow valuation model. As stated in the discounted cash flow model the stock prices are equal to the present value of the future cash flows of a firm. Changing the existing monetary policy can impact this present value in two ways: first, by altering the discount rate, and second, by having an effect on the expected value of the future cash flows. More so, as argued by Ioannidis and Kontonikas (2008) these two components are inter-related, as tightening monetary policy leads to a higher discount rate and lower cash flows as a result of lower future economic activity. An expansive monetary policy on the other hand entails a lower discount rate and higher economic activity. Interestingly the Asset Purchase Program launched by the ECB as mentioned in the above sub section, endorses its commitment to substantiating its mandate by actively using this

measure to address the risks of a low inflation time period thereby reassuring investors a stable inflation rate over the medium – to – long term, of roughly 2%.

An important effect of unconventional monetary policy, which could change stock prices, is a signaling effect. This effect can be separately studied in two sub signaling effects. One occurs after the central bank announces about a specific monetary policy. An example here would be, as per Rogers et al. (2014), the central bank signaling that they will expand asset acquisitions and other programs to drive term premia and risk premia down, after a LSAP (large scale asset purchases) is announced. In addition, it has been argued that a credible signal by itself is enough to drive these yields down because agents anticipate the effects of the purchases. The other effect results from an information asymmetry problem, namely that the central bank having more information about the current and future state of the economy than investors. For example, Haitsma et al. (2016) suggest that in times of a crisis a lowering of the policy rate may signal to investors that future economic conditions are worse than expected. By combining the two signaling effects in his so-called news effect, Bomfim (2003) states that announcements may uncover new information not previously assimilated into asset prices.

In addition, Krishnamurthy and Vissing-Jorgensen (2011) suggest that the signaling effect is a way that QE could influence financial markets. In fact, they propose that signaling is only one of the channels in which QE could affect the financial market. Taken all together there are roughly seven different channels that have been established, viz. the signaling, interest rate, duration risk, liquidity, safety, prepayment risk premium, and default risk channel. The signaling and valuation effect of unconventional monetary policy on stock prices leads to the first hypothesis which postulates that an announcement with respect to unconventional monetary policy has an effect on stock prices. Although, whether the effect is positive or negative is not known as the policy can be either tightening or expanding. If the ECBs asset purchases pushes down rates, one could expect stock prices to rise, however, these announcements could also lead investors to think that the government is taking measures to stabilize government bond yields, thus attracting the attention of investors to safer assets like treasuries, causing a shift of capital from riskier equity markets to safer treasury instruments.

An ECB announcement to purchase assets also indicate a positive future outlook for the country that will lower future expected long-term rates, attracting investors to push more money into equity capital markets.

To formulate our first hypothesis, in relation to the events selected, one can notice from Table 2, that the first (10-05-2010) and third (26-07-2012) events reduced intra euro spreads, indicating a loosening nature of rates, while the second (04-08-2011) event tightens rates within the euro area. On 10-05-2010, Italian 10-year yield fell from 4.3% to 3.9% while German 10-year yield rose from 2.7% to 3% similarly on 26-07-2012, Italian 10-year yield fell from 6% to 5.8% while German 10-year yield rose from 1.3% to 1.4%. However, on 04-08-2011, in contrary to the aforementioned events, Italian 10-year yield rose from 6.09% to 6.3% and German 10-year yield fell from 2.3% to 2%. The change in yields witnessed on the event dates are an indication of the loosening or tightening nature of policies, for the ones reducing intra euro spreads we expect a positive effect on European stock markets, with an expectation of increased inflation and for the event further widening the intra euro spreads we expect a negative effect on stock markets thereby, postulating our first hypothesis.

*Hypothesis 1: An expansionary unconventional monetary policy announcement has a positive signaling effect on stock prices.*

The second hypothesis emerges from the fact that there is a common monetary policy in the European Economic and Monetary Union (EMU), while there is heterogeneity the several countries within the EMU. In addition, Rogers et al. (2014) contend that the ECB policies aim at reducing market fragmentation in the euro area, in particular tightening intra-Eurozone spreads and that monetary policy would have varying effects between Eurozone countries. This is because of the fact that the same monetary policy is operating for countries/regions that are different. These differences are in, amongst others, financial and macro-economic conditions. Thus, the second hypothesis postulates that the effects of an unconventional monetary policy announcement lead to different effects on stock prices across the euro area.

I will group into two regions that share some similarity, namely North Europe and South Europe.

*Hypothesis 2: an unconventional monetary policy announcement results in a negative effect on the returns of North European firms and a positive effect on the returns of South European firms.*

### 3. Data

This section initiates a descriptive discussion about the data used and its relevant treatments and transformation and, subsequently, discusses the research methodology.

The data used in this paper can be ascertained into primarily, two groups; unconventional monetary policy announcements and return indices sets.

The unconventional monetary policy data points are sourced from the paper Haitsma et al. (2016), thereby distinguishing the announcements between conventional and unconventional monetary policies. Obtaining all data from the aforementioned paper and the official website of the ECB<sup>2</sup> results in a list of **nineteen** policy announcements (Table 1). However, as mentioned by Rogers et al. (2014) certain monetary policy announcements had been anticipated by market participants prior to their official announcement, and do not make up for the data used in our event study analysis and is therefore, omitted.

According to the efficient market hypothesis, equity markets that are efficient, must reflect all expected policy changes in their stock prices efficiently. Thus, it is inferred that only unexpected policy announcements shall affect stock prices. This paper follows the approach suggested by Rogers et al. (2014) to calculate a surprise coefficient for measuring the magnitude of discrepancies in prices during a monetary policy announcement. It is built on

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<sup>2</sup> <https://www.ecb.europa.eu/press/pr/html/index.en.html>



the concept that the ECB aims to narrow intra euro spreads. Therefore, if there is a change in the spreads on the day of a policy announcement, either increasing or decreasing, one could infer that the policy was respectively tighter or looser than expected. The following formula established in the paper Haitsma et al. (2016) has been used to find a surprise coefficient<sup>3</sup>, which is a proxy established to calculate the change in daily spreads using ten year Germany and Italian Government bond yields, basing it on the implicit objective to tighten intra-euro spreads. The surprise coefficient, thus, is measured as the daily change in the spread between Italian and German yields, i.e.:

$$\Delta y_t^{u,c} = (y_{s,t}^I - y_{s,t}^G) - (y_{s,t-1}^I - y_{s,t-1}^G) \quad (1)$$

Where  $y_{s,t}^I$  and  $y_{s,t}^G$  are the Italian and German ten-year government bond yields at day t. Rogers et al. (2014) state that, from a general perspective the magnitude of change in the bond yields after a policy announcement, reveals how well the market participants expected this announcement. Debating the fact that EMU countries could react differently on monetary policies, e.g. Rogers et al. (2014) explain that “actions that succeed in lowering sovereign spreads tended to drive German yields up”, alternatively drive Italians yield down. A formula consisting of more than one yield is necessary to ascertain the surprise coefficient for the Eurozone. Our methodology suggests that most unconventional monetary policy announcements are almost entirely anticipated by the financial market. Therefore, all policy announcements that have involved announcing a new program are used for the analysis.

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<sup>3</sup> See appendix A, table 1 for surprise coefficients

As a result, three policy announcements remain. Table 2 presents the relevant information

Table 2, Selected Event Dates

Date	Surprise Coefficient	Short Description
10-05-2010	-50%	Securities market program
04-08-2011	19%	Long-term refinancing program.
26-07-2012	-43%	The 'London whatever it takes' speech

The sign of the surprise Coefficient determines the loosening or tightening nature of the policy announcements, such that a negative surprise coefficient indicates the loosening nature of rates as intra euro spreads narrow down, while positive surprise coefficients depict tightening policy announcements as the spread widens.

The second cluster of data contains the continuous returns of the firms used to measure the response of an unconventional monetary policy announcement. The dataset used for the analysis consists of the total return indices between 2006 and 2017 for firms listed on a select set of equity Indices, which include: CAC, IBEX, DAX, AEX, and MIB30, and the Eurostoxx 50 total return index. This is done keeping in mind to take a proxy of the economy to bifurcate the Northern part of the Core EU and its southern counterpart. The raw data has been sourced from **DataStream**. Certain firms with missing observations, either due to removal from indexes or late IPOs or bankruptcy's amongst other reasons have not been included, consequently, 138 firms remain. Subsequently, Daily returns are calculated from the total return indices through the following formula.

$$r_t = \frac{TR_t - TR_{t-1}}{TR_{t-1}} * 100 \quad (2)$$

Wherein,  $r_t$  represents the percentage return while  $TR_t$  shows the total return index, both at day  $t$  respectively. The returns are categorised into three sets, (i) demonstrating the entire EMU, including observations from the Indices representative of France, Spain, Germany, Italy, and the Netherlands, and its relevant composite (ii) representing the Northern EMU, including observations from Netherlands and Germany, and, finally, (iii) representing the Southern EMU, with observations from Portugal, Italy and Spain. In conclusion to this section, there are four possible unconventional monetary policy announcements post sample correction in line with primary literature along with three samples of European stock returns categorised under geographical borders. Appendix A presents tables (2-10) with descriptive statistics for the stock returns. Finally, a third dataset containing 6 portfolios segregated on the basis of market capitalisation and investment is used to analyse whether the events have an effect on securities subject to its size. The data has been sourced from the Kenneth French database. Each portfolio consists of European exchange listed companies that fall under similar size brackets.

## 4. Research Methodology

The paper conducts an event study methodology in order to analyse the signalling effect of monetary policy announcement shocks on stock markets.

The format of an event study analysis has been a preferred technique in research with respect to the relationships between monetary policies and capital markets for over several decades, among others by Thorbecke (1997), Prabu et al. (2016), and Ricci (2015). In a midst of the several methodologies established, many have analysed the effect of Monetary policy shocks on cumulative abnormal returns as a whole with corresponding estimation windows, while others have employed an impulse response analysis to measure coefficients by using a dummy variable of ‘1’ on the day of such unconventional monetary policy announcements. Papers have used the event study method in isolation or in amalgamation with other methods in a way different from each other and/or in different kinds of research, largely these research papers have used the market model to calculate expected returns.

### 4.1 Calculating Abnormal Returns

The estimation of expected returns can be carried out through more than one way. The two popular methods that are applied is the historical mean model (HMM) and the CAPM or single index model (SIM).

$$E(r_{(i,t)}) = \mu_i \quad (3)$$

$$E(r_{(i,t)}) = \alpha_i + \beta_i R_{(m,t)} \quad (4)$$

With respect to the former (see Eq. 3), the mean of an assets historical return over the selected estimation window represents the expected return (*unconditioned to the event*). Conversely, the latter represents the CAPM or the single index model (see Eq. 4), where the expected

return depends on the parameters  $\alpha_i$  and  $\beta_i$  (explained in the next paragraph) estimated over the estimation windows, and the market return  $R_{(m,t)}$ . A special case of this model is the market adjusted model (MAM), wherein a constraint (0 and 1) is set on the estimated parameters  $\alpha_i$  and  $\beta_i$  respectively, to return a purer effect of the market. Furthermore, to improve the observations in quantifying the variation of the error term which is the abnormal return (AR) in our case of an event study, scholars have used the 3 factor Fama-French model (1993) in order to better estimate the deviations. Consequently, this paper, in line with popular literature, will use the market model. The market model calculates the relation between the expected return of an individual security and that of the market using the above formula (see Eq. 4), where  $\alpha_i$  is the ‘alpha’ of a security that is the abnormal return unexplainable by the market while the  $\beta_i$  is the return explained by the market return as a whole, both which are estimated parameters,  $E(r_i)$  is the expected return and  $r_m$  is the market return, both at day  $t$ . Once expected returns are computed, the paper proceeds to obtain abnormal returns (ARs). However, ARs are used when computing the impact of an event/s on a security for a single day. Since the paper aims to observe the effect on a combination of days as mentioned above while determining the event window, hence calculating a time series aggregation. The ARs and CARs are obtained by the following formulae as described by equations (5) & (6).

$$AR_{i,t} = R_{(i,t)} - E_{(r(i,t))} \quad (5)$$

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^t AR_{(i,t)} \quad (6)$$

The next element to the analysis builds on the previous section pertaining to the nature of our data. When dealing with panel data like the one present in our paper, both time series and cross-sectional data have to be accurately reflected in our analysis. The aforementioned equations (5) and (6) take care of the time series nature of our observations. However, since

we are also dealing with a pool of firms here, on a bottom – top approach the results need to reflect an aggregation of the time series on the chosen datasets, thus consolidating the results into Average Abnormal Returns and Cumulative Average Abnormal Returns, which are obtained by the following formulae.

$$AAR_t = 1/N (\sum_{i=1}^N AR_{(i,t)}) \quad (7)$$

$$CAAR(t_1, t_2) = \sum_{t=t_1}^T AAR_t \quad (8)$$

Where  $AR_{(i,t)}$  represents the abnormal return estimated on the i-th security and N the securities' population. In the words of Kothari and Warner (2008), the cross-sectional aggregation of abnormal returns makes sense if one aims either at studying if the event alters, on average, the security holders' wealth, or at testing economic models and alternative hypotheses suggesting the sign of the mean impact.

Consistent with Haitsma et al. (2016), the Eurostoxx 50 index has been used as a proxy for the market to estimate the market return. The estimation window used for this analysis is set at twelve, three and one month, while the event window makes use of several combinations at three days with the event dates in the middle ( $t_{-1}$ ,  $t$ ,  $t_{+1}$ ). The lengths selected for the estimation and event window are comparable with the estimation window of Haitsma et al. (2016) and the event window of Prabu et al. (2016).

## 4.2 Statistical Characteristics of Abnormal Returns

Testing for the statistical significance to provide a robustness to the results obtained through our analysis is not as straightforward. As per statistical principle it is mandatory to test for the variance calculated in the event study, thereby, verifying if the square of the Abnormal Returns ( $AR^2$ ) is significantly different from zero.

The literature researched offers two types of tests to ascertain the significance of the aforementioned variable ( $AR^2$ ). Namely, Parametric and Non-Parametric tests. Parametric tests essentially take the variance to be normally distributed while non-parametric tests are not linked to any strict form distribution. Amongst popular parametric tests like the T-test that are fairly straightforward to conduct, it might not be the most suitable option for verifying the significance for Abnormal Returns in our event study, since it assumes that the dataset possesses no cross-sectional correlation. In our case, the model certainly contains cross-sectional correlation because the event dates are the same for all securities (Event clustering), hence, the model is biased. Moreover, attached to the ‘normality’ property assumption of the distribution, the tests may seriously underperform if the distributions are not normal.

By relying on no specific distribution in the returns generated in our analysis, we use the non-parametric Wilcoxon test that checks for the statistical significance of AARs solving the event clustering issue of the magnitude in the variance (ARs), while the generalized rank test (GRANK) outperforms the parametric ones without suffering either from the serial correlation of ARs or from the event-induced volatility in calculating the (CAARs). The GRANK test is, especially, useful as Kolari and Pynnonen (2011) specifically argue that the generalized rank t-test statistic is more robust, when event days are clustered. Therefore, the Wilcoxon test is used for estimating significance levels of the AARs (T-1, T0 & T+1) and CAAR3.

The Wilcoxon rank test can be regarded as an extension of the GSIGN test, since it considers both the sign and the magnitude of abnormal returns. This test assumes that none of the absolute values are equal and are non-zero.

$$W_t = \sum_{i=1}^N \text{rank} (A_{i,t}) \quad (9)$$

where  $\text{rank} (A_{i,t})$  is the positive rank of the absolute value of abnormal returns  $A_{i,t}$  at time point  $t$  for firm  $i$ . The test statistic for testing ( $H_0: AAR=0$ ) is then defined as

$$Z_{\text{wilcoxon},t} = \frac{W - N(N-1)/4}{(N(N+1)(2N+1)/12)} \quad (10)$$

In the case for testing the cumulative averaged abnormal return ( $H_0: CAAR=0$ ), we add the CAAR value for each firm  $i$  to the abnormal returns in the event window and do the same calculations as for AAR.



## 5. Results

This section will summarise and discuss the results obtained in order of the hypothesis.

### 5.1 Hypothesis 1

The first hypothesis strives to ascertain whether an unconventional monetary policy announcement has a positive signalling effect on stock returns, furthermore, if that effect is positive for the first and third event, since pushing more money into the economy and the loosening nature of the policies should surge financial and economic growth. Additionally, we expect a negative effect on stock markets for the second event, because intra-Euro spreads had widened on the event day (04-08-2011). The following Tables 3 and 4 exhibit the average abnormal returns (AARs) along with the 3-day cumulative average abnormal return (CAAR3) with an estimation window of three months and twelve months respectively, to verify if the hypothesis holds true. The tables show the AARs and CAARs of the event days, and shows whether the returns are significantly different from zero by using a Wilcoxon ranking test.

As mentioned in the Data section of this paper, one amongst the 3 events had to be dropped for the 12-month analysis, since the event was lying within the estimation period of an event with a significantly higher surprise coefficient.

Table 3, AARs and CAARs 3 month's estimation window using Wilcoxon-ranking test.

Event date	AAR at T-1	AAR at T0	AAR at T+1	CAAR3
10-05-2010	-0.46%	-0.21%***	0.48%***	-0.19%*
04-08-2011	-0.22%*	-0.49%***	-0.06%***	-0.78%**
26-07-2012	0,08%**	-0.11%***	0.15%**	0.12%***

Significance at 10%\*, at 5%\*\* and at 1%\*\*\*

Table 4, AARs and CAARs 12 month's estimation window using Wilcoxon-ranking test.

Event date	AAR at T-1	AAR at T0	AAR at T+1	CAAR3
10-05-2010	0.31%***	-0.46%***	0.54%***	-0.23%***
26-07-2012	0.12%***	0.04%***	0.23%***	0.39%***

Significance at 10%\*, at 5%\*\* and at 1%\*\*\*

It is evident from the aforementioned tables that the returns on the day of the event ( $T_0$ ) along with the day after the event ( $T_1$ ) are both different from zero, as the average abnormal returns for the corresponding dates are almost all significant at the 1% level. The three day Cumulative average abnormal returns are almost all significant at the 1% level as well. The day before the event date ( $T-1$ ) indicates that they are not significantly different than zero with the exception of the event on 26/07/2012, which showed a significant surge in returns on the EU as a whole. On the day of the event ( $T_0$ ) all AARs plummeted except one on the 26-07-2012 at the 3 month estimation window. One thing we are certain about is that the tables are not biased on the basis of cross-sectional correlation due to event clustering, since we have used the Wilcoxon and GRANK tests to determine the significance in the variations of the abnormal returns. Consequently, there seems to be no explicitly intuitive pattern that is unambiguously observed from Tables 3 and 4. Despite these differences, the abnormal returns for the event date are still significantly different from zero, for the announcements on 10-05-2010 and 04-08-2011 the returns were lower than the market expected and for 26-07-2012 the returns were higher.

In accordance with our expectation from the first hypothesis, two out of three results stand in line with our expectations. Event two shows a significant drop in the European stock markets with a 224 BPS surge in the Italian 10-year yield, causing the market to drop by -0.21%. Event three although showing a slight drop of -0.11% on  $T_0$  in the 3-month estimation window, turns upwards on the following day resulting in a net positive CAAR3, which is also in line with the expectations of this dissertation. In the 12-month estimation window all AARs for the third event 26-07-2012 are positive, conclusive with an upward movement in the German 10-year yield by 100 BPS, while Italian 10-year yields dropped by 300 BPS. Both of these events are indicative of a successful UMP announcement transmitted through the signalling channel into financial markets. However, the only counter intuitive result lies in the first event held on 10-05-2010, where a 352 BPS drop in Italian 10-year yield and a 200 BPS surge in German 10-year yield did not influence the European stock market to surge on  $T_0$  but it picked up pace on the following day ( $T_1$ ), exhibiting a positive effect. It is important

to note that this was the first SMP program launched. It is also important to notice that on the day after the announcement T1, it was the event with the sharpest turn in markets from day T0 to T1, with a surge of 0.27%. Also as observed on a longer event horizon of 5 days, a CAAR5 shows a significant positive return in the stock markets thus falling in line with our expectations. However, no conclusive evidence is found for the drop in European stock markets on the announcement day of event 1. One reason for the event 1 to show negative returns is the fact that the euro area markets are largely skewed to the norther EMU firms with respect to the listing on the composite index (EUROSTOXXX50), but since value weighted returns were constructed, we miss the results of an equally weighted dataset.

Therefore, due to the fact that the stock returns reacted after an announcement but not exactly as per expectation, hypothesis 1 partially holds.

The 26-07-2012 event has gone down as a cornerstone event in the history of unconventional monetary policy announcements, with Mario Draghis speech in London, it could justify the counter intuitive surge on the event day. Since the event on 26-07-2012 was a speech carefully curated for the citizens of the EU discussing the power of unconventional monetary policies to secure a brighter future for the nation. The market response is best explained by a signalling effect since no particular monetary policy was discussed, although it was at the brink of the OMT program announcement, which was followed months later. The second hypothesis may shine some light into the reasons for this differences. In summary, an unconventional monetary policy announcement does not only affect future macro-economic conditions and consequently the medium to long term capital market, but also the immediate state of the capital market and potentially the money market as well.

## 5.2 Hypothesis 2

Hypothesis 1 gave us an indication of the market expectation as a whole, however, the market index used for the analysis of the first hypothesis includes firms across the euro area that react differently in lieu of its geography. As established in the above section of the dissertation, pools of sub-economies within the EMU react differently to policy announcements, in the event of varying country risk rates amongst member states, hypothesis 2 breaks down the source of the equity returns generated within the EMU.

The second hypothesis argues that a geographical bifurcation of the EU into firms within the Northern EMU and the Southern EMU, might show results that indicate a reaction within the stock markets that are different than one another. The argument backed by literature justifying this hypothesis is that of the European monetary policies focusing on narrowing intra-Eurozone spreads and that macro-economic conditions and/or business cycles differ between the two regions. Both capital markets cannot move in the same direction, thereby causing dissonance within the member states. Tables 5 and 6 present the AARs and CAARs for the Northern states of the EMU, namely Germany and the Netherlands, while tables 7 and 8 present the AARs and CAARs for the Southern part, Portugal, Italy and Spain.

Table 5, Northern EMU, AARs and CAARs three months estimation window using Wilcoxon-ranking test.

Event date	AAR at T-1	AAR at T0	AAR at T+1	CAAR3
10-05-2010	-0.51%***	-1.86%***	0.95%***	-1.42%***
04-08-2011	-0.48%***	-1.89%***	0,51%**	-1.86%**
26-07-2012	0.33%	-1.13%***	-0.26%***	-1.06%***

Significance at 10%\*, at 5%\*\* and at 1%\*\*\*

Table 6, Northern EMU, AARs and CAARs three months estimation window using Wilcoxon-ranking test.

Event date	AAR at T-1	AAR at T0	AAR at T+1	CAAR3
10-05-2010	-0.09%***	-2.83%***	1.06%***	-1.85%***
26-07-2012	0.34%***	-1.07%***	-0.22%***	-0.95%***

Significance at 10%\*, at 5%\*\* and at 1%\*\*\*

Table 7, Southern EMU, AARs and CAARs three months estimation window using Wilcoxon-ranking test.

Event date	AAR at T-1	AAR at T0	AAR at T+1	CAAR3
10-05-2010	-0.07%***	0.60%***	-0.32%	0.21%**
04-08-2011	-0.31%***	-1.54%***	0.55%***	-0.68%***
26-07-2012	0.31%***	2.27%***	0.06%***	2.64%***

Significance at 10%\*, at 5%\*\* and at 1%\*\*\*

Table 8, Southern EMU, AARs and CAARs three months estimation window using Wilcoxon-ranking test.

Event date	AAR at T-1	AAR at T0	AAR at T+1	CAAR3
10-05-2010	-0.02%***	1.18%***	-0.81%***	0.35%***
26-07-2012	0.27%***	2.37%***	0.08%***	2.71%***

Significance at 10%\*, at 5%\*\* and at 1%\*

These tables indicate a plethora of observations, amongst which one can notice that firms comprising the Southern members of the EMU react strikingly better than its northern counterparts with immediate impact on announcement day, on average. Consistent with previous research and our proposed assumption, differing movements can be observed in the regional analysis conducted. Before beginning a comprehensive summary of the analysis, to further finalize and verify our results of the second hypothesis, a two-sample t-test is conducted. This provides clearer evidence as to the differences in the abnormal returns post policy announcements, within the bifurcated regional samples used. As is common in the two-sample t-test the assumption that there is no correlation between the two sub-samples holds. As a consequence, the t-values might be underestimated. Table 9 and 10 provide the results of the two-sample t-test assuming the null hypothesis that the firms in the two sub-samples do not react differently on the policy announcement.

Table 9, two sample t-test north versus south (3 months estimation window, 99 degrees of freedom)

Event date	AAR at T-1	AAR at T0	AAR at T+1
10-05-2010	-3.67***	-04.15***	3.52%***
04-08-2011	-4.32%***	-3.26%***	01.31%
26-07-2012	0.08	-3.49%***	-1.01

Significance at 10%\*, at 5%\*\* and at 1%\*\*\*



Table 10, two sample t-test north versus south (12 months estimation window, 99 degrees of freedom)

Event date	AAR at T-1	AAR at T0	AAR at T+1
10-05-2010	-0.96%	-3.26%***	-1.32
26-07-2012	-3.75%***	-2.36%**	-0.96

Significance at 10%\*, at 5%\*\* and at 1%\*\*\*

For event day ( $T_0$ ), all observations are significantly different from zero at the 5% level at the least, while for the day before or after the event it is marginally less consistent. The results largely fall in line with the expectations indicating a movement similar to changes in yields of respective economies, the northern EMU stock markets fell although the Euro area as a whole ended on a high. This was indicative of the fact that German 10-year yields rose to an average of 5%. The results indicate that northern and southern EMU move in line with the movement of the country specific yields. The southern EMU benefitted from most announcements, with the exception of event 2 (04-08-2011) which shows southern firms reacting in same direction to that of northern firms, one plausible explanation could be the Securities market program announced on the day had the ‘no bail out clause’. With the ongoing discord with Greece and its depleting economy, it might have driven money out of the stock market momentarily. However, these events occurred in the peak of the sovereign debt crisis and the effects were largely in line with issues associated with it. Fear of a debt-

ridden economy in the future is also a bearish perspective to a sector of influential speculators that exist within financial intermediaries.

This paradoxical movement could occur as a consequence of the primary agenda in the ECB to narrow intra euro zone spreads. This effect though seemingly reduces money supply within the stock markets of the northern firms, the result of such policies has been strengthening the weaker economies manifold. One could propose that the ECB deliberately announced policies with different effects for Northern and Southern markets focusing on intra-Eurozone variables. Another explanation for the difference is that the two regions have different macro-economic conditions and business cycles and consequently react differently on an unconventional monetary policy.

In a midst of these results, it would be interesting to conduct an industry wide analysis to further ascertain if contrasting results are not so much to do with geographical boundaries but more to do with the nature of each firm's business. Unfortunately, unavailable data prohibits diving into an industry wide analysis, however, this paper conducts a third analysis wherein all European firms are divided into 6 portfolios categorized on a metric distributed through size and market capitalization. The goal is to spot a mild effect into the investor mindset, in capacity of the hypothesis, if smaller firms react differently to larger significant firms as a whole. This removes the geographical quotient and concentrates on general consensus of investor decision making during these unconventional monetary policy announcements. The data for this analysis has been sourced from the Kenneth French database. Table 11 and 12 indicate the results of the analysis conducted with an estimation window of 12 months with the two events consistent throughout the analysis in this paper. The data is cleaned on STATA, with 2 metrics for the size and three metrics for the market capitalization. The Portfolios are divided into 6 groups, namely: (1) SMALLloINV, (2) SMALLmedINV, (3) SMALLhiINV, (4) BIGliINV, (5) BIGmedINV, (6) BIGhiINV. The SMALL and BIG denoting the size of the firms while the INV denotes the Market Capitalization of the firms divided into low, medium and high (lo, med, hi). These portfolios are made with a 2\*3 matrix, of value weighted stocks wherein the 6 portfolios are divided into two sizes Small and Big,

and the investments by the firms are divided into 3 parts denoting the bottom 30%, middle 40% and top 30%.

Table 11, 6 portfolios through size and market Capitalization. (Using Wilcoxon test)

10-05-2010	-1	0	1
SMALL-lo-INV	-0.16%	-1.21%	-0.84%
SMALL-med-INV	0.10%	-1.46%**	-0.49%
SMALL-hi-INV	0.30%	-2.31%***	0.07%
BIG-lo-INV	1.15%*	-3.12%***	0.10%
BIG-med-INV	1.62%**	-2.36%***	0.06%
BIG-hi-INV	1.29%*	-3.00%***	0.04%

Table 12, 6 portfolios through size and market Capitalization. (Using Wilcoxon test)

04-08-2011	-1	0	1
SMALL-lo-INV	0.08%	-1.93%***	-2.20%**
SMALL-med-INV	-0.32%	-2.10%***	-2.32%**
SMALL-hi-INV	-0.72%	-2.63%***	-3.14%***
BIG-lo-INV	0.84%	-0.83%	-0.38%
BIG-med-INV	0.45%	-1.54%**	-0.86%
BIG-hi-INV	0.19%	-1.85%***	-1.53%

Though not much can be claimed from this analysis, one can observe that on the day of the event ( $T_0$ ), most of the portfolio returns on  $T_0$  for the portfolios are negative and significant, it is to be noted that the portfolios were made up of firms situated largely in the Northern EMU region. The results suggest that unconventional policy announcement surprises have a weak significant influence on the portfolios and there is no clear pattern observed in the magnitude of the coefficient estimations. This result is in line with the portfolio wide analysis conducted in Haitsma et. al (2015), wherein a suitable connection between the results linking it to a credit channel is difficult.

## **6. Conclusion and Future Research**

The objective of this paper has been to study the effect that an unconventional monetary policy announcement has on equity stock returns, consequently, test the effect on two subsets of firms categorised on its geography (Northern and Southern firms within the Economic and Monetary Union of Europe). For the purpose of this analysis, an event study methodology had been constructed with assistance from a combination of previous research and literature, and subsequently put to test, which resulted in an output justifying the first hypothesis. Proceeding with the first result that was in consistency with several other papers including those of Haitsma et al. (2016) and Rigobon and Sack (2004), this dissertation further tests for the second finding to ascertain a differential relationship between northern and southern firms within the European market. The first finding dictates that unconventional monetary policy announcements effects have an immediate effect on stock markets through the transmission of the signalling and valuation channel. The second finding dictates that the working of these unconventional monetary policies works in a manner as to assert different effects for different sub-economies within the union. It is backed up by the fact that the ECB policy contributed to reduce intra euro spreads, which have different effects on the northern and southern

economy respectively. However, these effects can also be contributed to differences in financial and macro-economic conditions.

Expansionary policies almost always tend to drive asset prices upwards including equities. We have no reason to believe otherwise and test for the effect of unconventional expansionary monetary policies on equity prices. The major observation leads to believe that stock markets react almost immediately to policy announcements, however, some policies pushed down equity markets on the day of the announcement, but eventually corrected themselves to market averages. In relation to yields, from 2012-2015 as and when falling German yields resulted in selloffs, the increased supply reduced prices and pushed yields back up again in this cycle. Thus, one cannot conclude with certainty if the total effect of these policies were detrimental to European stock markets, irrespective of the fact that the northern EMU region had reacted negatively on the day of most policy announcements.

In modern day, German equity markets have hit record highs while Italian 10-year yields are touching record lows, showing that unconventional monetary policies have done a good job in stabilising government yields as in their agenda. Another interesting aspect is that with German bunds falling below the zero level for a long time now, the demand for German bonds have not decreased but have increased as a matter of fact. Intuitively, as long as their reserves increase, the demand for German bonds will not decrease, the falling Euro helped Germany to increase exports globally, thereby powering this negative yield state to function with harmony so far. Therefore, plummeting yields can only bring about shocks of downfalls but will tend to hit mean levels in the following days. Another observation that can be made is all markets ended positively on a 5-day CAAR analysis, which reinstates the positive effect of unconventional monetary policy announcements on stock markets.

One could argue that the results achieved might come with its own set of biases. It is argued by Rigobon and Sack (2004) that the used event study methodology is not appropriate for this kind of research, as the assumptions made regarding the event window are too strong. The presence of Macro-economic along with indirect global movements tend to smudge such

shocks. There exist several indirect implications of the various financial instruments traded in and out of Europe. Thus, conducting an event study might not be the most appropriate tool to analyse such a subject, and could be seen as a limitation for this dissertation. However, the criticism of Rigobon and Sack (2004) is on using monetary policy as the event and not the announcement of such policy. Another possible limitation is that this dissertation does not go into the depth of the different kinds of Unconventional Policy programs that have been launched. Several little clauses could have played a role in the market movements, since high volume investors including financial intermediaries like hedge funds and AMCs carefully analyse these programs to extract the forecasted implications of such measures. Consequently, the discovered relationship between the announcements and stock returns could be for a specific kind of unconventional monetary policy. This is especially worrying as only two different kind of announcements were used. However, including more events through a more sound methodology of controlling the announcement effects of one or more policies in the estimation window in future research might rectify for this limitation, such that individual effects are of less influence on the overall conclusions/results. An industry wide research could be conducted in order to see the implications of these unconventional monetary policy announcements on different firms with respect to the nature of their business, thereby trying to establish a credit channel linked to such announcements.

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# Appendix

## Data and Methodology

Table 1, surprise coefficients

<b>Announcement date</b>	<b>surprise coefficient in %</b>
<b>22-08-2007</b>	<b>-1%</b>
<b>23-08-2007</b>	<b>0%</b>
<b>28-03-2008</b>	<b>-2%</b>
<b>04-06-2009</b>	<b>4%</b>
<b>03-12-2009</b>	<b>-1%</b>
<b>04-03-2010</b>	<b>0%</b>
<b>10-05-2010</b>	<b>-50%</b>
<b>03-03-2011</b>	<b>0%</b>
<b>04-08-2011</b>	<b>19%</b>
<b>06-10-2011</b>	<b>-17%</b>
<b>21-12-2011</b>	<b>13%</b>
<b>09-02-2012</b>	<b>-13%</b>
<b>28-02-2012</b>	<b>-5%</b>
<b>26-07-2012</b>	<b>-43%</b>
<b>2-8-2012</b>	<b>41%</b>
<b>06-09-2012</b>	<b>-29%</b>
<b>22-03-2013</b>	<b>-8%</b>
<b>03-07-2014</b>	<b>-3%</b>
<b>22-01-2015</b>	<b>-7%</b>

**Table 2, descriptive statistics, and 1-year estimation window all securities combined**

<b>event date</b>	<b>10-05-2010</b>	<b>04-08-2011</b>
<b>Mean</b>	<b>0,10%</b>	<b>-,02%</b>
<b>Median</b>	<b>0,04%</b>	<b>0,00%</b>
<b>Minimum</b>	<b>-18,00%</b>	<b>-23,69%</b>
<b>Maximum</b>	<b>24,59%</b>	<b>13,50%</b>
<b>Jacques-Bera</b>	<b>2821,10</b>	<b>143,14</b>
<b>Number of observations</b>	<b>36432</b>	<b>36570</b>
<b>Number of observations per security</b>	<b>264</b>	<b>265</b>
<b>Number of securities/firms</b>	<b>138</b>	<b>138</b>

**Table 3, descriptive statistics, and 3-months estimation window all securities combined**

<b>event date</b>	<b>10-05-2010</b>	<b>04-08-2011</b>	<b>26-07-2012</b>
<b>Mean</b>	<b>0,07%</b>	<b>-0,31%</b>	<b>-0,02%</b>
<b>Median</b>	<b>0,00%</b>	<b>-0,23%</b>	<b>0,00%</b>
<b>Minimum</b>	<b>-14,28%</b>	<b>-18,88%</b>	<b>-16,63%</b>
<b>Maximum</b>	<b>24,59%</b>	<b>12,19%</b>	<b>19,88%</b>
<b>Jacques-Bera</b>	<b>4098,18</b>	<b>361,99</b>	<b>250,06</b>
<b>Number of observations</b>	<b>9384</b>	<b>9384</b>	<b>9246</b>
<b>Number of observations per security</b>	<b>68</b>	<b>68</b>	<b>67</b>
<b>Number of securities/firms</b>	<b>138</b>	<b>138</b>	<b>138</b>

**Table 4, descriptive statics, and 1-month estimation window all securities combined**

<b>event date</b>	<b>10-05-2010</b>	<b>04-08-2011</b>	<b>6-10-2011</b>	<b>26-07-2012</b>
<b>Mean</b>	<b>-0,20%</b>	<b>-0,69%</b>	<b>-0,05%</b>	<b>0,09%</b>
<b>Median</b>	<b>-0,31%</b>	<b>-0,55%</b>	<b>-0,09%</b>	<b>0,10%</b>
<b>Minimum</b>	<b>-14,28%</b>	<b>-18,88%</b>	<b>-12,35%</b>	<b>-11,49%</b>
<b>Maximum</b>	<b>24,59%</b>	<b>9,98%</b>	<b>16,89%</b>	<b>19,88%</b>
<b>Jacques-Bera</b>	<b>2545,99</b>	<b>89,93</b>	<b>30,93</b>	<b>143,05</b>
<b>Number of observations</b>	<b>3588</b>	<b>3588</b>	<b>3588</b>	<b>3588</b>
<b>Number of observations per security</b>	<b>26</b>	<b>26</b>	<b>26</b>	<b>26</b>
<b>Number of securities/firms</b>	<b>138</b>	<b>138</b>	<b>138</b>	<b>138</b>

**Table 5, descriptive statistics, 1-year estimation window northern securities**

<b>event date</b>	<b>10-05-2010</b>	<b>04-08-2011</b>
<b>Mean</b>	<b>0,15%</b>	<b>0,00%</b>
<b>Median</b>	<b>0,06%</b>	<b>0,00%</b>
<b>Minimum</b>	<b>-18,00%</b>	<b>-23,69%</b>
<b>Maximum</b>	<b>24,59%</b>	<b>10,14%</b>
<b>Jacques-Bera</b>	<b>1013,37</b>	<b>286,69</b>
<b>Number of observations</b>	<b>13200</b>	<b>13250</b>
<b>Number of observations per security</b>	<b>264</b>	<b>265</b>
<b>Number of securities/firms</b>	<b>50</b>	<b>50</b>

**Table 6, descriptive statistics, 3-months estimation window northern securities**

<b>event date</b>	<b>10-05-2010</b>	<b>04-08-2011</b>	<b>26-07-2012</b>
<b>Mean</b>	<b>0,00%</b>	<b>-0,25%</b>	<b>-0,04%</b>
<b>Median</b>	<b>0,08%</b>	<b>-0,16%</b>	<b>-0,01%</b>
<b>Minimum</b>	<b>-9,07%</b>	<b>-10,80%</b>	<b>-11,47%</b>
<b>Maximum</b>	<b>24,59%</b>	<b>8,79 %</b>	<b>17,02%</b>
<b>Jacques-Bera</b>	<b>563,97</b>	<b>126,87</b>	<b>50,15</b>
<b>Number of observations</b>	<b>3400</b>	<b>3400</b>	<b>3350</b>
<b>Number of observations per security</b>	<b>68</b>	<b>68</b>	<b>67</b>
<b>Number of securities/firms</b>	<b>50</b>	<b>50</b>	<b>50</b>

**Table 7, descriptive statistics, 1-month estimation window northern securities**

<b>event date</b>	<b>10-05-2010</b>	<b>04-08-2011</b>	<b>6-10-2011</b>	<b>26-07-2012</b>
<b>Mean</b>	<b>0,00%</b>	<b>-0,58%</b>	<b>-0,04%</b>	<b>0,25%</b>
<b>Median</b>	<b>-0,16%</b>	<b>-0,42%</b>	<b>-0,16%</b>	<b>0,25%</b>
<b>Minimum</b>	<b>-8,30%</b>	<b>-10,80%</b>	<b>-11,22%</b>	<b>-11,47%</b>
<b>Maximum</b>	<b>24,59%</b>	<b>8,79%</b>	<b>14,50 %</b>	<b>9,30%</b>
<b>Jacques-Bera</b>	<b>501,00</b>	<b>61,17</b>	<b>8,29</b>	<b>0,90</b>
<b>Number of observations</b>	<b>1300</b>	<b>1300</b>	<b>1300</b>	<b>1300</b>
<b>Number of observations per security</b>	<b>26</b>	<b>26</b>	<b>26</b>	<b>26</b>
<b>Number of securities/firms</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>

**Table 8, descriptive statistics, 1-year estimation window southern securities**

<b>event date</b>	<b>10-05-2010</b>	<b>04-08-2011</b>
<b>Mean</b>	<b>0,00%</b>	<b>-0,07%</b>
<b>Median</b>	<b>0,00%</b>	<b>-0,03%</b>
<b>Minimum</b>	<b>-13,41%</b>	<b>-17,36%</b>
<b>Maximum</b>	<b>23,22%</b>	<b>12,19%</b>
<b>Jacques-Bera</b>	<b>1429,60</b>	<b>0,03</b>
<b>Number of observations</b>	<b>13464</b>	<b>13515</b>
<b>Number of observations per security</b>	<b>264</b>	<b>265</b>
<b>Number of securities/firms</b>	<b>51</b>	<b>51</b>

**Table 9, descriptive statistics, 3-months estimation window southern securities**

<b>event date</b>	<b>10-05-2010</b>	<b>04-08-2011</b>	<b>26-07-2012</b>
<b>Mean</b>	<b>0,00%</b>	<b>-0,39%</b>	<b>-0,10%</b>
<b>Median</b>	<b>0,00%</b>	<b>-0,30%</b>	<b>-0,03%</b>
<b>Minimum</b>	<b>-11,62%</b>	<b>-17,36%</b>	<b>-11,35%</b>
<b>Maximum</b>	<b>23,22%</b>	<b>12,19%</b>	<b>19,88%</b>
<b>Jacques-Bera</b>	<b>2224,50</b>	<b>23,35</b>	<b>166,64</b>
<b>Number of observations</b>	<b>3468</b>	<b>3468</b>	<b>3417</b>
<b>Number of observations per security</b>	<b>68</b>	<b>68</b>	<b>67</b>
<b>Number of securities/firms</b>	<b>51</b>	<b>51</b>	<b>51</b>

**Table 10, descriptive statistics, 1-month estimation window southern securities**

<b>event date</b>	<b>10-05-2010</b>	<b>04-08-2011</b>	<b>6-10-2011</b>	<b>26-07-2012</b>
<b>Mean</b>	<b>0,00%</b>	<b>-0,75%</b>	<b>-0,05%</b>	<b>-0,09%</b>
<b>Median</b>	<b>-0,47%</b>	<b>-0,66%</b>	<b>0,11%</b>	<b>-0,06%</b>
<b>Minimum</b>	<b>-8,41%</b>	<b>-17,36%</b>	<b>-10,91%</b>	<b>-9,34%</b>
<b>Maximum</b>	<b>23,22%</b>	<b>9,98%</b>	<b>16,89 %</b>	<b>19,88%</b>
<b>Jacques-Bera</b>	<b>1121,22</b>	<b>1,95</b>	<b>4,08</b>	<b>105,01</b>
<b>Number of observations</b>	<b>1326</b>	<b>1326</b>	<b>1326</b>	<b>1326</b>
<b>Number of observations per security</b>	<b>26</b>	<b>26</b>	<b>26</b>	<b>26</b>
<b>Number of securities/firms</b>	<b>51</b>	<b>51</b>	<b>51</b>	<b>51</b>