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# Master thesis

# Does Quantitative Easing positively affect stock returns in European stock markets in the short and long run?

NGUYEN THANH VY

s1008306

MSc. Financial Economics

Supervisor: Dr. Jianying Qiu

Radboud University

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**Abstract**

This paper aims to examine the relation between the unconventional monetary policy of Quantitative Easing (QE) of European Central Bank (ECB) and stock returns in Euro zone financial markets. We cover the whole period from the announcement date until the end of the program. We apply the event study to examine the abnormal return (AR) or buy-and-hold abnormal return (BHAR) to several major event windows. The main findings are: first, not all Euro zone nations are equally affected by QE. We find in short term, only Finland, Germany and Austria have impact of QE in Announcement and Implement period respectively. Secondly, in long term, there are only significant effect of QE found in stock markets of France, Ireland and Spain. The effects are diversified. Our results contribute to literatures by confirming the effectiveness of QE to financial markets, complementing similar findings of earlier researches. Furthermore, we provide evidence of heterogeneous impact of QE to euro zone countries, calling for more consideration when comes to such unconventional monetary policy of ECB.

**Key words:** Quantitative Easing, stock market, ECB, different European countries, event study.

**Paper type**: Master thesis

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**Master thesis**

**Does Quantitative Easing positively affect stock returns in Euro zone financial markets in the short and long run?**

# 1 INTRODUCTION

Since 17th century, monetary policy has been used to boost the economy (Bordo, 2007). Firstly, for conventional expansionary policy, central banks (CB) buy government bonds on open markets to increase the liquidity in the market and lower interest rate toward desired targets in order to stimulate domestic investment and consumption. However, since interest rate is very close to zero, the policy does not work effectively as before because the interest rate cannot be below zero. This is called "liquidity trap" which took place in Japan, United States, United Kingdom, European zone and developed countries in early 2000s. Under great depression and liquidity trap, many central banks of these countries have to intervene directly on financial market by unconventional monetary policy – known as Quantitative Easing program (Asset Purchasing Program) to stimulate the economy as last resort (Hadas & Dixon, 2009) (Heather, 2010). In other words, CBs buy bonds predetermined quantity or financial assets of private financial institutions on financial market regardless of interest rate (Bullard, 2010). The main purpose of QE is to increase the reserves of banks and ease financial conditions to stimulate the private lending via these banks. In fact, QE was implemented during depression in Japan in 2001 and in the US, UK and European area in the period of after financial crisis of 2007.

QE is used to stimulate the economies through five main channels such as credit channel (increase banking loans), portfolio rebalancing on financial markets of investors, exchange rate (depreciate home currency to facilitate export), fiscal effect (governments borrow cheaper) and signal effect (Joyce, Lasaosa, Stevens, & Tong, 2010).

This paper focuses on how QE affects portfolio rebalancing of investors on financial market through examining relationship between QE and asset prices on stock markets of European zone from March 2015 to December 2018.

In terms of this aspect, the findings of former literatures are heterogeneous. For example, Lima et al. found that there is a positive relation between QE and stock markets of USA, Japan and the UK (Lima, Vasconcelos, Simao, & de Mendonca, 2016). It is argued that the expansionary monetary policy will boost the stock market because the expectation of the return increases (Rozeff, 1974) (Fama & French, 1998) (Thorbecke, 1997) (Friedman & Schwartz, 1971) (Gali & Gambetti, 2014). On the other hand, there is negative relationship between return on stock market and monetary policy because investors will decrease expectations of the returns due to the raising of the asset prices, which leads to a fall in stock market (Patelis, 1997) (Laopodis, 2013). Besides, there is no evidence on this relationship in other researches such as (Laopodis, 2013) (Gali & Gambetti, 2014).

Moreover, there is also not homogeneous result about the effect in short and long term. For example, some studies conclude that unconventional monetary policy only has effectiveness temporarily (Gambacorta, Hofmann, & Peersman, 2014) (Penida, 2017) (Schenkelberg &

Watzka, 2013) while there are also findings about positive impact of QE on stock market in long term (Lima, Vasconcelos, Simao, & de Mendonca, 2016). However, most of the researches are independent when short-and long-run analyses are separated with different methodologies and models. So, if we conduct an examination for certain objectives with the same method for short and long run, then will the results still be the same as the other former independent studies? Therefore, from concerns above, the aim of this thesis is to use one methodology (event study) to examine that:

*Does it exist a positive relation between QE and returns on stock market in European zone in both short and long term?*

QE of ECB is selected for this research because it is the latest unconventional monetary policy and just ended in December 2018. So, there have not been many studies about the whole period from beginning to ending of this policy since last three years. Only 11 European nations are selected because they are directly involved in ECB's implement program (List included in Appendix).

The paper is structured as:

The next part is Literature Review (Part 2), following by Methodology and Data of Part 3. Then Part 4 is Result and Discussion. The limits and further study are displayed in Part 5 as well as Conclusion is the final part.

# 2 LITERATURE REVIEW

The studies about relation between QE and asset pricing in stock market have increased since subprime crisis in economics. Because it is stated that during the subprime crisis, CBs only focused on lowering interest rate and controlling inflation via conventional monetary policy. They did not intervene other aspects such as asset pricings (Gali & Gambetti, 2014). As consequences, it generated heavy losses from the asset pricing fluctuation in financial market (Greenspan, 2013). So, if QE has positive impact on returns on stock market, the losses are expected to be lower.

Secondly, it is proven that the important role of stock market on economic growth in supporting consumption and economic activity (Cole, Moshirian, & Wu, 2008) (Arestis, Demetriades, & Luintel, 2001). In fact, during the QE implement in 2010 there was a rise in stock market in the US, which contributed to increase domestic consumption and support the economic activity after that (Navarro, 2010) (Stein, 2010) (Gambacorta, Hofmann, & Peersman, 2014). "But one important route is through higher asset prices, which should reduce the cost of obtaining funding and increase the wealth of asset holders, thus boosting spending and increasing nominal demand." (Joyce, Lasaosa, Stevens and Tong, 2010).

Thirdly, they found that QE declines long term interest rate of treasury bonds (Bernanke, 2010). In other words, QE decrease risk free component which make stocks more attractive to investors. QE affects the portfolio channel, which lower the discount factor and hence decrease the long-term bond yields (Ramaprasad, Malliaris, & Malliaris, 2015). Then investors have to search for assets with higher risk and higher return, so they are more likely to buy stocks. So, the stock price will increase as results.

In terms of macroeconomic effect of QE, in the article of Gambacorta, Hofmann, & Peersman, (2014), the authors find that at zero lower bound, unconventional monetary policies have a temporary positive impact on economic activity and consumer prices when observing eight advance economies by a panel vector autoregression (VAR) during the global financial crisis. Moreover, there are no major differences about the macroeconomic effects of QE across countries (Canada, the euro area, Japan, Norway, Sweden, Switzerland, the United Kingdom, and the United States). In his working paper for ECB, (Peersman, 2011) also finds that unconventional monetary policy shocks have a significant effect on economic activity and inflation by using a structural vector autoregressive (SVAR) model for the Euro area economy from 1999 to 2009. It is the significant shift on the monetary base or the balance sheet size of European system. Comparing to traditional interest rate innovation, the transmission mechanism of this non-formal policy has slower effect on economic activity and consumer prices, which take more than one and a haft year while with the traditional policy, the effect reaches a peak after about one year.

In working paper for Bank of England about the impact of QE in the UK on financial market, the authors conducted event-study method for effect of QE announcement news on equities with two-day window (Joyce, Lasaosa, Stevens, & Tong, 2010). They find that lower gilt yields (result from QE) increase the present value of future dividends so it will raise equity prices. Investors will rebalance their portfolios from safe assets (gilts) to riskier assets, the additional

compensation investors desire for equity risk premium should fall, which may put more upward pressure on equity prices in long run. However, the announcement of QE may give investors the outlook of the economy. In case of it is worse than they expect, their short-term expectation for future dividends will decrease and impact risk premia, hence put downward pressure on equity price in short run. So, the effect of QE is influenced by expectation of investors. In fact, the FTST All-Share index did not response to QE news in a uniform way in short run. In details, it fell in March MPC announcement, then increased in next three QE announcements and then fell after that in February 2010. On the other hand, the effect of QE through portfolio rebalancing channel is expected to come through a longer period. Indeed, the *the FTSE All-Share* increased around 50 over period of 2009 to 2010 while its volatility decreased significantly around 40 during 2009. The reason for it is suggested that investors less concern about the fall of equity indices and become more confident about the corporate earning aspect.

As regards to effect of QE on stock market, they find that in long run QE has positive impacts on stock markets of three advanced countries (the US, UK and Japan) by analyzing the historic data for 2 separated periods of 2001-2007 and 2008-2014 by first ARDL model approach (Lima, Vasconcelos, Simao, & de Mendonca, 2016). In details, in 2001-2007, in many models conducted, there are positive effect of the monetary aggregates on the stock market of these countries because of "The Great Moderation" when the world economy witnessed a good moment of economic growth. From 2008-2014, in the US, the increase in monetary aggregate has stronger positive impact on stock market indices than the US industrial production and the appreciation of exchange rate. While in Japan, there are positive impacts of increasing money supply from QE on stock market but only in models with interest rate and similar effects happening in the UK but only in models with exchange rate.

This thesis is inspired from the study of impact of QE on eight European countries by short-run event study (Penida, 2017). In the report, by a multivariate regression model, the author finds evidence of significantly positive abnormal returns in 5 out of 8 benchmark indices. During the announcement and launch period, there are different effects of QE on different countries. For example, in launch time, German index (DAX30) has positive effect, while Spanish (IBEX35) and French (CAC40) indices have negative impact in short run. However, while this thesis takes into account the foundation research of this paper, we also develop with larger data, adding the ending period and conducting long-run event study to have broader picture of the effect. The second idea is coming from studies that differences in national financial system (Dornbusch et al., 1998) and expectation of investors (Joyce, Lasaosa, Stevens, & Tong, 2010) might make different countries react differently to a monetary policy.

The short- and long-run event studies are conducted as below:

***For short-run event study***, the aim is to test the effect of QE on 11-european stock markets in 3 event windows in short time from two to ten days after event dates. They include three periods of announcement (22/01/2015), implement (09/03/2015) and ending (19/12/2018) of the policy. The market return is the Euro stock index STOXX 600. The CAPM model will be used as benchmark model to calculate normal return.

*Hypothesis 1:* QE has effect on all European nations (All cumulative average abnormal returns (CAAR) are significantly different from zero).

Because QE is the unconventional monetary policy of ECB through purchasing bonds and assets on the financial markets. Hence, it is expected that stock markets of these countries will be influenced by this policy through rebalancing portfolios of investors as an indispensable result. However, because the essence of three events of QE are different so we expect the effect will be in Table 2.1.

| Hypothesis | Event date | Expected effect of QE on stock markets |
|---|---|---|
| 1a | Announcement | Positive |
| 1b | Implement | Positive |
| 1c | Ending | Negative |

**Table 2.1: Expected effect of QE on stock markets**.

For Announcement and Implement event, we expect that investors in Eurozone will hold optimistic view about the return on stock market in near future under the policy. Moreover, they also shift their portfolios to riskier assets like securities. Then the stock prices will increase. Hence, abnormal return is predicted to be significantly positive. Therefore, ending period is opposite because when CB stop buying bonds and assets, the pressure on asset price on stock markets will be downward. The immediate action of investors is predicted to selling securities to prevent decreasing price when more and more investors have same action after that.

***For long-run event study***, with the same countries and the benchmark model as short-run analysis, we observe the buy-and-hold-abnormal-return (BHAR) on stock markets in the three periods of 12, 24 and 36 months since the implement of QE. The market return is the Euro stock index STOXX 600. The CAPM model will be used as benchmark model to calculate normal return.

*Hypothesis 2:* The longer the time, the more countries are positively affected by QE.

*Hypothesis 3*: There are all significant positive impact of QE on four main regions of Europe (Western, Northern, British Isles and Southern groups).

*Hypothesis 4:* QE has positive effect on return on stock market in both short- and long-run in Implement period.

# 3 METHODOLOGY AND DATA

## 3.1 METHODOLOGY

Event study is a popular method to examine effect of an economic event on value of stock market. It was invented by (Eugene F. Fama, 1969). According to (MacKinlay, 1997), given the rationality in the marketplace, “the effects of an event will be reflected immediately in security prices”. The foundation idea of this method is to find abnormal return during the event

date, which is the difference between the actual return and the normal (estimated) return on the stock market. To conclude the effect of an event, the abnormal returns should differ from zero with some statistical validity (MacKinlay, 1997). This paper uses t-test, which divides the abnormal return to the root mean square error of the regression. Although, concept of conducting an event study is similar, the abnormal returns are obtained differently for short- and long-run analysis.

Return on stock market at time t ($R_t$) is calculated by continuous compounded rate of return (Cuthbertson & Nitzsche, 2004): $R_t = \ln(\frac{Price\ of\ stock\ at\ time\ t}{Price\ of\ stock\ at\ time\ t-1})$

Time line for an event study includes three windows. $t = 0$ is the event date. Estimated window is from $T_0$ to $T_1$, event window is between $T_1$ and $T_2$ and $T_2$ to $T_3$ is post-event window (MacKinlay, 1997).

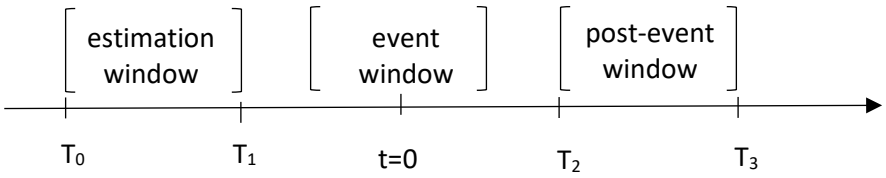


**Figure 3.1: Time line for event window.**

There are many benchmark models to estimate normal return in estimation window. In this research, we use CAPM model.

### 3.1.1 Benchmark model for expected (normal) return in estimation window:

A popular benchmark model used in estimated window of both short-term and long-term event study is Capital Asset Pricing Model (CAPM) of (Sharpe, 1964) and (Lintner, 1965):

$$R_i - R_f = \alpha + \alpha_1 * (R_m - R_f)$$

Where $R_i - R_f$is return of stock market i in excess of risk free rate; $R_f$ is the risk-free rate; $R_m$: is return of the market; α: Intercept; $\alpha_1$: coefficient of excess market return $(R_m - R_f)$.

The estimated intercept and coefficient obtained from estimation windows are used to generate the normal return (expected return) in the event window (T1-T2) for short- and long-run event study.

In this paper, $R_i$ is return of each components of each market and $R_m$ is the European market return, EURO STOXX 600. We use daily and monthly data for short- and long-run examination respectively.

### 3.1.2 Abnormal return:

***For short-run event study***,

For a firm/security:

- An abnormal return (AR) is defined as below (MacKinlay, 1997):

$$AR_{i,t} = (R_{i,t} - R_f) - E(R_{i,t} - R_f)$$

Where $AR_{i,t}$, $(R_{i,t} - R_{f,t})$ and $E(R_{i,t} - R_{f,t})$ are the abnormal return, actual and normal return respectively for time period t in excess of risk free rate.

Abnormal return is compounded to cumulative abnormal return (CAR) and is averaged to cumulative average abnormal return (CAAR) as well as average abnormal return (AAR) for cross-sectional research. N is number of stocks trading in one market.

- Cumulative abnormal return: $CAR_i = \sum_{t=T1}^{T2} AR_{i,t}$

For a country:

- Average abnormal return across firms: $AAR_t = \frac{1}{N}\sum_{t=T1}^{T2} AR_{i,t}$
- Cumulative average abnormal return across firms: $CAAR = \frac{1}{N}\sum_{i=1}^{N} CAR_i$

For example, in stock market of a country, we will conduct AR, CAR, AAR, CAAR as below:

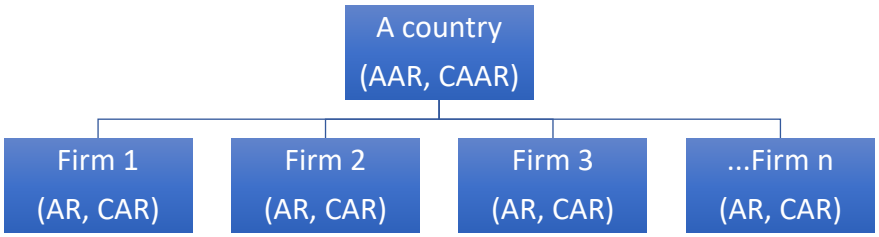


**Figure 3.2: Levels of abnormal returns in short-run event study.**

***For long run event study***

The event study has been developed to capture the longer time effect of an economic event on stock prices for several months or years with a popular method of Buy-and-hold abnormal return approach (BHAR) (Lyon, Barber, & Tsai, 1999). BHAR is calculated based on the assumption of buy-and-hold investment strategy. Investors buy stocks and hold them for long time. A t-month BHAR for a stock market is defined as below, which is the difference between actual and normal buy-and-hold abnormal return.

At first in the estimation window, we use the CAPM model to estimate the intercept and coefficient of the excess market return as mentioned in part 3.1.1. Then we use these parameters to calculate normal return in event window. Finally, we compound monthly expected and actual return for 12, 24 and 36 months to get buy-and-hold normal return $E(R_{i,t}^{bh})$ and buy-and-hold real return $(R_{i,t}^{bh})$. Then we can find the BHAR by subtracting $E(R_{i,t}^{bh})$ for $R_{i,t}^{bh}$ as below:

$$BHAR_i(t,T) = R_{i,t}^{bh} - E(R_{i,t}^{bh}) = \prod_{t=s}^{s+t}\left(1 + (R_{i,t} - R_{f,t})\right) - \left[\prod_{t=s}^{s+t}(1 + E(R_{i,t} - R_{f,t})\right]$$

$R_{i,t}^{bh}$ and $E(R_{i,t}^{bh})$ are actual and normal buy-and-hold returns respectively in excess of risk-free rate.

Average buy-and-hold abnormal returns (ABHAR) of n firms in a market is defined as:

$$ABHAR = \frac{\sum_{i=1}^{n} BHAR}{n}$$

### 3.1.3 Parametric test

***For short-run event study:***

For short-run event study, in order to conclude that QE has effect on stock market of a country, we use result of conventional t-test of AAR and CAAR. AAR represents the average abnormal return of stocks traded within this market for each single event day while CAAR represents the cumulative abnormal return of the whole market during the entire event window.

T-test for AAR aims at examining whether average abnormal returns across n firms for a day are significant different than 0. It is defined as:

$$t_{AAR(t)} = \sqrt{n}\frac{AAR_t}{S_{AAR_t}}$$

In order to examine how an event impacts on a stock market, cumulative average abnormal return (CAAR) is tested by conventional t-test with null hypothesis: H0: CAAR=0

$$t_{CAAR} = \sqrt{n}\frac{CAAR}{S_{CAAR}}$$

With $S^2_{CAAR} = \frac{1}{N-1}\sum_{i=1}^{N}(CAR_i - CAAR)^2$

The critical value of t- value bases on the t-student distribution table.

***For long-run event study:***

For long-run event study, we use result of conventional t-test and skewness-adjusted-t-statistic test of ABHAR which represent average buy-and-hold abnormal return of selected firms inside a stock market of a country.

Conventional t-statistic test that mean buy-and-hold abnormal returns equals to zero for a market of n firms is defined as:

The null hypothesis H0: $ABHAR_i = 0$

$$t = \frac{ABHAR}{S_{BHAR}/\sqrt{n}}$$

$S_{BHAR}$: is the cross-sectional sample standard deviation of buy-and-hold abnormal return for sample of n firms.

The skewness-adjusted t-statistic ($t_{sa}$) is employed to eliminate the skewness bias in long-run event study when using ABHAR (Johnson, 1978; Hall, 1992 and Sutton, 1993).

$$t_{sa} = \sqrt{n}(S + \frac{1}{3}\hat{\gamma}S^2 + \frac{1}{6n}\hat{\gamma})$$

Where

$$S = \frac{AHBR_t}{\sigma(BHAR_t)} \qquad \text{and} \qquad \hat{\gamma} = \frac{\sum_{i=1}^{n}(BHAR_{i,t} - AHBR_t)^3}{n\sigma(BHAR_t)^3}$$

$\hat{\gamma}$ is an estimate of the coefficient of skewness

$S$ is the conventional t-statistic of t-test above

$n$ is number of firms

$\sigma(BHAR_t)$ is standard deviation of BHAR at time t.

The critical value of t- value bases on the t-student distribution table.

## 3.2 DATA

We retrieved stock prices of 11 European stock markets which are directly related to QE program from 31/12/2013 to 31/1/2019 from Thomson Reuters Eikon source (retrieved in 6/2019). The index EURO STOXX 600 represents the market return for European market, which covers approximately 90 percentage of market capitalization of European stock market including France, Germany, Austria, Belgium, Finland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain and etc. The selected countries must meet two conditions that at first, they are on list of Public sector purchase program of ECB (in QE policy) with higher than 30.000 million EUR purchased until December 2018 (Appendix) and secondly, they are components of EURO STOXX 600 index. Daily and monthly data are used for short- and long-run event study respectively. Risk free rate is 6-month interest rate of Euribor retrieved from Thomson Reuters Eikon source (retrieved in 6/2019).

In one stock market which represents for a country, we retrieved historical data of components of its benchmark stock index. The data of selected securities must have full data (daily and monthly) from 31/12/2013 to 31/1/2019. The data is divided into parts such as Estimation Windows and Event Windows for each event date in both short-and long-run.

### 3.2.1 For short run event study

Summary statistics of daily data of returns on stock markets is in Table 3.1. There are 11 European countries chosen. The components inside each benchmark stock index are from 6 to maximum of 54 firms which meet the conditions above. The total firms observed are 251 with 297.472observations. The mean returns of the whole European market are 0,01% with -30,91% and 32,45% of their minimum and maximum respectively.

| No. | Country | Benchmark stock index | Components | Obs. | Mean | Std. dev | Min | Max |
|---|---|---|---|---|---|---|---|---|
| 1 | Austria (AUS) | ATX | 18 | 23904 | 0,02 | 1,88 | -31 | 19 |
| 2 | Belgium (BEL) | BEL 20 | 17 | 22576 | 0,03 | 1,44 | -21 | 16 |
| 3 | France (FRA) | CAC40 | 54 | 71712 | 0,02 | 1,53 | -25 | 16 |
| 4 | Germany (GER) | DAX | 28 | 37184 | 0,01 | 1,61 | -20 | 15 |
| 5 | Luxemburg (LUX) | LUX | 6 | 7968 | -0,02 | 1,98 | -15 | 14 |
| 6 | Netherlands (NTL) | AEX | 18 | 23904 | 0,02 | 1,64 | -21 | 16 |
| 7 | Finland (FIN) | OMX Helsinki 25 | 23 | 30544 | 0,02 | 1,90 | -46 | 20 |
| 8 | Ireland (IRE) | ISEQ overall | 6 | 7968 | 0,02 | 1,55 | -24 | 9 |
| 9 | Italy (ITA) | FTSE MIB | 30 | 3984 | 0,01 | 2,03 | -29 | 28 |
| 10 | Portugal (POR) | PSI 20 | 19 | 25232 | -0,01 | 2,61 | -77 | 182 |
| 11 | Spain | IBEX 35 | 32 | 42496 | 0,01 | 1,77 | -31 | 22 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (SPA) | | | | | | | |
| Eurozone | | EURO STOXX 600 | 251 | 297472 | 0,01 | 1,81 | -30,91 | 32,45 |

**Table 3.1: Summary statistics of daily returns of Eurozone stock markets.** The selected countries must meet two conditions that at first, they are on list of Public sector purchase program of ECB (in QE policy) with higher than 30.000 million EUR purchased until December 2018 (Appendix) and secondly, they are components of EURO STOXX 600 index. Each component must have full data from 31/12/2013 to 31/1/2019.

The estimation window is one year before one month of the event date. The event windows are 2 days (0-2), 5 days (0-5) and 10 days (0-10) after event dates. We observe three different events date which are Announcement, Implement and Ending events to examine two main things. They are differences between these events and between each national stock market corresponded to each event.

| Event | Announcement date<br>22nd Jan 2015 | Implement date<br>9th Mar 2015 | Ending date<br>19th Dec 2018 |
|---|---|---|---|
| Estimation window | 1st Jan 2014 – 22nd Dec 2014<br>(-277; -23) | 9th Feb 2014 – 9th Feb 2015<br>(-283; -23) | 19th Nov 2018 – 19th Nov 2017<br>(-283; -23) |
| Event window | (0-2), (0-5), (0-10) | (0-2), (0-5), (0-10) | (0-2), (0-5), (0-10) |

**Table 3.2: Estimation and event windows of short-run event study**. Data is divided into two windows i.e. Estimation and Event windows. In each event, we set up three event windows which are two, five and ten days after each event date to capture the immediate change of stock market under each event. The estimation window is one year before one month of the event date.

### 3.2.2 For long-run event study:

We have description of monthly data of returns on stock markets in Table 3.3. With the same 251 firms as in short-run event study above, we take the monthly returns on stock markets with the mean of them is 0.20% with -39,64% and 42,82% of minimum and maximum return respectively in 13.870 observations. With selected countries, we divide them into four groups i.e. West, North, British Isles and South of Europe. Because we also want to examine the effect on each group.

| Region | No. | Country | Benchmark stock index | Components | Obs. | Mean | Std. dev | Min | Max |
|---|---|---|---|---|---|---|---|---|---|
| West | 1 | Austria (AUS) | ATX | 18 | 1,098 | 0,15 | 8,25 | -33 | 43 |
| | 2 | Belgium (BEL) | BEL 20 | 17 | 1,054 | 0,63 | 6,38 | -34 | 52 |
| | 3 | France (FRA) | CAC40 | 54 | 3,348 | 0,44 | 6,44 | -34 | 52 |
| | 4 | Germany (GER) | DAX 30 | 28 | 1,736 | 0,21 | 7,13 | -38 | 28 |
| | 5 | Luxemburg (LUX) | LUX | 6 | 372 | -0,39 | 6,57 | -32 | 18 |
| | 6 | Netherlands (NTL) | AEX | 18 | 1,116 | 0,39 | 7,35 | -41 | 52 |
| North | 7 | Finland | OMX | 23 | 1,426 | 0,33 | 8,14 | -52 | 39 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | (FIN) | Helsinki 25 | | | | | | |
| British Isles | 8 | Ireland (IRE) | ISEQ overall | 6 | 372 | 0,49 | 6,01 | -27 | 19 |
| South | 9 | Italy (ITA) | FTSE MIB | 30 | 1,860 | 0,07 | 8,71 | -50 | 59 |
| | 10 | Portugal (POR) | PSI 20 | 19 | 1,178 | -0,39 | 11,78 | -54 | 73 |
| | 11 | Spain (SPA) | IBEX 35 | 32 | 1,984 | 0,24 | 7,31 | -41 | 36 |
| Eurozone | | | EURO STOXX 600 | 251 | 13870 | 0,20 | 7,64 | -39,64 | 42,82 |

**Table 3.3: Summary statistics of monthly returns of Eurozone stock markets.** The selected countries must meet two conditions that at first, they are on list of Public sector purchase program of ECB (in QE policy) with higher than 30.000 million EUR purchased until December 2018 (Appendix) and secondly, they are components of EURO STOXX 600 index. Each component must have full data from 31/12/2013 to 31/1/2019. The regions are grouped based on geographical position.

We only focus on effect of an economic event when investors buy and hold stocks from the beginning until the end for a long period (months or years). So only Implement period of QE program is considered. According to former studies, buy-and-hold abnormal return (BHAR) of longer time than 36 months do not provide reliable results and have more distortions (Mitchell and Stafford, 2000; Cowan and Sergeant, 2001). Hence, we decide to conduct event windows up to maximum of 36 months. Luckily, the implement period of QE is in 44 months so we believe that 36/44-month study (80%) is sufficient to represent for the effect of this policy.

| Event | Implement date: $9^{th}$ Mar 2015 (is 3/2015 in monthly data) |
|---|---|
| Estimation window | 2/2014-2/2015 (-13, -1) |
| Event window | 12 months: 4/2015-3/2016 |
| | 24 months: 4/2015-3/2017 |
| | 36 months: 4/2015-3/2018 |

**Table 3.4: Estimation and event windows of long-run event study**. Monthly data of each component is divided into two parts such as estimation and event windows. For the estimation window, the data lasts from one month before the event date until 12 months backward. We only focus on the effect when investors buy and hold stocks until the end of a long period with monthly data. So only Implement period of QE program is examined with 12,24,36-month event windows.

# 4 PART IV: RESULTS AND DISCUSSION

## 4.1 Part A: Short run event study

Overall, although all countries are impacted by QE in single event days, only some of them have significant cumulative average abnormal return (CAAR) in event windows. In detail, investors in Finland and Germany hold optimistic expectation about the stock markets when their returns are positive significantly in Announcement and Implement periods respectively. Conversely, Austria has significantly negative CAARs in Implement period. There is no significant effect of QE found on Eurozone in Ending period.

In terms of the whole European countries, the stock market is impacted positively in Announcement event and negavetively in Ending event. There is no significant CAARs of entire market in Implement time.

### 4.1.1 Announcement event:

As regards to single day in event window, at event day (0), all stock markets still have normal return on their market as estimated when there is no statistically significant average abnormal return found in all nations. In day 2, 6, 8 and 10, most of countries have significantly positive AARs with the highest number in day 2 and 8 with 5/11 nations. After that, less nations have significant AARs until day 10. Finland has the highest number of days that AARs are statistically significant with 7/10 days during the observation time.

| No. | Country | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AUS | 0,26 | -0,96 | 0,36 | -0,30 | -0,72 | 0,04 | 0,60 | 0,74 | **1,26*** ** | -0,70 | -0,29 |
| 2 | BEL | -0,37 | -0,13 | 0,50 | **0,38*** | -0,04 | 0,18 | 0,10 | 0,37 | 0,40 | -0,48 | 0,22 |
| 3 | FRA | -0,16 | 0,04 | **0,33*** | 0,07 | -0,15 | **0,59*** ** | -0,10 | 0,04 | 0,24 | -0,07 | 0,08 |
| 4 | GER | -0,10 | -0,33 | **1,23*** ** | -0,26 | 0,37 | **0,65**** | -0,12 | 0,36 | -0,30 | **-0,53**** | 0,02 |
| 5 | LUX | 0,10 | 0,69 | -0,10 | 0,30 | 1,38 | -1,86 | **0,80**** | 0,37 | **0,76**** | 0,11 | -1,47 |
| 6 | NTL | -0,28 | -0,42 | 0,46 | -0,18 | -0,34 | 0,50 | 0,32 | 0,28 | 0,19 | **-0,84*** ** | 0,24 |
| 7 | FIN | 0,68 | **1,10**** | **0,74*** | **-1,61*** ** | **0,73*** | **-0,86*** | **1,05*** | -0,17 | 0,68 | -0,74 | **2,52*** ** |
| 8 | IRE | 0,02 | **1,34*** | 1,44 | -0,72 | 0,61 | -3,58 | -0,09 | 0,49 | -0,53 | 0,02 | 0,65 |
| 9 | ITA | 0,30 | **-1,14**** | **0,70*** ** | **1,00**** | -0,32 | 0,69 | **0,89*** ** | -0,01 | **0,97*** ** | -0,55 | -0,52 |
| 10 | POR | 0,70 | -0,04 | 0,55 | **-0,81*** | -1,13 | 0,51 | -0,03 | 0,98 | **1,22*** | -0,28 | 0,02 |
| 11 | SPA | -0,23 | **-2,31*** ** | **0,91*** ** | 0,24 | -0,59 | 1,11 | -0,13 | **-0,82**** | **1,14*** ** | **-0,92*** ** | -0,12 |

*p <0,1; **p <0,05; ***p <0,01

**Table 4.1: AAR (%) in single-event day of Annoucnement date (22/01/2015).** This table represents for the conventional t-test results of the average of abnormal returns (AARs) of countries. For each country, we take the AAR of all its components in each day and then test if they are significantly different than zero.

Overview, for the cumulative average abnormal returns in stock markets in first 10 days, most of CAARs of countries are positive and in increasing trends. On the other hand, CAARs of Spain are always negative and it reaches the bottom of CAAR in day 1 with -2,31%.

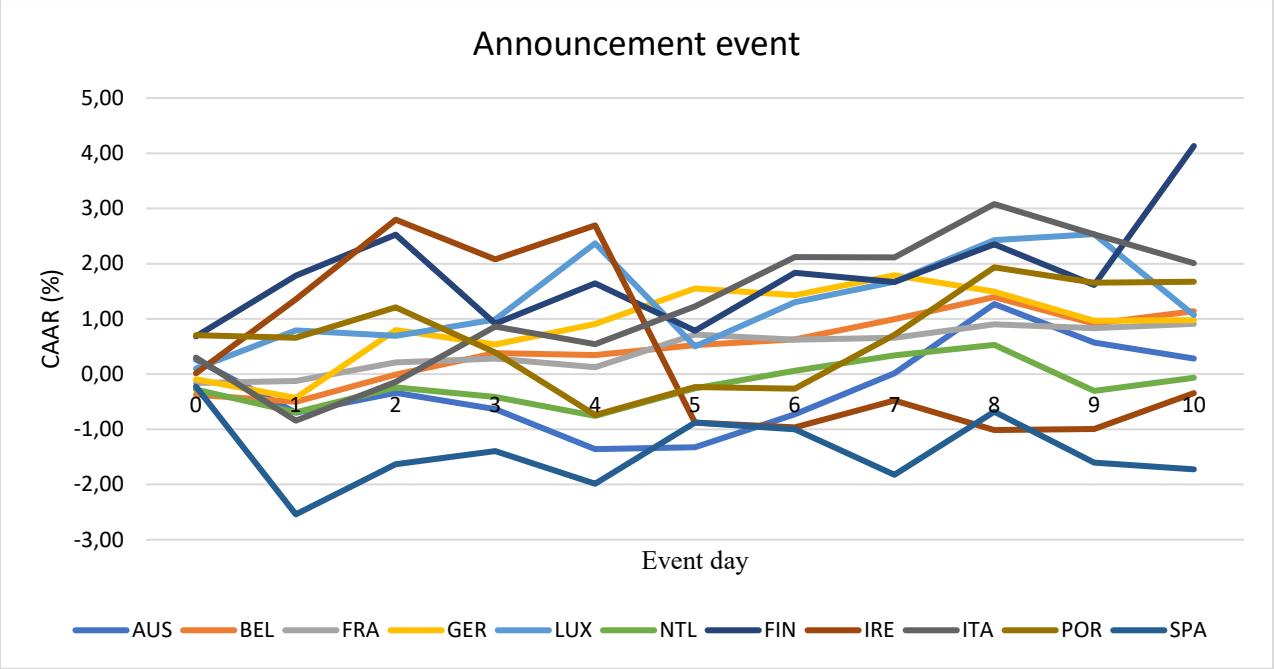


**Figure 4.1: CAARs of European countries in Announcement event**

When we compound the AARs of 10 event days into 3 event windows (Table 4.2), the significant CAAR is only found in Finland. In details, after two days of event date, it is strongly impacted by QE in positive way with more than 2,52% higher than its normal return.

For the whole Euro zone in this period, the cummulative average abnormal retruns of all countries is positive and significant with 0,75% in window (0-2). However, there is no significant average abnormal return found in any nation after that in the rest event windows.

| No. | Country | ANNOUNCEMENT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-2 | | | 0-5 | | | 0-10 | | |
| | | CAAR (%) | T-value | P value | CAAR (%) | T-value | P value | CAAR (%) | T-value | P value |
| 1 | AUS | -0,34 | -0,22 | 0,83 | -1,31 | -0,57 | 0,57 | 0,30 | 0,07 | 0,95 |
| 2 | BEL | 0,00 | 0,00 | 1,00 | 0,53 | 0,28 | 0,78 | 1,15 | 0,28 | 0,78 |
| 3 | FRA | 0,22 | 0,36 | 0,72 | 0,73 | 0,66 | 0,51 | 0,93 | 0,45 | 0,65 |
| 4 | GER | 0,80 | 0,95 | 0,35 | 1,56 | 1,25 | 0,22 | 1,00 | 0,38 | 0,71 |
| 5 | LUX | 0,69 | 0,53 | 0,62 | 0,51 | 0,15 | 0,89 | 1,08 | 0,24 | 0,82 |
| 6 | NTL | -0,23 | -0,18 | 0,86 | -0,25 | -0,10 | 0,92 | -0,05 | -0,01 | 0,99 |
| 7 | FIN | **2,52** | **2,84*****| **0,01***** | 0,78 | 0,35 | 0,73 | 4,13 | 0,87 | 0,39 |
| 8 | IRE | 2,80 | 1,46 | 0,20 | -0,87 | -0,09 | 0,93 | -0,33 | -0,03 | 0,98 |
| 9 | ITA | -0,13 | -0,15 | 0,89 | 1,24 | 0,76 | 0,45 | 2,03 | 0,60 | 0,55 |
| 10 | POR | 1,21 | 0,50 | 0,62 | -0,23 | -0,07 | 0,94 | 1,69 | 0,30 | 0,77 |
| 11 | SPA | -1,62 | -1,42 | 0,17 | -0,87 | -0,37 | 0,71 | -1,71 | -0,42 | 0,68 |
| Euro zone | | **0,75** | **2,23*** | **0,05**** | 0,17 | 0,59 | 0,57 | 0,93 | 2,08 | 0,64 |

*p <0,1; **p <0,05; ***p <0,01

**Table 4.2: Result of t test of CAAR in Announcement Event.** The table represents the t-test of Cumulative Average Abnormal Returns (CAAR) in three event windows such as after two, five and ten days of Announcement Date (22/1/2015) with the null hypothesis that CAAR equals zero. Before the test, for each

national stock market, the cumulative abnormal returns (CAR) of each component in each event window are averaged CAARs for cross-sectional study.

So we can conclude that Euro zone stock market is positive impacted by the announcement news of QE. But it does not mean that all its countries are influenced by the news. In details, we only find evidence in Finland. The investors of this nation holds an optimistic view for the stock price under this announcement with 2.52 higher in the actual returns than normal. As we can see in Figure 4.2, although there are some decreases in day 3, 5 and 9, the overall trend is increasing.

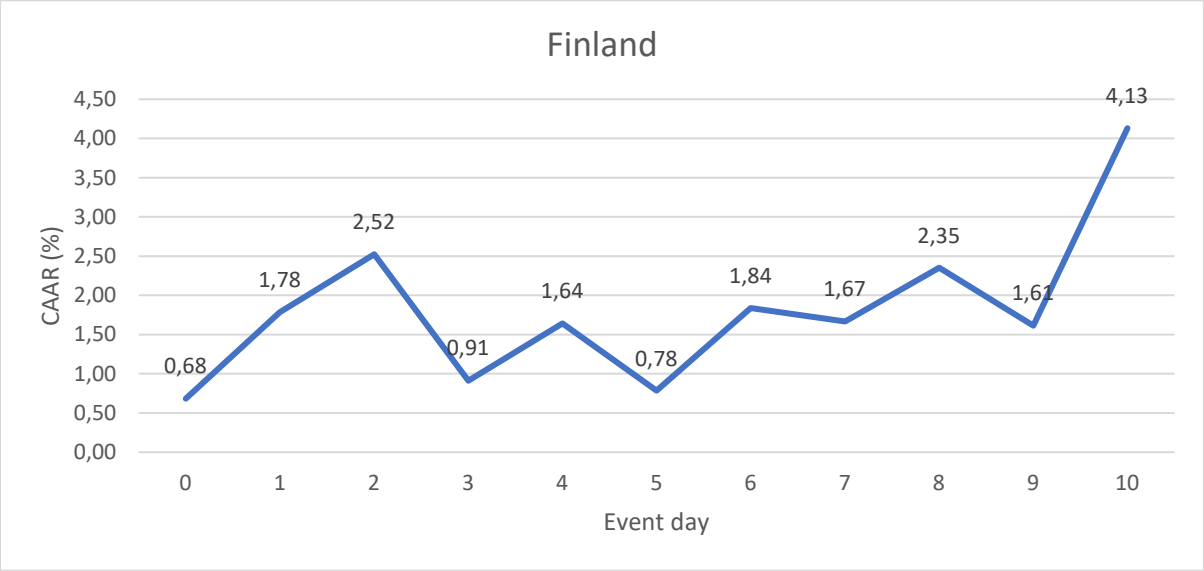


**Figure 4.2: CAAR of Finland in single event days in Announcement period.** CAAR of each day is compounded from AARs of the days before. We take the CAAR of 23 components inside its benchmark stock market index (OMX Helsinki 25) to represent for the Finland stock market.

### 4.1.2 Implement date:

In term of single event day, more countries have significant AAR in 5-10 days after the event date than first 5 days. On the first day of event, the stock markets of Germany and Italy are impacted positively at the first beginning of the policy while investors in French markets have pessimistic view about it. Germany has the highest number of days that its AARs have statistically significant with 8/10 days with mostly in positive side.

| AAR (%) in event day | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Country | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | AUS | 0,04 | **-1,07*****| -0,41 | 0,50 | 0,02 | -0,58 | -0,18 | **-0,67*** | 0,38 | -0,54 | **0,88**** |
| 2 | BEL | -0,47 | -0,23 | 0,39 | -0,29 | 0,27 | 0,25 | **-0,51*** | -0,36 | -0,10 | 0,09 | 0,24 |
| 3 | FRA | **-0,34*** | 0,16 | **0,71**** | -0,25 | 0,24 | **0,27*** | -0,23 | **-0,59***** | **-0,37**** | -0,09 | 0,05 |
| 4 | GER | **0,79***** | 0,21 | **0,83***** | -0,31 | **0,41*** | **1,00***** | -0,45 | **-0,71*** | **-0,62**** | **0,44**** | **-0,53*** |
| 5 | LUX | 0,09 | 0,35 | -1,30 | 0,26 | 0,49 | -0,53 | 0,10 | -0,01 | -0,19 | 0,00 | -0,21 |
| 6 | NTL | -0,09 | 0,34 | 1,02 | -0,44 | -0,20 | 0,26 | -0,51 | -0,02 | -0,72 | -0,33 | 0,20 |
| 7 | FIN | 0,42 | 0,06 | -0,02 | 0,26 | -0,18 | -0,09 | **0,74**** | -0,42 | 0,56 | -0,07 | **0,58*** |
| 9 | IRE | -0,21 | -0,32 | 1,08 | 0,67 | 0,31 | 0,67 | -0,14 | 0,09 | -0,37 | 0,03 | 0,10 |
| 10 | ITA | **0,68**** | 0,36 | 0,27 | 0,27 | -0,02 | 0,09 | -0,03 | **-0,67*** | -0,02 | 0,18 | **0,84***** |
| 11 | POR | 0,70 | -0,04 | 0,55 | **1,26**** | 0,10 | **-0,88*** | -0,23 | 0,29 | 0,76 | 0,39 | **1,17***** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | SPA | 0,22 | 0,14 | -0,36 | -0,10 | 0,07 | **-0,35*** | **-0,36*** | **-0,42*** | -0,26 | **1,40***** | **1,04***** |

*p <0,1; **p <0,05; ***p <0,01

**Table 4.3: AAR (%) in single event days of Implement event (09/03/2015).** This table represents for the conventional t-test results of the average of abnormal returns (AARs) of countries. For each country, we take the abnormal returns all its components in each day and then take the average for a whole national market to get AAR and finally test AARs if they are significantly different than zero.

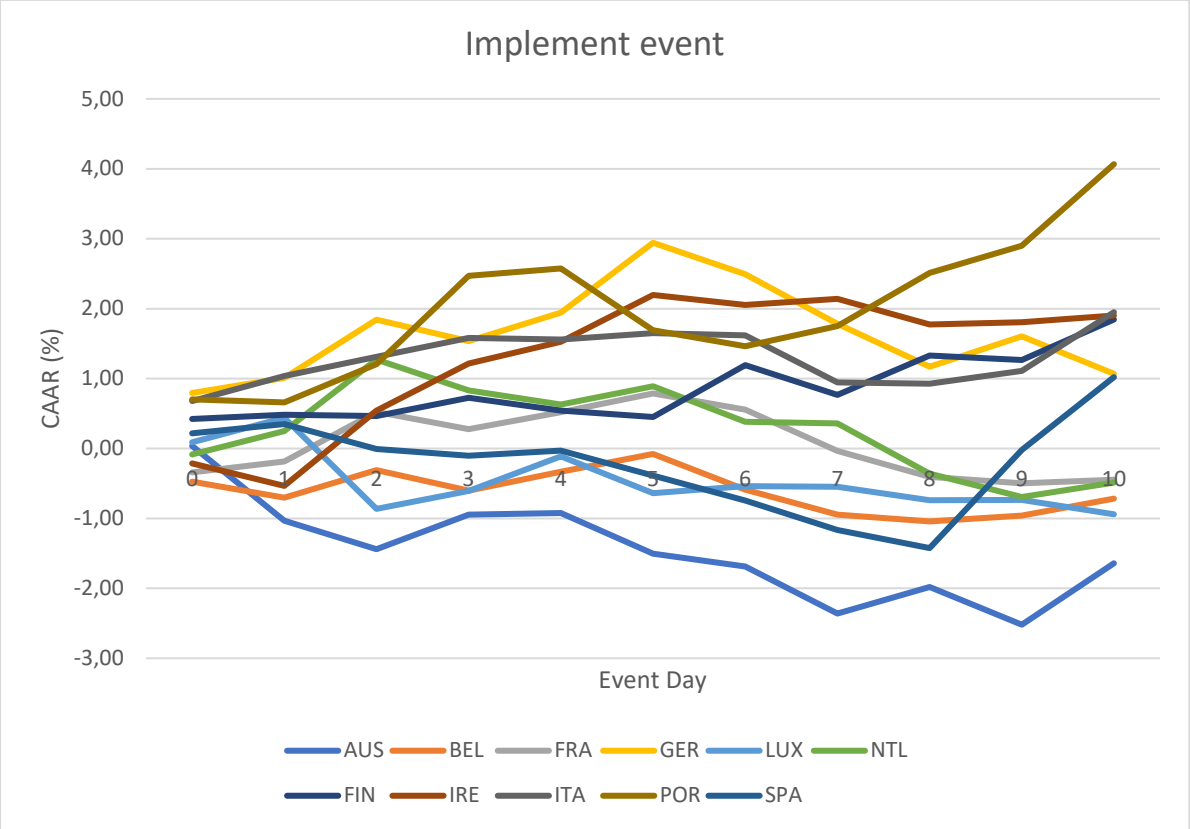


**Figure 4.3: CAAR of Eurozone stock markets in single days of Implement event.**

In the graph, we can see that in the first half of the time, more countries have positive CAARs than negative ones. By contrast, there are more negative CAARs found in the second half of the period. However, the overall trend is increasing at the end of the time.

When we test the significant of CAARs in three event windows, Austria has negatively significant CAAR with 1,44% which is lower than its normal return when QE applied in first event window (0-2). On the other hand, Germany has actual return higher than its expectation with significant 1,84% in the same event window (0-2) and (0-5). This result is in line with study of (Penida, 2017) when the author also found that German index (DAX30) has positive effect and Austria has negative effect (ATX) with Event Study method by Multivariate and Seemingly Unrelated Regression Models in short run. There is no significant CAAR found in any nation in the rest of event windows.

For the whole Euro zone, there is no significant CAAR found in three event windows. Most of the nations have actual returns which are similar to their normal ones during this time (CAAR equals zero).

| No. | Country | IMPLEMENT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-2 | | | 0-5 | | | 0-10 | | |
| | | CAAR (%) | T-value | P value | CAAR (%) | T-value | P value | CAAR (%) | T-value | P value |
| 1 | AUS | **-1,44** | **-2,21**** | **0,04**** | -1,51 | -0,69 | 0,50 | -1,64 | -0,62 | 0,54 |
| 2 | BEL | -0,31 | -0,17 | 0,87 | -0,08 | -0,04 | 0,97 | -0,72 | -0,26 | 0,80 |
| 3 | FRA | 0,53 | 0,79 | 0,44 | 0,79 | 0,76 | 0,45 | -0,45 | -0,29 | 0,77 |
| 4 | GER | **1,84** | **3,33***** | **0,00***** | **2,94** | **2,04*** | **0,05*** | 1,07 | 0,53 | 0,60 |
| 5 | LUX | -0,86 | -0,57 | 0,57 | -0,64 | -0,16 | 0,88 | -0,94 | -0,15 | 0,89 |
| 6 | NTL | 1,27 | 0,82 | 0,42 | 0,89 | 0,49 | 0,63 | -0,49 | -0,23 | 0,82 |
| 7 | FIN | 0,46 | 0,49 | 0,63 | 0,45 | 0,31 | 0,76 | 1,84 | 0,54 | 0,59 |
| 8 | IRE | 0,54 | 0,8 | 0,46 | 2,20 | 0,75 | 0,49 | 1,90 | 0,42 | 0,69 |
| 9 | ITA | 1,31 | 1,73 | 0,09 | 1,65 | 0,85 | 0,40 | 1,95 | 1,03 | 0,31 |
| 10 | POR | 1,21 | 0,5 | 0,62 | 0,96 | 0,18 | 0,86 | 3,34 | 0,50 | 0,62 |
| 11 | SPA | -0,01 | -0,01 | 0,99 | -0,38 | -0,23 | 0,82 | 1,02 | 0,46 | 0,65 |
| Euro zone | | 0,41 | 1,37 | 0,2 | 0,66 | 1,69 | 0,12 | 0,63 | 1,33 | 0,21 |

*p <0,1; **p <0,05; ***p <0,01

**Table 4.4: Result of t test of CAAR in Implement Event**. The table represents the t-test of Cumulative Average Abnormal Returns (CAAR) in three event windows such as after two, five and ten days of Implement Date (09/03/2015) with the null hypothesis that CAAR equals zero. Before the test, for each national stock market, the cumulative abnormal returns (CAR) of each component in each event window are averaged CAARs for cross-sectional study.

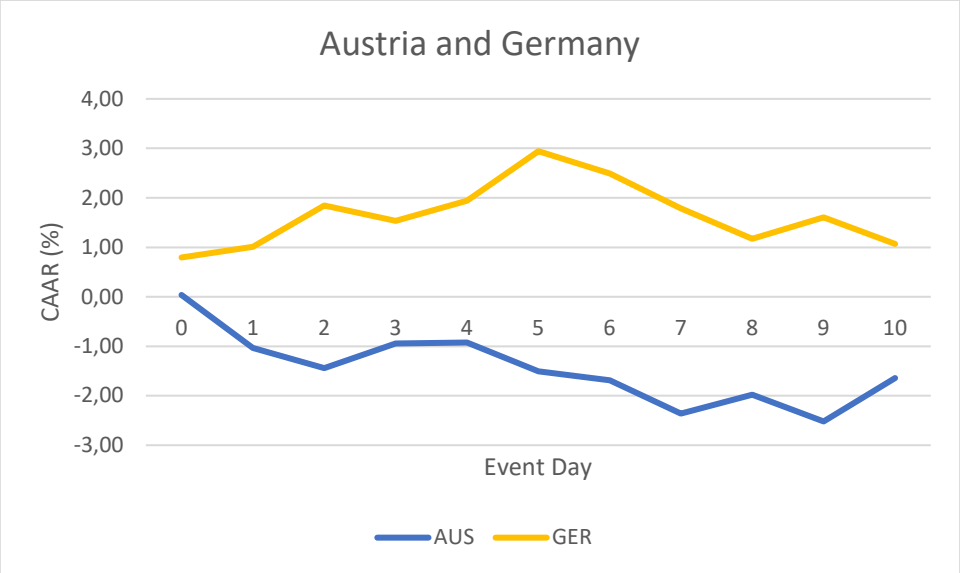


**Figure 4.4: CAAR of Austria and Germany in single event days in Implement period.** CAAR of each day is compounded from AARs of the days before. We take the CAAR of 18 components inside Austria's benchmark stock market index (ATX) and 28 securities of DAX 30 index of Germany to represent for the whole stock markets.

During the implement period, CAAR of Austria is below zero and in downward trend. Germany is affected positively by QE within 5 first days with positive CAARs. Five days later the effect seems in negative trend.

To sum up, most of European countries do not have immediate action under Implement date of QE. Only investors in Austria and Germany are affected by Implement of QE policy when they have different expectation about the markets in future under the policy.

### 4.1.3 Ending date:

Overall, ending period witnessed declines in average abnormal returns of stock markets of more countries in term of single-event-day observations. While in day 0, there are still some countries have positive AARs by QE, the effects of all nations are mostly negative after that. Day 8 and 10 have the highest number of nations having significant AAR values with 6/11 countries. Most of them are positive. In day 4,5 and 9, there is no significant AAR found in any nation.

| AAR (%) in event day | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Country | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | AUS | **-1,46**** | **-1,46**** | -0,01 | **0,39***** | 0,00 | 0,00 | 0,08 | 0,51 | **-0,38***** | 0,00 | **1,15*** |
| 2 | BEL | 0,09 | -0,95 | 0,00 | -0,25 | -0,02 | -0,02 | -0,19 | **-0,48*** | **0,64*** | -0,02 | -0,42 |
| 3 | FRA | 0,25 | **-0,61**** | 0,00 | **-0,60***** | 0,00 | 0,00 | **0,57**** | **-0,30**** | **0,79***** | 0,00 | **-0,88***** |
| 4 | GER | -0,10 | **-0,78*** | 0,00 | 0,48 | 0,03 | 0,03 | **-0,67*** | -0,26 | -0,42 | 0,03 | **0,97***** |
| 5 | LUX | 0,26 | -0,93 | -0,01 | -0,10 | 0,01 | 0,01 | -0,09 | 0,56 | -1,63 | 0,01 | 2,07 |
| 6 | NTL | 0,12 | -0,53 | **-0,01*** | **-1,07***** | -0,01 | -0,01 | **0,80**** | **-0,49**** | **0,83**** | -0,01 | **-0,76**** |
| 7 | FIN | **0,74**** | **-0,72*** | -0,01 | **0,43***** | 0,00 | 0,00 | 0,12 | **-0,74*** | -0,42 | 0,00 | **1,46***** |
| 8 | IRE | -0,78 | -0,23 | 0,00 | -0,12 | -0,03 | -0,03 | -0,58 | 0,60 | 0,20 | -0,03 | 0,68 |
| 9 | ITA | **0,77***** | -0,29 | -0,01 | 0,52 | 0,03 | 0,03 | 0,35 | -0,56 | -0,46 | 0,03 | 0,49 |
| 10 | POR | -0,32 | -0,58 | **-0,01*** | -0,14 | 0,04 | 0,04 | 0,24 | -0,97 | **1,53***** | 0,04 | **1,46**** |
| 11 | SPA | **0,40*** | **-0,85**** | **-0,01**** | -0,21 | -0,01 | -0,01 | -0,18 | -0,49 | **0,59**** | -0,01 | -0,09 |

*p <0,1; **p <0,05; ***p <0,01

**Table 4.5: AAR (%) in single event days of Ending event (19/12/2018).** This table represents for the conventional t-test results of the average of abnormal returns (AARs) of countries. For each country, we take the abnormal returns all its components in each day and then take the average for a whole national market to get AAR and finally test AARs if they are significantly different than zero.

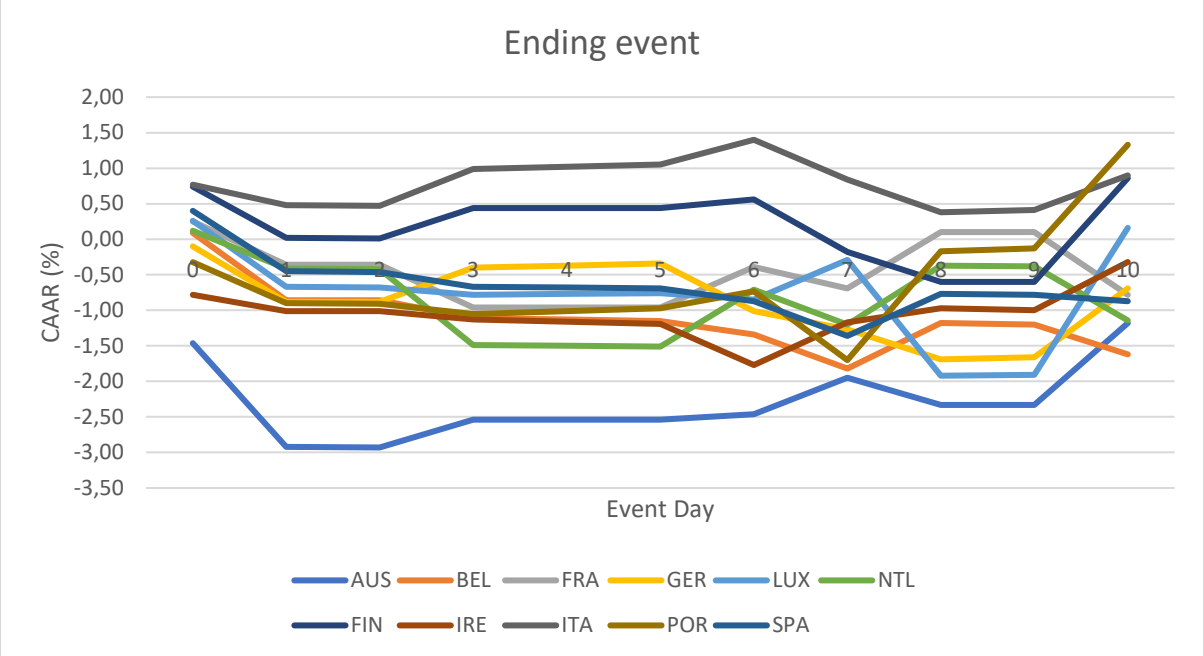

**Figure 4.5: CAAR of Eurozone stock markets in single days of Ending event.**

As we can see in Figure 4.5, most of the CAARs of nations are below 0. We can see that in Announcement and Implement periods, stock markets response in different ways, but in Ending time, seems like most of countries have similar trends and less fluctuation in their abnormal returns. In details, there are steady decreases in all countries after the ending date (19-12-2018) and increases slightly in day 10.

When taking t-test for CAARs into account, there is no single nation having significant CAAR in all three event windows i.e. (0-2), (0-5) and (0-10). However, the whole Euro zone stock market is impacted negatively in all event windows when its CAARs are strongly significant at 1% statistical level.

| No. | Country | ENDING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-2 | | | 0-5 | | | 0-10 | | |
| | | CAAR (%) | T-value | P value | CAAR (%) | T-value | P value | CAAR (%) | T-value | P value |
| 1 | AUS | -3,45 | -2,00 | 0,61 | -3,06 | -1,25 | 0,23 | -1,71 | -0,56 | 0,58 |
| 2 | BEL | -1,16 | -1,51 | 0,15 | -1,45 | -1,04 | 0,31 | -1,92 | -0,90 | 0,38 |
| 3 | FRA | -0,28 | -0,58 | 0,56 | -0,87 | -1,08 | 0,29 | -0,69 | -0,58 | 0,56 |
| 4 | GER | -0,55 | -0,70 | 0,49 | -0,02 | -0,02 | 0,98 | -0,37 | -0,21 | 0,84 |
| 5 | LUX | -2,12 | -1,55 | 0,18 | -2,20 | -0,62 | 0,56 | -1,29 | -0,27 | 0,80 |
| 6 | NTL | -1,15 | -1,35 | 0,19 | -2,25 | -1,52 | 0,15 | -1,89 | -0,85 | 0,41 |
| 7 | FIN | -0,48 | -0,63 | 0,54 | -0,05 | -0,04 | 0,97 | 0,37 | 0,19 | 0,85 |
| 8 | IRE | -0,88 | -0,37 | 0,73 | -1,05 | -0,35 | 0,74 | -0,17 | -0,03 | 0,98 |
| 9 | ITA | -0,25 | -0,28 | 0,78 | 0,32 | 0,25 | 0,80 | 0,16 | 0,07 | 0,94 |
| 10 | POR | -1,84 | -1,45 | 0,16 | -1,90 | -0,94 | 0,36 | 0,40 | 0,14 | 0,89 |
| 11 | SPA | -1,23 | -1,61 | 0,12 | -1,45 | -1,05 | 0,30 | -1,62 | -0,85 | 0,40 |
| Euro zone | | **-1,22** | **-4,23** | **0,00*** ** | **-1,27** | **-3,97** | **0,00*** ** | **-0,79** | **-2,85** | **0,02** ** |

*p <0,1; **p <0,05; ***p <0,01

**Table 4.6: Result of t-test of CAAR in Ending event.** The table represents the t-test of Cumulative Average Abnormal Returns (CAAR) in three event windows such as after two, five and ten days of Ending Date (19/12/2018) with the null hypothesis that CAAR equals zero. Before the test, for each national stock market, cumulative abnormal return (CAR) of each component in each event window are averaged CAARs for cross-sectional study.

### 4.1.4 Discussion for short-run analysis:

The response of stock market is different in 3 periods.

Overall, although all countries are impacted by QE in single event days, only some of them have significant cumulative average abnormal return in event windows. In detail, investors in Finland and Germany hold optimistic view about the stock markets when their returns are positive in Announcement and Implement periods respectively. While Austria has significant negative CAARs in Implement event. From Table 4.1, 4.3 and 4.5, we can see clearly that stock markets of European nations response differently to QE policy. For example, some countries increase CAAR, others decline and even if they have similar trend, they also differ in volume.

From the results, we can accept hypothesis 1a that stock market will be impacted positively in Announcement event for countries having significant CAARs in this period (Finland and Euro

zone case). In Implement event, Germany and Austria have significant CAARs in different sides so we can reject hypothesis 1b that CAAR of these countries will be significantly positive. The result of Germany and Austria is similar to findings of Penida (2017) with event study method but different kind of model appiled in short term.

We can accept hypothesis 1c that in Ending time, CAARs will be significantly different from zero and in negative side. Although there is no significant CAAR found in any single nation, the average of CAARs of all nations are statistically significant at Euro zone scale.

Given the evidences in short run, we can reject the main hypothesis 1 and conclude that there are only few European stock markets are affected by QE policy of ECB in both positive and negative sides. This finding is similar to findings of Joyce, Lasaosa, Stevens, & Tong (2010) that there is no uniform in the way stock market response to QE in short time (it can be both negative and positive). Besides, they also proved that the effect of QE on daily return of stock market is weak. Secondly, we find that the effect of QE on stock markets differs in each period of Announcement, Implement and Ending. Overall, in the Announcement and Implement period, there are more positive abnormal returns and increasing trends. While the Ending has less fluctuations in abnormal returns but CAARs are in decreasing trends. It can be explained that differences in national financial system and expectation of investors might make different countries react differently to a monetary policy (Dornbusch et al., 1998), (Joyce, Lasaosa, Stevens, & Tong, 2010).

## 4.2 Part B: Long-run event study

### 4.2.1 Result

In general, average buy-and-hold abnormal returns (ABHAR) of countries are positive and in increasing trends while Austria, Luxemburg and Spain have downward trends in 36-month observation.

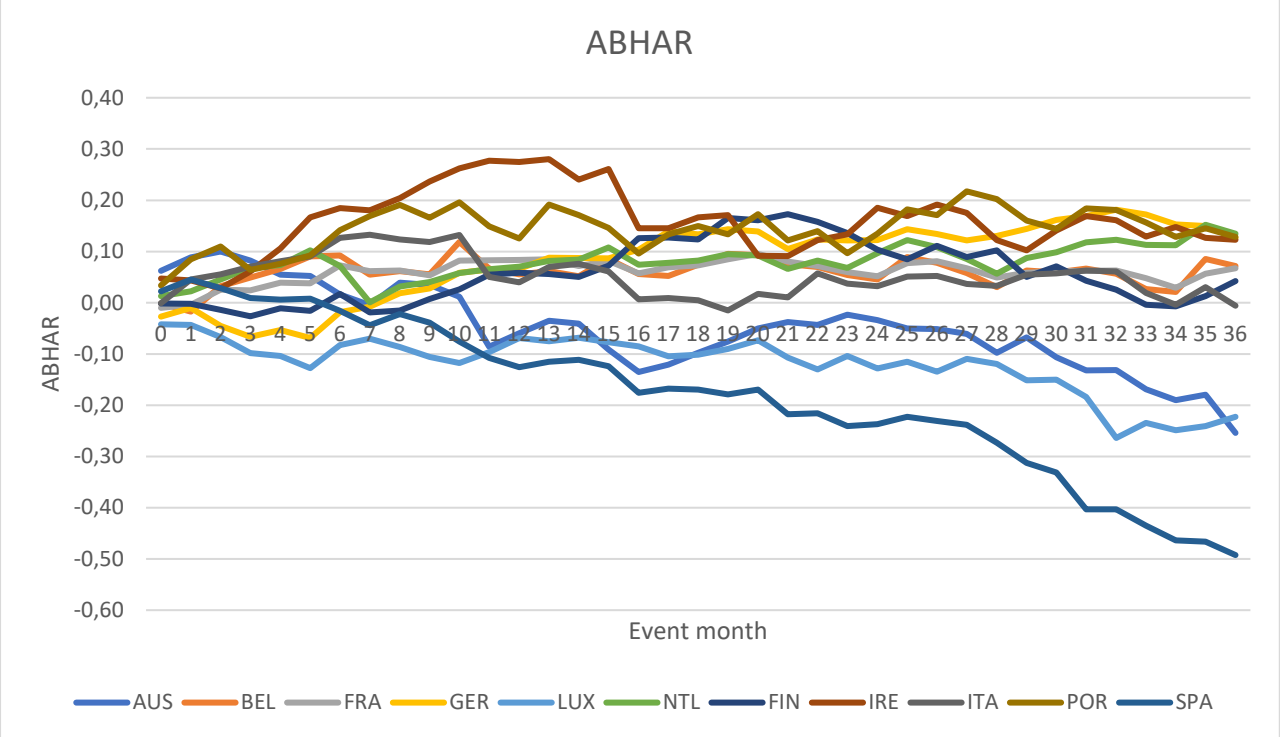

**Figure 4.6: Average buy-and-hold abnormal returns of Eurozone stock markets**. This table represent the ABHARs of these countries from month 0 to 36 since Implement date (09/03/2015). Each country, we take the ABHAR of all its components of its benchmark stock index to represent for a whole national stock market.

When we conduct conventional t-test (t-value) and skewness adjusted t-statistic (tsa), in 12 months, France and Ireland have positively significant ABHAR values. There is no major difference between t-value and tsa so the outcomes are reliable (controlled skewness bias of BHAR in long term). The implement of QE affects positively on returns of stock markets in two countries. Ireland witnessed the higher ABHAR compared to France when 27,33 higher of actual buy-and-hold return than normal one, followed by France with 8,95 ABHAR in first year.

In terms of 24 and 36 months, only Spain has the negatively significant ABHAR with -23,79 and -48,32. The ABHAR of Spain decreased sharply in 36 months after Implement date (in 3/2015).

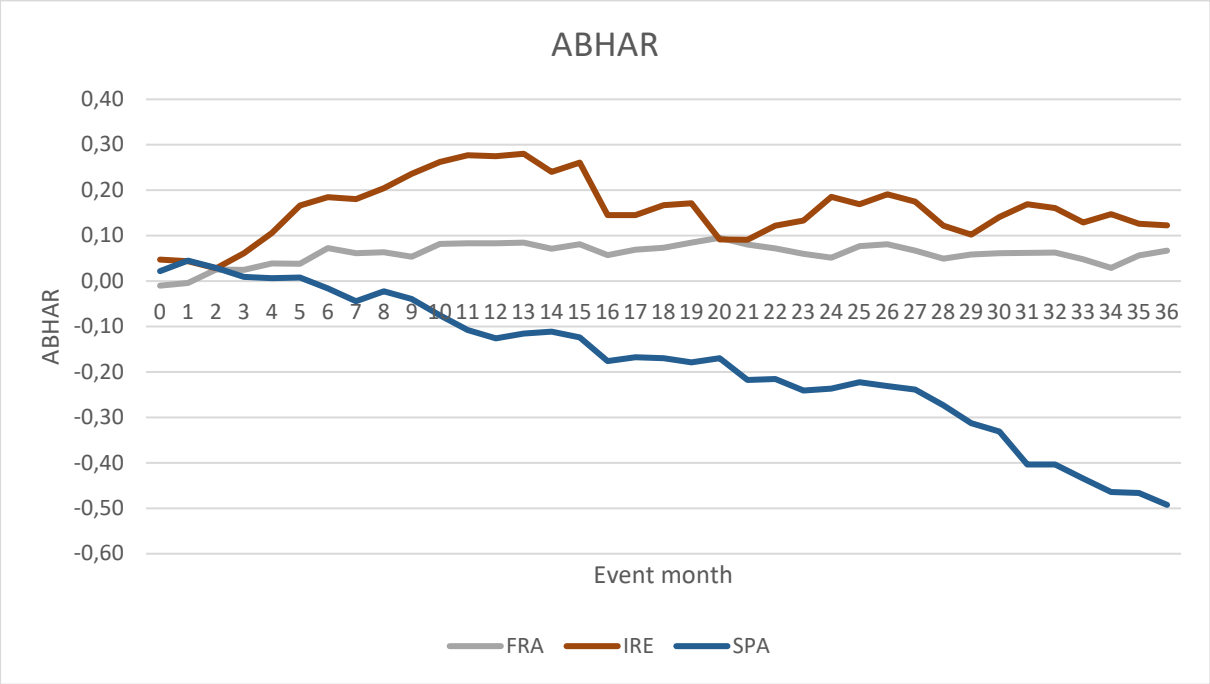


**Figure 4.7: Average buy-and-hold abnormal returns of stock markets of France, Ireland and Spain.**

| ABHAR | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Country | 12 months | | | | | 24 months | | | | | 36 months | | | | |
| | | | Conventional t-test | | Skewness adjusted t-statistic | | | Conventional t-test | | Skewness adjusted t-statistic | | | Conventional t-test | | Skewness adjusted t-statistic | |
| | | mean | t-value | p-value | tsa | p-value | mean | t-value | p-value | tsa | p-value | mean | t-value | p-value | tsa | p-value |
| 1 | AUS | -5,94 | -0,53 | 0,60 | -0,55 | 0,59 | -3,42 | -0,13 | 0,90 | -0,17 | 0,87 | -25,41 | -0,49 | 0,63 | -0,58 | 0,57 |
| 2 | BEL | 5,56 | 1,15 | 0,27 | 1,11 | 0,28 | 4,55 | 0,40 | 0,69 | 0,38 | 0,71 | 7,17 | 0,39 | 0,70 | 0,36 | 0,72 |
| 3 | FRA | **8,35** | **3,02**** | **0,00***** | **3,09**** | **0,00***** | 5,15 | 0,81 | 0,42 | 0,77 | 0,44 | 6,69 | 0,63 | 0,53 | 0,57 | 0,57 |
| 4 | GER | 6,57 | 0,89 | 0,38 | 1,00 | 0,33 | 12,20 | 0,91 | 0,37 | 1,03 | 0,31 | 12,65 | 0,70 | 0,49 | 0,72 | 0,48 |
| 5 | LUX | -6,90 | -0,88 | 0,42 | -0,90 | 0,41 | -12,81 | -0,60 | 0,57 | -0,62 | 0,56 | -22,24 | -0,72 | 0,50 | -0,80 | 0,46 |
| 6 | NTL | 7,06 | 1,44 | 0,17 | 1,35 | 0,19 | 9,63 | 1,07 | 0,30 | 1,18 | 0,25 | 13,45 | 1,09 | 0,29 | 1,16 | 0,26 |
| 7 | FIN | 5,88 | 0,79 | 0,44 | 0,80 | 0,38 | 10,35 | 0,93 | 0,36 | 0,92 | 0,37 | 4,19 | 0,25 | 0,80 | 0,20 | 0,84 |
| 8 | IRE | **27,50** | **10,82***** | **0,00***** | **7,95**** | **0,00***** | 18,55 | 1,60 | 0,17 | 1,66 | 0,16 | 12,27 | 0,70 | 0,52 | 0,69 | 0,52 |
| 9 | ITA | 4,00 | 0,62 | 0,54 | 0,60 | 0,55 | 3,26 | 0,25 | 0,80 | 0,24 | 0,81 | -0,60 | -0,03 | 0,97 | -0,07 | 0,94 |
| 10 | POR | 12,56 | 1,22 | 0,24 | 1,23 | 0,23 | 13,44 | 0,70 | 0,49 | 0,65 | 0,52 | 12,85 | 0,43 | 0,67 | 0,38 | 0,71 |
| 11 | SPA | -12,58 | -1,96 | 0,06 | -1,61 | 0,12 | -23,68 | **-2,01*** | **0,05*** | **-2,15**** | **0,04**** | **-49,25** | **-2,47**** | **0,02**** | **-3,15**** | **0,00***** |

*p <0,1; **p <0,05; ***p <0,01

**Table 4.7: Result of ABHAR of selected European countries.** This table shows two tests for ABHAR of each country, i.e conventional t-test (t-value) and Skewness adjusted t-statistic (tsa). An ABHAR is concluded to be significant when having both significant t-value and tsa. The numbers under t-value and tsa are the corresponding p-values. For each country, we take average of BHAR of its components to represent for the whole stock market.

When grouping the firms studied of countries into 4 groups, we find evidence of positive effect of QE in Western European and British Isles areas with significant ABHAR values with 5,23% and 27,50% respectively in 12 months. There is no region found QE effect in 24 and 36 months.

| ABHAR | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Region | 12 months | | | 24 months | | | 36 months | | |
| | | mean | t-value | tsa-value | mean | t-value | tsa-value | mean | t-value | tsa-value |
| 1 | WEST | **5,23** | **2,10** (0,04**) | **2,12*** (0,04**) | 5,93 | 1,15 (0,25) | 1,13 (0,26) | 5,49 | 0,61 (0,54) | 0,55 (0,58) |
| 2 | NORTH | 5,88 | 0,79 (0,44) | 0,80 (0,38) | 10,35 | 0,93 (0,36) | 0,92 (0,37) | 4,19 | 0,25 (0,80) | 0,20 (0,84) |
| 3 | BRITISH ISLES | **27,50** | **10,82*** (0,00***) | **7,95** (0,00***) | 18,55 | 1,60 (0,17) | 1,66 (0,16) | 12,27 | 0,70 (0,52) | 0,68 (0,52) |
| 4 | SOUTH | -0,51 | -0,12 (0,90) | -0,11 (0,91) | -4,84 | -0,59 (0,56) | -0,61 (0,54) | -15,64 | -1,22 (0,23) | -1,31 (0,19) |

*p <0,1; **p <0,05; ***p <0,01

**Table 4.8: Result of ABHAR of four European regions.** The table displays two tests of ABHAR, such as conventional t-test and Skewness adjusted t-statistic (tsa). An ABHAR is concluded to be significant when having both significant t-value and tsa. The numbers under t-value and tsa are the corresponding p-values. For each region, we take average of BHAR of its components to represent for the whole stock market.

### 4.2.2 Discussion for long-run analysis

Given the evidence, we can reject the hypothesis 2 that the longer the time, the more countries are positively affected by QE policy. Because as we can see, there are only France and Ireland have positively significant ABHARs in 12 months. This finding is partly similar to study of Lima, Vasconcelos, Simao, & de Mendonca (2016) while they also find positve impact of QE on stock market in long run but the data used is in five years while we only find this effect in 12 months. On the other hand, in 24 and 36 months, Spain has a decreasing trend of significant ABHAR.

In term of France in long-run analysis, with 420,259 million EUR purchased (counted until December 2018) by ECB, it is the second position in top countries in Asset Purchasing Program list of ECB. So, QE really works effectively in French stock market with 8,35% higher in actual buy-and-hold returns than normal one in 12 months. The investors in France hold optimistic expectation about the stock price and return in future under the policy. Hence, after ECB buy bonds and assets of individual institutions, they quickly turn to riskier assets like securities and then put the prices and returns higher in 12 months. However, the effect disappears in longer months observed (24 and 36 months).

As regard to Ireland and Spain cases, there are interesting effects of QE policy on their stock markets. As we know that Ireland and Spain were countries having European debt crisis at the end of 2009 because of the bubbles in the real estate and construction markets. Although these countries exited the bailout programs of ECB and International Monetary Fund (IMF), but their sovereign debts are still high. However, due to the fiscal consolidation and high real GDP dynamics, Ireland has managed to decrease successfully their debt to GDP ratio. On the other hand, Spain has more difficulties than Ireland when having high unemployment rate and slower GDP dynamic, hence its debt-to –GDP ratio is still on the upward path (Ptak & Szymanska, 2016). These macroeconomic elements are reflected clearly in stock market when Ireland has

significantly positive 27,50% ABHAR in 12 months, Spain still suffers with their stock market with the downturn of its economy in long run of 24 and 36 months later since Implement date of QE policy. So, in fact QE program did support Ireland's economy through its stock market. Because when ECB buy bonds of state and private financial institutions, it helps to provide more liquidity in bank systems and cheaper loans to simulate the economy. Hence investors have more optimistic about returns of securities of these firms in the stock market. Therefore, it leads to the positive ABHARs in Ireland in 12 months.

However, because Spain has its debt crisis and downturn of economy, so the stock market has negative abnormal return in long run as a result. So, when ECB applies the same policy, although bonds and safe investment are less, but because of the poor performance of its economy and high state debt, investors still are not confident about the future dividends of securities. Hence the stock prices decrease in 24 and 36 months after the Implement date. However, it might be more complicated than we can see. This leads to a gap for further research when researchers can focus on Spain case with more factors to investigate this relation deeply.

In term of European regions, we can reject the hypothesis 3 that there are all significant positive ABHARs in four main regions of Europe (Western, Northern, British Isles and Southern groups). Because only ABHAR of Western and British Isles group are significantly different from zero. It can be explained that Western countries (France, Germany, The Netherlands, Austria, Belgium, etc.) have the larger financial market and more stable economies as well as British Isles group, represented by Ireland, has dynamic economic growth rate. Hence, the investors hold optimistic expectation about the future returns on securities hence push the price and return upward. The rest have the actual buy-and-hold returns which are same as their normal buy-and-hold returns.

When we compare the main findings of short- and long- run event studies in part 4.1 and 4.2, we can reject the hypothesis 4 that QE has positive effect on return on stock market in both short- and long-run in Implement period. Because significant negative influence of QE is also found in the stock markets during the observation time (Austria and Spain in short- and long-run analysis respectively).

# 5 Limits and further research

At first, the benchmark model is CAMP which considers only market return and risk-free rate. Other models with more factors can help to estimate better the normal return on stock market can be used for further study like Fama and French three and five factors (Fama & French, 1993). Secondly, returns on stock market of firms are assumed with equal weight in this paper, so if we can improve it by using weighted-returns of firms, the results might be more exactly.

Secondly, from the case of Ireland and Spain, for future research, European countries having sovereign debts are recommended to be studied deeply to understand clearly the relation between QE and their stock markets.

In fact, the evidence in this paper is just providing differences of QE effect on each stock market. But it is surface of the issue. In order to understand deeply which factors that are real reasons behind, we should continue the study when considering more other factors such as the

market capital and structure of financial market of these countries. There are many articles proposing the potential factors about the difference among European nations about cultures, politics, religions, economic growth rates, government debts, etc. So, the question about effect of QE or a monetary policy will be explained broader and deeper hopefully after that.

# 6 Conclusion

This paper examines the relation between QE and stock market of selected European countries by event study method in short and long run analysis. In general, we have evidence to conclude that QE policy of ECB does not affect similarly on stock market of Eurozone in short and long run. In short run, only event windows of 2 days after event date witnessed the effect of QE in three periods. In Announcement and Implement periods, there are more positive abnormal returns in increasing trends in single event days when in Ending time, there are more negative ARs and in downward trends. Finland and Germany have positive impact by QE on their stock market from Announcement to Implement period while investors of Austria hold pessimistic expectations about its stock market in Implement period. In terms of Euro zone level, the average CAARs of all nations are significant positve in Announcement time and negative in Ending time however, it is no effect in Implement period.

In long run, only France, Ireland and western region have positively significant ABHARs in 12 months and Spain has negative effect of QE in long run of 24 and 36 months. It is partly explained by its high government debt and downturn of the economy.

We can see that returns on stock market and QE effect reflect correctly with the situations of different European economies. So, findings of this paper hope to suggest for ECB some ideas about how they differ under one policy for their consideration in next action. However, in order to have deeper understanding about the relation, further researches suggested above should be conducted.

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# 8 APPENDIX

| Book value as at 30 April 2009 (EUR million) | Cumulative purchases end December 2018 |
|---|---|
| Austria | 58,188 |
| Belgium | 73,367 |
| Cyprus | 678 |
| Germany | 518,558 |
| Estonia | 7 |
| Spain | 260,820 |
| Finland | 33,135 |
| France | 420,259 |
| Ireland | 30,130 |
| Italy | 365,353 |
| Lithuania | 3,163 |
| Luxembourg | 2,612 |
| Latvia | 2,077 |
| Malta | 1,154 |
| The Netherlands | 115,183 |
| Portugal | 36,845 |
| Slovenia | 7,947 |
| Slovakia | 11,684 |
| Supranationals | 230,118 |
| Total | 2,171,277 |

**Table 8.1: Cumulative Monthly Net Purchases of Public sector purchase program from 9th March 2015 to end of December 2018.** Retrive at : https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html

**1. Austria (ATX):**

| No. | Component | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | ERSTE GROUP BANK | 57% | 88% | 164% |
| 2 | OMV | 49% | 113% | 165% |
| 3 | VOESTALPINE | 0% | 43% | 69% |
| 4 | RAIFFEISEN BANK INTL. | 63% | 162% | 246% |
| 5 | ANDRITZ | 11% | 17% | 17% |
| 6 | LENZING | -16% | 81% | -36% |
| 7 | IMMOFINANZ | 13% | 19% | 41% |
| 8 | WIENERBERGER | 58% | 67% | 87% |
| 9 | CA IM. ANLAGEN | -25% | -51% | -49% |
| 10 | VERBUND | -32% | 1% | 37% |
| 11 | AT&S AUSTRIA TECH.&(WBO) SYSTEMTECH | -9% | -96% | -88% |

| | | | | |
|---|---|---|---|---|
| 12 | SCHOELLER-BLECKMANN | 27% | 75% | 104% |
| 13 | UNIQA INSU GR AG | -13% | 18% | 54% |
| 14 | VIENNA INSURANCE GROUP A | -37% | -40% | -29% |
| 15 | OSTERREICHISCHE POST | -40% | -63% | -76% |
| 16 | ZUMTOBEL | -105% | -237% | -474% |
| 17 | TELEKOM AUSTRIA | -14% | -16% | -9% |
| 18 | PORR | -92% | -241% | -680% |
| | ABHAR | -6% | -3% | -25% |

**Table 8.2: BHAR of Austria stock market in 12, 24 and 36 months.**

**2. Belgium (BEL 20):**

| No. | Components | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | ACKERMANS & VAN HAAREN | 10% | 3% | -3% |
| 2 | AGEAS (EX-FORTIS) | 27% | 32% | 59% |
| 3 | AB INBEV (FRA) | -6% | -42% | -75% |
| 4 | BARCO NEW | 10% | 48% | 69% |
| 5 | COFINIMMO | -8% | -24% | -38% |
| 6 | COLRUYT | 39% | 25% | 28% |
| 7 | GALAPAGOS | 39% | 107% | 119% |
| 8 | GBL NEW | 5% | 9% | 24% |
| 9 | ING GROEP | 6% | 13% | 21% |
| 10 | KBC GROUP | -1% | -3% | 19% |
| 11 | PROXIMUS | -43% | -112% | -189% |
| 12 | SOFINA | 5% | 32% | 38% |
| 13 | SOLVAY | -8% | 9% | 16% |
| 14 | TELENET GROUP HOLDING | 7% | 5% | 5% |
| 15 | UCB | -9% | -39% | -63% |
| 16 | UMICORE | 25% | 39% | 135% |
| 17 | WDP | -5% | -25% | -43% |
| | ABHAR | 6% | 5% | 7% |

**Table 8.3: BHAR of Belgium stock market in 12, 24 and 36 months.**

**3. France (CAC 40)**

| No. | Component | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | AB INBEV (FRA) | 10% | 3% | -3% |
| 2 | ACCOR | 27% | 32% | 59% |
| 3 | ACKERMANS & VAN HAAREN | -6% | -42% | -75% |
| 4 | AGEAS (EX-FORTIS) | 10% | 49% | 70% |
| 5 | AIR LIQUIDE | -8% | -24% | -38% |
| 6 | AIRBUS | 39% | 24% | 28% |
| 7 | ATOS | 39% | 107% | 119% |
| 8 | AXA | 5% | 9% | 24% |
| 9 | BARCO NEW | 6% | 12% | 21% |
| 10 | BNP PARIBAS | -1% | -2% | 19% |

| | | | | |
|---|---|---|---|---|
| 11 | BOUYGUES | -43% | -111% | -188% |
| 12 | CAPGEMINI | 5% | 32% | 38% |
| 13 | CARREFOUR | -8% | 9% | 16% |
| 14 | COFINIMMO | 7% | 5% | 6% |
| 15 | COLRUYT | -9% | -38% | -63% |
| 16 | CREDIT AGRICOLE | 25% | 38% | 134% |
| 17 | DANONE | -5% | -24% | -41% |
| 18 | DASSAULT SYSTEMES | 3% | -25% | -12% |
| 19 | ENGIE | -3% | -12% | -8% |
| 20 | ESSILORLUXOTTICA | 72% | 98% | 161% |
| 21 | GALAPAGOS | 13% | 74% | 69% |
| 22 | GBL NEW | 16% | 20% | 39% |
| 23 | HERMES INTL. | 11% | 46% | 71% |
| 24 | ING GROEP | 17% | 0% | 7% |
| 25 | KBC GROUP | 10% | -17% | -14% |
| 26 | KERING | 21% | 14% | 7% |
| 27 | LEGRAND | -18% | -16% | -7% |
| 28 | L'OREAL | 14% | -1% | 1% |
| 29 | LVMH | 19% | 8% | 38% |
| 30 | MICHELIN | -18% | -45% | -41% |
| 31 | ORANGE | 4% | -24% | -39% |
| 32 | PERNOD-RICARD | 8% | 30% | 34% |
| 33 | PEUGEOT | 10% | 34% | 42% |
| 34 | PROXIMUS | 2% | -9% | -22% |
| 35 | PUBLICIS GROUPE | 6% | 4% | 20% |
| 36 | RENAULT | 9% | 17% | 42% |
| 37 | SAFRAN | 23% | 34% | 58% |
| 38 | SAINT GOBAIN | -43% | -148% | -278% |
| 39 | SANOFI | -1% | -23% | -15% |
| 40 | SCHNEIDER ELECTRIC | -32% | -117% | -254% |
| 41 | SOCIETE GENERALE | 18% | 25% | 27% |
| 42 | SODEXO | 23% | 6% | 7% |
| 43 | SOFINA | 11% | 10% | 44% |
| 44 | SOLVAY | 36% | 61% | 75% |
| 45 | STMICROELECTRONICS | 8% | 11% | -5% |
| 46 | TELENET GROUP HOLDING | 6% | 13% | 28% |
| 47 | TOTAL | 21% | 51% | 71% |
| 48 | UCB | 8% | 3% | -11% |
| 49 | UMICORE | -5% | 77% | 107% |
| 50 | VALEO | 13% | 19% | 23% |
| 51 | VEOLIA ENVIRON | -1% | -22% | -86% |
| 52 | VINCI | 36% | -31% | -27% |
| 53 | VIVENDI | 52% | 65% | 97% |
| 54 | WDP | -10% | -29% | -13% |
| | ABHAR | 8% | 5% | 7% |

**Table 8.4: BHAR of French stock market in 12, 24 and 36 months.**

**4. Germany (DAX 30):**

| No. | Component | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | ADIDAS | 119% | 217% | 246% |
| 2 | ALLIANZ | 2% | 6% | 18% |
| 3 | BASF | 3% | 33% | 35% |
| 4 | BAYER | -14% | -30% | -44% |
| 5 | BEIERSDORF | 25% | 25% | 31% |
| 6 | BMW | -14% | -25% | -28% |
| 7 | CONTINENTAL | 1% | -22% | -18% |
| 8 | DAIMLER | -6% | -21% | -25% |
| 9 | DEUTSCHE BANK | -16% | 3% | 0% |
| 10 | DEUTSCHE BOERSE | 31% | 25% | 66% |
| 11 | DEUTSCHE LUFTHANSA | 29% | 29% | 117% |
| 12 | DEUTSCHE POST | -5% | 23% | 40% |
| 13 | DEUTSCHE TELEKOM | 13% | -3% | -28% |
| 14 | E ON N | -29% | -35% | -25% |
| 15 | FRESENIUS | 3% | -10% | -69% |
| 16 | FRESENIUS MED.CARE | -10% | -39% | -68% |
| 17 | HEIDELBERGCEMENT | 27% | 43% | 34% |
| 18 | HENKEL | -7% | -5% | -17% |
| 19 | INFINEON TECHNOLOGIES | 24% | 56% | 88% |
| 20 | MERCK KGAA | -12% | -23% | -75% |
| 21 | MUENCHENER RUCK. | 5% | -8% | -10% |
| 22 | RWE | -40% | -31% | -16% |
| 23 | SAP | 38% | 72% | 74% |
| 24 | SIEMENS | 14% | 56% | 47% |
| 25 | THYSSENKRUPP | -43% | -41% | -73% |
| 26 | VOLKSWAGEN PREF. | 118% | 218% | 255% |
| 27 | VONOVIA | -56% | -132% | -246% |
| 28 | WIRECARD | -17% | -38% | 43% |
|  | ABHAR | 7% | 12% | 13% |

**Table 8.5: BHAR of German stock market in 12, 24 and 36 months.**

**5. Luxembourg (LUX)**

| No. | Component | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | LUXEMPART | -12% | -12% | 9% |
| 2 | REINET INVESTMENTS SCA | -10% | -50% | -85% |
| 3 | RTL GROUP (LUX) | 18% | 19% | 27% |
| 4 | SES FDR | -36% | -91% | -145% |
| 5 | SOCFINAL | -12% | -1% | 8% |
| 6 | SOCFINASIA | 11% | 59% | 52% |
|  | ABHAR | -7% | -13% | -22% |

**Table 8.6: BHAR of Luxembourg stock market in 12, 24 and 36 months.**

### 6. Netherlands:

| No. | Component | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | AALBERTS | 13% | 19% | 38% |
| 2 | AEGON | -15% | -9% | 6% |
| 3 | KONINKLIJKE AHOLD DELHAIZE | 29% | 4% | -23% |
| 4 | AKZO NOBEL | -4% | -2% | 17% |
| 5 | ARCELORMITTAL | -29% | 49% | 66% |
| 6 | ASML HOLDING | -29% | -34% | -30% |
| 7 | DSM KONINKLIJKE | 24% | 66% | 119% |
| 8 | GALAPAGOS | 39% | 107% | 119% |
| 9 | HEINEKEN | 20% | -8% | -11% |
| 10 | ING GROEP | 6% | 12% | 21% |
| 11 | KPN KON | 15% | -35% | -57% |
| 12 | PHILIPS ELTN.KONINKLIJKE | 14% | 35% | 51% |
| 13 | RANDSTAD | 34% | 40% | 54% |
| 14 | ROYAL DUTCH SHELL A | -26% | -21% | -20% |
| 15 | WFD UNIBAIL RODAMCO STAPLED UNITS | -2% | -40% | -64% |
| 16 | UNILEVER DUTCH CERT. | 13% | -2% | -17% |
| 17 | KONINKLIJKE VOPAK | 6% | -14% | -15% |
| 18 | WOLTERS KLUWER | 19% | 4% | -11% |
| | ABHAR | 7% | 10% | 13% |

**Table 8.7: BHAR of Dutch stock market in 12, 24 and 36 months.**

### 7. Finland (OMX Helsinki 25):

| No. | Component | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | AMER SPORTS | 54% | 21% | 30% |
| 2 | CARGOTEC 'B' | 27% | 78% | 83% |
| 3 | ELISA | 36% | 5% | 5% |
| 4 | FORTUM | -20% | -20% | -1% |
| 5 | HUHTAMAKI | 18% | 0% | -19% |
| 6 | KEMIRA | 40% | 60% | 63% |
| 7 | KESKO B | 11% | 11% | 13% |
| 8 | KONE 'B' | -8% | -32% | -48% |
| 9 | KONECRANES | -19% | 17% | 23% |
| 10 | METSO | -22% | -4% | -16% |
| 11 | NESTE | 6% | -40% | -2% |
| 12 | NOKIA | -15% | -44% | -52% |
| 13 | NOKIAN RENKAAT | 85% | 130% | 135% |
| 14 | NORDEA BANK | -8% | -9% | -26% |
| 15 | ORION B | 18% | 41% | -49% |
| 16 | OUTOKUMPU 'A' | -55% | -12% | -67% |
| 17 | OUTOTEC | -5% | 42% | 85% |
| 18 | SAMPO 'A' | 4% | -11% | -10% |
| 19 | STORA ENSO R | 12% | 30% | 77% |
| 20 | UPM-KYMMENE | 2% | 21% | 37% |

| | | | | |
|---|---|---|---|---|
| 21 | VALMET | -68% | -133% | -267% |
| 22 | WARTSILA (FRA) | -25% | -13% | -8% |
| 23 | YIT | 66% | 100% | 113% |
| | ABHAR | 6% | 10% | 4% |

**Table 8.8: BHAR of Finland stock market in 12, 24 and 36 months.**

## 8. Ireland (ISEQ overall)

| No. | Component | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | KERRY GROUP 'A' | 29% | -9% | -8% |
| 2 | KINGSPAN GROUP | 32% | 30% | 32% |
| 3 | GLANBIA | 24% | -7% | -50% |
| 4 | C&C GROUP | 35% | 54% | 40% |
| 5 | ABBEY | 18% | -3% | -10% |
| 6 | CPL RESOURCES | 26% | 47% | 69% |
| | ABHAR | 27% | 19% | 12% |

**Table 8.9: BHAR of Finland stock market in 12, 24 and 36 months.**

## 9. Portugal (PSI 20)

| No. | Component | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | ALTRI SGPS | 3% | -11% | -32% |
| 2 | BANCO COMR.PORTUGUES 'R' | 7% | -14% | 9% |
| 3 | CORTICEIRA AMORIM | 49% | 91% | 32% |
| 4 | CTT CORREIOS DE PORTUGAL | -91% | -211% | -379% |
| 5 | EDP ENERGIAS DE (FRA) PORTUGAL | -20% | -47% | -67% |
| 6 | EDP RENOVAVEIS | -15% | -80% | -129% |
| 7 | GALP ENERGIA SGPS | 41% | 86% | 105% |
| 8 | IBERSOL - SGPS | 4% | 76% | 72% |
| 9 | JERONIMO MARTINS | 95% | 122% | 131% |
| 10 | MOTA ENGIL SGPS | 8% | 20% | 89% |
| 11 | NOS SGPS | 41% | 20% | 17% |
| 12 | NOVABASE | -1% | 42% | 55% |
| 13 | PHAROL SGPS | 6% | 23% | 12% |
| 14 | REN REDES ENERGETICAS NACIONAIS | 5% | -5% | -10% |
| 15 | SEMAPA | -38% | -55% | -71% |
| 16 | SONAE SGPS | 1% | -21% | 10% |
| 17 | SONAE CAPITAL | 102% | 165% | 256% |
| 18 | SONAE INDUSTRIA SGPS | 58% | 77% | 159% |
| 19 | NAVIGATOR COMP | -15% | -23% | -15% |
| | ABHAR | 13% | 13% | 13% |

**Table 8.10: BHAR of Portugal stock market in 12, 24 and 36 months.**

**10. Spain (IBEX 35):**

| No. | Component | 12 months | 24 months | 36 months |
|---|---|---|---|---|
| 1 | ACCIONA | -5% | -55% | -104% |
| 2 | ACERINOX 'R' | -61% | -83% | -157% |
| 3 | ACS ACTIV.CONSTR.Y SERV. | -38% | -47% | -81% |
| 4 | AMADEUS IT GROUP | 13% | 18% | 53% |
| 5 | ARCELORMITTAL (LUX) | -29% | 49% | 66% |
| 6 | BANCO DE SABADELL | -45% | -65% | -76% |
| 7 | BANCO SANTANDER | -41% | -21% | -18% |
| 8 | BANKIA | -23% | -7% | 0% |
| 9 | BANKINTER 'R' | -37% | -47% | -70% |
| 10 | BBV.ARGENTARIA | -4% | 10% | 27% |
| 11 | CAIXABANK | -48% | -36% | -36% |
| 12 | CIE AUTOMOTIVE | -12% | -40% | -40% |
| 13 | ENAGAS | -49% | -117% | -202% |
| 14 | ENCE ENERGIA Y CELULOSA | 41% | 26% | 118% |
| 15 | ENDESA | -19% | -45% | -98% |
| 16 | FERROVIAL | -11% | -38% | -69% |
| 17 | GRIFOLS ORD CL A | 34% | 34% | 47% |
| 18 | INTL.CONS.AIRL.GP. (MAD) (CDI) | -19% | -86% | -122% |
| 19 | IBERDROLA | -16% | -50% | -89% |
| 20 | INDITEX | 27% | 23% | 2% |
| 21 | INDRA SISTEMAS | 53% | 85% | 85% |
| 22 | INMOBILIARIA COLONIAL | -59% | -234% | -487% |
| 23 | MAPFRE | -22% | 16% | 16% |
| 24 | MEDIASET ESPANA COMUNICACION | -45% | -66% | -136% |
| 25 | MELIA HOTELS INTL. | 7% | 20% | 18% |
| 26 | NATURGY ENERGY | -25% | -26% | -32% |
| 27 | RED ELECTRICA | -43% | -117% | -211% |
| 28 | REPSOL YPF | -7% | 28% | 47% |
| 29 | SIEMENS GAMESA RENEWABLE ENERGY | 113% | 135% | 32% |
| 30 | TECNICAS REUNIDAS | -15% | 25% | 7% |
| 31 | TELEFONICA | -15% | -21% | -35% |
| 32 | VISCOFAN | 0% | -27% | -31% |
|  | ABHAR | -13% | -24% | -49% |

**Table 8.11: BHAR of Spanish stock market in 12, 24 and 36 months.**

| No. | Country | 12 months | | | 24 months | | | 36 months | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | S | $\hat{\gamma}$ | sd | S | $\hat{\gamma}$ | sd | S | $\hat{\gamma}$ | sd |
| 1 | AUS | -0,13 | -0,35 | 47,43 | -0,03 | -0,83 | 107,84 | -0,11 | -1,69 | 221,85 |
| 2 | BEL | 0,28 | -0,23 | 19,96 | 0,10 | -0,32 | 46,73 | 0,09 | -0,65 | 76,01 |
| 3 | FRA | 0,41 | 0,14 | 20,31 | 0,11 | -0,77 | 46,65 | 0,09 | -1,51 | 78,56 |
| 4 | GER | 0,17 | 1,38 | 39,12 | 0,17 | 1,40 | 70,76 | 0,13 | 0,36 | 95,89 |
| 5 | LUX | 0,34 | -0,43 | 20,86 | 0,25 | 0,86 | 38,12 | 0,26 | 0,60 | 52,60 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | NTL | -0,36 | -0,11 | 19,28 | -0,24 | -0,16 | 52,55 | -0,29 | -0,57 | 75,92 |
| 7 | FIN | 0,16 | 0,17 | 35,75 | 0,19 | -0,13 | 53,47 | 0,05 | -1,31 | 80,40 |
| 8 | IRE | 4,42 | -0,18 | 6,22 | 0,65 | 0,15 | 28,38 | 0,29 | -0,11 | 42,80 |
| 9 | ITA | 0,11 | -0,46 | 35,05 | 0,05 | -0,49 | 70,59 | -0,01 | -1,24 | 107,20 |
| 10 | POR | 0,28 | 0,08 | 44,79 | 0,16 | -0,59 | 83,84 | 0,10 | -1,04 | 130,10 |
| 11 | SPA | -0,35 | 1,38 | 36,33 | -0,35 | -0,53 | 66,79 | -0,44 | -1,76 | 112,77 |

**Table 8.12: Result of S, Standard deviation (sd) and $\hat{\gamma}$ in test long run.**

Which $S = \frac{AHBR_t}{\sigma(BHAR_t)}$ and $\hat{\gamma} = \frac{\sum_{i=1}^{n}(BHAR_{i,t} - AHBR_t)^3}{n\sigma(BHAR_t)^3}$, $\hat{\gamma}$ is an estimate of the coefficient of skewness; $S$ is the conventional t-statistic of t-test above; sd is standard deviation of BHAR in time t