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THE IMPACT OF THE ECB MONETARY POLICY ANNOUNCEMENTS ON EUROPEAN STOCK INDEX FUTURES RETURNS AND CORRELATIONS

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ABSTRACT

The purpose of the study is to examine the ECB's monetary policy decisions and their impacts on European stock index futures returns and correlations.

During the sample period from January 2005 to December 2011 there was 82 target rate decisions, which consisted 19 target rate changes. In addition, six target rate decisions were treated as a surprise. Event study methodology was used to examine the impact of these target rate decisions to euro-zone (Euro Stoxx 50) and non euro-zone (OMX Stockholm 30 and FTSE 100) stock index futures returns and their correlation. In addition, the impact of the ECB's target rate decisions was also examined under different business cycles.

The ECB's monetary policy decisions do have an impact on both euro-zone and non euro-zone stock index futures markets and their correlations. The main findings suggest that only changes and surprises in the target rate do have an impact. In addition, there were no significant differences between the euro-zone and non euro-zone futures returns.

KEYWORDS: The ECB, monetary policy, stock index futures returns, correlation, business cycle

1. INTRODUCTION

Originally, futures markets were introduced to eliminate the risk of commodities. Futures trading have exploded since the year 1970. (Carlton 1984) Since the early 1982 trading began at three different exchanges in futures contracts based on stock indexes. Stock index futures were an immediate success leading rapidly to a launch of new futures and option series tied to various indexes. One possible reason for such success was that index futures greatly extended the range of investment and risk management strategies available to investors by offering them, for the first time, the possibility of unbundling the systematic and nonsystematic components of risk and return in their portfolios. (Figlewski 1984.)

Since the creation of stock index futures contracts vast amount of new indexes have emerged into the markets. These stock indexes are used as an underlying asset for stock index futures contracts. Unlike most futures contracts, stock index futures are settled by cash amount equal to the value of the stock index in question on the contract maturity date times a multiplier that scales the size of the contract. Second possible reason for the fact that stock index futures are so popular among investor is that they substitute for holding in the underlying stock themselves. Index futures let investors participate in broad market movements without actually buying or selling large amount of stocks. (Bodie, Kane & Marcus 2009.)

After the formation of euro-zone at 1999, an economic and monetary union (EMU) of 17 European Union member states that have adopted the euro as their common currency, Europe was divided into euro-zone and non euro-zone economies. The Euro-zone, in addition to it’s currency, has it’s own central bank. The European Central Bank (from here after the ECB), has the mandate to oversee and execute monetary policy actions in order to sustain price stability in the Euro area. (ECB 2012.) These monetary policy actions and announcements tend to have a significant impact on derivatives markets at some level. (Beber & Brandt 2006.) And more specifically, vast amount of recent studies examines the impact of monetary policy decisions to stock market reactions. Bernanke and Kuttner (2005), for instance, document that an unexpected 25 basis points cut in the target rate of the Federal Reserve typically increases stock prices in the U.S. by around one percent. Similar finding on stock market reactions to monetary policy decisions are recently reported e.g. in Wang, Yang and Wu (2006), Basistha and Kurov (2008), Bohl, Siklos and Sonderman (2008) and Kurov (2010a).

The stock index futures contracts are mainly traded by highly informed investors, such as fund manager, and therefore futures prices are leading the underlying stock index. (Gaul & Theissen 2008.) The price discovery feature that the stock index futures contracts possess is academically recognized and therefore their use has rapidly increased. Based on the price discovery assumption the stock index futures prices should reflect immediately all new information represented to markets. Beber and Brandt (2006) stated in their study that new and surprising information is first treated in derivatives market and such news as monetary policy decisions do have an impact on derivative prices.

Bohl et al. (2008) examined the impact of the ECB's interest rate decisions to European stock market returns and reported consistent findings with previous studies. Despite the growing rate of studies that examines the impact of macroeconomic news and monetary policy decisions on equity markets, there are only few or none research studies that examine the impact of the ECB's monetary policy announcements, more specifically the target rate decisions, to both euro-zone and non euro-zone futures markets. The purpose of this study is to illuminate the impact of the ECB's monetary policy news announcements to euro-zone and non euro-zone stock index futures.

1.1. Previous Studies

Earlier studies focused on stock index futures are ground work for this study that examines the impact of the ECB's monetary policy news announcements to European non euro-zone stock index futures such as OMXS 30 (OMX Stockholm 30 stock index future) and FTSE 100 (stock index future listed in London Stock exchange consisting 100 most highly capitalized UK companies) and compare their correlation and returns with Euro Stoxx 50 (euro-zone blue chip stock index future). The impact of macroeconomic news announcements and policy decisions to both equity and treasury markets are widely examined by respected economist and significant body of literature has evolved (see e.g. Ahn, Cai and Cheung 2001; Kim, Mckenzie and Faff 2004; Simpson and Ramchander 2003; Äijö 2006; Wang, Yang and Wu 2006; Basistha and Kurov 2008; Bohl, Siklos and Sonderman 2008; Kholodilin, Montagnoli, Napolitano and Siliversotvs 2009; Hess and Niessen 2009; Kurov 2010a and Vähämaa and Äijö 2010). Previous research generally suggests that there is strong and consistent evidence that the stock and treasury markets do react on macroeconomic and monetary policy news announcements. Basistha and Kurov (2008) and Vähämaa and Äijö (2010) among others, reported also findings suggesting that the impact of monetary policy news announcements on stock markets vary under different economic cycles, expansive period having more pronounced impact on market uncertainty.

In academic sense it can be stated that macroeconomic news and monetary policy announcements do have an impact on stock markets. Research paper made by Nikkinen and Sahlström (2004) also indicated that US macroeconomic news announcements do have an impact on European stock market valuation. These findings support the assumption that stock markets are integrated in some level and that there is ground for further research on how these international news (euro-zone) effect on domestic stock index futures (Sweden, United Kingdom).

In order to assess the impact of the ECB's monetary policy news to the stock markets it is academically justified to use stock index futures. Under frictionless markets, new information should be impounded simultaneously in futures and their underlying spot prices. In reality, however, futures markets are likely to incorporate market-wide information more efficiently than spot markets because of their inherent leverage, low transaction costs, and lack of short-sale restrictions. (Bohl, Salm & Schuppli 2011.) A large body of literature looking at mature futures markets has confirmed that stock index futures typically lead the cash market, implying that large part of price discovery takes place in the futures market. (see e.g. Booth, So & Tse 1999; Chiang and Fong 2001; Hasbrouck 2003; Chou & Chung 2006; Tse, Xiang and Fung 2006; Rosenberg and Traub 2007 and Gaul & Theissen 2008).

1.1.1. Economic Announcements and Market Reactions

General macroeconomic information is important to investors as it has an obvious and fundamental role to play in influencing the path of asset prices. (Kim et al. 2004.) In their research Kim et al. (2004) tested the impact of six most important US macroeconomic indicators on US stock, bond and foreign exchange markets. Their quantitative results suggest that it is not the act of releasing macroeconomic information which the market considers to be important, but rather the ”news” component of each release – i.e., the difference between the markets expectation and the actual figure. They also reported findings that balance of trade news was found to have the greatest impact on the foreign exchange market. In the bond market, news related to the internal economy was generally found to be important while for the US stock market, consumer and producer price information was significant.

Äijö (2006) also investigated the effects of US and UK macroeconomic news announcements on return distribution implied by FTSE-100 index options prices. In his study Äijö extracted the option-implied moments of the return distribution by using two separate indexes, 22 days and 66 days time-to-maturity. The construction of these fixed time-to-maturity indexes has three benefits; 1) daily changes can be compared, 2) robustness of the results is obtained, and 3) the effects of the macroeconomic variables on different time-to-maturity of options can be investigated. Consistent with Kim et all. (2004) five macroeconomic variables from the UK and US were chosen based on previous studies.

In addition to previews studies Äijö (2006) reported several interesting phenomena. First, Äijö states that implied volatility should decrease after the news announcement, as uncertainty is resolved. Second, the whole implied distribution is found to be consistently affected by some news announcements, which has not yet been documented in literature. Results show that after bad news implied volatility increases, option-implied return distribution becomes more left-skewed and kurtosis decreases, whereas after good news the opposite occurs. Äijö’s interpretation of good (bad) news is as follows: risks are lower (higher), market participants attach greater weight to the possibility of future positive (negative) returns and market has greater (weaker) confidence in the current price level.

Since the reported academic results of the macroeconomic indicators, such as gross domestic product, employment report, industrial production, producer price index and money supply etc. having a significant impact on stock market valuation a new line of studies have emerged. These studies were examining the impact of monetary policy decisions. Monetary policy decisions of central banks are often associated with large stock price movements. Bohl et al. (2008), for instance, documented that an unexpected rate hike of 25-basis points in the ECB's target rate typically decreases the European stock markets between 1,42% and 2,30%. These findings are consistent with Bohl et al. (2008), Basistha and Kurov (2008) and Wang et al. (2006) examined the impact of monetary policy announcements to equities markets. Both of these studies were based on US data and the Federal Reserve target rate changes. Wang et al. (2006) documented findings suggesting that unanticipated 25-basis point cut in the federal funds rate target is associated with about a 2,3% increase in the S&P 500 stock index.

While the effects of monetary policy actions on stock prices have been examined extensively in the prior literature, considerably less attention has been given to the effects of monetary policy on stock market volatility. Nikkinen and Sahlström (2004), Farka (2009), and Andersson (2010) studied the effects of monetary policy decisions on stock market volatility and they documented a significant increase in volatility during the days of monetary policy announcements. Farka (2009) and Andersson (2010) used intraday data to examine volatility dynamics around monetary policy meetings and reported large increases in stock market volatility in the immediate aftermath of monetary policy decisions. In addition, Farka (2009) showed that the increase in volatility is substantially larger during recessions and expansive monetary policy cycles than during periods of restrictive policy.

Basistha and Kurov (2008), Kurov (2009), and Vähämaa and Äijö (2010) reported consistent findings with Farka (2009). Basistha and Kurov (2008) reported findings suggesting that there is much stronger response of stock returns to unexpected changes in the federal funds target rate in recessions and in tight credit market conditions. They also showed that firms that face financial constraints are more affected by monetary shocks in tight credit conditions than the relatively unconstrained ones. Farka (2009) reported findings that monetary policy shocks have a strong impact on investor sentiment in bear market periods. Furthermore, his analysis of stock returns on the Federal Open Market Committee (FOMC) announcements days shows how the stocks that are more sensitive to sentiment changes react much more strongly to monetary news.

Based on prior literature Vähämaa and Äijö (2010) studied the impact of the Fed's monetary policy decisions on stock market uncertainty. They regressed the daily changes in implied volatility index on alternative monetary policy variables: (i) dummy variable for FOMC meetings, (ii) target and path surprises, (iii) scheduled surprise variables that identify target and path surprises in scheduled FOMC meetings, (iv) unscheduled scheduled surprise variables that identify target and path surprises in scheduled FOMC meetings and (v) positive and negative surprise variables. Their results indicate that implied volatility decreases on the FOMC meeting days. The result is consistent with previous studies but nevertheless it should be noted that the approach based on the FOMC dummy variable ignores the actual decision made in the meeting.

In further analysis Vähämaa and Äijö (2010) took the surprise components of the meeting into account. Their regression estimates show that the target surprises are positively associated with stock market uncertainty. Positive target rate surprises increases the market uncertainty and vice versa. In their study Vähämaa and Äijö (2010) also examined whether the policy surprises in scheduled and unscheduled FOMC meetings have different impact on stock market uncertainty. Their results indicate that scheduled and unscheduled path surprises have counteracting effects on volatility. Finally they found results indicating that good monetary news tends to reduce market volatility.

Vähämaa and Äijö (2010) also examined whether the impact of monetary policy decisions on implied volatility is asymmetric across monetary policy cycles. Recently reported results from similar studies suggest that reactions of stock markets to monetary policy decisions may vary depending on monetary policy cycle. Their findings were consistent with the results from previews studies and suggesting that the effects of monetary policy decisions on stock markets are stronger during economic downturns. They also showed results that suggest that stock markets react to new information about the future path of monetary policy. Vähämaa and Äijö (2010) states: Coefficient estimates for the FOMC meeting dummies are always negative and highly significant and this positive relation seems to be mostly driven by the volatility-reducing effects of negative surprises during periods of expansive monetary policy.

Finally, after large amount of academic evidence suggesting that there is a strong impact between monetary policy announcements and stock returns there are few studies that have found these relationships between international stock markets. Nikkinen, Omran, Sahlström & Äijö (2006) studied global stock market reactions to scheduled US macroeconomic news announcements. They found evidence suggesting that G7 countries, the European countries other than G7 countries, developed Asian countries and emerging Asian countries are closely integrated with respect to US macroeconomic news, while Latin America and Transition economies are not affected by US news. Although, Nikkinen et al. (2006) excluded FED's policy announcements from their empirical testing, the results show that developed global stock markets are highly integrated and investors should be careful when picking markets to receive diversification benefits.

More related to this study, Bohl et al. (2008) and Kholodilin et al. (2009) examined the impact of the ECB's monetary policy announcements to different European stock markets. Bohl et al. (2008) examined the impact of the ECB's unexpected monetary policy announcements in the euro area. To describe the impact of monetary policy shocks on European stock markets they focused on the four largest national stock markets, namely the German DAX 30, the French CAC 40, the Spanish IBEX 35 and the Italian MIB 30. As a proxy for the aggregate European stock market, they choose the Euro Stoxx 50 stock index. Their daily price data sample spans from 1 January 1999 to 28 February 2007 consisting 127 ECB's monetary policy surprises.

Bohl et al. (2008) reported findings that support the assumption of homogeneous reaction between the stock indices price reactions and monetary policy shocks. The variance estimate for policy shocks for the Euro Stoxx 50 is -8.40, implying that an unexpected 25-basis-point increase of the main lending rate results in a 2.1% decline in the Euro Stoxx 50 on the same day. The coefficients for the national stock indices produce similar responses, although the size of the response is slightly lower. In particular, a 1.42 - 2.3% fall of the respective indices follows an unexpected 25-basis-point interest hike. With the exception of Italy, having statistically insignificant and lower response to policy surprises, their findings are supportive of a homogeneous reaction of major EMU stock markets to the ECB's monetary policy shocks.

1.1.2. Stock Index Futures and the Underlying Markets

The spectacular growth in the volume of trading in stock index futures contracts reveals the interest in these instruments that is shared by broad cross section of market participants. It is generally agreed that arbitrageurs maintain the linkage in prices between the underlying basket of stocks and the futures. If this link is maintained effectively, then investors who are committed to trade will recognize these markets as perfect substitutes, and their choice between these markets will be dictated by convenience and their transaction cost. (MacKinaly & Ramaswamy 1988.) Since the early stage of derivatives markets concurrent changes in trading mechanisms, technology and the choice of exchange have taken place and produced an increased demand of stock index futures. Due to the rapid development in trading technology and low transaction cost different motivations for trading derivatives, commonly categorized as speculative and hedging demand has emerged. (Aguenaou, Gwilym & Rhodes 2010.)

The fast growth of stock index futures markets has increased the amount of academic interest and large body of literature has evolved. Herbst, McCormack & West (1987) were one of the first to discover the lead and lags of futures and spot prices. They found a strong contemporaneous relationship between spot and futures returns and that the futures markets lead the stock markets by a few minutes. Similar findings were found when Chiang & Fong (2001) examined the futures market returns and the stock market returns on the Hang Seng Index (HSI) based in Hong Kong. Their intraday data was from nine-month period in 1994. They used model similar to GARCH to remove the autocorrelation effects from the stock returns and found that the futures market in fact lead the stock market.

A vast amount of studies have found consistent evidence of the lead-lag relationship between the futures and spot market returns suggesting that futures markets contribute to price discovery. (see eg. Tse, Xiang and Fung 2006; Rosenberg and Traub 2007 and Gaul & Theissen 2008). There is a widespread evidence that futures trading contributes to price discovery and thus to the efficiency of stock markets. Brooks, Rew & Ritson (2001) study ten-minute observations of FTSE 100 index prices and its index futures prices from 1996 to 1997. They found, unsurprisingly, that the futures market leads the spot market, and that this predictive power of futures returns support the hypothesis that new systematic information disseminates first in the futures market and then in the stock market, with arbitrageurs trading across both markets to maintain the cost of carry relationship.

It is important to notice that most of the markets under investigation in existing studies are similar in terms of investor structure. In the majority of cases, a high level of institutional trading characterizes futures markets. In the finance literature, institutions are usually presumed to be well-informed, rational investors, whereas individuals are viewed as uninformed or driven by sentiment and behavioral biases. (Bohl et al. 2011.) A large body of empirical literature on institutional and individual trading supports this view. Because of limited information processing capacity, individuals seem to pick stock based on attention-grabbing events. Furthermore, individual investors are prone to behavioral biases such as disposition effects and overconfidence. Because their decisions are sentiment-driven, individual act as “dumb money” when investing in mutual funds or buy stocks that subsequently underperform. Accordingly, they lose from trading with more sophisticated institutional investors. (Barber, Lee, Liu & Odean 2009.)

Bohl et al. (2011) states that previous literature on price discovery in stock index futures and spot markets neglects the role of different investor groups. Their empirical results suggest that during the dominance of presumably uninformed private investors, the futures market does not contribute to price discovery. By contrast, there is evidence of information flows from futures to spot markets and a significant increase in conditional correlation between both markets as institutional investors share in trading volume increases. Based on these findings it can be stated that mature stock index future markets with high level of institutional and foreign investors adopt new information more efficiently than the underlying spot market.

1.2. Purpose of the Study and Hypotheses

This study investigates the impact of the ECB's monetary policy announcements, more closely the target rate decisions, on three European stock index futures contracts. First the impact of the ECB's target rate decisions to euro-zone and non euro-zone stock index futures prices reactions is examined. Secondly, the correlation between the euro-zone and non euro-zone stock index futures prices during the ECB's target rate decision dates are examined. Thirdly, the relationship between the stock index futures returns and the ECB's target rate decision under recessionary and non-recessionary business cycle is observed. The two vastly traded European non euro-zone stock index futures OMXS 30 and FTSE 100 were chosen and as a proxy for the aggregate European stock index future market, the Euro Stoxx 50 was chosen consistent with the selection method used by Bohl et al. (2008).

From the large field of empirical studies and findings explained above, the research hypotheses can be derived. First, a distinct presumption that monetary policy announcements do effect on stock markets can be formed. Secondly, vast amount of studies also indicate that developed stock markets are highly integrated and correlated. Therefore, quite conceivably, the two first hypotheses are as follows:

> H_1: The ECB's target rate decisions do have an impact on OMXS 30, FTSE 100 and Euro Stoxx 50 futures returns.

> H_2: The correlation increases between the non euro-zone and the euro-zone futures returns during the days of ECB's target rate decisions.

In addition, previews studies indicate that the stock market reactions to monetary policy announcements differ under expansive and restrictive economic cycle, restrictive economy having stronger impact. Third hypotheses as follows:

> H_3: The ECB's target rate decisions do have a greater impact on OMXS 30, FTSE 100 and Euro Stoxx 50 futures returns under restrictive economy.

Now, if H_1 would be rejected, it would mean that the ECB's monetary policy news do not effect on stock index futures market and therefore further examination would be in vain. Moreover, if we continue from the assumption that H_1 is accepted and H_2 is accepted meaning that the ECB's monetary policy news does have an impact on European stock index futures markets and that they are highly integrated, it gives ground for further examination. If the H_3 is rejected it would mean that there is no difference between the economic stance and the reaction of stock index futures market to the ECB's monetary policy news.

1.3. Thesis Structure

The remainder of this thesis contains four sections in the following order: theoretical, descriptive, empirical and conclusive. The next two chapters constitute the theoretical segment. Chapter two summaries the theory of futures and stock index futures, explains principals of futures pricing and gives further insight into concept of stock index futures and construe its properties and attributes. Chapter three covers the reasons for the monetary policy news announcements and the role of information to the markets. Chapter four focuses on the research data and the methodology with which it is going to be studied. Chapter five contains the empirical analysis and results arising from the data. The last chapter summaries and concludes the work the thesis has achieved.

2. THEORY OF FUTURES CONTRACTS

A futures contract is essentially a forward contract that is traded and settled on an organized financial exchange. As forwards contracts, futures contracts are agreements between two agents. Agents agree to buy or sell an asset for certain pre-fixed price at a certain time in the future. The agent who agrees to buys the contract assumes long position and the seller assumes short position, similarly to forward contracts. The price for futures contracts are composed consistently to any other object that is priced by the law of supply and demand. Increased demand usually raises the price of a futures contract and vice versa. One major difference between forwards and futures contracts is that they are highly standardized and traded through an exchange like any other financials. Futures contracts are also more suitable for investors than forwards due to their standardized qualities. Futures contracts unlike forwards are easily traded, they employ additional means, such as capital requirements to reduce probability of defaults. Trading partners are easily found by the centralized trading and the investors can close their positions prior to the maturity and avoid actual delivery of the underlying asset or commodity. (Kolb & Overdahl 2003: 4-6; Hull 2012: 7-43)

Organized futures markets as we see them arose in the mid-1800s in Chicago. Futures markets began with contracts trading corn, oats and wheat as the underlying asset. Today futures contracts are traded continually around the globe and new assets underlying the contracts are listed actively with multiple options for contract lengths. Now investors can trade futures contracts that have either commodities or financial assets as an underlying asset. Examples for underlying commodities are pork bellies, live cattle, sugar, wool, lumber, wheat, grain, copper, aluminum, gold and tin and for financial assets interest rates like treasury bonds, stock indexes or foreign currencies. Evidently the largest exchanges on which these futures contracts can be traded include CME Groups two exchanges: Chicago Board of Trade (CBOT), Chicago Mercantile Exchange (CME). Other exchanges are Eurex, London Financial Futures and Options Exchange (LIFFE), Tokyo International Financial Futures Exchange (TIFFE) and Singapore International Monetary Exchange (SIMEX). (Kolb & Overdahl 2003: 4-24; Bodie, Kane & Marcus 2005: 791-813; Hull 2012:7-43.)

Hedging and speculating are two polar uses of futures markets. A speculator uses a futures contract to profit from price movements, a hedger to protect against such movements. Investor whose sole purpose is to secure ones assets from price fluctuations hedges his position by selling or buying futures contracts to reduce the level of market exposure. This is a normal situation faced in companies where main business is to produce a product or consume a commodity that is predisposed to market price fluctuations. Unlike hedgers, speculators intention is to buy and sell futures contracts for the sole purpose of profit making. Speculators as their name indicates are driven mainly by market movements and their intention is not to use or close the futures contract in order receive the actual underlying asset. (Kolb & Overdahl 2003: 24- 35; Bodie et al. 2005: 802-806.)

Stock index futures contracts as they are financial futures are always settled in cash and do not lead to a delivery of underlying stocks. This is simply because delivering an index such like S&P 500 would require delivery of 500 shares with consistent weights to the index. This would obviously be too expensive and more importantly inefficient and difficult. The most popular stock indexes that are selected as underlying assets for stock index futures contracts are S&P 500, DIJA, NASDAQ 100, Nikkei 225, CAC-40, DAX-30, FTSE 100 and DJ Euro Stoxx 50. They are daily traded in global markets and are futures contracts with large open interests. To make trading possible, the exchange specifies certain standardized features of the contract. As the two parties of the contract do not necessarily know each other, the exchange also provides a mechanism that gives the two parties a guarantee that the contract will be honored. (Kolb & Overdahl 2003: 24; Hull 2012: 7-61.)

2.1. Futures Contracts

A future contracts both financial or commodities are traded in organized futures exchanges as explained above. Each exchange provides a trading floor where all of its standardized contracts are traded. Futures exchanges main responsibilities is to provide an institutional framework for standardized contract terms and mitigating credit risk in order to avoid defaults. Organized futures exchange must specify the contract terms such as the underlying asset, contract size, daily settlements, delivery arrangements and market regulations. (Kolb & Overdahl 2003: 24-25; Bodie et al. 2005: 791-802; Hull 2012: 22-26.)

Futures contract that is based on commodities requires the exchange to specify different levels of grades for the underlying asset. For example, when trading with copper futures it is vital to know whether the grade of underlying copper of the future contract is high or low and by that acceptable upon delivery. In contrast to commodity futures, financial futures contracts are commonly well defined. For example, CBOT trades a treasury bond futures that call for the delivery of U.S Treasury bonds. The contract specifies the seller to deliver $ 100,000 face value of U.S Treasury bonds that are not callable and do not mature within 15 years from the first delivery month of the futures contract. The terms regulate both the way of delivery and the timing of the delivery. This leads to a situation where investors immediately know the level of the good being traded. (Kolb & Overdahl 2003: 25; Hull 2012: 24-25.)

One of the most important features of futures contracts is the contract size that defines the quantity of the underlying asset to be delivered under one futures contract. This decision has made the futures market more attractive in expense sense. The contract size may vary from large size, usually associated with financial futures, to small contract size used more commonly when trading agricultural futures. The futures exchange usually provides different contract sizes in both commodity and financial futures to meet the investor's requirements. (Hull 2012: 25.)

One of the most important functions to avoid contract defaults is the mark to market feature giving secure to both sides of the contract. It basically means that at initial execution of a trade, each trader establishes a margin account. The margin is a security account consisting of cash or near-cash securities, such as Treasury bills, which ensures the trader is able to satisfy the obligations of the futures contract. Because sides, buyer and seller, to a futures contract are exposed to losses, both must post margin. The initial margin can be seen as insurance that the contract will be executed as agreed by the parties involved. As the price of the futures contract varies over time, the margin account is rebalanced on a daily base and the investor's profit or loss is either added or deduct from the margin account. In the end of each trading day the value of the futures contract should be back to zero. If the price of the futures contract decreases and causes the margin account balance to drop under initial agreed level, better known as maintenance margin, the exchange is forced to issue a margin call to the investor. After received the margin call the investor has to rebalance the margin account to the initial margin level. If the investor fails to settle the day's losses, the broker may seize the margin deposit and liquidate the investor's position. (Kolb & Overdahl 2003: 27-28; Bodie et al. 2005: 799-802.)

There is a third party, usually referred to as the clearinghouse to which the exchanges outsource all the mark to market, reconciliation and settlement functions. The clearinghouse member, better known as the broker, becomes the seller's buyer and buyer's seller and usually interacts straight with the actual investors. It guarantees the performance of the parties to each transaction. The main task of the clearinghouse is to keep track of all the transactions that take place during market hours, so that it can calculate the net position of each of its members. The margin accounts for clearinghouse members are adjusted for gains and losses at the end of each trading day in the same way as are the margin accounts of investors. However, in the case of clearinghouse member there is no maintenance margin, only an original margin. Every day the balance of a account for each contract must be maintained at an amount equal to the original margin times the number of contracts outstanding. (Bodie et al. 2005: 796-802; Hull 2012: 29-30.)

The exchange is obligated to specify the place and time for the delivery of futures contracts. Each futures contract must have its own specified rules for making and taking the delivery. These rules must cover both time and the location of the delivery, and the way in which the financial futures funds covering the underlying assets will change hands. The delivery time or better known as the maturity must also be stipulated by the exchange because the maturity has a significant impacts on the futures contract price. The maturity of the futures contracts usually varies in order to meet the investor's heterogeneous demands. Most common delivery months for stock index futures are March, June, September and December. The exchange also must set the date when the trading begins and when it closes for each listed futures contract. There are there critical days for a futures contract: the first notice day, the last notice day and the last trading day. The first notice day is the first day on which a notice of intention to make delivery can be submitted to the exchange and the last day of notice is the last such day. Generally the last trading day is a few days before the last notice day to avoid the risk of having to take delivery. (Kolb & Overdahl 2003: 29; Hull 2012: 36.)

Most of the futures contracts that have been traded are unlikely to lead to actual delivery of the underlying assets. Nonetheless, it is vital to agree and specify the terms of the futures contracts delivery if needed. As the delivery date approaches, the clearinghouse will supervise the arrangements for the actual delivery. The seller declares his willingness to deliver to the clearinghouse, this is known as notice of intention to deliver. After notice of intention, the clearinghouse will pair buyers and sellers for the delivery and will identify and contact the two parties for each other. After this the buyer and seller will communicate the relevant information to the clearinghouse in order to fulfill their obligations. In case when the buyer wishes to avoid the actual delivery, he simply closes his position by entering a reversing trade prior to the time of delivery. (Kolb & Overdahl 2003: 30-31; Bodie et al. 2005: 796-802; Hull 2012: 35-36.)

In addition to futures contracts with commodities as an underlying assets, a new line of futures contracts have emerged – financial futures. Most of the financial futures contracts are settled with cash rather than physically delivered. This simply means that at the maturity of cash settled contracts, the buyer receives a cash payment from the seller if the spot price prevailing at the contracts maturity date is above the purchase price listed in the contract. If the situation is vice versa, the buyer is obligated to make cash payment to the seller. One and very common example of these cash settled futures are stock index futures contracts. Imagine a situation where the delivery of one futures contract would require a delivery of a portfolio consisting hundreds of shares. When a contract is settled in cash, all outstanding contracts are declared closed on a pre-determined day. The final settlement price of the futures contract is set equal to the spot price of the underlying asset at either the opening or close of trading on that pre-determined day. (Kolb & Overdahl 2003: 31; Hull 2012: 36-37.)

Like any other standardized markets both futures and option markets are regulated and supervised by the federal government. One example for these regulators in the United States is the Commodity Futures Trading Commission (CFTC) that regulates the futures exchanges that trade all futures contracts and options on futures. The sole purpose for these commissions is to increase transparency in the derivatives markets. The trading commissions are responsible for creating a trading environment where futures prices are rightly communicated and that the futures trading providers are properly licensed. This also means that the commissions do have an authority over the futures trading providers in case of serious irregularities and lack of transparency and can execute disciplinary actions against those who do not play by the rules. (Kolb & Overdahl 2003: 18-19; Bodie et al. 2005: 802; Hull 2012: 38.)

2.1.1. Futures Prices and Spot Prices

As the futures contract has its underlying asset where its price is tide, there is a strong relationship between these two prices. When the maturity or delivery time of the futures contract is coming closer the price of the futures contract is approaching the spot price of the underlying asset. At the delivery day or at maturity the futures price should equal with the underlying spot price. Although, there are some occasions where this does not apply and this is due to the arbitrage aspect of the futures a contract. Arbitrage opportunity appears when for example the futures price is above the underlying spot price during the delivery period. This situation possess a clear opportunity for investors with low transaction cost to short or sell the futures contract and buy the actual underlying asset and then make the delivery. These situations are quickly exploited and as Kolb and Overdahl (2003) states there are few or none of these occasions and the mispricing is quickly corrected. (Hull 2012: 26-27.)

The fact that futures markets are widely used by professional investors leads to a situation where the futures price and the underlying spot price are, if not equal, very close to each other at the maturity. The convergence of the future and spot prices during the delivery period is better known as co-integration. Both Kolb and Overdahl (2003) and Hull (2012) states that there have been significant amount of academic studies reporting strong co-integration during the delivery period and at maturity. This situation is shown graphically in Figure 2. (Kolb & Overdahl 2003: 35-45; Hull 2012: 26.)

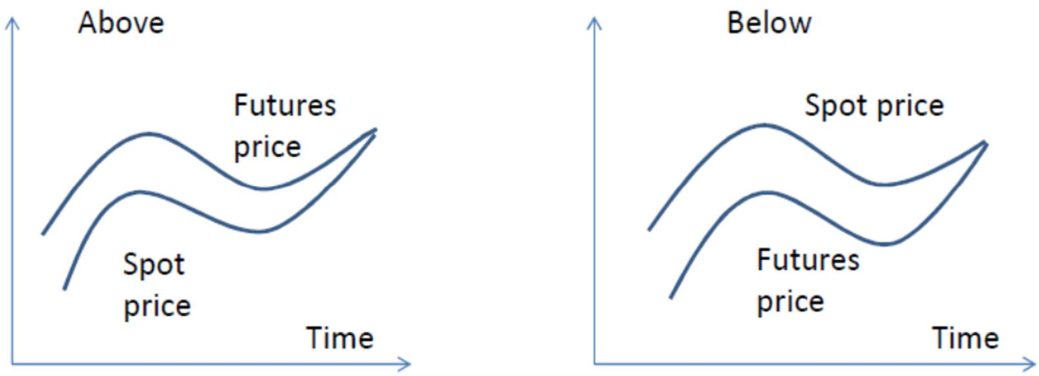

Figure1. Relationship between spot and futures prices as the maturity is approached. Futures price (above) spot price, futures price (below) spot price.

2.1.2. The Yield of Futures Contracts

Futures contract always requires two participants, the buyer and the seller both willing to trade the futures contract with specified underlying asset and terms of the contract. The buyer of the futures contract takes so called long position and the seller of the futures contract takes so called short position. The yield for futures contract is rather simply defined and very similar to forward contracts. As explained in previous section, the yield of the buyer of the contract goes up simultaneously when the price of the futures contract increases. On the contrary, if the price of the futures contract decreases the sellers yield rises and vice versa. Simply, the buyer or long position makes profit when the futures price goes up and the seller or the shot position makes profit when the price of the futures contract goes down. (Hull 2012: 5-6.)

The yield for a futures contract is the difference between the delivery price and the spot price at the maturity. Therefore, the yield to a buyers (long) futures contract is

(1) $$S_T – K,$$

where K is the delivery price and S_T is the spot price of the underlying asset at maturity. Consistently, the yield to a sellers (short) futures contract is

(2) $$K - S_T$$

The yields of the futures contracts can be both positive and negative and it is vital for investors to understand that equations and figure 1. explained below are simplifications and do not reflect the real trading with futures contracts. As Hull explains in his book, the figure above is actually true with forwards and

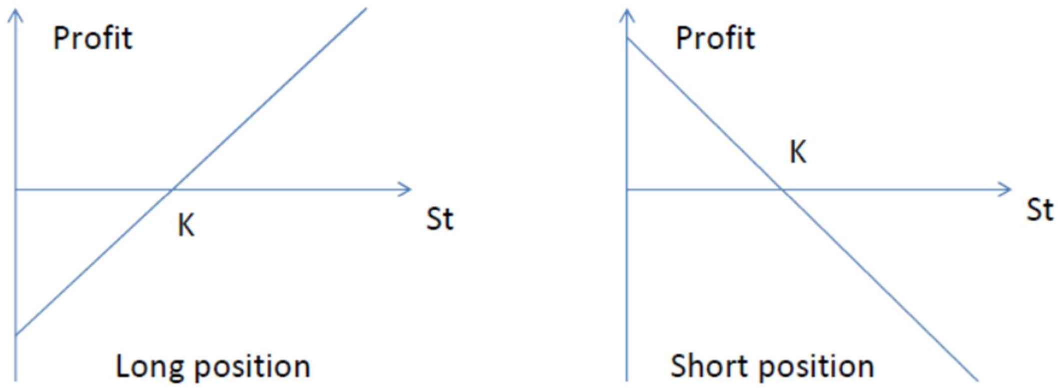

Figure 2. Yield from long position and short position, *K* = Delivery price and *St* = price of the asset at maturity.

futures are quit close to each other it can be used explaining futures yields as well. (Hull 2012: 5-7.)

2.1.3. Pricing Futures Contracts

Forward contracts and futures contracts are deceptively similar securities and therefore we can use forward prices when defining the theoretical price for futures contracts. Both forward and futures contracts must be exercised if held until the maturity. When the contract is initiated the exercise price is set so that the each has a zero initial value. One major difference between the forward and futures contracts is the cash flow, futures contract makes interim payments during its life – forward dose not. For this reason forward contracts are easier to evaluate than futures and therefore the following equations and analysis is in fact for forwards. In addition, Hull (2012) states that when the risk-free interest is constant and equal for all maturities, the price of a futures contract and forward's with same maturity is equal. (Jarrow & Oldfield 1981; Hull 2012: 101.)

The price for futures contract can be derived from different assumptions that are based on forward pricing models. Investor can use arbitrage arguments when pricing forward and the futures, the price can be defined by observing various market variables. Unfortunately, this cannot be done with consumption assets as underlying assets. Forward and futures contracts and their underlying assets can be derived into two different sub-categories: consumption and investment assets. In following valuation models and pricing theories we make an assumption that the underlying asset of a futures contract is in fact investment asset. (Hull 2012: 105.)

One of the most robust ways to valuate futures contracts is to valuate futures contract with underlying asset that creates no income or cash flow during its life time. Good examples of these underlying assets are zero-coupon bonds, non-dividend-paying stocks or stock indexes. Hull (2012) postulates that if the price of an underlying asset is S_0, the constant risk-free interest rate is r, and time to maturity is T, then the price of future, F_0, is

(2) $$F_0 = S_0 e^{rT}$$

Quit conveniently, we can turn the equation (2) around and make an assumption as follows: if the investors purchase one unit of underlying asset at a price S_0 and goes for a short futures contract to sell it for F_0 at time T, the cost will be S_0 and it is certain to lead to a cash flow of F_0 at time T. This leads to a situation where, S_0 must equal the present value of F_0. This can be written as follows,

(3) $$S_0 = F_0 e^{-rT}$$

This is the case when there is no arbitrage opportunity in the markets and simply means that equations (2) and (3) are equivalent to one another. Kolb and Overdahl (2003) introduced a case where there is difference between the futures contract and the spot price. This is an arbitrage opportunity as follows, $F_0 > S_0 e^{eT}$. The investors should now buy the asset and short futures underlying the same asset, making arbitrage for an amount equal to $F_0 – S_0 e^{rT}$. This should result as increased price of the underlying asset. In case of a situation where the futures price is mispriced and higher than the actual underlying asset the investors should act just the opposite than explained above. In case of efficient markets where the investors are well informed and act immediately when these arbitrage occurs, their actions should eliminate the mispricing. (Hull 2012: 104-106; Bodie et al. 2005: 806-813.)

At the end of the futures contract, at maturity, the futures price must equal the underlying asset price. This can be written as follows,

$$F_T = S_T \tag{4}$$

where F_T is the futures price at the end of the contract and S_T is the underlying asset price at the expiry of the futures contract. This is simply because, the investor with a long position of the futures contract can derive instant profit from the asset with price F_T. (Bodie et al. 2005: 811-812.)

The pricing model explained above assumes that there is no income involved with the actual underlying asset. In addition, the simple pricing models have faced some criticism and therefore more advanced models are much needed. Next model is based on underlying asset that provides steady and well predictable income in a regular base for its holder. One simple example of these assets is a bond that pays coupon on pre-mixed dates. Futures contract with an underlying asset that will pay dividend or coupon, or any income with a present value of I during the life of a futures contract, Hull (2012) writes the equation as follows:

$$F_0 = (S_0 - I)e^{rT} \tag{5}$$

Equation (5) is a theoretical and simple model for any investment asset that underlies the futures contract and provides known income. The model is vulnerable in terms of deviation from the absolute income and therefore should be treated as theoretical. (Hull 2012: 107-108.)

In addition to known income, if the underlying asset of futures contract offers a known yield a new model is in place. Yield is simply an income that is shown as a percentage, not as absolute cash. Few assumptions need to be made, first we assume that the underlying asset of the futures contract pays known yield, secondly we should use average annual yield instead of realized yields. Now, if we define q as the average annual yield on an underlying asset during the life of a futures contract similar to Hull (2012), we can write an equation as follows:

(6) $$F_0 = S_0e^{(r-q)T}$$

Equation (6) is very similar to equation (5) and it should be said that both *I* and *q* are only theoretical and are relatively unstable to predict with enough accuracy. In many cases the futures contract might have long time period and the forecast to the maturity have to be made based on robust assumptions. In addition, the way the yield is measured might have an impact to the outcome from equation (6). Yields are usually calculated and presented as continues compounded or annually compounded. (Kolb & Overdahl 2003: 35 – 43; Bodie et al. 2005: 831 - 833; Hull 2012: 109.)

2.1.4. Cost of Carry

The relationship between futures prices and their underlying spot prices can be summarized in terms of the cost of carry. This measures the storage cost plus the interest that is paid to finance the asset less the income earned on the asset. For a non-dividend-paying stock, the cost of carry is r, because there are no storage costs and no income is earned. For a stock index it is $r - q$, because income is earned at rate q on the asset. For a currency, it is $r - r_f$, and for a commodity that provides income at rate q and requires storage costs at rate u, it is $r - q + u$. The cost of carry can be defined as c giving for an investment asset an equation for futures prices as follows:

(7) $$F_0 = S_0e^{cT}$$

Basically the futures price is determined by relative cost of buying a stock with deferred delivery in the futures market versus buying it in the spot market with immediate delivery and carrying it in inventory. If investor buys a stock now, he tides up his funds and incur a time-value-of-money cost of r per period. On the other hand the investor receives a dividend payments with a current yield of q. The net carrying cost advantage of deferring delivery of the stock is therefore $r_f - q$ per period. This advantage must be offset by a differential between the futures price and the spot price. The cost-of-carry relationship is easily generalized to multiperiod applications and we simply recognize that the difference between the futures and spot price will be larger as the maturity of the contract is longer. (Bodie et al. 2005: 808; Hull 2012: 120.)

2.1.5. The Basis and Basis Risk

One essential element of futures contract trading is the term basis. The basis can be determined as follows:

Basis = difference between the spot and futures price

This is the usual definition of the basis, however, the alternative definition Basis = Futures price – Spot price is sometimes used, particularly when the futures contract is on financial asset. The basis can be both positive and negative ($S_0 > F_0$ or $S_0 < F_0$) prior to its maturity and at maturity the basis is zero doe to the convergence theory of futures and spot prices. As time passes, the spot price and the futures price for particular period do not necessarily change by the same amount. As a result, the basis changes. An increase in the basis is referred to as a *strengthening of the basis*; a decrease in the basis is referred to as a *weakening of the basis*. Figure 3. illustrates how a basis might change over time in a situation where the basis is negative prior the expiration and at the maturity it is zero. (Bodie et al. 2005: 805; Hull 2012: 52 – 54.)

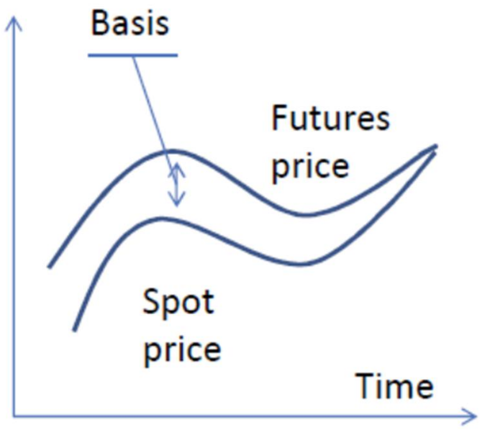

Figure 3. Variation of basis over time.

Although, the basis is always zero at maturity, it can be negative or positive during the life of the futures contract. This leads to a situation very we have a basis risk, which is the fluctuation between the underlying spot price and the actual price of the futures contract. Basis risk is somewhat important when considering different futures trading strategies. This can be easily demonstrated with Hull's (2012) example of basis risk and time to maturity. We make the same assumption: F_1 is the futures price and S_1 the underlying spot price at time t_1, in addition, F_2 is the futures price and S_2 is the underlying spot price at time t_2. After this we have b_1 and b_2 as the basis at time t_1 and t_2. From the definition of the basis explained above, we get:

(8) $$b_1 = S_1 – F_1$$

and,

(9) $$b_2 = S_2 – F_2$$

An investor who is willing to take futures position at time t_1 and is looking for to close it at time t_2, the risk that the investor has to bear is b_2, as it is not well known at time t_1. The term b_2 represents the basis risk of the possible trade. The basis risk is very important for investors who are trying to obtain perfect or optimal hedging strategies their assets. The basis risk is very important for investors who are trying to obtain perfect or optimal hedging strategies their assets. (Hull 2012: 53 - 55.)

2.1.6. Hedging and Speculation

Many of the participants in futures markets are hedgers. The demand for trading futures contracts mainly raises from the price fluctuations of the underlying assets. Most commonly the reason for investor who's willing to take futures position is to reduce the risk they face in some particular asset or commodity. For example companies that rely heavily on some particular commodity in their everyday business are willing to close the price of the commodity to certain level. This allows the company to buy the commodity at price they already know today in the future. Another example could be derived from the financial markets. A fund manager who is reluctant to sell his underlying assets can take a futures position and create a cover for his investments. These actions explained above are made to reduce the risk, but it is vital to understand that they are perfect hedges. Although there is a term of perfect hedge in the financial theory, it is only theoretical. (Bodie et al. 2005: 802; Hull 2012: 47.)

Hedging can be divided into two basic strategies, short and long hedges. A short hedge is a hedge that involves a short position in futures contracts. A short hedge is appropriate when the hedger already owns an asset and expects to sell it at some time in the future. For example, a short hedge could be used by a farmer who owns some hogs and knows that they will be ready for sale at the local market in two months. A short hedge can also be used when an asset is not owned right now but will be owned at some time in the future. A long hedge is a reverse to a short hedge. A long hedge is appropriate when a company knows it will have to purchase a certain asset in the future and wants to lock the price now. (Hull 2012: 48 – 49.)

Speculators are very opposite to hedgers already by definition. Whereas hedgers want to avoid exposure to adverse movements in the price of an asset, speculators wish to take a position in the market. Either they are betting that the price of the asset will go up or they are betting that it will go down. Speculators are simply investors who are trying to bet the futures direction of the markets using different strategies. Most commonly speculators are using historical data in order to detect price trends and profit from them in short term. Speculating with derivatives is somewhat more risky than with other assets, already based on derivatives nature. (Bodie et al. 2005: 802; Hull 2012: 13.)

2.2. Stock Index Futures Contracts

Stock index futures contracts are enjoying increasing popularity among investors. There are multiple reasons for this trend, such as highly liquid market conditions, good leverage, and some taxation and regulation aspects. Although, all of these reasons are important, one has been above them all since the very first introduction of the stock index futures contract at 1982 – low level of cost. The main reason for the popularity of the stock index futures contracts is their ability to provide high level hedge to different financial portfolios with lower cost. (Bodie et al. 2005: 829; Hull 2012: 60.)

In contrast to most futures contracts, which call for delivery of a specified commodity, stock index futures contracts are settled by a cash amount equal to the value of the stock index in question on the contract maturity date times a multiplier that scales the size of the contract. A stock index tracks changes in the value of a hypothetical portfolio of stocks. The weight of a stock in the portfolio at a particular time equals the proportion of the hypothetical portfolio invested in the stock at that time. (Bodie et al. 2005: 830; Hull 2012: 60 - 61.)

Stock index futures contracts enable investors to have low cost substitute for holding the actual underlying stocks of the portfolio itself. Through stock index futures contracts the investor can easily participate in to price movements in the market without having to buy every single stock in the market portfolio. This leads to a lower costs structure and increases the liquidity in the investor's portfolio. In addition, stock index futures are settled by cash on a daily base and at maturity only cash exchange hands, not the actual stocks themselves. In this chapter we will dive deeper into stock index futures contracts and especially in their underlying stock indexes. (Bodie et al. 2005: 829-837.)

2.2.1. Underlying Stock Indexes

Stock indexes are fundamental component to stock index futures contracts and therefore it is vital to understand the underlying asset and how it is composed. A stock index is a portfolio of selected stocks that are tradable in the stock markets. Stock indexes are designed to quantify broad movements in the stock markets: either for the whole stock market e.g. S&P 500, or for some precise section of the market e.g. financials. Since the introduction of stock indexes the investors are able to monitor and analyze not just one individual stock, but rather the whole stock market itself. Stock indexes provide useful information to investors and are used as historical comparison. A quick look at the stock index levels will tell you something about the health and direction of financial markets. (Sutcliffe 2006: 3.)

Since the introduction of the first stock index by Charles Dow back at 1896, there has been major increase in the amount of different types and forms of stock indexes. Today stock indexes are divided by size, sectors, location, internationality, monetary areas and currencies and etc. In addition, there are also multiple ways to calculate the daily index price, by excluding or including dividends or using average prices and etc. The major stock indexes are based on the performance of the whole local stock market and include a great number of all sizes of stocks from various sectors. (Bodie et al. 2005: 47-53.)

As an example, in this study we use major stock indexes to capture the price movements during the ECB announcements. These stock indexes are Euro Stoxx 50 in Frankfurt Stock Exchange, OMXS 30 in Stockholm Stock Exchange and FTSE 100 in London Stock Exchange. Other examples of these major stock indexes are DJIA in NYSE, NASDAQ-100 in NASDAQ, S&P500 in NYSE, DAX 30 in Frankfurt Stock Exchange, CAC 40 in Euronext Paris and Nikkei 225 in Tokyo Stock Exchange. In addition to these major national stock indexes there are always smaller sub-indexes that are constructed and divided by some particular property. These stock indexes can be constructed by using only some particular company sector, company size, market size, company ideology, green values or by companies that appraise environmental values and responsible way of production. (Bodie et al. 2005: 47-53.; Sutcliffe 2006:3-4.)

The qualities of the selected stocks in the stock index are one thing, but another much more important one is the way the index itself is constructed and valuated. One rather usual problem is how companies are included or excluded into the index. Another problem seems to be that the index provider selects above average performers to the index which leads to misleading price levels. In addition, in many cases the index values are compounded averages of the index itself at different times which alters the transparency and makes it more difficult to analyze. As a conclusion, there are multiple ways to construct and valuate a stock index and therefore further discussion of the valuating models is much needed. (Sutcliffe 2006: 15-17.)

2.2.3. The Value of Stock Indexes

The value of a stock index can be calculated in multiple ways and for investor this is vital to understand. Most commonly the index is either valuated by the weighting method or by averaging method. Neither of them is significantly better nor worse and both of them have their advantages and disadvantages. One example of the first method, the weighting method, is the DIJA price-weighted stock index. The price movements of the companies in the DIJA with higher share price are more dominants to companies with low share price. This leads to situation where above average performers are gaining more absolute weight in the index than others. (Bodie et al. 2005: 48.)

Because of the tendency to overweight the high performers in indexes like DIJA, another way to value the stock index has been created – the equal weight method. Equal weight method as its name unveils gives each company an equal weight in the stock index by considering the proportionate price change of the single company share. Unlike the price-weighted stock index, the equally weighted stock index is not skewed by the high performers. (Sutcliffe 2006: 3-5.)

Although, both of the methods explained above are relatively well used the major stock indexes are calculated by using capitalization-weighting method, also known as market-value weighted method. Market value weighted indexes are more difficult to manipulate doe to the fact that each share is weighted consistently with its importance in the average portfolio of shares. In addition, to improve the stock index resistance to manipulation efforts there are usually upper bounds or maximum percentage levels for weight of single share. This of course manipulates the index performance from the real performance and therefore major stock index providers have recently switched to free-floating weights in market-value weighted indexes. Examples of these stock indexes are S&P 500, FTSE 100, DAX, STOXX 50 etc. (Bodie et al. 2005: 48 – 52; Sutcliffe 2006: 4 - 5.)

2.2.4. Properties of Stock Index Futures

Stock index futures contracts are somewhat different than most other classes of futures contracts. One major difference is the cash settlement procedure that is not known in commodity futures contracts which trade for example raw materials as underlying assets. In addition, stock index futures contracts also differ from other financial futures contracts by its liquidity, price discovery behavior and lead-lag relationship. Many academic research studies show that stock index futures contracts possess price discovery behavior. In other words, the information seems to flow first to the prices of stock index futures contracts and then to their underlying spot markets – stock markets. (Gaul & Theissen 2008; Sutcliffe 2006:158-162.)

Multiple reasons for this behavior have been presented, and one of the most plausible reason might be that most traders who trade with stock index futures contracts are institutional traders like fund managers etc. Hedging as explained in previous chapters is rather usual reason for stock index futures usage. Stock index futures contracts are used in order to reduce exposure to stock market fluctuations, especially steep declines in prices. Few additional reasons why the fund managers and other institutional investors are willing to use stock index futures contracts is their ability to manipulate the beta of their portfolios. Stock index futures contracts provide more accurate means to lower or increase the beta without dramatic changes in the portfolio structure. Stock index futures contracts are also much cheaper than trading the actual underlying stocks in the portfolio. In addition, Stock index futures contracts provide faster solution in need of industry allocation changes than the actual stock themselves. (Sutcliffe 2006: 301-330.)

The price discovery leads to relationship between the stock index futures contracts and the underlying spot market which is better known as the lead-lag relationship. This relationship was discussed in the first chapter. Lead-lag relationship is somewhat more reported with stock index futures contracts than with other futures contracts and this is mainly due the reasons listed above, and mostly because the high liquidity. (see eg. Tse, Xiang and Fung 2006; Rosenberg and Traub 2007 and Gaul and Theissen 2008)

3. MONETARY POLICY AND FINANCIAL MARKETS

On 1 of January 1999 a new currency – the euro – was created. In 2011 the euro was the official currency for 17 European countries including more than 330 million citizens. The treaty assigns the Eurosystem the primary objective of maintaining price stability, reflecting a broad consensus in society that maintaining stable prices is the best contribution that monetary policy can make to economic growth, job creation and social cohesion. (ECB 2011: 7.)

The conditions for achieving price stability have not been easy and the single monetary policy has faced a number of significant challenges. Several adverse shocks have hit the euro area economy. (ECB 2011:9.) The ways the ECB can operate and how those operations such as interest rate cuts affect to stock markets, how new information is treated in the markets and how the interest rates and stock values are connected are discussed in this chapter.

3.1. The European Central Bank and Monetary Policy

In the short run, a change in money market interest rates induced by the central bank sets in motion a number of mechanisms and actions by economic agents, ultimately influencing developments in economic variables such as output or prices. This process is called as the monetary policy transmission mechanism. The transmission of monetary impulses to the real sector involves a number of different mechanisms and actions by economic agents at various stages of the process. As a result, monetary policy action usually takes a considerable time to affect price developments. Furthermore, the size and strength of the different effects can vary according to the state of the economy, which makes the precise impact difficult to estimate. (ECB 2011:58.)

The long chain of cause and effect linking monetary policy decisions with the price level starts with a change in the official interest rates set by the central bank on its own operations. In these operations, the central bank typically provides funds to banks. The banking system demands money issued by the central bank to meet the public demand for currency, to clear interbank balances and to meet the requirements for minimum reserves that must be deposited with the central bank. Given its monopoly over the creation of base money, the central bank can control the interest rates on its own operations. Through this process, the central bank can exert a dominant influence on money market conditions and thereby steer money market conditions. (ECB 2011:59.)

Expectations of future official interest rate changes affect longer-term market interest rates, since these reflect expectations of the future evolution of short-term interest rates. However, the impact of money market rate changes on interest rates at very long maturities is less direct. In other words, changes in the central bank's official rates do not normally affect these longer-term rates unless they were to lead to a change in the market expectations concerning long-term economic trends. (ECB 2011:60.)

Because of their impact on financing conditions in the economy and on expectations, monetary policy decisions can affect other financial variables such as asset prices and exchange rates. They may also have implications for financial stability when protracted asset price bubbles suddenly burst. Boom-bust cycles in asset prices are often associated with periods of prolonged loose monetary policy. Monetary policy can also guide economic agent's expectations of future inflation and thus influence price developments. (ECB 2011: 60.)

The expectation channel mainly works by influencing the private sector's longer-term expectations. It has gained particular relevance for the conduct of monetary policy over the past decades. Its effectiveness crucially depends on the creditability of central banks communication which primarily rests on a sound monetary policy framework. For instance, if a central bank enjoys a high degree of creditability in pursuing its objective, monetary policy can exert a powerful direct influence on price developments by guiding economic agent´s expectations of future inflations and thereby influencing their wage and price-setting behavior. If economic agents believe in the central bank's ability and commitment to maintain price stability, inflation expectations will remain firmly anchored to price stability. (ECB 2011: 61.)

The central bank provides guidance to the markets by publicly announcing its monetary policy strategy and communicating its regular assessments of economic developments so that expectations can be formed more efficiently and accurately. This helps the markets to understand the systematic response pattern of monetary policy to economic developments and shocks and thus to anticipate the broad direction of monetary policy over the medium term, making policy moves more predictable. Such predictable is important for the conduct of monetary policy: while central banks only directly control very short term interest rates, the expected path of these rates over longer horizons and the premia for uncertainty are also significant for the transmission of monetary policy to the economy. If agents can broadly anticipate policy responses, this allows a rapid incorporation of any changes in monetary policy into financial variables. This in turn shortens the process by which monetary policy is transmitted into investments and consumption decisions and accelerates any necessary economic adjustment, thus potentially enhancing the effectiveness of monetary policy. (ECB 2011: 87-88.)

3.2. Monetary Policy Communication and Impact of Surprise

Over the last two decades, communication has become an increasingly important aspect of monetary policy. Central bank communication can be defined as the provision of information by the central bank to public regarding such matters as the objectives of monetary policy, the monetary policy strategy, the economic outlook, and the outlook for future policy decisions. (Blinder, Ehrmann, Fratzscher, De Haan and Jansen 2008.)

It is widely accepted that the ability of a central bank to affect the economy depends critically on its ability to influence market expectations about the future path of overnight interest rates, not merely on their current level. According Blinder et al. (2008) standard theories of the term structure is that interest rates on longer-term instruments should reflect the expectations sequence of future overnight rates. These expectations are guidelines for investors and various studies find that financial markets react to information on the outlook of the economy that central banks provide. Investors update their own views in response to the information conveyed by the central bank. (Anderson, Dillén and Sellin 2006.)

The theoretical literature has not generated clear conclusions regarding the optimal level of central bank transparency. The academic models differ with respect to both which aspects of central bank transparency they consider and their assumption about how communications influence the monetary transmission mechanism. One theory states that only unanticipated money matters, and that the central bank's preferences are not precisely known by the public. In addition, fully-transparent central bank is not capable to create surprises and practice effectiveness monetary policy. (Blinder at al. 2008.)

There are also studies that suggest fractionally otherwise, Anne Sibert's (2006) study focuses on the role of private information and non-transparent central bank communication. She states that the central bank's welfare is increasing in unexpected inflation and decreasing in actual inflation. An unobserved shock that is realized after the public's expectations are formed but before monetary policy decisions are made offers the central bank an opportunity to exploit a short-run Phillips curve tradeoff. However, her main conclusion is that both the central bank and society are always better off with increased transparency because it reduces the inflation bias.

3.3. Role of Information in the Financial Markets

The way information is treated in the markets have become more vital to understand since Maurice Kendall proposed the theory of random walk in 1953. After this rather eye-opening theory, the role of information in the financial markets has been studied in a growing extent. Kendall's random walk theory suggests that there is not a predictable pattern in stock prices. He simply states that stock prices are as likely to go up as they are to go down on any market day, regardless of past performance. Therefore, the future movements of the stock markets cannot be predicted by their historical movements.

Kendall made assumptions whish he based his theory: if stock prices reflect all available information, it must be that they fluctuate only in response to new information. New information, by definition, must be unpredictable. If it could be predicted, then the predicted information would be part of today's information. This ultimately leads to a situation where stock prices that change in response to new information must also be unpredictable. This is the key argument that stock prices should follow random walk. In other words, price changes should be random and unpredictable. (Bodie et al. 2009:345.)

The information available in the financial markets is different between investors and the information and the quality of information differs between the professional and non-professional investors. This simply means that the daily market prices are rather established by marginal amount of investors who actively trade in the markets, than by all. These investors are stated to be well-informed and intelligent professionals, who exploit all available information. These well-informed investors receive information which is up-to-date, thoroughly analyzed before the actual trades. This, by the theory leads to a situation where the market operates relatively efficiently. (Haugen 1997: 642-643.) Kendall’s theory was the one of the first one concerning information in the markets and originated the idea of efficient markets, markets where all information such as central bank’s monetary policy announcements and target rate changes are all efficiently priced in the securities.

3.3.1. The Efficient Market Hypothesis

One of the most well-known and highly disputed theories concerning the information in the capital markets is the *Efficient Market Hypothesis (EMH)*, which was introduced by Eugene Fama back in 1965. The efficient market is defined as follows: market where large numbers of rational, profit-maximizing investors are actively competing, each trying to predict future market values of individual securities, and where relevant new information is freely available to all market participants. When markets are efficient, competition among the intelligent investors leads to a situation where, at any point in time, actual prices of particular securities already occurred and on events, which the market expects to take place in the future.

As explained above, a market in which prices always “fully reflect” available information is efficient. After Fama in 1965 presented his EMH theory he then at 1970 divided market efficiency into three different forms of efficiency. These three classes of relevant information for the adjustment of security prices are *the week, semi-strong and strong form of market efficiency*. (Fama 1970.)

The three efficiency levels of the market are distinguished by the degree of information reflected in security prices. The asset price at first level, the week form of market efficiency, reflects the historical information. When the markets are efficient by the week form, it should be impossible to make consistently abnormal profits by analyzing past returns. In other words, the asset prices will follow a random walk. The second efficiency level prices, the semi-strong form of market efficiency, reflect both past and all other published information. At semi-strong markets the equity prices should adjust directly to public information such as the policy announcements or interest rate changes etc. (Brealey & Myers 2003: 351.)

Finally, the third and strong form of the efficient market hypothesis suggest that equity prices reflect all information relevant to the firm, including company insider's information. (Bodie et al. 2009:349.) The strong form of the efficient market hypothesis is somewhat extreme and has faced counter arguments by the research society. Under this form, those who have access to inside or private information should act on it by buying or selling the stock. Their actions should then have an impact to the price of the stock. After this the price of the stock should reflect all information concerning the stock. (Haugen 1997:644.) The figure 4. below shows how the three forms of market efficiency are in line with each other.

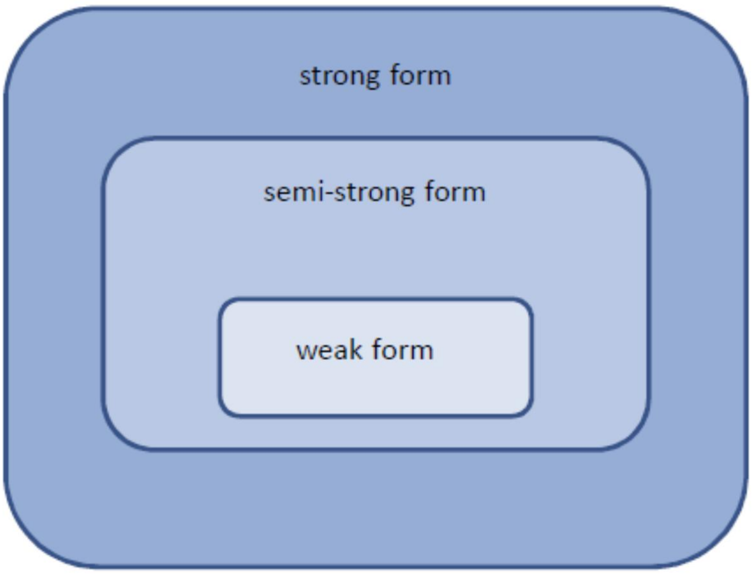

Figure 4. Three different forms of market efficiency.

3.3.2. Testing the Forms of Market Efficiency

Since the introduction of efficient market hypothesis, the three different forms of market efficiency has been continuously tested by academics. First testes were focused on the first and the weak form of market efficiency. Is it possible to speculators to find repeatable trends in historical prices that would enable them to earn abnormal returns? This is in other words, a test of the efficacy of technical analysis, speculating with stock trends in order to find lows and highs in the price behavior. The test for weak form of market efficiency simply tries to observe and identify a pattern in the historical prices for stocks. (Bodie et al. 2009: 349 - 359.)

Second level of the market efficiency is most usually tested by fundamental analysis that uses a much wider range of information than just historical prices. Investigations based on fundamental analysis will ask whether publicly available information in addition to the trading history of a security can be used to enhance investment performance, and therefore is a test of semi-strong form of market efficiency. Fundamental analysis is based on earnings and dividend prospects of the firm, expectations of future interest rates, and risk evaluations of the firm or economy to evaluate the assets so called wright value. (Bodie et al. 2009: 350 - 361.)

The most problematic level of market efficiency is the strong form, since insider trading is basically illegitimate and very closely monitored by the market authority. It would be surprising if the insiders were not able to create excess profits by trading their company's stock. Simply because insider information and the possible trades made by insiders using that information is illegal, it is not expected that the markets would be strong form efficient. (Bodie et al. 2009: 365-366.)

In case when the market fully reflects all available information in the markets, various types of investment analysis and strategies would become completely ineffective and would make the difference between profitable and unprofitable investments challenging to notice. It is highly important to absorb the following assumptions on testing the different levels or forms of market efficiency. If the weak form of market efficiency applies, technical analysis becomes ineffective. There is no information in the historical price series which would benefit in predicting the future. The stock prices have settled to a level, which reflects all the information involved in historical stock prices. (Haugen 1997:644.)

In case when the semi-strong form of market efficiency applies, both the fundamental analysis and the technical analysis are useless in terms of predicting the future of stock prices. All published and public information is already fully reflected in the stock prices. In order to make excess profits investors have to uncover or purchase private information to unveil the future directions for the stock prices. In addition, if the strong form of market efficiency applies, only those who possess inside information act on it and quickly force the stock price to reflect the information. Based on the Fama's theory, the initial purchase of new pieces of private information is merely a matter of chance, and since stock prices already reflect the existing inside information due to insider actions, efforts to search out inside information in order to overcome the market are imprudent. (Haugen 1997: 644.)

3.4. Relationship between Interest Rates and Stock Markets

Central banks primary tool to manipulate the ongoing and upcoming economic stance is the possibility to adjust the central banks interest rate. This by fact has an impact on stock markets and therefore in this chapter we are taking closer view on the means of this relationship. A change in the interest rate reflects immediately to stock valuation usually through the discount rate or by some other economic transmission channel.

A procedure for valuating stock price with discount models is based on discounting the future cash flow of a stock to present. These cash flows can be either value generated by market growth or paid dividends. The main problem and uncertainty when pricing a stock is the prediction of these free cash flows. Another major problem is to define the discount rate, in other words the yield. Based on Nikkinen, Rothovius and Sahlström (2002: 149) the yield must reflect the riskiness of the company and therefore the yield increases when there is increased uncertainty of the company's future cash flows.

Bodie et al. (2005) defined the discount rate $E(k)$ as a sum of risk free interest rate kf and risk premium kp as follows:

$$E(k) = kf + kp \tag{13}$$

Investors also face the challenge of defining the risk free interest rate. Wawerek (2004: 18) states that it is generally acceptable to use long and short term government bond rates as risk free interest rates. Furthermore the risk free interest rate affects to stock price trough the discount rate component k*f*. There are multiple ways to calculate the price of a stock using discount models. The most robust dividend discount model assumes that stock is bought and held for one year, it receives dividend payment and then it is sold. This can be calculated as follows:

$$P_0 = D_1/(1+k) + P_1/(1+k) \tag{14}$$

Where D_1 is the dividend, k is the discount rate and P_1 is the price of the stock when sold. Based on this equation it can be stated that an increase in interest rate affects negatively to the price of the stock P_0. (Bodie, Merton & Cleeton 2009: 246.)

Equation 14 assumes that we know the sell price P_1 of the stock. The sell price can be derived from the equation 15 as follows:

$$P_1 = (D_2 + P_2) / (1+k) \tag{15}$$

Replacing the equation for P_1 in to equation 14 we get the equation for commonly known dividend discount model that can be written as follows (Bodie et al. 2009:246).:

$$P_0 = D_1/(1+k) + D_2/(1+k)^2 + \ldots \Sigma D_t/(1+k)^t \tag{16}$$

Equations 14 – 16 require an estimate of future dividend payments. An alternative approach is to estimate a steady grow rate for dividend payments from here to eternity. This can be written as follows:

$$P_0 = \frac{D_1}{k-g} \tag{17}$$

Now the present value of a stock P_0 includes the first year dividend D_1, discount rate k, and the estimate for future dividend payment growth rate g. One notable problem with the equation 17 is that if the future dividend growth rate g and the discount rate *k* are equal the present value of a stock P_0 gets value of eternity. (Bodie et al. 2009:247)

Furthermore, not all of the companies listed in the stock exchange pay dividends and then the price of a stock can be valued based on investments and realized profits. Now we can calculate the present value of a stock P_0 as a difference between the realized profits and investments. Equation can be written as follows:

(18) $$P_0 = \sum \frac{D_t}{(1+k)^t} = \sum \frac{E_t}{(1+k)^t} - \sum \frac{I_t}{(1+k)^t}$$

where E_t is the realized profit and I_t investments made. (Bodie et al. 2009:248)

All of the models listed above from 14-18 are based on the discount rate. It is notable that the relationship between the discount rate and the present value of a stock is negative. Vast amount of studies have concentrated on this relationship. For example Fama & Schewert (1977), Campbell (1987), Breen, Glosten & Jagannathan (1989) and Ferson (1989) suggest that short-term interest rates predict short-term stock market returns. For investors it is vital to understand that the relationship between the interest rates and stock market returns is more complicated than what might be understood based on the discount models. It is commonly acknowledged that interest rates affect trough different economic channels to stock market returns and those channels are discussed next.

Interest rate changes have indirect affect to stock market returns that can be monitored trough consumption and investments. Increased or decreased consumption has notable role in economic growth, which is the foundation for future stock market returns. Burda & Wyplosz (1997:359) suggest that there is significant and positive correlation between the level of consumption and economic growth. Investments, in other words internal inputs to growth, affects to economy and company level returns trough out their multiplier nature. Also it has been academically acknowledged that there is strong and positive correlation between investments and economic growth. (Burda et al. 1997:359.)

Relationship between interest rates and consumption can be demonstrated with intertemporal budget line, where consumption is divided in to present (period 1) and future (period 2). This theory also covers the impact of both net income and interest rate in both periods that are the foundation for consumption. This theory can be simply written as follows:

(19)
$$C_1 + \frac{C_2}{(1+k)} = Y_1 + \frac{Y_2}{(1+k)}$$

where *C* is the consumption, *Y* net income and *k* the interest rate. (Burda et al. 1997:48.) Theory assumes that interest rates growth in period 1 increases savings and lowers consumption. Increased interest rates also can be assumed to have an influence to consumer's loan payments and trough that for example affecting decreasingly to demand for houses and lowering housing prices. This eventually leads to lower economic stance. Based on this theory it can be stated that present interest rate and its increase affects trough different economic channels negatively to economic growth and by that eventually to stock market returns. (Burda et al. 1997:48.)

4. DATA AND METHODOLOGY

In this chapter the data and methodology related to this study are presented and specified in a more detailed way. It is important to clarify the data sources and study methodologies before entering the study results. The data has been collect from four different sources and study methodology is aggregated based on different studies.

4.1. Data Sources and Sample Constructions

The data for this study consist of daily observations of three major European stock index futures contracts Euro Stoxx 50, OMXS 30, FTSE 100 and the ECB's target rate decisions and the ECB's overnight interbank interest rate or Eonia from January 2005 to December 2011. The daily stock index futures data and values where obtained from the Vaasa University Datastream.

The Euro Stoxx 50 future is based on Dow Jones Euro Stoxx 50 index which is widely applied as a benchmark index for Eurozone equities. The Euro Stoxx 50 index covers 50 blue chip stocks form 12 Eurozone countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, The Netherlands, Portugal and Spain. The index weighting is based on free float market capitalization subject to 10 % weighting cap and the distribution between countries is as shown in figure 5. (Stoxx 2013)

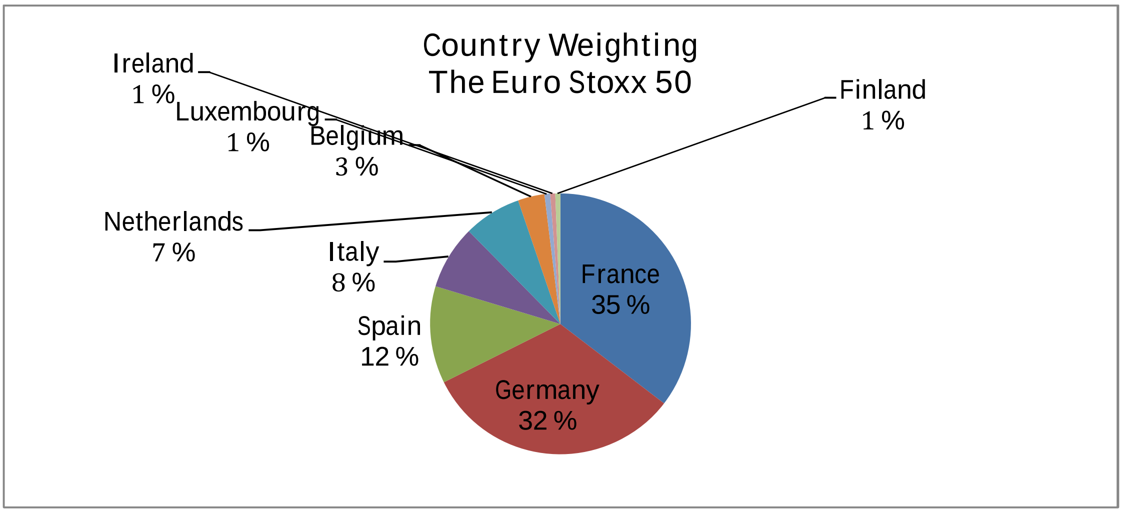

Figure 5. Country weighting in the Euro Stoxx 50 index.

The OMXS 30 future is based on Nasdaq OMX Stockholm 30 index which is stock market index for the Stockholm Stock Exchange. It is a market weighted price index consisting 30 most-traded stocks and the composition of the index is revised twice a year. It is also notable that the stocks in the index are totaled in Swedish kronor in case of parallel listing. (Nasdaqomxnordic 2013)

The FTSE 100 future contract is based on FTSE 100 stock index that consist 100 largest blue chip companies listed on the London Stock Exchange. The index represents approximately 85,2% of the UK's market and 8,02% of world's equity market capitalization. FTSE 100 is a market-capitalization weighted index and it is also notable that the stocks in the index are totaled in British Pounds in case of parallel listing. (FTSE 2013)

Also the ECB's key interest rate, in other words, the target rate is observed form the same time period. The ECB announces its interest rate decisions at 1.45 pm CET in advanced scheduled dates. Between January 2005 and December 2011 there have been 19 actual changes in the ECB's target rate and 82 announcements. (ECB 2012.) The ECB's target rate path is shown in figure 6.

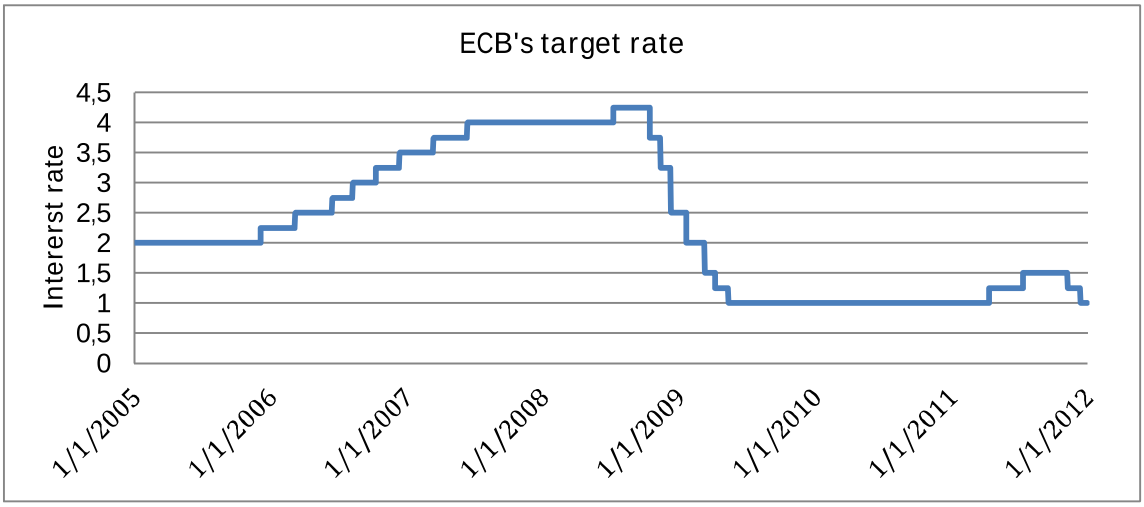

Figure 6. ECB's target rate from January 2005 to December 2011.

In addition, we also examined the Eonia overnight index average that is interest rate computed as a weighted average of all overnight unsecured lending transactions in the interbank market. The Eonia rates are calculated by the ECB and they are settled daily at 6 p.m. CET and published at 7 p.m CET. These daily observations where obtained from Thompson Reuters from January 2005 to December 2011.

4.2. Study Methodology

In this chapter the methodology that has been used to extract the impact of the ECB's target rate decisions first to the Stock index futures contracts daily returns is discussed. Secondly, how the economic stance affects these daily returns and thirdly, is there a positive correlation between the stock index futures contracts returns during the ECB's target rate decisions. In order to compound stock index futures contracts into continuing series of daily values we use the closest to maturity contracts thus contracts close to expiry normally have significant amount of trading providing statistically significant values and roll them over. This approach is similar to McMillan and Speight 2003.

To examine the impact of the ECB's target rate decisions on stock index futures contracts daily returns, first assumption is that these returns are normally distributed and calculate log-normal daily returns for the stock index futures contracts. The log-normal daily returns are calculated for the three futures contracts. Then the regression model for the stock index futures contracts return is formed as follows:

(20) $$\Delta R_t = \alpha + \beta[ECB_a] + \varepsilon_t$$

where ΔR_t denotes log-normal stock index futures return estimate to surprises (Euro Stoxx 50, OMXS 30 or FTSE 100) at time t, α and β are regression coefficients, ε_t random variable and ECB_a is defined as one of the following variables: (i) a meeting dummy that takes a value of one on the ECB's target rate decision day, (ii) a target rate change variable that identifies the impact of target rate changes, (iii) a target rate change variable that identifies the impact of increased target rate, (iv) a target rate change variable that identifies the impact of decreased target rate. In addition, a fifth regression specification in which the monetary policy surprise as defined in equation (21) is divided into positive and negative surprise is constructed. This approach is similar to Vähämaa and Äijö (2006).

To examine the impact of surprise in the ECB's target rate decisions the surprise component is formed from the announcement flow by using the ECB's Eonia overnight interbank offered rate and compare it to the actual ECB's target rate.

We also make a difference between the positive and negative surprise. The surprise component is calculated as follows:

(21) $$\Delta s_t^u = \frac{D}{D-d}(T_t^0 - E_{t-1}^0)$$

where s_t^u is the surprise component of the ECB's decision, Δ is the first difference operator, T_t^0 is the ECB's target rate at the end of the ECB's target rate decision day *d*, E_{t-1}^0 is the Eonia interbank overnight rate one night before the ECB's decision day and *D* is the number of days in the month. This approach with its variations has been recently used in order to measure monetary policy surprises by e.g. Bomfirm (2003), Wang et al. (2006), Basistha and Kurov (2008) and Chuliá, Martens and Dijk (2010).

In addition, the impact of the ECB's target rate decisions to stock index futures returns under different business cycles is examined. Recent studies made by Chuliá et al. (2010) and Kurov (2010) have shown that stock market reactions vary under different policy cycles and economic conditions. To examine whether the ECB's target rate decisions do have a different impact to stock index futures returns we estimate the following model:

(22) $$\Delta R_t = \alpha + \beta_1[ECB_t^{reces}] + \beta_2[ECB_t^{non-reces}] + \varepsilon_t$$

where ΔR_t denotes log-normal stock index futures return estimate to surprises (Euro Stoxx 50, OMXS 30 or FTSE 100) at time *t*, Δ is the first difference operator, α, β_1 and β_2 are regression coefficients and ε_t a random variable. The $ECB_t^{non-reces}$ and ECB_t^{reces} denotes the ECB's target rate decision variables in non-recession period form 2005-2007 and recession period 2008-2011, respectively, and the alternative variables are defined as follows: (i) a meeting dummy that takes a value of one on the ECB's target rate decision day, (ii) a target rate change variable that identifies the impact of target rate changes.

After examined the impact of the ECB's target rate decisions to the stock index futures returns, the correlations between the stock index futures returns during the ECB's target rate decision days is observed. The correlation estimate between the two stock index future contracts is calculated as follows:

(23) $$\rho(X,Y) = \frac{x_t}{x_{t-1}} \times \frac{y_t}{y_{t-1}}$$

where $\rho(X,Y)$ is the correlation estimate between the stock index futures *x* and *y* returns at time *t.* After we have calculated the correlation estimate between the pair we construct a regression model to examine the impact of ECB's target rate decisions as follows:

(24) $$\Delta\rho_t(X,Y) = \alpha + \beta_1[ECB_D] + \beta_2[ECB_C]\varepsilon_t$$

where $\Delta\rho X, Y$ denotes the correlation estimate between the pair of stock index futures returns at time *t*, Δ is the first difference operator, α and β are regression coefficients, ε_t random variable and ECB_D is defined as a meeting dummy that takes a value of one on the ECB's target rate decision day, and ECB_C a target rate change variable that identifies the impact of target rate changes.

5. EMPIRICAL RESULTS

In this chapter the empirical results regarding the impact of the ECB's monetary policy announcements, more closely, the target rate decisions to stock index futures prices are presented. The analysis of the ECB's target rate decisions to the three stock index futures returns are divided into three different parts, which are observed separately in this chapter. First part of this chapter focuses on the impact of the ECB's target rate decisions to euro-zone and non euro-zone stock index futures prices reactions. In the second part, the correlation between the euro-zone and non euro-zone stock index futures prices during the ECB's target rate decision dates are observed. In the last part of this chapter, the empirical results presented are obtained from regression, where the relationship between the stock index futures returns and the ECB's target rate decision dates and actual changes are reviewed in both recessionary and non-recessionary business cycle.

5.1. The ECB's Target Rate Decisions and Stock Index Futures Returns

There have been 82 actual target rate meetings or decisions by the ECB during the sample period from January 2005 to December 2011. From these 85 meetings there have been 19 actual target rate changes: 8 decreased target rate decisions and 11 increased decisions. When increased the target rate, the ECB made 25 basic point increases. On the contrary, when the ECB decreased the target rate they made changes from 25 to 70 basic point. These changes are often expected by the markets and well informed by the ECB. Nevertheless, as Kurov (2010b) suggest in his study, some of the changes can be also treated as a surprise in the stock markets.

Table 1. Descriptive statistics, the ECB's target rate decisions.

	No. of Obs.
ECB meeting	82
ECB change	19
ECB decrease	8
ECB increase	11
Positive surprise	3
Negative surprise	3

To extract the surprise components from the ECB's target rate decisions, a modified approach is created similar to Vähämaa and Äijö (2006). From the ECB's 82 target rate decisions only 6 decisions were actually treated as a surprise in the stock markets: 3 of them positive and 3 of them absolute negative surprise. These results are reported with other descriptive results in table 1. decrease

Table 2. The ECB's decisions and the OMXS 30.

Impact of the ECB's target rate decisions to OMXS 30 stock index futures log-normal daily returns. Reported results based on the following regression specification:
$\Delta R_t = \alpha + \beta[ECB_a] + \varepsilon_t$
where ΔR_t denotes log-normal OMXS 30 stock index futures return estimate to surprises at time t, α and β are regression coefficients, ε_t random variable and ECB_a is defined as one of the following variables: (i) ECB meeting dummy, (ii) a target rate change variable, (iii) increase variable, (iv) decrease variable, (v) positive surprise and (vi) negative surprise. The reported t-statistics are based on consistent standard errors. ***, **, and * denote significance at the 0,01, 0,05, and 0,10 levels, respectively.

	Model 1.	Model 2.	Model 3.	Model 4.	Model 5.
Constant	0,000	0,000	0,000	0,000	0,000
ECB meeting	-0,0026				
	(-1,43)				
ECB Change		0,0108 *			
		(1,88)			
ECB decrease			0,0115		
			(1,41)		
ECB increase				-0,0288 ***	
				(-3,58)	
Positive Surp.					0,0454 ***
					(4,67)
Negative Surp.					-0,0218 ***
					(-2,11)
Adjusted R	0,006	0,007	0,006	0,008	0,010
F-stat	5,884	6,368	5,652	6,226	7,223

The results for the impact of the ECB's target rate decisions to OMX Stockholm 30 stock index futures returns (table 2.) indicate that there is somewhat strong statistical relationship between the futures returns and the ECB's changes in the target rate. The t-statistics for the OMX Stockholm 30 sample shows that the returns are not significantly different from zero when there is an actual target rate meeting or when the ECB decreases the target rate. However, when there is a general change in the target rate or the target rate has been increased, the returns are statistically significant and different from zero at the 0,10 and 0,01 levels.

The results (table 2.) also indicate that surprises have more significant impact to future returns. The stock index futures returns are statistically significant and different from zero in both positive and negative surprises at the level of 0,01. A positive target rate surprise is approximately associated with 4,54 % returns and negative surprises with - 2,18 % returns. These results indicate that the ECB's monetary policy decisions do affect non euro-zone market returns.

Table 3. The ECB's decisions and the FTSE 100.

Impact of the ECB's target rate decisions to FTSE 100 stock index futures log-normal daily returns. Reported results based on the following regression specification:
$\Delta R_t = \alpha + \beta[ECB_a] + \varepsilon_t$
where ΔR_t denotes log-normal OMXS 30 stock index futures return estimate to surprises at time t, α and β are regression coefficients, ε_t random variable and ECB_a is defined as one of the following variables: (i) ECB meeting dummy, (ii) a target rate change variable, (iii) increase variable, (iv) decrease variable, (v) positive surprise and (vi) negative surprise. The reported t-statistics are based on consistent standard errors. ***, **, and * denote significance at the 0,01, 0,05, and 0,10 levels, respectively.

	Model 1.	Model 2.	Model 3.	Model 4.	Model 5.
Constant	0,000	0,000	0,000	0,000	0,000
ECB meeting	-0,0014				
	(-0,88)				
ECB Change		-0,0174 ***			
		(-3,35)			
ECB decrease			0,0226 ***		
			(3,34)		
ECB increase				-0,0187 ***	
				(-3,77)	
Positive Surp.					0,0387 ***
					(4,73)
Negative Surp.					-0,018 **
					(-2,06)
Adjusted R	0,000	0,006	0,007	0,009	0,010
F-stat	0,987	5,678	5,641	6,182	7,221

The results for the impact of the ECB's target rate decisions to FTSE 100 stock index futures returns (table 3.) indicate that there is strong statistical relationship between the futures returns and the ECB's target rate changes. The t-statistics for the FTSE 100 sample shows that futures returns during target rate decision meeting of The ECB are not statistically significant and significantly different from zero. Nonetheless, changes in the ECB's target rates generate returns, which are statistically highly significant and different from zero, at the 0,01 level. Decrease in the ECB's target rate approximately has an impact of 2,26 % in the FTSE 100 future returns, and decision to increase the target rate generates -1,87 % returns, respectively.

The results (table 3.) also indicate that surprises have more significant impact to the FTSE 100 futures returns and these findings are consistent with the OMX Stockholm 30 findings. The stock index futures returns with positive surprise are statistical and highly significant and different from zero at the 0,01 level and negative surprise at the 0,05 level. A positive target rate surprise is associated with 3,87 % returns and negative surprise with – 1,80 % returns.

Finally, the results for the impact of the ECB's target rate decisions to Euro Stoxx 50 stock index futures returns (table 4.) indicate that there is also a strong statistical relationship between the ECB's target rate decisions and the futures returns. The actual meeting where the ECB makes the target rate decisions has an impact on euro-zone futures returns. The t-statistics for the Euro Stoxx 50 samples meeting variable shows that the returns are statistically significant and different from zero, at the 0,10 level. Consistent with earlier findings, the impact of target rate changes are statistically significant and different from zero, at the 0,01 level.

The results (table 4.) also indicate that the target rate decrease has statistical and significant impact on Euro Stoxx 50 futures returns at the 0,01 level, when target rate increase has not statistical and significant impact on futures returns. The results (table 4.) also indicate that surprises have more significant impact to futures returns, being consistent with the earlier findings. The stock index futures returns with positive surprise are statistical and highly significant and different from zero at the 0,01 level and negative surprise at the 0,01 level. A positive target rate surprise is associated with 4,12 % returns and negative surprise with - 2,17 % returns.

Table 4. The ECB's decisions and the Euro Stoxx 50.

Impact of the ECB's target rate decisions to Euro Stoxx 50 stock index futures log-normal daily returns. Reported results based on the following regression specification:
$\Delta R_t = \alpha + \beta[ECB_a] + \varepsilon_t$
where ΔR_t denotes log-normal OMXS 30 stock index futures return estimate to surprises at time t, α and β are regression coefficients, ε_t random variable and ECB_a is defined as one of the following variables: (i) ECB meeting dummy, (ii) a target rate change variable, (iii) increase variable, (iv) decrease variable, (v) positive surprise and (vi) negative surprise. The reported t-statistics are based on consistent standard errors. ***, **, and * denote significance at the 0,01, 0,05, and 0,10 levels, respectively.

	Model 1.	Model 2.	Model 3.	Model 4.	Model 5.
Constant	0,000	0,000	0,000	0,000	0,000
ECB meeting	-0,0084 *				
	(-1,86)				
ECB Change		-0,0148 ***			
		(-3,00)			
ECB decrease			0,0214 ***		
			(3,35)		
ECB increase				-0,0052	
				(-0,977)	
Positive Surp.					0,0412 ***
					(5,32)
Negative Surp.					-0,0217 ***
					(-2,63)
Adjusted R	0,007	0,005	0,008	0,000	0,010
F-stat	6,987	5,868	8,461	0,882	8,102

The results shown in tables 2-4 indicates that the ECB target rate decisions are well expected by the traders of the three stock index futures contracts. The stock index futures returns where all significant and different from zero, at the 0,05 or 0,01 levels, when there were either positive or negative surprise in the ECB's target rate decision.

5.2. The ECB Target Rate Decisions and Stock Index Futures Correlation

The impact of the ECB's target rate decisions to stock index futures correlation is shown in table 5. The results indicate a strong statistical relationship between the ECB's target rate decisions and the correlation between the stock index futures returns. The correlation between the stock index futures returns lowered during the actual 82 decision days. The results where similar in both samples and statistically significant and different from zero, at the 0,01 level. Furthermore, the correlation increased significantly in both samples when the ECB made target rate changes. The correlation between the Euro Stoxx 50 and FTSE 100 during the days of target rate changes increased being significant and different from zero at the 0,10 level. The correlation between the Euro Stoxx 50 and OMX Stockholm 30 increased being significant and different from zero, at the 0,05 level. The correlations between the stock index futures returns during the whole sample period was not strongly affected by the ECB's target rate announcements, only actual changes in the ECB's target rate had an significant absolute impact to correlations.

Table 5. The ECB's target rate decisions and stock index futures correlations.

Impact of the ECB's target rate decisions to stock index futures daily return correlations. Reported results based on the following regression specification:
$\Delta\rho_t(X,Y) = \alpha + \beta_1[ECB_D] + \beta_2[ECB_C]\varepsilon_t$
where $\Delta\rho(X,Y)$ denotes the correlation estimate between the pair of stock index futures returns at time t, Δ is the first difference operator, α and β are regression coefficients, ε_t random variable and ECB_D is defined as a meeting dummy that takes a value of one on the ECB's target rate decision day, and ECB_C a target rate change variable that identifies the impact of target rate changes. The reported t-statistics are based on consistent standard errors. ***, **, and * denote significance at the 0,01, 0,05, and 0,10 levels, respectively.

	STOXX 50/ FTSE 100		STOXX 50 / OMXS 30	
Constant	0,000		0,000	
ECB meeting	-0,0157	***		
	(-3,56)			
ECB change	0,0175	*		
	(1,89)			
ECB meeting			-0,0155	***
			(-3,29)	
ECB change			0,0206	**
			(2,13)	
Adjusted R	0,005		0,005	
F-stat	6,368		5,652	

5.3. The ECB Target Rate Decisions and Different Business Cycles

Table 6 reports the regression result for the effects of the ECB's target rate decisions to stock index futures returns under different business cycles. Model 1 is applied to examine the impact of the ECB's general target rate decision days and model 2 to examine the ECB's target rate changes. Both models where used to each stock index futures returns and the results are shown in table 6.

Table 6. The ECB's target rate decisions and business cycles.

Impact of the ECB's target rate decisions to stock index futures returns under different business cycles. Reported results based on the following regression specification:
$\Delta R_t = \alpha + \beta_1[ECB_t^{reces}] + \beta_2[ECB_t^{non-reces}] + \varepsilon_t$
where ΔR_t denotes log-normal stock index futures return estimate to surprises (Euro Stoxx 50, OMXS 30 or FTSE 100) at time t, Δ is the first difference operator, α, β_1 and β_2 are regression coefficients and ε_t a random variable. The $ECB_t^{non-reces}$ and ECB_t^{reces} denotes the ECB's target rate decision variables in non-recession period form 2005-2007 and recession period 2008-2011, respectively, and the alternative variables are defined as follows: (i) a meeting dummy, (ii) a target rate change variable. The reported t-statistics are based on consistent standard errors. ***, **, and * denote significance at the 0,01, 0,05, and 0,10 levels, respectively.

Model		OMXS 30	FTSE 100	EStoxx 50
	Constant	0,000	0,000	0,000
Model 1.	ECB meeting non-rec	-0,0009	-0,0014	-0,001
		(-0,29)	(-0,62)	(-0,46)
	ECB meeting rec	-0,0035	-0,0019	-0,0019
		(-1,37)	(-0,83)	(-0,85)
	Adjusted R	0,000	0,000	0,000
	F-stat	0,981	0,548	0,468
Model 2.	ECB change non-rec	0,0011	-0,0032	-0,003
		(-0,18)	(-0,63)	(-0,71)
	ECB change rec	-0,0058	-0,0054	-0,0041
		(-1,12)	(-1,23)	(-0,91)
	Adjusted R	0,000	0,001	0,000
	F-stat	0,620	0,952	0,740

The results for model 1 and 2 are irrelevant in statistical matter and inconsistent with earlier studies. The results also conflicts with study hypotheses. There is no statistically significant impact between the ECB's target rate decisions and futures returns under different business cycles during the sample period 2005-2007 and 2008-2011. Despite the fact that none of the results show statistically significant returns or difference from zero, the t-statistics during the recessionary cycle, sample period 2008-2011, indicate that equities do react more likely to the ECB target rate decisions under recession.

The result in model 1 shows that the ECB's target rate meetings do have more significant impact to OMXS 30 futures returns under recession compared to non recessionary period. Similar results are found when examining the impact to FTSE 100 and Euro Stoxx 50 futures returns. These finding are somewhat expected, although they are not statistically significant.

The result in model 2 shows that the ECB's target rate changes do have more significant impact to OMXS 30, FTSE 100 and Euro Stoxx 50 futures returns under recession compared to non recessionary period. These finding are somewhat expected, although they are not statistically significant, at 0,01, 0,05, or 0,10 levels.

6. CONCLUSIONS

The purpose of this study was to examine the impact of the ECB's monetary policy announcements, more closely the target rate decisions, on three European stock index futures returns. The focus of this study was in the euro-zone and non euro-zone stock index futures reactions to euro-zone monetary policy announcements. The OMX Stockholm 30 and the FTSE 100 stock index futures contracts were chosen for non euro-zone instruments and the Euro Stoxx 50 stock index future as a proxy for the aggregate euro-zone instrument.

Three main research questions were formed for the basis of the study. First research question (H_1) covered the overall impact of the ECB's target decisions to the three selected stock index futures returns. The second research question (H_2) was whether the correlation between euro-zone and non euro-zone stock index futures returns increases during the ECB's target rate decision days. The last research question (H_3) stated that the ECB's target rate decisions do have a grater impact on stock index futures returns under recessionary business cycle.

The empirical results were obtained from three different perspectives. First of all, the first research question was observed and tested if the ECB's target rate decisions affect the stock index futures returns by dividing the ECB's target rate decisions into six different impact variables: target rate meeting, target rate change, target rate increase, target rate decrease, positive target rate surprise, and negative target rate surprise. Secondly, the impact of the ECB's target rate meetings and changes to the correlation between the euro-zone and non euro-zone returns were tested. Thirdly, the impact of the ECB's target rate meetings and changes to euro-zone and non euro-zone stock index futures returns under different business cycles were observed and tested.

The empirical results show that the ECB's monetary policy does have a statistically significant impact on both euro-zone and non euro-zone stock index futures returns. Although, the overall results show that the ECB's monetary policy affects both euro-zone and non euro-zone futures markets, the actual target rate meetings where no changes were made did not affect the non euro-zone futures markets. In other words, non euro-zone stock index futures markets only reacted significantly to target rate changes and surprises. Based on the results for the ECB's target rate decisions and the stock index futures returns, the answer to research question (H_1) is that the ECB's target rate decisions do have an impact on both euro-zone and non euro-zone stock index futures returns. The results provide statistical significance proof and therefore the H_0 is rejected, and H_1 accepted.

Since the ECB's target rate decisions do have an impact on the European stock index future markets it is justified to observe the correlations between the euro-zone and non euro-zone markets. The empirical results show that the ECB's target rate decision meetings and changes in the target rate do have a strong and statistically significance impact on correlations. The correlations between the euro-zone and non euro-zone stock index futures returns decreases during the ECB's target rate decision days and increases when there is an actual change in the ECB's target rate. Although, an assumption of increased correlation during the ECB's target rate decision days were made the empirical results suggest otherwise. Based on the results the H_0 is not rejected and the H_1 is rejected.

During the non-recessionary period of the years 2005 until 2007, the ECB's target rate decision meetings and changes indicated negative stock index futures returns with no statistical significance. In addition, during the recessionary period of 2008-2011, the ECB's target rate decision meetings and changes indicated negative stock index futures returns with no statistical significance. Although, the results does not show statistical significance, the impact of the ECB's monetary policy announcements had a larger impact to both euro-zone and non euro-zone stock index futures returns during the recessionary period. The empirical results suggest that there is no difference between the ECB's target rate decisions and the stock index futures returns under different business cycle, and therefore we accept the H_0 and reject the H_1.

All in all, it can be concluded that the ECB's monetary policy do have an impact on both euro-zone and non euro-zone stock index futures markets. The main findings suggest that only changes and surprises in the ECB's target rate do have an impact and that there were no significant differences between the euro-zone and non euro-zone futures returns.

The reported findings in this study are somewhat consistent and in line with earlier studies that has examined central banks monetary policy actions on stock markets.(see eg. Bohl et al. 2008, Basistha and Kurov 2008) Kholodilin et al. (2009) examined also the impact of the ECB's monetary policy announcements to different euro-zone stock markets. The results are very similar although the point of view is focused only in euro area. The results in this study suggest that the European stock markets are rather highly integrated and that ECB's policy surprises or target rate shocks are transmitted to non euro-zone stock markets.

The new perspective of this study was the analysis of the ECB's monetary policy and its impacts to European non euro-zone stock index futures markets. Central bank's monetary policy and its impacts are always a current topic in finance and much discussed among investors and researchers. In recent years the ECB has received more interest from the public and in extensive rate academic studies are emerging to illuminate the impacts of its actions. An important contribution for this study was to examine the impact of the ECB's monetary policy decision on correlations between the euro-zone and non euro-zone futures returns.

The ECB's monetary policy decisions are moderately well expected by the public and from the 82 target rate decisions only six where associated with surprise. In this study we used only daily closing prices and therefore couldn't extract intra-day movements in the futures contracts. One of the implications for future research from this study could be to examine the non euro-zone stock index futures intra-day price path immediately after the ECB's target rate announcement surprises. To examine, whether the surprise is immediately transmitted into the prices or do they tend to drift might provide valuable information and allow tradable profits.

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