The European Central Bank's Monetary Policy Effects on German, Spanish, French and Italian Equity Indices: A Recession versus Non-Recession Comparison of Sovereign Fundamentals

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Abstract

This study aims to detangle monetary policy complications inherent in the European monetary system and explain how sovereign fundamentals and stock returns interact. Four stock market indices are examined (German DAX 30, Spanish IBEX 35, French CAC 40, and Italian FTSE MIB). The research aims to understand the extent to which sovereign fundamentals depend on global markets, and when they diverged within the Eurozone. By analyzing effects of actual changes in policy proxied by the 1-month Euribor rate, it was found that an increase in policy rates leads to a negative change in stock market return. For recession times, where the policy action is an increase in ECB's balance sheet, negative coefficients could superficially indicate that the ECB's asset purchase program is not effective in its policy transmission. Contributions of the control variables indicate that European markets are highly affected by global economic indicators during the 2008 US financial crisis, more than during the European Sovereign Debt Crisis. By analyzing surprise and expected changes in policy rate, it was found that German markets conform to the efficient market hypothesis (EMH) during non-recession times, and do not conform during recession times. For France, it was found that the EMH does not hold true overall. Italy and Spain's coefficients do not provide statistically significant results.

Keywords: Monetary Policy, European Central Bank, Transmission, Stock Index returns, Equity Index Returns

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1. Introduction

Studies on monetary policy effects on stock markets have been extensive, and several have attempted to identify the underlying causes and factors. The stock market channel of monetary policy transmission works such that an increase in policy rates increases the discount factor used in asset pricing models, thereby decreasing the value of assets. Therefore, present value of expected cash flow is affected. However, empirical analyses are complicated by a number of factors. One of the most widely discussed issues is the endogeneity problem. With typical monetary indicators such as M1 (M2 and M3) and central banks assets, there is a possible reverse causation that could occur. In other words, stock markets could react to monetary policy, or monetary policy could react to asset prices. In attempt to overcome the edogeneity puzzle, several authors use short term interest rates as their proxy for the central bank policy (e.g. ECB Main Refinancing Rate or the Federal Funds rate), though these also do not fully solve the problem.

Furthermore, each stock market index is affected by its own unique set of factors, and so studies also struggle to have a high explanatory power in their models. In the European case, the set up of an international central bank working in conjunction with National Central Banks (NCBs) faces complications. Within the European Union, sovereign fundamentals may vary and so, transmission of monetary policy into the stock markets may also vary. The recent financial crises have shown that there has been divergence within Europe, causing a separation into "core" and "peripheral" countries.

This study aims to detangle the monetary complications inherent in the European monetary system and explain how sovereign fundamentals and stock returns interact. Four stock market indices are examined (German *DAX 30*, Spanish *IBEX 35*, French *CAC 40*, and Italian *FTSE MIB*). In each case, the analysis is split into recession and non-recession periods. Furthermore, two definitions of recession periods are used: one based on the United States' housing market bubble crash and the other based on the European sovereign debt crisis. This is in order to understand the extent to which sovereign fundamentals depend on global markets, and when they diverged within the Eurozone. The overall expectation is that Germany and France

show “stronger” fundamentals than Italy and Spain. The study also splits monetary policy changes into a surprise and expected change component based on 3-month Euribor futures data. This part tests whether or not the efficient market hypothesis (EMH) holds . The EMH postulates that anticipated market changes should have already priced the information into the market, and so only surprise changes should have a statistically significant effect on changes in stock indices.

By analyzing effects of actual changes in policy proxied by the 1-month Euribor rate, it was found that an increase in policy rates leads to a negative change in stock market return. For recession times, where the policy action is an increase in ECB’s balance sheet, negative coefficients could superficially indicate that the ECB’s asset purchase program is not effective in its policy transmission. Contributions of the control variables indicate that European markets are highly affected by global economic indicators during the 2008 US financial crisis, more than during the European Sovereign Debt Crisis. By analyzing surprise and expected changes in policy rate, it was found that German markets conform to the efficient market hypothesis (EMH) during non-recession times, and do not conform during recession times. For France, it was found that the EMH does not hold true overall. Italy and Spain’s coefficients do not provide statistically significant results.

The rest of the paper is organized as follows. Section 2 is a literature review, where current findings (and their methodology) on stock market reactions are discussed. Here, factors other than monetary policy are also discussed that will then go on to form control variables in the regression analysis to follow. Section 3 is a discussion on the ECB’s monetary policy measures and some complications faced in the transmission into member states’ economies. Section 4 discusses data and methodology, section 5 deals with regression specifications and expectations. Section 6 is where the results are discussed and finally, a conclusion follows.

2. Literature Review

2.1 Stock market reactions to monetary policy

Bernanke and Kuttner (2004) is a widely cited paper that deals with the endogeneity issue using federal funds futures data. They clarify that a policy surprise could also entail a *lack* of action, when market participants initially anticipated a policy change. They find a significant effect of unanticipated policy changes to equity market returns. The authors also find that monetary policy's effects only account for a small portion of the overall variability in stock market prices, and that these effects are not caused by changes in the real interest rate. Instead, it is expected future dividends and excess returns that affect stock prices. The authors also create industry-based portfolios, and find that different sectors react to policy surprises to different degrees. For example, high-tech and telecommunications sector respond more than utilities sector to monetary policy. Campbell (1991) in his analysis of stock returns, based on a variance decomposition also find changes in unexpected stock returns to be associated with expectations of future dividends and returns. His analysis of stock returns decomposes prices into a "transitory" and "permanent" component. In contrast to changes in the permanent component, changes in transitory component are associated with alterations in rational expectations of returns.

Thorbecke (1997), in his analysis of monetary policy effects on stock returns, distinguishes between large and small firms, based on their access to credit. The study shows that monetary policy shocks cause an important and statistically significant effect on the return of small firms, since their access to credit is limited vis-à-vis large firms. Large firms, on the other hand, are better collateralized and protected from temporary credit constraints. Thus, they are not as affected by monetary policy, and this further explains the credit channel transmission of monetary policy. These findings are in contrast to Bernanke and Kuttner's argument that interest rates have a negligible effect on stock prices. However, differences in these results could be due to the different methodology and data used between these two studies.

Ehrmann and Fratzscher (2004) find a strong and significant relationship between equity markets and monetary policy, and identify 3 scenarios in which stock

markets' reaction is intensified. They find that stock markets react more strongly to monetary policy when changes are unexpected, there is a directional change in policy stance of the Fed and when there is high general equity market volatility. Similar to Thorbecke (1997), they also study the demand and supply effects in the credit channel, distinguishing between large and small firm effects. They also find that more financially constrained firms (with low cash flow, small size, poor credit ratings, low debt-to-capital ratios, high price-earnings ratio or a high Tobin's Q) react more strongly to monetary policy. Furthermore, they find that industry effects are stronger than firm-specific effects in explaining different private-sector reactions to monetary policy.

In contrast to studies discussed so far, Bjornland and Leitemo (2008) allow for the simultaneity (reverse causation) between monetary policy and financial markets. While imposing a combination of short- and long-run restrictions in their model, they still manage to hold the interdependence between interest rates and stock prices intact. So although it does not hold in the short-run, long-run money neutrality assumption is used in their study. They find that an increase in the federal funds rate of 100 basis points has a strong negative (-9%) impact on equity returns.

2.1.1 Estimation Methodologies

Methodological decisions in current literature primarily deals with 3 main issues: endogeneity, omitted variable bias (OVB) and separating the surprise component of policy changes from the market expected changes (Bredin et .al., 2009).

As specified by Bernanke and Kuttner (2004), wealth effects through stock markets should not be significant in the long run if the monetary neutrality condition holds. However in the short to medium term, monetary policy may affect real and nominal variables, including changes anticipated by the market.

The efficient market hypothesis posits that asset prices already contain all the information available and so only surprise effects should have a significant effect on asset prices. Bredin et. al. state that this should mean on policy announcement days, asset prices should only react to the unexpected change in interest rates on that day. Expected changes in policy should already be priced into

asset prices before the policy announcement day. Bredin et. al. (2009) argue that empirical works that do not take unanticipated interest rate changes into account may suffer from biased results because of errors in variables problem. The benefit of using a short(er) term interest rate is that surprise effects can be measured using an appropriate futures market where rates change frequently. In current literature, unexpected changes are separated from expected changes in interest rates using direct survey of market participants, futures market data or Vector Autoregression (VAR) analysis to derive expectations.

The futures market has gained a lot of traction more recently as a useful methodology because there has been an increase in the futures contracts traded. In the European case, the 3 month Euribor futures are the most widely traded contracts. Erhmann and Fratzscher (2004) also state the limitation in measuring monetary policy shocks with federal funds futures that in reality, monetary policy is not perfectly exogenous, so the endogeneity bias is not completely eradicated in this methodology. The VAR method's benefits are that by making monetary policy changes exogenous, effects on stock prices are more clear with the use of impulse response functions on the "short and medium run" (Bredin et. al., 2009). Bredin et. al. (2009) argue that because of aggregation and timing concerns, the VAR approach may lose some credibility based on the fact that mostly monthly and quarterly data is used. Event studies, on the other hand, use a short "window" with of daily data. This way, there are fewer variables that can affect changes in asset prices if the reaction window is shortened. The shorter window also reduces the risk of omitted variable bias.

2.2 European Stock Markets and Sovereign Credit Ratings

Sovereign credit ratings are a "condensed assessment of a government's ability and willingness to repay its public debt in time" and, to a large extent, determine the interest rates a country faces in international markets. They are an important indicator for institutional investors, especially those who may have limits on the risk they undertake in their investments. Since sovereign credit ratings can limit the ratings assigned to its domestic financial and corporate institutions, they are an important factor in the credit risk perception of investors (Afonso et.al., 2011). In the European

case, sovereign credit ratings can help enhance investors' intra-European diversification strategies. A lower sovereign credit rating should be associated with lower stock returns. Hooper, Hume and Kim (2008) find that rating agencies do, indeed, provide the market with new information, and the rating upgrades significantly increase dollar denominated stock market returns, and decrease volatility.

Rating agencies typically use a combination of qualitative and quantitative criteria to determine their credit assessments. Afonso et. al. (2011) in their study find four main variables to affect credit ratings, both in the short- and long-term: GDP/capital, real GDP growth, public debt level and government balance have a short-term effect. Over the long term, government "effectiveness", level of external debt and external reserves, occurrences of past sovereign defaults and fiscal variables are significant. They discovery that rating agencies look at a wide range of criteria, such as solvency (capacity to repay debt) and socio-political factors (stability and strength). Similarly, Cantor and Packer (1996) state that per capita income, GDP growth, inflation, external debt, economic development and default history matter the most for sovereign credit ratings.

Under Basel II, credit ratings from approved agencies can be used by banks and financial institutions, and their use is even encouraged by the Basel Committee (Alsakka and Gwilym, 2010 and Hooper et. al, 2008). However, there are downsides to perpetuating the sovereign credit rating system as well. Hooper et. al. (2008) state that rating agencies have been heavily criticized in the past, especially where emerging market ratings are concerned. In the context of the Asian crisis, they argue that, rating agencies were "too slow to react" and that their eventual reaction contributed to the crisis, and possible even extended it. They quote arguments that rating agencies play a procyclical role in boom and bust cycles, and that emerging markets especially are disadvantaged by the volatility they facilitate. In the Asian financial crisis of the late 1990s, Li et. al. (2008) argue that, before the crisis very few international agencies saw the impending crisis coming.

The market for ratings faces differences and competition among agencies in itself. Because investors require timely information, speed is also as important as accuracy.

Rating agencies, thus, benefits by being the first to provide new information to the market. There are also those who argue that credit rating agencies, instead of issuing warnings based on market information they receive, respond to market performance and then provide ex-post ratings.

However, differences in timing of the ratings need not necessarily be bad. It is also possible that ratings react independently to the similar news (or other common fundamental information) related to the issuer. The reason for different timings of the same rating change could be due to the difference in models used by the agencies, where each model places different weights and thresholds to factors affecting the rating. It is confirmed by Alsakka and Gwilym (2010) that direction of rating changes are highly correlated among agencies.

Given this high correlation, the question arises as to how rating agencies interact with each other. The authors find evidence of interdependence across rating agencies, where Moody's seems to be the first mover in sovereign credit rating upgrades, but S&P leads the market in downgrades. Fitch seems to be a follower in both, upgrades and downgrades. Overall, they conclude that S&P operates most independently out of the 3 main rating agencies. Among these findings, in a probit model, they also find that for countries with a recent upgrade by an issuer, probability of receiving upgrades from other agencies is much higher compared to probability of downgrades from other agencies. As suggested by the authors, this information flow across the 3 agencies could be due to stronger negative reputational effects of an agency being late to react to market information that calls for a downgrade.

Cantor and Packer (1996) found that there are larger rating disagreements among agencies for sovereign ratings than corporate rating and investment grade ratings are a lot more varied than investment grade ratings. That required risk premia are much higher for sovereign debt issues than corporate debt with similar issuer ratings, adds to the difficulty in analysis. Cantor and Packer (1996) justify the variety on sovereign ratings methodology by the fact that agencies need to take into account factors beyond solvency and willingness to pay, such as political stability, social and economic consistency and future potential position in international financial markets.

Apart from the divergent ratings methodology, there are also asymmetries in the way financial markets respond to sovereign credit ratings. Brookes et. al. (2004) also find that stock market returns are impacted negatively by S&P, but not Moody's. The opposite is found true for Moody's in case of upgrades by Alsakka and Gwilym (2010). There is large consensus (e.g. Hooper et. al, 2008; Afonso et. al, 2011) that negative ratings announcements elicit a far stronger reaction that upgrades. Hooper et. al. (2008) state that both, stock market return and volatility are more affected by downgrades, foreign currency debt, emerging market debt and are especially sensitive during crisis periods. Afonso et. al. (2011) conduct a study where they also find no statistical significance of anticipation of positive announcements, in attempt to explain the market's asymmetric reaction. They state that one of the reasons why they find no statistical significance for that is because governments have an incentive to leak positive announcements, but none for negative, and thus place heavier weights on the negative announcements (also see Gande and Parsley 2005). They also find evidence of contagion, especially from lower rated countries to higher rated countries.

Diversity benefits in ratings methodology are addressed by Alsakka and Gwilym (2010) where investors and issuers benefit from the use of multiple rating (agencies). They quote Baker and Mansi (2002) in their study that found issuers use multiple ratings to bridge information gaps in their credit assessments, whereby different agencies provide a different set of information. For issuers, competition among credit rating agencies benefits them to obtain the most favourable rating, and thereby improving their borrowing conditions.

2.3 Other factors affecting (European) Stock Indices

European market integration

Specific to stock market integration, Pascual (2003) assesses co-movements in German, French and UK stock markets. They test these co-movements using cointegration relationships of error terms in their regressions. If error term cointegration increases over time, there is higher stock market convergence. They find that French markets seems to respond significantly to UK and German stock markets, but UK and German stock markets do not show any integration. Rangvid (2001) also considers integration among the same markets and postulates that there is increasing integration over time throughout the 1980s and 1990s. Cointegration vectors are used for various sample lengths to check consistency in their findings. The number of cointegrating vectors decreases over time and so they find there is increased integration among these stock markets.

Buttner and Hayo (2001) check for the same in a more recent sample between 1999 and 2007 among European Union member states. They use a pooled OLS model to examine dynamic conditional correlations based on interest rate spreads, exchange rate risk, market capitalization and business cycle integration. They find, in general, all EU member states are moving towards increasing stock market integration. Relative and absolute market capitalization promote integration, while foreign exchange risk and interest rate risk are inhibiting factors in the ongoing integration. In addition, the nominal determinants of equity market integration are found to be more important than real determinants.

Myliondis and Kollias (2010) assess convergence of *DAX30*, *CAC40*, *IBEX35* and *MIB* based on cointegration analysis for the first decade of the euro area. They find that there are structural breaks in cointegration relationships within this time frame. German and French markets are found to have higher convergence due to faster speed of adjustment to equilibrium coefficients. This could indicate, according to the authors, that they play a large role in overall euro area convergence. Bredin et. al. (2009) find that unexpected changes in the Bank of

England's policy have a significant effect on German and UK stock markets. They base unexpected changes in policy rates on the futures market.

Correlation with the US

Kanas (1998) examine linkages between European and US equity markets. The markets studied are UK, Germany, France, Switzerland, Italy and the Netherlands between 1983 and 1996. Contrary to findings among his peers, Kanas finds that European and US markets have no cointegration and therefore, investors would benefit from diversifying across these markets. Butler and Joaquin (2002) attempt to test the variation in correlation across distribution of domestic market returns and separate their analysis into bear, bull and calm markets. They find that stock market correlations are significantly higher during bear markets than bull markets. Gilmore and McManus (2002) test long-term international portfolio diversification benefits between US and Central European equity markets. They find that European markets have low correlation with US market, and so investors would benefit from diversifying across these markets.

Commodity prices

Park and Ratti (2008) test the effects of oil price shocks on stock markets in the US and 13 European countries. They find that for many European countries, increases in the volatility of oil prices significantly decreases stock returns, but this does not hold true for the US. Additionally, higher volatility of oil prices affect real stock returns much more than interest rate in the US and half of the European markets considered in their study. For the European Union, they control for contagion effects arising from US stock volatility into European markets. They still find that oil prices significantly affect European stock returns within the same month. Real oil price shocks have a more significant effect when they encompass global stock prices than just the national oil price.

Ciner (2002) finds that energy shocks and financial market linkages are nonlinear. It is suggested that previous assumptions in literature of linear relationships could have led to the conclusion that energy prices are not significant for stock returns. In contrast, this study is in line with findings that oil shocks significantly affect economic output. Sardosy (2006) models

volatility in petroleum futures and argue that oil price volatility is important in modeling macroeconomic trends, financial market risk assessment calculation (e.g. value-at-risk) and option pricing formulas for futures contracts. Jones and Kaul (1996) test whether the stock market rationally evaluates the impact of shocks in the economy and find this to be true, where stock prices rationally react to news on current and future cash flows. They also find no irrational trends or market overreaction.

Thorbecke (1997) state that those who argue against using the federal funds rate as the monetary policy indicator base their argument on the idea that when the federal funds rate is placed in a Cholesky ordering, increases in the funds rate are correlated with increases in inflation. This price puzzle, where there is a contractionary monetary policy and a subsewuent an increase in inflation, could occur if the central bank is using an indicator of inflation that the econometriciains studying these effects are not using. Christiano et. al (1994) state that adding an indicator of sensitive commodity prices as an indicator of inflation eliminates this puzzle, and then leads to the conclusion that positive changes in the funds rate are associated with decrease in price level.

3. ECB monetary policy measures and transmission

The ECB's policies and targets are implemented with macroeconomic price stability at the center. The reasoning provided by the ECB on their inflation-targeting policies are so that markets can incorporate changes in relative prices in their decisions, rather than overall prices. Lower inflation risk premia in interest rates reduces real interest rates. This, in turn increases agents' incentives to invest. The ECB also uses inflation targeting so that market participants can reduce risk management based on against negative effects of inflation. Moreover, reducing arbitrary re-distribution of wealth and income is an added benefit. All these incentives in total contribute towards greater financial stability.

3.1 Monetary Policy Measures

Conventional monetary policy is set based on the Taylor rule, where interest rates respond more than proportionally to changes in inflation rates and react to fluctuations in output gap (difference between target output and actual output). Therefore, inflation targeting has proven generally effective in managing output and price levels (Joyce et. al, 2012). Monetary policy has evidently failed to prevent asset bubbles, and there is extensive debate on whether or not monetary policy should react to asset prices.

This goes back to the endogeneity problem of whether or not central banks should react to stock prices. Though, this would call for a different study altogether, Paul de Grauwe's (2008) explanation of the two different schools of thought on this issue is noteworthy. One one hand, those such as Bernanke and Gertler, Schwartz and Greenspan argue that central banks should not use interest rates to influence stock prices. Intervention only makes sense if stock prices clearly deviate from fundamentals. However, even if a bubble can be identified ex-ante, interest rates would be ineffective in bursting it. The central bank's actions are limited to controlling the damage after the bubble bursts. Inflation targeting, on the other hand, promotes an sustainable growth environment, less likely to cater to large booms and recessions caused by bubbles. Opposing this view, it is also argued that central banks should react to these bubbles, since stock prices are highly vulnerable to such volatility. Central banks are primarily responsible for financial stability, and that includes asset price stability. De Grauwe states that fewer economists are of the view that central banks should target a particular value of the stock price (in the same way of inflation targeting).

The challenge faced by conventional monetary policy is that when the relevant mechanisms don't work (when interest rates are already extremely low), policy instruments that can be used to stimulate the economy are fewer. There needs to be a sufficient level of "economic health" in order for transmission mechanisms to be intact. Joyce et. al (2012) point out another complication during economic turmoil, and that is when the banking system is adversely affected by crises. In this situation, the link between central bank rates and market interest rates is hindered. Banks could further reduce credit supply into the economy as they maintain their own reserves and balance sheet positions.

The ECB's conventional policy uses 3 main instruments: Open Market Operations (OMOs), Standing Facilities, and minimum reserves. The OMOs manage liquidity in the market and are used to signal the ECB's monetary policy stance. Standing Facilities manage overnight liquidity, signaling monetary policy stance and also provide a window for overnight money market interest rates. *Table 1* summarizes these conventional policy tools.

Unconventional monetary policy (UMP), on most occasions, is executed through large expansion of central banks' balance sheets. By doing so, policymakers aim to influence interest rates with longer-term maturities. By purchasing more assets, the central bank provides liquidity to markets that saw capital losses during financial crises. For example, the Federal Reserve purchased mortgage-backed securities (MBS) in order to stimulate the housing market, ultimately aiming to pull the US out of financial crisis (Joyce et. al., 2012). Quantitative Easing (QE) is a high-profile unconventional monetary policy measure that started with the Bank of Japan, which other major central banks then followed. Here, large-scale (where the quantitative part comes in) buying or selling of securities from the banking system affects the reserves held. By targeting the level of reserves, central banks affect interest rate changes.

As mentioned by Peter Praet in an ECB Press release, the ECB's response to the crisis in Europe was to initially lower its marginal lending rate using fixed rate tenders, and then with its unconventional policy starting in May 2010 (starting with its Securities Market Programme, SMP). UMP tools are summarized in *Table 2*. The ECB has focused on balance-sheet expanding policies, where they aimed at influencing longer-term money market conditions. E.g. shift from the variable rate tender to fixed rate tenders and provided long-term liquidity to the banking systems. Peersman (2011) states that the ratio of volume of main refinancing operations (MROs) and longer-term refinancing operations (LTROs) has not been constant over time. He argues that the Eurosystem failed in ensuring that liquidity shocks affected long-term rates during conventional policy periods. He also states that the Eurosystem is unique in that borrowing and lending occur mainly through the intermediation of the banking sector, instead of the private sector (where securities market are usually predominant). Therefore, UMP in the Eurosystem was aimed at stimulating the banking sector. Joyce et. al. (2012) further explain that the Euro

area had faced stresses in 2011 and 2012 due to the Sovereign Debt Crisis. An imbalance occurred, where capital flowed from peripheral countries to core countries, forming a bank run on several institutions.

Table 1: Conventional Monetary Policy Tools

Policy Instrument	**Policy tool**	**Details**
Open Market Operations	Main Refinancing Operations (MROs)	Maturity upto 1 week, fixed and variable rate tenders, executed by NCBs
	Long-term refinancing operations (LTROs)	Maturity upto 3 months, fixed and variable rate tenders, executed by NCBs
	Fine tuning operations	(reverse transactions/forex swaps/fixed desposits) are held on an ad-hoc basis to manage interest rate effects of unexpected changes in liquidity
	Structural Operations	Reverse transactions, outright transactions and issuance of debt certificates
Standing Facilities	Marginal Lending Facility	Available to the most creditworthy institutions, this interest rate forms a "ceiling" for money market interest rates at which depository institutions lend to each other
	Deposit Facility	Forms the "floor" for money market rates, were financial institutions can deposit capital overnight with the ECB
Minimum Reserves	Reserve Requirements	Credit institutions set up in the Euro Area are required to hold certain levels of deposits with their subsequent NCBs.

Table 2: ECB's Unconventional Monetary Policy

CBPP3	Third Covered Bond Purchase Programme	Aimed at enhancing the functioning of monetary policy transmission mechanism Supports financing conditions in the euro area Helps credit provisino in the real economy Perpetuates positive spillovers into other markets
ABSPP	Asset Backed Securities Purchase Program	Aims at diversifying banks' funding sources Stimulates the issuance of new securities and increases supply of credit
PSPP	Public Sector Purchase Programme	Deals with normal and inflation-linked government bonds, bonds issued by recognized agencies, regional and local governments, and international organizations and multilateral Euro Area development banks

3.2 Monetary Policy Transmission in the EU

Mihov and Scott (2001) study monetary policy implementation and transmission in the Euro area. They address two main questions: the first is whether or not there has been (as studies prior to theirs have shown) a convergence of business cycle and second, whether or not there have been heterogeneities in the transmission of monetary policy. They find increasing correlation of business cycle among EMU countries and that policy co-ordination is largely responsible for that. They also find that there are heterogeneities in the way EMU countries respond to monetary policy changes. They test this because even though there may be a synchronization of business cycles, monetary authorities may be challenged in stabilizing their influence on member countries if their transmission is heterogeneous. They add that the reason for different responses is due to cross-country heterogeneity in structural and financial factors. Furthermore, they test the differences between the ECB's policies and NCB policies and find that the ECB closely follows (more than their respective NCBs) macroeconomic responses to Germany, France and Italy than to the Bundesbank alone.

Ramaswamy and Slok (1998) test the effects of contractionary monetary policy on various Euro area countries. They test differences between two groups: the first consists of Austria, Belgium, Finland, Germany, the Netherlands and United Kingdom, and the second group is (Denmark, France, Italy, Spain, Sweden and Portugal). Findings are that policy in the first group of countries takes twice as long to occur compared to the second, but is twice as impactful.

Peersman (2011) test the ECB's policy effectiveness over both, its conventional and unconventional policy time span (January 1999 to December 2009). He finds that monetary policy pass-through has been far less efficient in response to balance sheet expansions. He finds that bank interest rates spreads increase substantially post expansionary policy action. In contrast to this, interest rate spreads decline in response to increases in balance sheet. Moreover, the credit multiplier effect does not work efficiently, and thus, does not provide any significant short-run liquidity effects after an interest rate shock.

4. Data and Methodology

Stock index effects of monetary policy are measured with 1-day percentage change in total returns as the main dependent variable in all regressions. The stock indices analyzed are that of Germany (*DAX 30*), Spain (*IBEX 35*), France (*CAC 40*), and Italy (*FTSE MIB*). Net stock returns are a preferred measure for the main dependent variable, but due to data availability constraints, total returns are used in order to maintain consistency across the abovementioned equity indices.[1] Bohl et. al. (2008) also look at the overall *Euro Stoxx 50*, but this is not relevant for the purposes of this study as the main aim is to identify differences within the Eurozone.

The study is separated into two parts. The first examines the relationship between (percentage change in) total returns and "actual" change in monetary policy. In some literature (e.g. Bredin et. al., 2009) the ECB's Main Refinancing Rate is used (with fixed and variable rate tenders). However, I follow Bohl et. al. (2008) in their use of the 1-month Euribor offered rate as a proxy for monetary policy rate. Their argument for doing so is that the Euribor serves as the main benchmark money market rate for the Euro area. Interest rates with shorter maturities exhibit much higher amounts of volatility, while Euribor rates with longer maturities are not sensitive enough to reflect monetary policy changes. Therefore, the 1-month Euribor is the ideal proxy for policy rate. I add this this part of the analysis by also using change in ECB's balance sheet (in Billion Euros) as another proxy for policy actions. This only applies to the recession period during which the ECB responded to the European Sovereign Debt crisis and attempted to stimulate the European economy through its asset purchases.[2] This is not carried out in the next part as an interest rate is required to gauge surprise and expected effects. Therefore, ECB asset purchases are assessed only during European sovereign debt crisis period.

The second part of the analysis dismantles "actual" change in policy, still proxied by the 1-month Euribor, into changes already anticipated by the market and those unanticipated. The use of this proxy is assumed to add to consistency and comparability with the other main independent variables in this study. Surprise changes are proxied, as common practice in current

[1] See Appendix 4 for correlations between the available Net Returns data and corresponding Total Returns data.
[2] The analysis is done for SB2's recession period.

literature, by the futures market. The 1-day change in the 3-month Euribor futures rate (100 minus settlement price) is used. These are the most widely traded futures contracts in Euros and were introduced along with the Euro in January 1999. Bernoth and van Hagen (2004) study the impact of ECB policy announcements on the (3-month) Euribor futures market and find that it captures policy rate changes well, owing to efficient communication of these changes by the ECB. Expected changes in policy are proxied by the difference between the 1-month Euribor rate and surprise change. An argument against using a longer maturity for the futures contracts than policy rate is that the futures contracts may reflect changes expected to occur over the longer horizon, instead of the horizon relevant comparable with that of the policy rate. However, Bredin et. al. (2009) quote Rigobon and Sack (2003) in their argument that using a forward contract with longer maturity than policy rate will more likely capture a "genuine surprise" in the policy change, instead of a change in timing (e.g. the change that occurs due to the market participants simply get the timing wrong despite having anticipated the policy). Therefore, short-term movements of that nature are controlled for in this longer futures contract maturity.

This study follows the event-study methodology; so all variables are assessed around the Governing Council's meeting dates and press releases that follow.[3] Meeting schedules have varied in the past, but it is the release of this information to the market that is relevant in this study. Therefore, the date of the press release is used (though it is typically on the same day as that of meetings). As Bohl et. al. (2008) I assume that stock markets incorporate announcements occurring before closing of the trading day. The Governing Council's decisions are made available at 1:45 PM, and the Euribor rates are published at 11:00 AM. Thus, for market timing reasons, Euribor rates corresponding to the next trading date after announcement are used.

Control variables used in this study are the VIX (CBOE's volatility index), Standard and Poor's Commodity Price Index (in first differences), effective exchange rate of the euro, a change in the surprise component of the Bank of England's policy rate (proxied by a 1-day change in the sterling futures contract rate traded in LIFFE). Major outliers in the dependent variables were on non-announcement days, so they do not affect the regression outputs.

[3] See Appendix 1 for Announcement Dates used in the study, obtained from the European Central Bank website.

Regressions for which heteroskedasticity was found (using the Breusch-Pagan test), robust standard errors are used.

Table 3: Summary of Variables Used

Dependent variables (1-day change)	**Independent variables (1-day change, t+1)**	**Control variables**
DAX30	"Actual" policy change (1 month Euribor rate)	VIX
IBEX35	Surprise changes (3-month Euribor futures rate)	Euro effective exchange rate
CAC40	Expected Changes (Actual change−surprise change)	S&P Commodity Price index
FTSE MIB	Change in ECB Balance sheet	Surprise change in Bank of England policy rate

In both parts of the analysis, the results are divided into a "non-recession" (NR) and "recession" sample. This is to check any differences between both periods, as sovereign fundamentals may vary between each period. This, in turn, could affect monetary policy transmission. This will also help further compare each stock index with each other, i.e. this makes it possible to compare Germany's overall stock return response compared to Spain's. Furthermore, if sovereign fundamentals of Spain and Germany diverged from each other during the recession, these effects may be reflected in this sample separation method.

An important task is to correctly define when the recession starts. As European markets are also affected by the larger global stock markets (especially that of the United States), two different definitions of recession are used, leading to two different sample descriptions. This will help further determine at what point sovereign fundamentals deviated from each other within the Eurozone, if they did so in the first place. The first sample breakdown (SB1) is based on the United States, whereby the recession period starts on 1st September 2008. The Lehman Brothers filed for Bankruptcy on the 15th September 2008. The start of the month is defined as the

recession period to include market expectations regarding this collapse. The second sample breakdown (SB2) is based on the Sovereign Debt Crisis in the Eurozone. This breakdown relies on rating agencies' Sovereign Credit ratings. 1st November 2009 marks the start of this recession period as S&P was the first to provide a ratings downgrade for Spain. As discussed earlier, the market for sovereign credit ratings is complex and there are several factors that lead to downgrades and upgrades. Moreover, different agencies react with different timing due to, both, information available to them and competition among rating agencies.[4] S&P downgraded Spain in January 2009 and Moody's June 2010. Therefore, as a mid point, November 2009 is used as the start of the recession. It should be noted that the study of Italy is conducted to identify possible changes in sovereign fundamentals that may have led to the more recent Italian Banking Crisis. However, the sample is split based on Spain's economic health as it was a major contributing factor to the sovereign debt crisis.

All data for dependent and independent variables are extracted from Datastream. Sovereign credit ratings are obtained from Bloomberg and monetary policy announcement dates are from the ECB's official website.

Table 4: SB1 based on United States' recession period

Sample	**Beginning date**	**Ending date**
Full	01-Jan-99	31-Dec-16
NR	01-Jan-99	31-Aug-08
Recession	01-Sept-08	31-Dec-16

[4] Check Appendix 5 for Moody's and S&P's sovereign credit ratings for Spain.

Table 5: SB based on European Sovereign Credit Ratings movements.

Sample	**Beginning date**	**Ending date**
Full	01-Jan-99	31-Dec-16
NR	01-Jan-99	30-Oct-09
Recession	01-Nov-09	31-Dec-16

4. Regression specifications and hypotheses

This study follows in the footsteps of Bernanke and Kuttner (2004) in first assessing the impact of a "raw policy change" (in this case, change in the 1-month Euribor rate) on the stock market returns. After that, they proceed to decompose it into expected and surprise changes. Therefore, the first baseline specification is the following:

$$\Delta R_t = a_0 + a_1 \Delta r_t + + \varepsilon_t \qquad (1)$$

Here, ΔR_t is the 1-day percentage change in the stock market index between t and t-1. Δr_t is the "actual" change in policy rate, and an error term ε_t. The following specifications decomposes actual change (R_t) into surprise and expected changes:

$$\Delta R_t = a_0 + a_1 \Delta r_t^e + a_2 \Delta r_t^u + \varepsilon_t \qquad (2)$$

Here, Δr_t^u is the surprise change is measured by the one-day difference in futures rate. Δr_t^e is the expected change in policy rate, measured as the difference between actual change in policy rate and the surprise change

As Bredin et. al, I alter my baseline specification to include any omitted variables that may help improve the model's predictive power. In other words, European stock markets may be affected by various other variables, and so, the following will be the altered regression,

$$\Delta R_t = \alpha a_0 + a_1 \Delta r_t^e + a_2 \Delta r_t^u + a_3 \chi_t + \varepsilon_t \qquad (3)$$

Here, χ_t is a vector of the remaining control variables included in the regressions. As there are several private- and public-sector factors that stock returns react to, the control variables included here may not eliminate Omitted Variable Bias (OVB).[5]

[5] Factors that could contribute to stock market returns but are not used are discussed in the end.

There are three main expectations in this study. The first is that increases in policy rate (actual, surprise and expected changes) are associated with a negative impact on the stock index returns. This would be in line with theory as well that monetary policy tightening decreases returns. The recession period where ECB balance sheet changes are used as the policy measure, stock returns are expected to increase, since the aim of the ECB was to stimulate the economy. The second expectation is that the Efficient Market Hypothesis (EMH) does not hold across any of the indices for the full sample duration. This is a reasonable expectation because this sample includes recession period. Moreover, several studies find that even in non-recession times, this hypothesis does not hold in reality, as market participants are not perfectly rational. This expectation would be reflected either by the expected component being statistically significant, or by both, expected and surprise being significant. The third hypothesis is that, in case EMH is found to hold during the non-recession times, it holds more strongly in Germany and France compared to Italy and Spain.

6. Results

6.1 Effects of "actual" policy changes

For the full sample, it can be seen from *Table 6* that all four indices behave according to the theory and the expectations discussed earlier and are all statistically significant. The negative coefficient indicates that a 1-percentage point (100 basis points) increase in the 1-month Euribor rate is associated with a reduction in total returns of, for example in Germany's case, 5.70%.

Table 6: Full Sample

Full sample			
	Coefficient	**Standard Error**	**R^2**
DAX	-5.70***	2.06	9.9%
IBEX	-4.50**	1.92	8.7%
CAC	-5.39***	1.91	11.0%
MIB	-2.97**	1.30	8.4%

We can now assess differences within this sample, distinguishing between recession and non-recession periods. *Table 7* presents results for SB1:

Table 7: Stock return effects of "actual" policy change (SB1)

(a) NR period			
	Coefficient	**Standard Error**	**R^2**
DAX	-5.35***	2.02	5.8%
IBEX	-3.84*	2.05	5.3%
CAC	-4.75**	2.18	5.3%
MIB	-2.40	1.91	3.9%

(b) Recession period			
	Coefficient	**Standard Error**	**R2**
DAX	-0.15	0.47	18.5%
IBEX	-0.31	0.55	14.6%
CAC	0.05	0.50	20.0%
MIB	-0.33	0.56	13.4%

The results of the NR period are in line with expectations and theory. For Germany, Spain and France, the negative stock return coefficient is significant. Although for Italy the result is not significant, the coefficient's sign still matches that of other markets. In the recession sample, though all of the coefficients indicate that a 1 percentage point increase in the 1-month Euribor rate is associated with a negative effect total index returns, these results are not significant. As an additional check, monetary policy was proxied by the size of the European Central Bank's balance sheet in unconventional monetary policy. *Table 8* reports the corresponding results, and lead to the same conclusions.

An interesting point to note is that in the recession period, R-squared figures for all four regressions are much higher than the non-recession period. This could be due to the significance of the control variables, and corroborates that the European stock markets are highly influenced by external, global variables, and especially dependent during more volatile economic climates.

Table 8: Effect of a 1 billion euro change in ECB assets on stock index total returns (SB1)

	Coefficient	**Standard Error**	**R^2**
DAX	-0.0013	0.0014	19.2%
IBEX	-0.0016	0.0017	15.6%
CAC	-0.0015	0.0015	21.0%
MIB	-0.0020	0.0018	14.3%

Table 9: Stock return effects of "actual" policy change (SB2)

NR period			
	Coefficient	**Standard Error**	**R^2**
DAX	-5.67**	2.03	13.6%
IBEX	-4.43**	2.21	14.4%
CAC	-5.35**	1.91	16.6%
MIB	-2.92**	1.28	15.4%

Recession period			
	Coefficient	**Standard Error**	**R^2**

DAX	-0.11	0.45	1.7%
IBEX	-0.42	0.57	3.7%
CAC	-0.046	0.51	1.6%
MIB	-0.56	0.62	4.7%

Table 10: Effect of a 1 billion euro change in ECB assets on stock index total returns (SB2)

	Coefficient	**Standard Error**	**R^2**
DAX	-0.00035	0.0015	1.7%
IBEX	-0.00092	0.0018	3.4%
CAC	-0.00079	0.0016	1.9%
MIB	-0.00178	0.0020	4.6%

SB2 also shows that a 1 percentage point increase in 1-month Euribor offered rate corresponds to a negative change in stock returns for all four stock markets. The difference between the NR and recession period is that in the former all the coefficients are significant, but in the latter none of them are. However, the signs are consistent with expectations so far. Central bank assets are not significant and coefficients are negative as found in SB2. Here, the R-squared are lower than the same regression for SB1, indicating that global control variables do not contribute much to the model. An interpretation of this is, that in SB2, the coefficients capture the fact that European variables are more important during the sovereign debt crisis than global variables.

In brief summary, results for the full sample and non-recession period indicate that a 1 percentage point increase in the actual policy rate correlates with a negative stock market effect. For recession times, also the ECB's asset purchase program is taken into account and we find negative relationships with the stock index' total returns. Asset purchases are aimed at increasing interest rates in an environment where low interest rates adversely affects market participants. So, in this case, the negative coefficients could superficially indicate that the ECB's asset purchase program is not effective in its policy transmission. However, these variables are not statistically significant. Contributions of the control variables to the model indicate that European markets are highly affected by global economic indicators in SB1 and the opposite holds true for Sb2. European variables are have better explanatory power in SB2.

6.2 Decomposing policy changes into surprise and expected changes

Table 11: Surprise and Expected components for full sample

(a) Baseline Regression				**(b) Regression with Control Variables**			
	Surprise	**Expected**	**R^2**		**Surprise**	**Expected**	**R^2**
DAX	7.27** *(2.88)*	3.6 *(2.24)*	2.9%	***DAX***	5.82** *(2.93)*	2.90 *(2.35)*	9.5%
IBEX	2.98 *(2.92)*	3.62 *(2.27)*	1.2%	***IBEX***	1.70 *(2.81)*	2.97 *(2.37)*	8.0%
CAC	5.78** *(2.86)*	4.90 *(2.23)*	2.7%	***CAC***	4.21 *(2.78)*	4.29* *(2.22)*	10.9%
MIB	3.16 *(3.0)*	0.95 *(2.33)*	0.5%	***MIB***	1.80 *(3.13)*	0.38 *(2.07)*	8.0%

According to the efficient market hypothesis, only surprise changes in policy should have a significant effect on stock returns. *Table 11* presents the full sample results. The baseline regressions show that this proposition holds for Germany and France. However, after including the control variables, France is shown not to exhibit efficient market conditions[6]. Coefficients for Italy and Spain are are positive and indicate that an increase in both, expected and surprise policy rate is associated with an increase in stock market effects. However, they are not statistically significant and should be interpreted with caution.

During non-recession times, Germany is the only country for which the stock returns conclusively follows the efficient market hypothesis in SB1. For France, the baseline regression shows a significant expected component and the regression including control variables shows both, expected and surprise components to be significant. In either case, it is clear that the efficient market hypothesis does not hold for France. For Spain and Italy, the results are not significant.

[6] By virtue of the expected component being significant (and an insignificant surprise component)

Table 12: Non-recession period for SB1

(a) Baseline regression				(b) Regression with control variables			
	Surprise	**Expected**	**R^2**		**Surprise**	**Expected**	**R^2**
DAX	6.33** *(3.11)*	2.44 *(2.28)*	2.8%	***DAX***	5.65* *(3.18)*	2.53 *(2.06)*	4.5%
IBEX	3.47 *(2.74)*	2.80 *(2.00)*	1.7%	***IBEX***	3.21 *(2.78)*	3.08 *(2.08)*	4.7%
CAC	5.99 *(2.87)*	4.17** *(2.11)*	3.9%	***CAC***	5.41* *(2.95)*	4.48* *(2.21)*	5.7%
MIB	2.91 *(2.54)*	-0.67 *(1.86)*	1.4%	***MIB***	2.58 *(2.56)*	-0.41 *(1.87)*	3.8%

Table 12: Non-recession period for SB2

(a) Baseline regression for non-recession period				(b) Regressions with control variables			
	Surprise	**Expected**	**R^2**		**Surprise**	**Expected**	**R^2**
DAX	7.06** *(3.35)*	3.05 *(2.50)*	2.82%	***DAX***	5.43* *(3.26)*	2.22 *(2.47)*	12.2%
IBEX	3.44 *(3.06)*	3.38 *(2.28)*	1.60%	***IBEX***	2.15 *(2.77)*	2.90 *(2.40)*	13.1%
CAC	6.33** *(3.25)*	4.85* *(2.42)*	3.4%	***CAC***	4.65 *(2.95)*	4.37* *(2.34)*	16.0%
MIB	3.01 *(2.95)*	-0.004 *(2.19)*	0.77%	***MIB***	2.29 *(2.56)*	0.02 *(1.70)*	13.0%

Table 13: Recession period results for SB1

(a) Baseline regression of the recession sample				(b) Recession sample with control variables			
	Surprise	**Expected**	**R^2**		**Surprise**	**Expected**	**R^2**
DAX	8.08 *(6.7)*	15.38* *(8.6)*	5.1%	***DAX***	6.50 *(6.39)*	6.81 *(8.90)*	20.0%
IBEX	-1.43 *(7.75)*	15.56 *(9.95)*	2.7%	***IBEX***	-3.17 *(7.50)*	4.10 *(10.43)*	15.0%
CAC	2.80	14.91	3.0%	***CAC***	0.89	4.07	20.3%

	(7.20)	*(9.24)*			*(8.02)*	*(12.18)*	
MIB	-0.34 *(8.37)*	20.90* *(10.73)*	4.0%	***MIB***	-1.68 *(8.22)*	9.06 *(11.42)*	13.8%

Table 14: Recession sample results (SB2)

(a) Baseline regression of the recession sample				**(b) Recession sample with control variables**			
	Surprise	**Expected**	**R^2**		**Surprise**	**Expected**	**R^2**
DAX	4.9 *(6.37)*	16.38** *(7.82)*	7.11%	***DAX***	4.62 *(6.56)*	21.54** *(9.55)*	9.37%
IBEX	-2.01 *(8.15)*	14.40 *(10.00)*	2.6%	***IBEX***	-3.00 *(8.36)*	17.24 *(12.17)*	5.7%
CAC	0.99 *(6.80)*	13.82 *(8.35)*	3.8%	***CAC***	0.49 *(6.95)*	21.40** *(10.12)*	7.5%
MIB	-1.89 *(12.96)*	21.43 *(16.24)*	7.9%	***MIB***	-2.60 *(9.10)*	28.50** *(13.26)*	9.5%

In the recession period, SB1's baseline results indicate that both, Germany and Italy do not conform with the efficient market hypothesis. Upon inclusion of control variables, none of these coefficients are significant. In SB2's recession sample, Germany, France and Italy do not conform with the efficient market hypothesis. Spain has the lowest R-squared (5.7%), and so if other control variables are added, the same results may show up. The difference in recession sample results between SB1 and SB2 indicate that the efficient market hypothesis fails to hold more in the Sovereign Debt Crisis period.

Decomposing changes in policy into surprise changes and expected changes has led to four main conclusions. The first is that the efficient market hypothesis conclusively holds for Germany during non-recession times. The full sample also confirms this finding, but this could be because the NR period's conditions overshadow the recession period's. The EMH does not hold for Germany during recession times. In SB1, this is shown in the baseline regression, but

not when control variables are included. SB2 conclusively shows that that EMH does not hold during recession period. Therefore, the second conclusion is that Germany's deviation from efficient market behaviour occurred during (and possible as a result of) the European sovereign debt crisis, and not the crisis in the United States.

For France, it seems that the EMH does not hold in general. During non-recession times, both SB1 and SB2 indicate that it does not hold. In recession times, only SB2 provides statistically significant results for France (with control variables) and indicates a failure of EMH. Therefore, the third conclusion is that EMH may not be fulfilled over the entire sample period for France. However, if in reality EMH holds during non-recession period, the deviation must have occurred as a result of the sovereign debt crisis, instead of United States' recession.

In case of Italy and Spain, the regressions mostly do not provide conclusive results. The only exception is for Italy in the recession period in SB2, indicating that the EMH does not hold during that time. This still does not necessarily indicate a divergence in fundamentals from Germany and/or France. For Spain and Italy this is more likely because of Omitted Variable Bias in the model. If fundamentals deviated, it is likely that more control variables need to be added. It is reasonable to expect that fundamentals deviated during the sovereign debt crisis between core and periphery countries (as is the consensus in current literature). Another reason for lack of significance could be due to a timing failure by credit rating agencies. In case they were too slow to react, the sample period may have been specified differently, which may have provided more significant results. Therefore, the last finding is that understanding deviations in fundamentals for Italy and Spain could be improved by either adding other control variables or by defining the recession sample differently.

6.3 Explaining Positive Coefficients

One strange result is the positive coefficient found in relation to the stock markets in the second part of the analysis, where surprise and expected changes are considered. In the full sample and in both SB1 and SB2's non-recession period, positive coefficients are found between surprise and expected changes in policy and 1 day percentage change in stock returns. This

means an increase in the surprise and/or expected component of actual policy corresponds to an increase in total returns. This contradicts the initial hypothesis and also the findings in the first part, with the "actual" changes in policy rate. A positive coefficient could indicate that a surprise increase in the rate is beneficial for firms, thereby increasing their total returns. Moreover, surprise coefficients are in general larger than the expected coefficients. So this would indicate than an increased policy rate is a "positive shock" to the returns.

One justification for this can be found in *Figure 1* and *Figure 2* below. As can be seen, there is a large deviation between the 1-month and 3-month Euribor offered rate. The 3-month Euribor futures rate still closely follows its corresponding offered rate. Therefore, the explanation of positive coefficients could lie in this deviation. Surprises are proxied by changes in the 3-month Euribor rate.

It is possible that the ECB's inflation targeting practice may have been either communicated wrongly or the policy targets were counter-productive for the economy. This drop in 1-month euribor offered rate occurred in October, 2004 and the 3-month offered rate did not follow this drop. Bredin et. al. (2009) study similar effects until May 2004 and they find negative coefficients on overall stock index returns. Possibly, if their sample was extended to more recent times, they would have faced a similar issue. Therefore, it is clear that post this period, the 3-month Euribor futures are not a reliable indication of the policy rate. However, since these are such widely traded futures contracts, the efficient market hypothesis can still be tested. If the ECB policy setting was faulty, this could be the reason for lack of significance during the recession times while measuring "actual" policy change effects.

Figure 1: 3-Month Euribor Offered Rate vs. 3-month Euribor Futures Rate

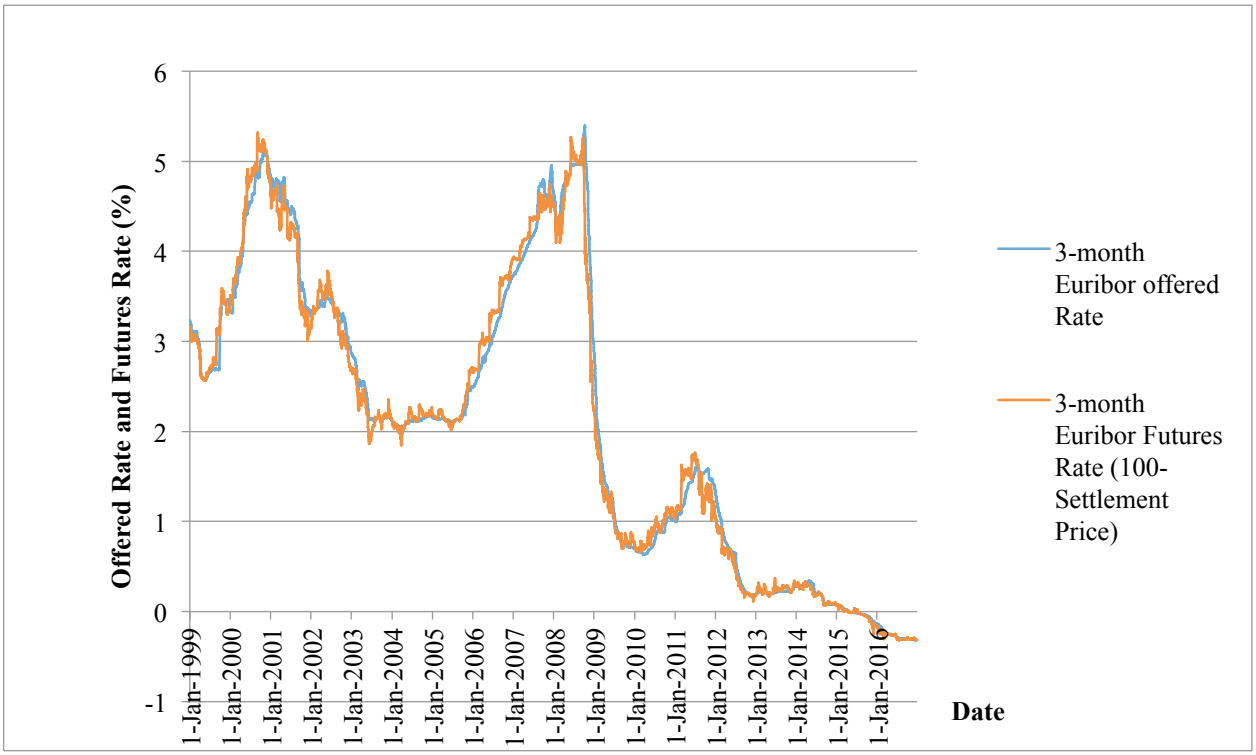
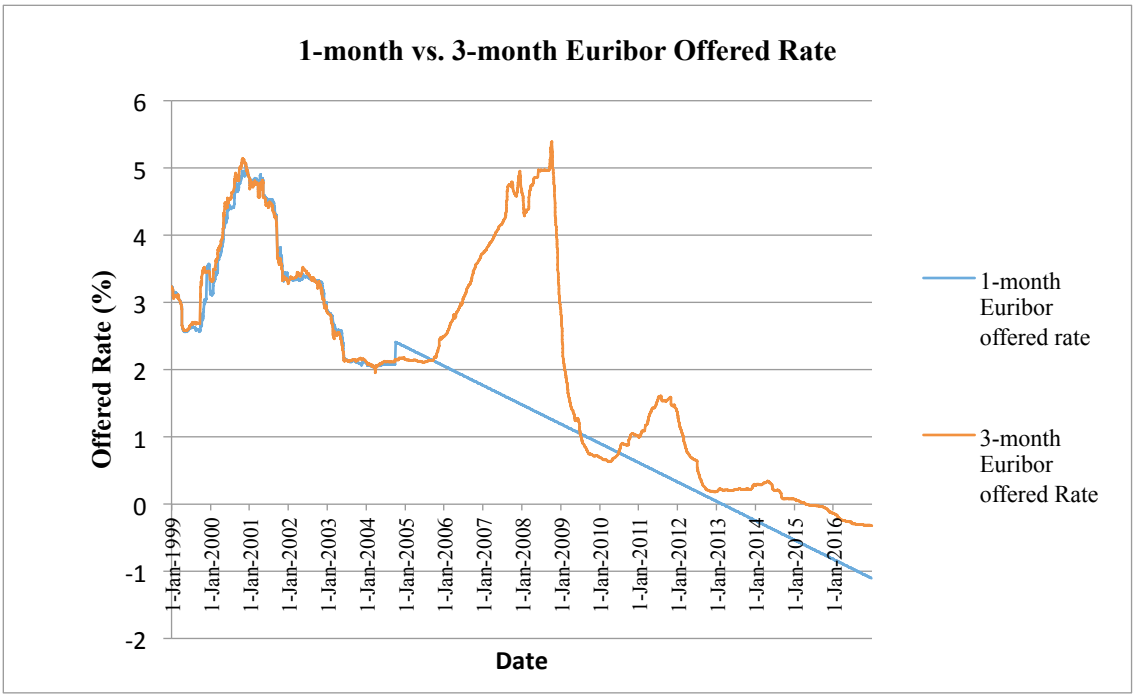


Figure 2: 1-month versus 3-month Euribor Offered Rate



7. Conclusion

This study aims to detangle the monetary complications inherent in the European monetary system and explain how sovereign fundamentals and stock returns interact. Four stock market indices are examined (German *DAX 30*, Spanish *IBEX 35*, French *CAC 40*, and Italian *FTSE MIB*). This is in order to understand the extent to which sovereign fundamentals depend on global markets, and when they diverged within the Eurozone.

By analyzing effects of actual changes in policy proxied by the 1-month Euribor offered rate, it was found that an increase in policy rates leads to a negative change in stock market return. For recession times, where the policy action is an increase in ECB's balance sheet, negative coefficients could superficially indicate that the ECB's asset purchase program is not effective in its policy transmission. Contributions of the control variables to the model indicate that European markets are highly affected by global economic indicators in SB1 and the opposite holds true for SB2. Including European variables may improve the explanatory power in SB2. By analyzing surprise and expected changes in policy rate, it was found that German markets conform to the EMH during non-recession times, and this condition does not hold during recession times. For France, it was found that the EMH does not hold true overall. Italy and Spain's coefficients do not provide statistically significant results.

This study was a preliminary glance into sovereign fundamentals' deviation between recession and non-recession times. Improvements can be made by closely examining the efficiency of the 3-month Euribor as this seems not to reflect monetary policy rate for significant period of the sample. A suggestion could be to consider the Eonia futures market instead as these contracts are characterized by shorter maturities. Omitted Variable Bias is a risk here even though the event window used is based on daily stock market data. Especially in recession periods in the Eurozone during the Sovereign Debt Crisis, more European (or "local") control variables can be tested. One more point to be noted is that stock index composition plays an important role as to how the results are reflected in this study. Vespro (2006) finds that compositional factors in stock indices have important effects on performance. Therefore, (as

Bredin et. al. (2009) do) it might be useful to test industry level portfolios to understand industry sensitivities to monetary policy. Comparisons between recession and non-recession times should be further developed in future literature. Another suggestion to improve the study could be using different selection criteria for recession samples to eliminate inconsistencies or inefficiencies in the sovereign credit rating market.

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Appendix 1: Governing Council Meeting Dates Used

4-Mar-99	2-Nov-00	9-Jan-03	4-May-06	3-Sep-09	10-Jan-13
18-Mar-99	16-Nov-00	6-Feb-03	8-Jun-06	8-Oct-09	7-Feb-13
8-Apr-99	30-Nov-00	6-Mar-03	6-Jul-06	5-Nov-09	7-Mar-13
22-Apr-99	14-Dec-00	3-Apr-03	3-Aug-06	3-Dec-09	4-Apr-13
6-May-99	4-Jan-01	8-May-03	31-Aug-06	14-Jan-10	2-May-13
20-May-99	18-Jan-01	6-Jun-03	5-Oct-06	4-Feb-10	6-Jun-13
2-Jun-99	1-Feb-01	10-Jul-03	2-Nov-06	4-Mar-10	4-Jul-13
17-Jun-99	15-Feb-01	31-Jul-03	7-Dec-06	8-Apr-10	1-Aug-13
1-Jul-99	1-Mar-01	4-Sep-03	1-Jan-07	6-May-10	5-Sep-13
15-Jul-99	15-Mar-01	2-Oct-03	8-Feb-07	10-Jun-10	2-Oct-13
29-Jul-99	29-Mar-01	6-Nov-03	8-Mar-07	8-Jul-10	7-Nov-13
26-Aug-99	11-Apr-01	4-Dec-03	12-Apr-07	5-Aug-10	5-Dec-13
9-Sep-99	26-Apr-01	8-Jan-04	10-May-07	2-Sep-10	9-Jan-14
23-Sep-99	10-May-01	5-Feb-04	6-Jun-07	7-Oct-10	6-Feb-14
7-Oct-99	23-May-01	4-Mar-04	5-Jul-07	4-Nov-10	6-Mar-14
21-Oct-99	7-Jun-01	1-Apr-04	2-Aug-07	2-Dec-10	3-Apr-14
4-Nov-99	21-Jun-01	6-May-04	6-Sep-07	13-Jan-11	8-May-14
18-Nov-99	5-Jul-01	3-Jun-04	4-Oct-07	3-Feb-11	5-Jun-14
2-Dec-99	19-Jul-01	1-Jul-04	8-Nov-07	3-Mar-11	3-Jul-14
15-Dec-99	2-Aug-01	5-Aug-04	6-Dec-07	7-Apr-11	7-Aug-14
5-Jan-00	30-Aug-01	2-Sep-04	10-Jan-08	5-May-11	4-Sep-14
20-Jan-00	13-Sep-01	7-Oct-04	6-Mar-08	9-Jun-11	2-Oct-14
3-Feb-00	17-Sep-01	4-Nov-04	10-Apr-08	7-Jul-11	6-Nov-14
17-Feb-00	27-Sep-01	2-Dec-04	8-May-08	4-Aug-11	4-Dec-14
2-Mar-00	11-Oct-01	13-Jan-05	5-Jun-08	8-Sep-11	22-Jan-15
16-Mar-00	25-Oct-01	3-Feb-05	3-Jul-08	6-Oct-11	5-Mar-15
30-Mar-00	8-Nov-01	3-Mar-05	7-Aug-08	3-Nov-11	15-Apr-15
13-Apr-00	6-Dec-01	7-Apr-05	4-Sep-08	8-Dec-11	3-Jun-15
27-Apr-00	3-Jan-02	4-May-05	2-Oct-08	12-Jan-12	16-Jul-15
11-May-00	7-Feb-02	2-Jun-05	8-Oct-08	9-Feb-12	3-Sep-15
25-May-00	7-Mar-02	7-Jul-05	6-Nov-08	8-Mar-12	22-Oct-15
8-Jun-00	4-Apr-02	4-Aug-05	4-Dec-08	4-Apr-12	3-Dec-15
21-Jun-00	2-May-02	1-Sep-05	15-Jan-09	3-May-12	21-Jan-16
6-Jul-00	6-Jun-02	6-Oct-05	5-Feb-09	6-Jun-12	10-Mar-16
20-Jul-00	4-Jul-02	3-Nov-05	5-Mar-09	5-Jul-12	21-Apr-16
3-Aug-00	1-Aug-02	1-Dec-05	2-Apr-09	2-Aug-12	2-Jun-16
31-Aug-00	12-Sep-02	12-Jan-06	7-May-09	6-Sep-12	21-Jul-16
14-Sep-00	10-Oct-02	2-Feb-06	4-Jun-09	4-Oct-12	8-Sep-16
5-Oct-00	7-Nov-02	2-Mar-06	2-Jul-09	8-Nov-12	20-Oct-16
19-Oct-00	5-Dec-02	6-Apr-06	6-Aug-09	6-Dec-12	8-Dec-16

Appendix 2: Dependent Variable Summary Statistics

Full Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
DAX30	-5.78	5.78	0	1.67	240
IBEX35	-6.27	4.91	0.04	1.68	240
CAC40	-6.38	5.37	-0.01	1.66	240
FTSE MIB	-5.85	4.77	-0.04	1.72	240

SB1 NR Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
DAX30	-4.52	5.78	0	1.58	147
IBEX35	-3.71	4.31	0.08	1.38	147
CAC40	-5.11	3.84	0.02	1.47	147
FTSE MIB	-3.4	3.34	-0.03	1.28	147

SB2 NR Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
DAX30	-5.78	5.78	-0.01	1.76	162
IBEX35	-6.27	4.78	-0.04	1.59	162
CAC40	-6.38	5.37	-0.12	1.71	162
FTSE MIB	-5.85	4.77	-0.16	1.53	162

SB1 Recession Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
DAX30	-5.78	-5.19	0	1.83	93
IBEX35	-6.27	4.91	-0.01	2.08	93
CAC40	-6.38	5.37	-0.06	1.93	93
FTSE MIB	-5.85	4.77	-0.06	2.26	93

SB2 Recession Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
DAX30	-4.36	3.56	0.22	1.48	78
IBEX35	-5.94	4.91	0.22	1.84	78
CAC40	-3.9	3.41	0.2	1.55	78
FTSE MIB	-5.16	4.31	0.2	2.05	78

The dependent variables are in percentage change in total stock index returns. In the full duration of the sample, the *CAC 40* has the higher percentage decrease in stock returns and Germany has the highest percentage increase. Standard deviations do not vary too much in the full sample. However, in SB1, the recession period has higher standard deviations of percentage change in

stock returns. In SB2, the Germany and France have lower standard deviations in the recession period compared to the non-recession period.

Appendix 3: Independent Variables Summary Statistics

Full Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
VIX	10.32	63.68	21.36	8.64	240
S&P Commodity Price Index	80.68	505.66	226.48	104.62	240
Effective Exchange Rate	75.06	106.041	89.62	7.75	240
BoE policy surprises	-0.44	0.175	0	0.06	240

SB1 NR Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
VIX	10.44	41.76	21.14	6.39	147
S&P Commodity Price Index	80.68	505.66	171.32	86.01	147
Effective Exchange Rate	75.06	106.04	86.59	7.6	147
BoE policy surprises	-0.2	0.15	0	0.05	147

SB2 NR Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
VIX	10.44	63.68	22.95	9.32	162
S&P Commodity Price Index	80.68	505.66	179.76	87.34	162
Effective Exchange Rate	75.06	106.04	87.95	8.45	162
BoE policy surprises	-0.44	0.18	0	0.07	162

SB1 Recession Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
VIX	10.32	63.68	21.7	11.36	93
S&P Commodity Price Index	169.69	424.36	313.65	64.44	93
Effective Exchange Rate	84.48	105.33	94.41	5.12	93
BoE policy surprises	-0.44	0.175	0	0.07	93

SB2 Recession Sample					
Variable	Min	Max	Mean	Std. dev.	No. of observations
VIX	10.32	36.27	18.05	5.82	78
S&P Commodity Price Index	169.69	424.36	323.5	62.42	78
Effective Exchange Rate	84.4817	104.34	93.08	4.37	78

BoE policy surprises	-0.07	0.04	0	0.01	78
Change in ECB balance sheet (Billions)	-357.96	416.49	34.46	137.53	78

Appendix 4: Correlation Tables between Stock Return Indices

Net Returns data was available in Datastream for IBEX 35 and CAC 40. In the correlation table below, it can be seen that for both indices, (change in) total returns and net returns are highly correlated. Therefore, using total returns does not compromise the quality of analysis.

	IBEX Total Returns	CAC Total Returns
IBEX Net Returns	0.9989	0.8871
CAC Net Return	0.8866	0.9999

In the table below, we see that the major European stock indices are highly correlated with each other. Ideally, in studying total returns changes there should be a control for financial contagion from near-by markets. However, in this case, including European stock index data as control variables in any of the regressions provides an unnaturally high R-squared and biases the regressions.

	DAX	IBEX	CAC	MIB	FTSE	BoE Surprise	Effective exchange rate	VIX
DAX	1							
IBEX	0.8037	1						
CAC	0.8976	0.8863	1					
MIB	0.8225	0.8802	0.8862	1				
FTSE	0.7725	0.7906	0.859	0.7776	1			
BoE Surprise	0.2225	0.1507	0.2311	0.149	0.1648	1		
Effective exchange rate	-0.0851	-0.1199	-0.0912	-0.0969	-0.1071	-0.0192	1	
VIX	-0.1871	-0.2152	-0.2188	-0.2405	-0.1739	-0.2466	-0.0562	1

Appendix 5: Spain's Sovereign Credit Ratings (Moody's and S&P)

Blue= Initial rating, Green= rating upgrade, Red= Rating downgrade

S&P Foreign Currency Long Term Debt	
Rating	Effective date (mm/dd/yyyy)
BBB+	10/2/2015
BBB+	5/23/2014
BBB-	10/10/2012
BBB+	4/26/2012
A	1/13/2012
AA-	12/5/2011
AA-	10/13/2011
AA-	4/28/2010
AA+	1/19/2009
AAA	1/12/2009
AAA	12/13/2004
AA+	3/31/1999
AA	8/1/1988

Moody's Foreign Currency Long Term Debt	
Rating	Effective date (mm/dd/yyyy)
Baa2	2/21/2014
Baa3	10/16/2012
Baa3	6/13/2012
A3	2/13/2012
A1	10/18/2011
Aa2	7/29/2011
Aa2	3/10/2011
Aa1	12/15/2010
Aa1	9/30/2010
Aaa	6/30/2010
Aaa	12/13/2001
Aa2	9/19/2001
Aa2	12/9/1992
Aa2	10/2/1992
Aa2	2/3/1998

S&P Local Currency Long Term Debt	
Rating	Effective Date (mm/dd/yyyy)
BBB+	10/2/2015
BBB+	5/23/2014
BBB-	10/10/2012
BBB+	4/26/2012
A	1/13/2012
AA-	12/5/2011
AA-	10/13/2011
AA	4/28/2010
AA+	1/19/2009
AAA	1/12/2009
AAA	12/13/2004
AA+	3/31/1999
AA	5/6/1998
AAA	12/11/1992

Moody's Local Currency Long Term Debt	
Rating	Effective date (mm/dd/yyyy)
Baa2	2/21/2014
Baa3	10/16/2012
Baa3	6/13/2012
A3	2/13/2012
A1	10/18/2011
Aa2	7/29/2011
Aa2	3/10/2011
Aa1	12/15/2010
Aa1	9/30/2010
Aaa	6/30/2010
Aaa	12/13/2001
Aa2	1/31/1997