The Impact of Conventional and Unconventional Monetary Policy on Expectations and Sentiment

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Abstract

This paper offers for the first time evidence on the effect of ECB's unconventional monetary policy on economic expectations in Euro-area countries during the EU crisis. Our main findings indicate that conventional monetary policy has a positive effect on expectations and sentiment, while non-standard policies seem to have a negative effect. The second quantitative easing by the Fed had a positive effect on expectations mainly for the core Eurozone countries. Furthermore, ECB's conventional monetary policy is an important contributor to the variance of Eurozone country economic sentiment, indicating an effective expectations transmission channel. During the EU financial crisis, Euro-area sentiment seems to have a contribution of 29%-33% to the US sentiment variance, while during the EU crisis conventional monetary policy appears to be the single most important net sender of shocks to both the core and the peripheral countries. Together, our findings highlight the importance of both conventional and unconventional monetary policy in the determination of economic expectations.

JEL Classification: E52, G02;
Keywords: Monetary Policy, Unconventional Monetary Policy, Investor Sentiment

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1. Introduction

The main aim of the European Central Bank (ECB) is to maintain price stability, defined as a year-on-year increase in consumer prices of below 2%, over the medium term; furthermore, it contributes to the stability of the financial system within the Euro-area by monitoring developments in the banking and financial sectors. The main instrument of monetary policy by central banks is their influence over money market interest rates which affect expectations of future official interest rates, the actions of economic agents, and ultimately the evolution of output or prices. As the ECB itself acknowledges, the expectations transmission channel of monetary policy has gained importance during the recent decades. For instance, a high degree of central bank credibility can have a strong impact on price developments by guiding economic agents' expectations, and thus "….understanding the transmission mechanism is crucial for monetary policy (p.61, The Monetary Policy of the ECB (2011), available at: http://www.ecb.europa.eu).

Many authors have also stressed the importance of monetary policy on financial markets, risk aversion, and expectations, and have argued that understanding the links between asset prices and monetary policy is crucial in understanding the monetary policy transmission mechanism (Bernanke and Kuttner, 2005). Furthermore, as Lutz (2015) argues, there is a necessity to understand the relationship between investor sentiment and monetary policy since central banks are contemplating the use of monetary policy tools in order to tackle the volatility associated with asset bubbles and financial crises. Indeed, during the recent financial crises in the US and the EU, official policy rates approached the zero lower bound and, as a result, central banks in

developed economies resorted to unconventional monetary policy mechanisms in order to tackle financial market volatility and preserve financial stability (see, among others, Gambacorta, et al., 2014; Fawley and Neely, 2013).

This is the first paper, to the best of our knowledge, that examines the effect of ECB's unconventional and conventional monetary policy during the EU crisis on economic expectations. For monetary policy to achieve the target of price stability it has to affect expectations, in other words, affect consumer and economic confidence. We ask whether ECB's monetary policy does that, since previous studies on unconventional policies focus on the Fed and US data. Note that, although both central banks have similar long term goals under their constitution, they may be using different policies to meet these goals, given that they are facing different challenges. For example, the ECB is at present trying to deal with slow growth and deflation risk, while the FED is trying to maintain the established growth and economic stability. Given the absence of any mechanisms that can tackle the side effects of this strategic divergences, empirical evidence that sheds light on the effects of non-standard policies is crusial in understanding its effectiveness. Morover, we also examine the effect of the Fed's unconventional policy on economic expectations in the Euro-area and sentiment spill-overs from the US to the Euro-area and visa versa. Note that many previous studies document the effect of economic agent expectations (measured as consumer confidence and/or economic sentiment) on economic activity, economic and investment behavior, and asset prices. For example, Benhabib et al. (2016), present a model where shocks in sentiment affect output, employment, and the business cycle; Chen (2011), finds that a bear equity market regime has a higher probability of occurring when there is a lack of consumer confidence; Hwang (2011)

finds that the way Americans feel about a country affects US investor demand for this country's securities and leads to a deviation from fundamental values (see also, among others, Bachmann and Sims, 2012; Baker and Wurgler, 2007; Brown and Cliff, 2004; Fisher, and Statman, 2003; Neal and Wheatley, 1998).

We measure the expectations of economic agents in the Euro-area with the Economic Sentiment Indicator (ESI), that is compiled by the Directorate-General for Economic and Financial Affairs of the European Commission (DG ECFIN). The ESI is a composite index with constituents five sectoral confidence indicators (industrial confidence, services confidence, consumer confidence, construction confidence, retail trade confidence) that are seasonally adjusted balances of answers to surveys within each sector. Empirical research shows that sentiment indexes, such as the ESI for the EU and the Michigan Survey for the US, may contain information that is not already reflected in other macroeconomic variables. For example, Carroll at al. (1994) find that sentiment forecasts spending; they argue that sentiment is an independent driving force in the economy since it reflects the economic outlook (see, among others, Acemoglu and Scott, 1994; Matsusaka and Sbordone, 1995; Bachmann and Sims, 2012; Barsky and Sims, 2012).

For the empirical analysis, we use a Panel Vector AutoRegression (PVAR) methodology, with all variables in the system treated as endogenous (VAR), while allowing for unobserved individual heterogeneity. With this method we are able to combine the traditional VAR model with a panel-data approach and treat all variables in the system as endogenous, as in a VAR model, but at the same time allow for unobserved individual heterogeneity, as in panel-data estimations (see, Love and

Zicchino, 2006). Gambacorta et al. (2014) use the PVAR methodology to examine the macroeconomic effects of unconventional monetary policies (for a brief discussion of these policies see next section) in a sample of eight advanced economies and find a positive effect on economic activity and prices following exogenous increases in central bank balance sheets. Our sample consists of nine Eurozone countries that we group in two sub-samples denoted for simplicity as the "core" countries (Germany, France, Netherlands, Belgium and Austria) and the "peripheral" countries (Spain, Portugal, Italy, and Greece). We combine the sentiment indicators with a set of macroeconomic and financial variables such as equity prices, industrial production, unemployment, trade balance, consumer price indexes.

Our main findings indicate that conventional ECB monetary policy has a positive and significant effect on EU expectations and sentiment, while unconventional policies seem to have a negative and significant effect; the first quantitative easing by the Fed has a negative impact while the second quantitative easing has a positive effect, mainly for the core Eurozone countries. Furthermore, ECB conventional monetary policy is an important contributor to the variance of European sentiment, especially during the 2007-2010 period, while Fed's conventional monetary policy also seems to contribute to the variance in sentiment, in conjunction with ECB policies. This indicates that the expectations transmission channel is succesfull in shaping expectations. As regards to expectation spill-over effects, during the 2007-2010 period we detect an important effect of US sentiment mainly on peripheral Euro-area country sentiment, while during the EU financial crisis, Euro-area sentiment seems to have a contribution of 29%-33% to the US sentiment variance. Finally, we find that during the EU crisis conventional monetary policy appears to be the single most

important net sender of shocks to both the core and the peripheral countries. During the US crisis, for all countries, the ESI is the single most important net sender of shocks to both core and peripheral countries.

The paper contributes to the relevant literature on the effects of monetary policy. For example, Bernanke and Kuttner find that the Fed's monetary shocks have a significant impact on expected excess equity returns and suggest that investors may overreact, or be very sensitive, to monetary shocks. This result is consistent with Kurov (2010) who finds that the Fed's monetary policy decisions have a significant effect on US investor sentiment, or with Bekaert et al. (2013) who document a relationship between investor risk aversion and monetary policy. Lutz (2015) studies the effect of Fed's conventional and unconventional monetary policy on investor sentiment and finds that during conventional policies a surprise drop in the rate has a positive impact on investor sentiment that lasts several months; unconventional monetary policy shocks have a similar impact on economic sentiment.

Our findings of a positive effect of conventional policy on sentiment are consistnet with previous findings, however, the finding of a negative effect of unconventional policy on sentiment is not. Lutz (2015) finds that Fed's unconventional monetary policy shocks have a similar impact on economic sentiment as the conventional policies. An explanation for the differences in the results may be the different nature of unconventional policies the two central banks followed after 2010. For example, one should make the distinction between the subprime crisis in the US (2007-2009) during which the reaction of the Fed and the ECB was similar, and the EU crisis that

erupted in 2010 where there have been important differences in the policies employed.

More specifically, as Gros, et al. (2012) point out, while the Fed (and the Bank of England) responded with QE policies signaling a strong will to undertake credit risk, the ECB responded with an approach that could be described as 'credit easing'; that is, the massive response to the crisis with the Long Term Refinancing Operations (LTROs) and the Securities Markets Programme (SMP) was also targeted at minimizing ECB's own risk (p. 5). It must be noted that while at the time the focus in the US was on the economic cycle and economic recovery, in the Euro area increased uncertainty about a Greek default, the effective isolation from the inter-bank market of some peripheral country banking systems, and the restoration the monetary policy transmission mechanism, was the priority (for a detailed discussion see Gross, et al. 2012). In the longer term, however, the evolution of the ESI for the EU overtime (see Figure 1) indicates that, despite sharp sentiment decreases during the US crisis in the US and during the outbreak of the EU crisis, sentiment seems to be in an upward channel. In addition, empirical evidence indicates that the ECB policies had a positive effect on asset prices and reduced bank credit (Fratzscher et al., 2014). Also, Falagiarda, et al. (2015), in a study on non euro-area EU countries, argue that for the SMP announcements portfolio rebalancing and signalling channels were important in policy transmission, while for the the Outright Monetary Transactions (OMT) the confidence transmission channel reduced redenomination risk. The rest of the paper is organized as follows: section 2 briefly reviews unconventional monetary policy actions, section 3 presents the data and the testing methodologies, section 4 presents the results on the impact of monetary policy on sentiment, section 5 presents the

results on sentiment spill-over effects, section 6 presents impulse response functions and robustness tests, while section 7 concludes the paper.

2. Unconventional Monetary Policies

The significance and the strength of the subprime crisis in the US in 2007-2008 and the financial crisis in the EU in 2010 led to unchartered territory for major central banks which responded by adopting non-standard monetary policy actions in line with their operational frameworks and mandates (see, for a review, Fawley and Neely, 2013). This section discusses briefly the unconventional monetary policy responses. Initially, the ECB together with other central banks from developed economies, responded by reducing its key interest rates. Soon a further reduction took place and as a result the main refinancing rate was reduced to 1% (a decrease of 325 bp) between October 2008 and May 2009. In addition to rate cuts the ECB implemented the Enhanced Credit Support (ECS) that mainly consisted of an extension of the maturity of liquidity provision in Longer-Term Refinancing Operations (LTROs), Supplementary Long Term Refinancing Operations (SLTROs), and "Very" Long Term Refinancing Operations (VLTROs); a fixed rate full allotment tender procedure where, in contrast to standard proccedures, financial institutions in the euro-area had unlimited access to central bank liquidity at the main refinancing rate; currency swap agreements that allowed the provision of liquidity in foreign currencies during the crisis; collateral requirements that involved an extension of the eligible collateral accepted in refinancing operations; a covered bond purchase programme. For instance, in March 2008 the ECB introduced 6-month SLTROs, in May 2009 the ECB announced for the first time 12-month SLTROs (in the largest 12-month auction the

ECB allotted around 442 billion euro), in December 2011 the ECB announced two "very" long term refinancing operations (VLTROs) with a 3-year maturity. Towards the end of 2009 the ECB initiated the phase-out of many elements of this policy.

By March 2010 when the EU crisis started to unfold, however, the ECB, in an attempt to inject liquidity and restore the monetary policy transmission mechanism announced the Securities Markets Programme (SMP), i.e. direct purchases of government bonds (Greek, Portuguese and Irish Government bonds) in secondary markets (often on a daily basis without a predetermined public target in terms of price or quantity, depending on market conditions). Within SMP all purchases were fully neutralised through liquidity-absorbing operations. In August 2011, the ECB extended the SMP to Italian and Spanish Government bonds; by early 2012, the ECB held around 220 billion euro of sovereign bonds. The SMP became "dormant" in early 2012 and was officially deactivated in September 2012. In September 2012, in the midst of fears of a euro area break-up, the ECB announced the introduction of a new policy instrument, the Outright Monetary Transactions (OMTs). The OMTs consist of (potentially unlimited) purchases of government bonds with a maturity of up to three years, issued by countries under a European Stability Mechanism (ESM) macroeconomic adjustment programme or a precautionary programme (Enhanced Conditions Credit Line).

On the other side of the Atlantic, the Fed responded to the subprime crisis with Quantitative Easing (QE). That is, before the crisis the Fed held between $700 billion and $800 billion of Treasury notes on its balance sheet; in late November 2008 it started buying $600 billion in mortgage-backed securities (QE1), by March 2009 it

held $1.75 trillion of bank debt, mortgage-backed securities, and Treasury notes, and by June 2010 it held $2.1 trillion. In November 2010, the Fed announced a second round of quantitative easing (QE2), buying $600 billion of Treasury securities by the end of the second quarter of 2011. A third round of quantitative easing (QE3) was announced on 13 September 2012, i.e. a $40 billion per month open-ended bond purchasing program of agency mortgage-backed securities. Additionally, the Federal Open Market Committee (FOMC) announced that it would likely maintain the federal funds rate near zero "at least through 2015" (due to its open-ended nature, QE3 is often termed as "QE-Infinity").

3. Data and Testing Methodology

For the empirical analysis of the impact of the conventional monetary policy measures on sentiment we employ a Panel Vector Autoregressive (PVAR) model with monthly data on sentiment indicators, macroeconomic aggregates, and financial variables (see, among others, Lutz, 2014), for the period between May 2007 and October 2012. To assess the impact of unconventional monetary policy actions on investor sentiment, we employ ECB and FED monetary policy announcement dates for the Eurozone and the US, respectively (Financial Times headlines, see for details Appendix 1 & 2,). The variables are discussed below. All data are monthly and obtained from Thomson Reuters EIKON and Bloomberg. The sample covers the period between May 2007 and October 2012.

As a proxy for sentiment in the Eurozone countries and the US we employ monthly observations on the Economic Sentiment Indicator (*ESI*) and the Michigan Consumer

Sentiment Index (*MCSI*), respectively. The ESI is compiled within the Joint Harmonised EU Programme of Business and Consumer Surveys and is a composite indicator made up of five sectoral confidence indicators (industrial, services, consumption, construction, retail trade) with different weights. The data are compiled according to the Statistical classification of economic activities in the European Community (NACE Rev.2; source: Eurostat, DG ECFIN, EIKON). The MCSI is a consumer confidence indicator published by the University of Michigan and is typically employed in empirical studies to measure expectations and consumer optimism and pessimism, or as a predictor of asset returns (see, among others, Barsky and Sims, 2012; Lemmon and Portniaguina, 2006; Fisher and Statman, 2003). For the empirical analysis we use the indexes in levels; however, as a robustness test, we also employ the differences of the index from the optimism-threshold (i.e. 100, see Georgoutsos and Migiakis, 2013). The results are qualitative the same.

In order to measure the impact of conventional monetary policy shocks we use the EONIA (Euro Overnight Index Average) and the FED Fund rates for the Eurozone and the US respectively (see Bernanke and Blinder, 1992; Romer and Romer, 2004; among others). We also consider a number of variables that gauge economic output and financial market behavior (Lutz, 2014; Stock and Watson, 2002; among others), such as Industrial Production (*IP*), the unemployment rate (*Unemloym*), the trade balance (*Tradebal*), the consumer price index (*CPI*), stock price indexes for the Eurozone countries and the US (*Stock_ret*). Note that consumer price inflation in the euro area is measured by the Harmonised Index of Consumer Prices (HICP), which is compiled by Eurostat and the national statistical institutes in accordance with harmonised statistical methods, and that the ECB aims to maintain annual inflation

rates below, but close to, 2% over the medium term. Appendix III presents a description of the variables and all the time series are transformed to stationary.

For the empirical analysis, in order to capture the announcement effect of unconventional policy measures we use impulse dummies. A first concern is that the announcement was sufficiently unexpected and significant enough to affect markets. To this end we focus only on ECB announcements related to unconventional policy measures (*SLTROs, SMP, OMT*) that were covered in the front page of the Financial Times on the following day. For example, the dummy *AN_OMTt* is equal to one on the day the ECB President Draghi made his speech in London (26th July 2012; "Whatever it takes") and on the day of the *OMT* announcement (6th September 2012). The dummy *AN_SMPt* is equal to one on the 10th of May 2010, when the ECB announced the SMP response to the escalation of the Greek Crisis, and on the 8th of August 2011 when the ECB re-activated the programme. In the robustness tests section, we further discuss the choice of event dummies extending the analysis to other events.

We distinguish between three types of US unconventional monetary policy measures in the analysis: announcements (denoted AN_1, AN_2, AN_3) are impulse dummies equal to 1 for a number of announcements related to QE1, QE2 and QE3 policies, respectively. We analyze fifteen key Fed announcements reported in the Financial Times between 2008 and 2012 (see also, Gagnon et al., 2011; Wright 2011). In order to check that the chosen event days do indeed have an impact on asset prices we also follow Wright (2012), where the impact of policy shocks is identified under the

assumption that the volatility of these shocks is higher on the days when the Fed made key announcements about its unconventional monetary policies.

Testing Methodology

For the empirical analysis, we use the Panel Data Vector Autoregression (PVAR) methodology, with all variables in the system treated as endogenous (VAR), while allowing for unobserved individual heterogeneity. Using a PVAR approach we are able to combine the traditional VAR model with a panel-data approach based on the PVAR routine written by I. Love (Love & Zicchino, 2006). We consider this to be a major advantage of this approach, as all variables in the system are treated as endogenous, as in a traditional VAR model, and unobserved individual heterogeneity is being allowed for, as in panel-data estimations. We specify a first-order seven-variable VAR model:

$$Z_{i,t} = \gamma_o + \gamma_1 Z_{i,t-1} + f_i + u_t \quad i = 1,\ldots,N \quad t = 1,\ldots T \qquad (1)$$

where $u_t \sim i.i.d.\ (0,\Sigma)$ and f_i expresses the time invariant fixed effects.

In (1), the PVAR shown, does not allow for dynamic interdependencies and cross sectional heterogeneities, since γ_o and $\gamma_1$are the same across all units, or for static interdependencies since we assume that $cov(u_{it}, u_{jt}) = 0$, for $i \neq j$ (see Love and Zicchino, 2006; Canova and Ciccarelli, 2013; Grossmann et al., 2014). We use the Love and Zicchino (2006) code for Panel VAR estimation in STATA, and all of the results are estimated using a PVAR with one lag. The evidence presented from this

analysis is mostly based on the results from the impulse-response functions and the variance decompositions. Furthermore, we use a Cholesky decomposition of the variance-covariance matrix of residuals, since the actual variance-covariance matrix of the errors is highly unlikely to be diagonal. In this case, it becomes difficult to isolate shocks to one of the VAR errors, i.e. we have to decompose the residuals in a way that they become orthogonal. With the Cholesky ordering we assume that the most exogenous variable is the Eonia rate and the least exogenous is the Economic Sentiment of each sample market.

An important restriction is that the underlying structure is the same for each cross-sectional unit, which however, may not hold. Thus, we allow for "individual heterogeneity" in levels by introducing fixed effects. Simple-mean differencing will provide biased estimators, as fixed effects are correlated with the repressors due to lags of the dependent variables. In order to avoid that we follow Love and Zicchino (2006), that is, we introduce the forward mean-differencing procedure also known as the Helmert transformation. According to Arellano and Bover (1995), the Helmert transformation removes only the forward mean. Since, dependent and lagged variables remain orthogonal we can estimate the coefficients by using system GMM. To analyze the impulse- response functions we need an estimate of their confidence intervals. Since the matrix of impulse-response functions is constructed from the estimated VAR coefficients, their standard errors need to be taken into account. We calculate standard errors of the impulse-response functions and generate confidence intervals which have been produced by Monte Carlo simulations with 200 replications. Therefore, whenever the zero line lies outside the confidence bands there is evidence of a statistically significant response to the shock inflicted.

4. The Impact of Monetary Policy on Sentiment

In Table 1, Panel A, we present descriptive statistics for the main variables. The panel unit root tests of Im-Pesaran-Shin (2003; IPS test) suggest that we cannot reject the null hypothesis of a unit root, for all sample variables (these results are not reported here but are available upon request). The next step is the lag selection for the PVAR model. In order to decide on the lag structure we use the overall coefficient of determination (CD). The results are presented in Table 1 (Panel B) and indicate that the optimal lag structure is one lag. In Panel C (Table 3) we report evidence on the stability properties of the estimated PVAR model, which reuires the moduli of the eigenvalues of the dynamic matrix to lie within the unit circle which is the case in our estimated model (see also, Figure 2).

Following the Cholesky Ordering, the variables are ordered as follows: Eonia rate, Stock returns, Industrial Production Index, unemployment rate, Trade balance, Consumer Price Index and Economic Sentiment Indicator (ESI). The recursive order dictates that each country's ESI responds to changes in the other variables in time *t*. In contrast, the Eonia index only responds to itself in time *t*, and only with a lag to the other variables. However, one could argue the other way if automatic stabilizers immediately change the ratio. We considered this alternative ordering, but the change in ordering does not greatly affect our analysis and conclusions. Note that Lutkepohl (1991) argues that the ordering of the variables makes little difference when the residuals' correlation is small. As far as the estimated parameters of the Panel Var are concerned, we present the estimates only in the case of the unconventional monetary

policy announcements' contribution as they are inserted in the system as exogenous. In the case of conventional monetary policy, we pay attention to the underlying moving average (MA) representation of the VAR model, namely the impulse response functions (IRFs) and the associated variance decompositions (VDs). These two combined, convey information on how each variable responds to a surprise change (a shock) to another variable in the system (the rest of the results are available upon request). In order to assess the contribution of conventional monetary policy in the behavior of investor sentiment, we estimate their variance decomposition.

The results of the impact of ECB monetary policy on the variables are presented in Table 2, in Panel A (Eurozone countries), Panel B (Core) countries), and Panel C (Peripheral) countries). Although all variables are included in the PVAR the Table presents only the impact of conventional and unconventional monetary policies (i.e. *Eonia*, *LTROs*, *SMP*, *OMT*). The results indicate that for the Eurozone countries (Panel A) the *LTROs* and *OMT* announcements have a significant and negative impact on investor sentiment. For instance, for all the Eurozone countries, the coefficient of *LTROs* is -1.1855 and stattistically significant at the 1% level (last column, Panel A); the coefficient of *OMT* is -1.8090 and statistically significant at the 1% level; the coefficient of *SMP* is -1.0910 but statistically insignificant. For the core Eurozone countries (last column, Panel B) all coefficients are statistically significant at the 5% and 1% levels, while for the peripheral countries (last column, Panel C) only the *OMT* coefficient is statistically significant at the 1% level and negative. The effect of conventional policies, however, is statistically significant and positive for all groups of countries.

Table 3 presents the results on the effect of US unconventional monetary policy announcements on European sentiment. In the Table, Panel A presents results for the all Eurozone countries, Panel B for Core countries, and Panel C for the Peripheral countries. We present the PVAR estimated parameters using the US Quantitative Easing 1 (*QE1*), Quantitative Easing 2 (*QE2*), and Quantitative Easing 3 (*QE3*) announcements as exogenous factors. Although all variables are included in the PVAR the Table presents only the impact of unconventional monetary policies (i.e. *QE1*, *QE2*, *QE3*). The results indicate that QE1 announcements had a negative effect on Eurozone sentiment (last column, Panel A); for instance, the coefficient of *QE1* is -1.9701 (*a*=1%). QE1 had the same impact on the sentiment of core countries, however, *QE2* had a positive impact with a coefficient of 0.8110 (*a*=5%). None of the Fed's unconventional policies had a statistically significant impact on peripheral country sentiment (last column, Panel C).

We next examine in more detail the impact of conventional ECB and Fed monetary policy on sentiment using variance decomposition analysis. The results for the ECB are presented in Table 4. The Table presents the the Economic Sentiment indicator (ESI) variance decomposition, i.e. the percentage of sentiment variance that is explained by each variable. Panel A presents results for the full sample, Panels B for the period between 2007 and 2010, while Panel C for the period between 2010 and 2012. Note that we perform variance decomposition analysis for all variables, however, we concentrate and report here the results only for sentiment (the rest of the results are available upon request). For example, for the full sample period (Panel A) Eonia contributes approximately 22.08% to the variance of sentiment for all Eurozone countries, 31.46% to the core countries, and 11.6% for the peripheral countries.

During the 2007-2010 period (Panel B) Eonia contributes approximately 23.75% to the variance of sentiment for all Eurozone countries, 28,38% for the core countries, and 17.53% for the peripheral countries. For the more recent period (Panel C) conventional monetary policy seems to contribute little to the variance of European sentiment. Equity market returns seem to also be an important contributor to sentiment variance.

The results for the Fed conventional policy (Fed funds rate) are presented in Table 5, which is organized in the same way as Table 4. The Fed funds rate is listed first in the Cholesky ordering as the most exogenous in the system (US factor in the European set). As we can see in Table 5, during the full sample period (Panel A), the Fed funds rate has approximately the same contribution to the three different country groups. More specifically, Fed funds rate contributes with 16.13% to all Eurozone country ESI variance, with 15.69% to the Core country sentiment variance, and 14.87% to Peripheral country sentiment variance. For the 2007-2010 period (Panel B), however, these percentages drop to 9.57%, 5.8%, and 14.08%, respectively. During the more recent period (Panel C) there is no effect, an expected result as Fed funds rate is at its lower bound.

The results, so far, indicate that conventional ECB monetary policy seems to have a positive and significant effect on sentiment, while unconventional policies seem to have a negative and significant effect. The first quantitative easing by the Fed has a negative impact while the second quantitative easing has a positive effect, mainly for the core Eurozone countries. A possible explanation for the differences in the results may be the different nature of unconventional policies the two central banks followed

after 2010. For example, one should make the distinction between the subprime crisis in the US (2007-2009) during which the reaction of the Fed and the ECB was similar, and the EU crisis that erupted in 2010 where there have been important differences in the policies employed. While the Fed responded with QE policies signaling a strong will to undertake credit risk, the ECB responded with an approach that could be described as 'credit easing'. It must be noted that while at the time the focus in the US was on the economic cycle and economic recovery, in the Euro area increased uncertainty about a Greek default, the effective isolation from the inter-bank market of some peripheral country banking systems, and the restoration the monetary policy transmission mechanism, was the priority. Thus, despite the possible longer term positive effects of the ECB policies, ate the time the short term effect on expectations was negative. Furthermore, ECB conventional monetary policy is an important contributor to the variance of European sentiment, especially during the 2007-2010 period, while Fed's conventional monetary policy also seems to contribute to the variance in sentiment, in conjunction with ECB policies.

5. Spill-Over Effects

An related interesting issue is whether there are sentiment spill-over effects from the Euro-area to the US and visa versa. In order to investigate this issue, we estimate the PVAR and procced with variance decomposition analysis as above. The models include all variables, however, we report here only the results for the sentiment indexes (the rest of the results are available upon request). Table 6 reports Variance Decomposition Analysis results with a focus of possible sentiment spill-overs from the US to EU. That is, we report the contribution of US sentiment to the sentiment

variance of Eurozone, Core, and Peripheral countries, for the sample periods. The Table is organized in a similar manner to Table 5. The Michigan sentiment index is listed first to the Cholesky ordering as the most exogenous in our set (US variable). During the 2007-2010 period (Panel A), we detect an important effect of US sentiment on peripheral EU country sentiment, i.e. US sentiment contributes to 11.17% to the total peripheral sentiment variance decomposition. During the financial crisis in the Eurozone (2010-2012) the effect of US sentiment appears more significant for Eurozone and peripheral countries, with a contribution of 12.35% and 13.97%, respectively, to total variance. Table 7 reports results with a focus of possible sentiment spill-overs from the EU to the US. Core Eurozone sentiment appears to have a significant contribution to US sentiment: its contribution is approximately 25% to the variance of US sentiment. This is mainly due to the events that took place the later sub-period. During the 2007-2010 period (Panel A) the total contribution is of minor importance (2%-6%), however, during the EU financial crisis (Panel B) the contribution of EU sentiment to the variance of US sentiment rises to 29% -33%.

Next, we estimate the total spillover effect caused by each variable in the system to every other variable, as well as its aggregate effect. To this end, we employ the Diebold and Yilmaz (2009, 2012) methodology who, within a generalized VAR methodology, suggest a measure of total and directional volatility spillovers. In their framework forecast-error variance decompositions are invariant to variable ordering. The matrices of potential spillover effects are presented in Table 8: Panels A and B present results for the US crisis for the core and peripheral countries, respectively, while Panels C and D present results for the EU crisis for the core and peripheral countries, respectively.

One way to read the Table is to focus on the *Sum Out* and *Sum In* columns and rows, which show the aggregate impact of shocks sent to and received from the other variables in the system. For instance, the results for the core countries in Panel C (*Sum Out* column) indicate that during the EU crisis the amount of shocks sent by the Eonia rate to all other variables is the biggest compared to all other factors in the system (63.16) with economic sentiment being the second (55.07). This holds also for the peripheral countries (Panel D) where the Eonia rate is the factor with the biggest impact (66.79) followed by equity market returns (51.63). During the US crisis, the results for the core countries in Panel A (*Sum Out* column) indicate that the amount of shocks sent by the Eonia rate to all other variables is the second biggest compared to all other factors in the system (55.52) with economic sentiment being the first (110.8). This holds also for the peripheral countries (Panel B) where the Eonia rate is the factor with the second biggest impact (56.59) with sentiment being first (104.28).

When one considers the net contribution of each variable (in the *Net* row), that shows the difference between the shocks that each variable receives and sends to the system, we can see that during the US crisis for the core countries (Panel A) the Eonia rate is a net receiver of shocks (-8.88%), while for the peripheral countries (Panel B) is a net sender of shocks (9.51%) in the system. The ESI during the US crisis is the single most important net sender of shocks to both core (69.84) and peripheral (73.97) countries. During the EU crisis (Panels C and D) the Eonia rate appears to be the single most important net sender of shocks to both the core (22.28) and the peripheral (28.03) countries, among all the seven variables we employ. Sentiment does not appear to be important.

Overall, the results in this section suggest the existence of bi-directional sentiment spill-over effects between the US and the EU; in addition, during the EU crisis the Eonia rate appears to be the single most important net sender of shocks to both the core and the peripheral countries. During the US crisis, for all countries, the ESI is the single most important net sender of shocks to both core and peripheral countries. These results are consistent with the notion that monetary policy and economic expectations have been significant contributors to the outcome of the EU financial crisis.

6. Impulse Response Functions (IRFs)

Impulse Response Functions (IRFs) are used to track the responses of the variables of a system to impulses of the system's shocks. Orthogonalising the VAR shocks is required so that the shocks tracked by IRFs are uncorrelated. Figures 3 and 4 present Orthogonalized Impulse Response Functions (IRFs) and the 5% error bands (in grey) generated by Monte Carlo simulation (200 repetitions) for the three periods for the Eurozone, core and peripheral countries. We present results for the response of the ESI variable to a shock in central bank rates. More specifically, Figure 3 presents the response of European expectations (economic sentiment) to a shock in Eonia. Note that during the full sample period (2007-2012) and the US financial crisis period (2007-2010), the pattern is quite similar across the countries, i.e. the positive response to a shock in Eonia indicates that economic agents react positively to a shock in Eonia. A similar pattern is observed when we examine the response of European

expectations to a shock in the Fed fund rate(Figure 4), with the exception of the third sub-period (2010-2012). In other words, changes in the interest rates seem to have generated a positive shift in economic expectations.

7. Conclusions

The main aim of the European Central Bank (ECB) is to maintain price stability and contribute to the stability of the financial system within the Euro-area, with the expectations of economic agents within the Euro-area being an important monetary policy transmission channel. This paper examines the effect of ECB's conventional and unconventional monetary policies during the EU crisis on economic expectations. We measure the expectations of economic agents with the Economic Sentiment Indicator (ESI) and employ a Panel Vector AutoRegression (PVAR) methodology. Our sample consists of nine Eurozone countries that we group in two sub-samples denoted for simplicity as the "core" countries (Germany, France, Netherlands, Belgium and Austria) and the "peripheral" countries (Spain, Portugal, Italy, and Greece). We combine the sentiment indicators with a set of macroeconomic and financial variables such as equity prices, industrial production, unemployment, trade balance, consumer price indexes.

Our main findings indicate that conventional ECB monetary policy has a positive and significant effect on EU expectations and sentiment, indicating an effective expectations transmission channel, while unconventional policies seem to have a negative and significant effect; the first quantitative easing by the Fed has a negative impact while the second quantitative easing has a positive effect, mainly for the core

Eurozone countries. Furthermore, ECB conventional monetary policy is an important contributor to the variance of European sentiment, while Fed's conventional monetary policy also seems to contribute to the variance in sentiment. We also detect sentiment spill-over effects, and find that during the EU crisis conventional monetary policy appears to be the single most important net sender of shocks to both the core and the peripheral countries. During the US crisis, for all countries, the economic sentiment is the single most important net sender of shocks to both core and peripheral countries.

Our findings of a positive effect of conventional policy on sentiment are consistnet with previous findings for the US, however, the finding of a negative effect of unconventional policy on sentiment is not. An explanation may be the different nature of unconventional policies the two central banks followed after 2010. For example, one should make the distinction between the subprime crisis in the US during which the reaction of the Fed and the ECB was similar, and the EU crisis that erupted in 2010 where there have been important differences in the policies employed.

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APPENDIX 1: Press coverage of ECB actions

Date	Event	Financial Times Headline	Headline Article	Front page	VIX	Dummy
28/3/2008	6 month SLTROs	*US sends in back-up for Iraqi offensive*	No	No	-0.17	AN_SLTROs
4/9/2008	Roll over of the outstanding 6 month SLTROs	*US stock s suffer on fear for economy*	No	No	2.6	AN_SLTROs
15/10/2008	6 month SLTROs and other measures	*Fresh squall rattles mark ets*	No	No	14.12	AN_SLTROs
7/5/2009	12 month SLTROs and other measures (including covered bond purchases)	*Us banks must add $74.6bn in equity*	No	text	0.99	AN_SLTROs
4/6/2009	Details for the purchase programme of covered bonds	*Obama appeal to muslims*	No	No	-0.84	
10/5/2010	SMP and other measures	*Markets rally on EU bail-out*	main text	-	-12.11	AN_SMP
30/6/2010	Completion of covered bond purchases	*EU bank bonus rules sow confusion*	No	No	0.41	
4/8/2011	SLTROs and other measures	*Stock markets plunge worldwide*	main text	-	8.28	
7/8/2011	SMP reactivation	*Traders braced for more turmoil*	main text	-	16	AN_SMP
6/10/2011	12 month SLTROs and covered bond purchases	*ECB raids policy cupboard*	title	-	-1.54	AN_SLTROs
8/12/2011	36 month VLTROs and other measures	*European banks' shortfall at €115bn*	-	-	1.92	
26/7/2012	Mr. Draghi's Speech "Whatever it takes"	*Nomura axe falls on top staff*	No	title	-1.81	AN_OMT
6/9/2012	Details for the OMT	*ECB signals resolve to save euro*	title	-	-2.14	AN_OMT

Notes to Appendix 1

Column "Event" describes the policy announcement; "Financial Times Headline" indicates the title ofthe "top story" on the front page of the Financial Times; "Headline Article" indicates where the ECB action is mentioned in the top story on the front page of the Financial Times (title, subtitle or main text); "Front page"indicates where the ECB action is mentioned in the on the front page of the Financial Times, if not in the "top story" (title, subtitle or main text). "VIX" indicates the change in the VIX on the day of the announcement;"dummy" indicate the impulse dummy capturing announcements effects in the baseline analysis.

APPENDIX 2: Press coverage of FED actions

Date	Event	Financial Times Headline	Headline Article	Front page	VIX	Dummy
25/11/2008	LSAPs announced	*Fed adds $800bn to boost borrowing*	title	-	-3.80	AN_QE1
1/12/2008	Bernanke first suggestion of extending QE to Treasuries	*Evidence of deep recession mounts*	main text	-	13.23	
16/12/2008	First suggestion of extending QE to Treasuries by FOMC	*US Fed slashesrates to near zero*	main text	-	-4.39	AN_QE1
28/1/2009	Fed stands ready toexpand QE and buy Treasuries	*Economic pain to be 'worst for 60years'*	main text	-	-2.59	AN_QE1
18/3/2009	QEs expanded	*Fed purchase plan stuns investors*	title	-	-0.74	AN_QE1
27/8/2010	Bernanke suggests role for additional QE	*Fed ready to boost economy*	title	-	-2.92	AN_QE2
12/10/2010	FOMC says additional accomodation may be appropriate	*Fresh Fed boost more likely*	title	-	-0.03	
15/10/2010	Bernanke says Fed stands ready for action	*Bernanke hints at further stimulus*	title	-	-0.85	AN_QE2
3/11/2010	QE2 announced	*Fed to pump in extra $600bn*	title	-	-2.01	AN_QE2
21/9/2011	Maturity Extension Programm announced	*Fed 'twist' seeks to boost US economy*	title	-	4.46	
20/6/2012	Maturity Extension Programm extended	*Fed opts to extend its Operation Twist' plan*	title	-	-1.14	
22/8/2012	FOMC says additional monetary accomodation is likely	*SA mining unrest spreads*	No	title	0.09	AN_QE3
13/9/2012	QE3 announced	*Bernanke takes plunge with QE3*	title	-	-1.75	AN_QE3
12/12/2012	QE3 expanded	*Fed links interest rates to US unemployment figures*	main text	-	0.38	

Notes to Appendix 2
See Notes to Appendix 1. The focus is set on the fifteen "expansionary" announcements listed in Table 1A in Fawley and Neely (2013).

APPENDIX 3: Description of Variables and Events

Description of Variables and Events	
Variable	**Description**
Endogenous Variables	
Eonia	Euro OverNight Index Average
Stock_Ret	Stock market returns : DAX 30 Performance Index, ATX - AUSTRIAN TRADED Index, FRANCE CAC 40 Index, AEX Index, BEL Index, IBEX 35 Index, FTSE MIB Index, ATHEX COMPOSITE Index, PORTUGAL PSI-20 and NYSE Composite Index
IP	The Industrial Production Index (excluding Construction)
Unemploym	Unemployment rate as a percentage of the labour force
Tradebal	Trade Balance of goods and services
HICP	The Harmonised Index of Consumer Prices
ESI	The Economic Sentiment Indicator
Fed_funds	Federal funds rate
CPI	US Consumer Price Index
Mich_Sen	University of Michigan Consumer Sentiment Index
Exogenous Variables	
LTROs_AN	Long Term Refinancing Operations Announcements
SMP_AN	Securities Market Program Announcements
OMT_AN	Outright Monetary Transactions Announcements
AN_QE1	First Qantitative Easing Announcements
AN_QE2	Second Qantitative Easing Announcements
AN_QE3	Third Qantitative Easing Announcements

Notes to Appendix 3:
Sources: Thomson Reuters EIKON and Bloomberg

Table 1

Panel A: Descriptive Statistics					
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Eonia	594	-0.0574	0.3344	-1.0791	0.7621
Stock_Ret	594	-0.0090	0.0736	-0.3260	0.1982
IP	594	-0.0017	0.0230	-0.0884	0.0857
Unemploym	594	0.0842	0.2156	-0.6101	1.0902
Tradebal	594	0.5208	1.6521	-5.7691	3.9414
HICP	594	0.0065	0.4220	-1.6011	2.3014
ESI	594	9.5183	1.1658	67.801	117.50
Panel B: Lag-order selection statistics for panel VAR estimated using GMM					
		Lag	**CD**		
		1	0.9791		
		2	0.9817		
		3	0.9868		
		4	0.9893		
Panel C: Roots of the Companion Matrix					
		Eigenvalue			
		Real	**Imaginary**	**Modulus**	
		0.9109	0	0.9109	
		0.3675	0	0.3675	
		-0.2653	0.1244	0.2930	
		-0.2653	-0.1244	0.2930	
		0.2099	0	0.2099	
		-0.1329	0	0.1329	
		0.0094	0	0.0094	

Notes to Table 1

Panel A presents descriptive statistics for the following variables: The Euro Overnight Index Average (denoted as Eonia), the Stock market returns (denoted as Stock_Ret), the Industrial Production index (denoted as IP), the Unemployment rate (denoted as Unemploym), the Trade balance (denoted as Tradebal), the Harmonised Index of Consumer Prices (denoted as HICP) and the Economic Sentiment Indicator (denoted as ESI). All of the time series are transformed to ensure stationarity; Eonia, Unemployment rate and Harmonised Index of Consumer Prices are used in first differences, Stock market returns and Industrial Production in log differences, trade balance in growth rate, while the sentiment indices (ESI and Mich_Sent) are used in levels. All data are monthly and obtained from DataStream International and Bloomberg. The sample covers the period between May 2007 and October 2012. Panel B presents test results for the optimal lag structure. CD is the overall coefficient of determination. Panel C: the stability of the PVAR requires the moduli of the eigenvalues of the dynamic matrix to lie within the unit circle, which is the case in the estimated model (Lütkepohl, 2005).

Table 2
The Effect of ECB Monetary Policy Announcements

Variables	Eonia	Stock_Ret	IP	Unemploym	Tradebal	HICP	ESI
Panel A : Eurozone countries							
L.Eonia	-0.2340***	0.0530***	0.0054	0.0380	0.9490	0.1652**	1.6020***
LTROs_1	-0.1840***	-0.0438***	-0.0073**	-0.0637**	0.1422	-0.1914***	-1.1850***
SMP_1	-0.0806	-0.0635***	0.0193***	0.0511	-1.5890	0.0380	-1.0910
OMT_1	-0.1563***	-0.0222	-0.0042	-0.0181	0.3020	-0.1332	-1.8090***
Panel B : Core countries							
L.Eonia	-0.1534	0.0608***	0.0026	0.0716	-2.385	0.288**	2.1490**
LTROs_1	-0.1873**	-0.0511**	0.0047	-0.0719**	0.7180	-0.1940**	-1.3950**
SMP_1	-0.0880	-0.0538***	0.0190**	0.0108	-5.237	0.0849	-1.4060**
OMT_1	-0.2013***	0.0017	-0.0029	0.0000	4.364	-0.3143***	-1.659***
Panel C : Peripheral countries							
L.Eonia	-0.2770***	0.0426***	0.0032	-0.0210	0.7530	0.0908	1.1690**
LTROs_1	-0.1859**	-0.0330	-0.0193***	-0.0395	0.8751	-0.2100**	-0.9052
SMP_1	-0.0481	-0.0775***	0.0151**	0.0787	-0.0663	0.0410	-0.6180
OMT_1	-0.1421**	-0.0429	-0.0038	-0.0163	-2.789	0.0725	-1.8300***

Notes to Table 2

The Table presents the results of the impact of monetary policy on the variables: Panel A (Eurozone countries), Panel B (Core) countries), and Panel C (Peripheral) countries). Although all variables are included in the PVAR the Table presents only the impact of conventional and unconventional monetary policies (i.e. *Eonia*, *LTROs*, *SMP*, *OMT*). Variables: Euro Overnight Index Average (denoted as Eonia), stock market returns (denoted as Stock_Ret), Industrial Production index (denoted as IP), unemployment rate (denoted as Unemploym), Trade balance (denoted as Tradebal), Harmonised Index of Consumer Prices (denoted as HICP), Economic Sentiment Indicator (denoted as ESI). All time series are transformed to ensure stationarity; Eonia, Unemployment rate and Harmonised Index of Consumer Prices are used in first differences, Stock market returns and Industrial Production in log differences, trade balance in growth rate, while the sentiment indices are used in levels. All data are monthly and obtained from DataStream International and Bloomberg. The sample covers the period between May 2007 and October 2012. *** denotes significance at the 1% level; ***** denotes significance at the 5% level.

Table 3
The Effect of FED Monetary Policy Announcements

Variables	Eonia	Stock_Ret	IP	Unemploym	Tradebal	HICP	ESI
Panel A : Eurozone countries							
AN_QE1	-0.5880***	0.0041	-0.0199***	-0.0094	0.380	-0.5060***	-1.9701***
AN_QE2	-0.0795**	-0.0231**	0.0072**	-0.0232	-0.626	-0.1300***	0.1610
AN_QE3	-0.1080***	0.0249	0.0180	-0.0555	-1.032	0.1580	-0.7970
Panel B : Core countries							
AN_QE1	-0.5270***	-0.0223	-0.0015	-0.0733	0.6601	-0.3880*	-2.2670**
AN_QE2	-0.1090**	-0.0137	0.0023	0.0017	-0.1893	-0.1540**	0.8110**
AN_QE3	-0.0520	0.0112	0.0160	-0.0604	0.3396	0.0096	-0.7970
Panel C : Peripheral countries							
AN_QE1	-0.6100***	0.0251	-0.0282***	0.0771	-0.1372	-0.6650***	-1.5040
AN_QE2	-0.0567	-0.0332	0.0111**	-0.0565	-0.1500	-0.0874	-0.7290
AN_QE3	-0.2010**	0.0487	0.0216	-0.0220	-0.5361	0.2940	-0.8240

Notes to Table 3

Table 3 presents te results on the effect of US unconventional monetary policy announcements on European sentiment. In the Table, Panel A presents results for the all Eurozone countries, Panel B for Core countries, and Panel C for Peripheral countries. We present the PVAR estimated parameters using the US Quantitative Easing 1 (*QE1*), Quantitative Easing 2 (*QE2*), and Quantitative Easing 3 (*QE3*) announcements as exogenous factors. Although all variables are included in the PVAR the Table presents only the impact of unconventional monetary policies (i.e. *QE1*, *QE2*, *QE3*). See also *Notes to Table 2*.

Table 4
Conventional ECB Policy: Variance Decomposition Analysis

	Impulse variables						
Response variable	Eonia	Stock_ret	IP	Unemploym	Tradebal	HICP	ESI
Panel A: 2007 – 2012							
	Eurozone countries						
ESI	22.08	24.72	6.75	3.22	0.24	3.04	39.94
	Core countries						
ESI	31.46	24.88	8.16	4.78	0.73	7.09	22.87
	Peripheral countries						
ESI	11.6	20.13	6.73	3.86	1.11	0.58	55.97
Panel B: 2007 – 2010							
	Eurozone countries						
ESI	23.75	33.49	3.67	2.08	0.7	15.65	20.65
	Core countries						
ESI	28.38	34.35	0.55	0.98	1.26	17.31	17.16
	Peripheral countries						
ESI	17.53	30.36	9.52	3.46	1.18	14.38	23.55
Panel C: 2010 – 2012							
	Eurozone countries						
ESI	4.64	15.37	3.42	7.25	0.12	1.68	67.49
	Core countries						
ESI	5.14	27.77	7.35	8.95	0.08	3.07	47.62
	Peripheral countries						
ESI	4.26	7.18	1.73	5.02	0.22	0.76	80.82

Notes to Table 4
The Table presents results for Variance Decomposition Analysis, i.e. the contribution of each variable to the variance in sentiment. Panel A presents results for the full sample, Panels B for the period between 2007 and 2010, while Panel C for the period between 2010 and 2012. Note that we perform variance decomposition analysis for all variables, however, we report here only the results for sentiment (the rest of the results are available upon request). See also *Notes to Table 2*.

Table 5
Conventional Fed Policy: Variance Decomposition Analysis

	Impulse variables							
Response variable	Fed_funds	Eonia	Stock_ret	IP	Unemploym	Tradebal	HICP	ESI
Panel A: 2007 – 2012								
	Eurozone countries							
ESI	16.13	9.5	25.67	5.42	2.55	0.62	1.22	38.85
	Core countries							
ESI	15.69	17.66	28.05	7.17	3.23	1.39	3.91	22.87
	Peripheral countries							
ESI	14.87	3.62	20.73	3.79	2.64	1.24	0.07	52.99
Panel B: 2007 – 2010								
ESI	Eurozone countries							
	9.57	15.4	33.37	3.13	2.17	1.19	14.09	21.05
ESI	Core countries							
	5.8	21.47	35.66	0.47	1.02	1.76	16.54	17.25
ESI	Peripheral countries							
ESI	14.08	8.93	27.94	7.74	3.52	0.93	12.44	24.41
Panel C: 2010 – 2012								
ESI	Eurozone countries							
	0.63	4.18	15.31	3.47	7.45	0.1	1.61	67.22
ESI	Core countries							
	0.27	3.57	35.75	3.92	8.09	0.34	2.35	45.67
ESI	Peripheral countries							
	1.49	5.42	3.51	4.13	3.49	0.11	0.16	81.67

Notes to Table 5
The Table presents results for Variance Decomposition Analysis, i.e. the contribution of each variable to the variance in sentiment. Fed_funds is the Fed rate. Panel A presents results for the full sample, Panels B for the period between 2007 and 2010, while Panel C for the period between 2010 and 2012. Note that we perform variance decomposition analysis for all variables, however, we report here only the results for sentiment (the rest of the results are available upon request). See also *Notes to Table 2*.

Table 6
Variance Decomposition Analysis: Sentiment Spill-Overs from US to EU

	Impulse variables							
Response variable	Mich_Sen	Eonia	Stock_ret	IP	Unemploym	Tradebal	HICP	ESI
Panel A: 2007 – 2010								
	The contribution of US sentiment to the sentiment variance of Eurozone countries							
ESI	5.44	21.73	34.12	2.68	1.51	0.33	16.84	17.34
	The contribution of US sentiment to the sentiment variance of Core countries							
ESI	3.00	26.83	37.52	0.1	0.81	0.59	17.08	14.02
	The contribution of US sentiment to the sentiment variance of Peripheral countries							
ESI	11.17	16.22	26.49	6.96	2.34	1.42	15.73	19.65
Panel B: 2010 – 2012								
	The contribution of US sentiment to the sentiment variance of Eurozone countries							
ESI	12.35	2.8	1.32	2.75	17.08	7.92	3.79	51.98
	The contribution of US sentiment to the sentiment variance of Core countries							
ESI	6.57	0.57	29.85	14.81	8.8	1.27	7.18	30.92
	The contribution of US sentiment to the sentiment variance of Peripheral countries							
ESI	13.97	6.47	1.84	0.19	8.22	16.87	0.25	52.18

Notes to Table 6
Table 6 reports Variance Decomposition Analysis results with a focus of possible sentiment spill-overs from the US to EU. That is, we report the contribution of US sentiment to the sentiment variance of Eurozone, Core, and Peripheral countries, for three sample periods. The Table is organized in a similar manner to Table 5. The models include all variables, however, we report here only the results for the sentiment indexes. *See also Notes to Table 5.*

Table 7
Variance Decomposition Analysis: Sentiment Spill-Overs from EU to US

	Impulse variables							
Response variable	ESI	Fed_funds	Stock_ret	IP	Unemploym	Tradebal	CPI	Mich_Sen
Panel A: 2007 – 2012								

	The contribution of Eurozone countries sentimemt to the variance of US sentiment							
Mich_Sen	15.48	12.1	6.21	7.57	7	1.75	2.16	47.73
	The contribution of Core countries sentimemt to the variance of US sentiment							
Mich_Sen	24.93	12.1	4.08	5.27	14.54	1.63	4.17	33.27
	The contribution of Peripheral countries sentimemt to the variance of US sentiment							
Mich_Sen	5.3	10.04	9.26	8.94	1.83	2.19	1.41	61.01
Panel B: 2007 – 2010								
	The contribution of Eurozone countries sentimemt to the variance of US sentiment							
Mich_Sen	2.89	15.78	10.17	15.93	8.55	5.45	41.21	2.89
	The contribution of Core countries sentimemt to the variance of US sentiment							
Mich_Sen	2.01	15.97	9.53	15.19	8.36	5.12	43.81	2.01
	The contribution of Peripheral countries sentimemt to the variance of US sentiment							
Mich_Sen	6.08	15.83	10.96	15.12	7.46	5.33	39.19	6.08
Panel C: 2010 – 2012								
	The contribution of Eurozone countries sentimemt to the variance of US sentiment							
Mich_Sen	32.73	5.07	2.71	6.29	3.39	49.78	32.73	5.07
	The contribution of Core countries sentimemt to the variance of US sentiment							
Mich_Sen	33.24	4.14	1.88	1.53	2.16	57.03	33.24	4.14
	The contribution of Peripheral countries sentimemt to the variance of US sentiment							
Mich_Sen	29.22	1.09	7.62	12.82	5.74	43.51	29.22	1.09

Notes to Table 7

Table 7 reports Variance Decomposition Analysis results with a focus of possible sentiment spill-overs from the EU to US. That is, we report the contribution of US sentiment to the sentiment variance of Eurozone, Core, and Peripheral countries, for three sample periods. The Table is organized in a similar manner to Table 5. The models include all variables, however, we report here only the results for the sentiment indexes. *See also Notes to Table 5.*

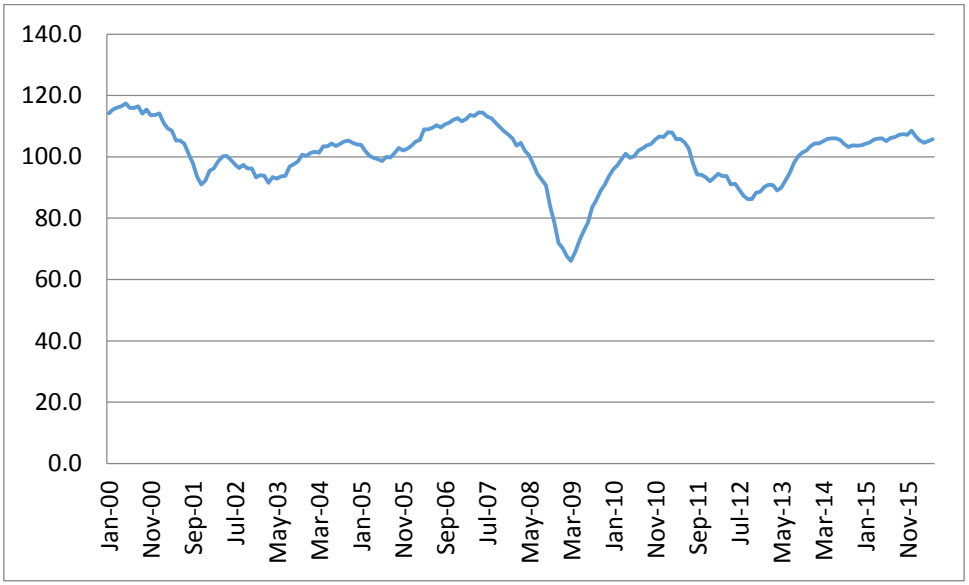
Table 8
Spill-Over Matrices

	Panel A: Core countries / US Crisis								**Panel C: Core countries / EU Crisis**							
Response/Impulse	Eonia	Stock_Ret	IP	Unemploym	Trade_bal	HICP	ESI	**Sum OUT**	Eonia	Stock_Ret	IP	Unemploym	Trade_bal	HICP	ESI	**Sum OUT**
Eonia	**68.63**	9.79	9.01	0.98	0.81	24.46	10.4	55.52	**69.27**	8.53	11.6	4.89	31.31	4.81	2.02	63.16
Stock_Ret	11.26	**82.81**	5.73	0.92	0.40	7.21	10.7	36.31	13.3	**85.1**	2.57	3.36	3.22	2.79	9.69	34.93
IP	12.56	9.15	**80.65**	1.95	0.92	9.62	5.21	39.41	8.38	7.53	**84.52**	2.59	2.56	5.55	6.87	33.48
Unemploym	4.61	10.71	5.95	**79.52**	1.53	3.74	8.85	35.39	4.01	10.46	2.99	**78.18**	3.77	2.33	24.1	47.66
Trade_bal	0.48	0.49	0.76	1.59	**97.48**	0.52	0.77	4.61	3.35	1.47	1.21	4.04	**88.78**	5.06	2.8	17.93
HICP	7.12	8.4	1.45	2.8	2.12	**83.79**	4.86	26.75	6.7	3.26	1.39	5.01	6.4	**87.91**	0.6	23.36
ESI	28.37	43.66	12.3	1.11	1.23	24.13	**52.1**	110.8	5.14	31.72	2.61	14.67	0.05	0.88	**85.9**	55.07
Sum IN	64.4	82.2	35.2	9.35	7	69.68	40.9	**309**	40.88	62.97	22.3	34.56	47.31	21.42	46.0	**276**
Net	-8.88	-45.89	4.21	26.04	-2.39	-42.9	69.8		22.28	-28.04	11.1	13.1	-29.38	1.94	8.99	
	Panel B: Peripheral countries / US Crisis								**Panel D: Peripheral countries / EU Crisis**							
Response/Impulse	Eonia	Stock_Ret	IP	Unemploym	Trade_bal	HICP	ESI	**Sum OUT**	Eonia	Stock_Ret	IP	Unemploym	Trade_bal	HICP	ESI	**Sum OUT**
Eonia	**58.78**	5.97	9.63	4.05	1.71	32.28	2.95	56.59	**55.66**	13.45	1.74	5.22	40.8	3.15	2.43	66.79
Stock_Ret	7.11	**82.04**	3.49	2.56	2.09	7.11	8.18	30.54	11.22	**67.19**	0.09	27.56	1.95	6.62	4.19	51.63
IP	6.25	4.97	**73.0**	2.81	0.58	19.78	7.54	41.93	2.12	0.94	**93.6**	1.87	2.06	3.49	2.03	12.51
Unemploym	5.79	12.84	9.37	**69.38**	1.5	13.82	5.99	49.31	8.01	8.01	3.75	**78.92**	8.68	2.14	8.9	39.49
Trade_bal	2.85	1.76	1.9	2.59	**94.46**	2.64	1.53	13.27	6.16	2.72	0.59	3.96	**81.93**	0.75	10.4	24.59
HICP	7.55	4.59	7.17	6.9	1.19	**83.41**	4.12	31.52	6.99	6.87	1.81	3.68	12.04	**79.92**	1.98	33.37
ESI	17.53	33.29	18.4	7.01	0.03	28.01	**43.1**	104.28	4.26	9.88	1.22	10.3	0.11	0.17	**88.8**	25.94
Sum IN	47.08	63.42	49.9	25.92	6.1	103.	30.3	**326**	38.76	41.87	9.2	52.59	65.64	16.32	29.9	**254**
Net	9.51	-32.88	-8.04	23.39	7.17	-72.1	73.97		28.03	9.76	3.31	-13.1	-41.05	17.05	-4.0	

Notes to Table 8

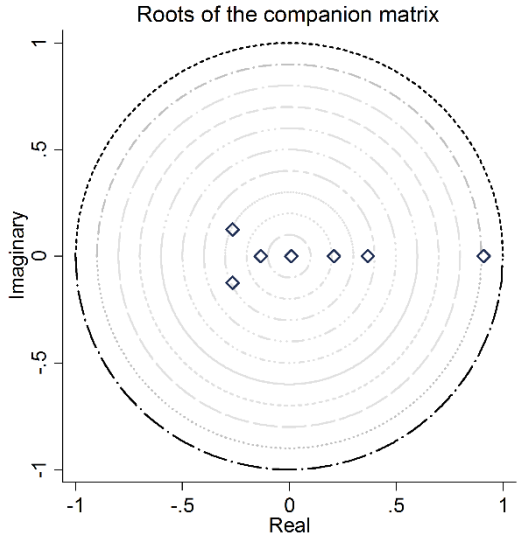
Variables in the first column are the impulse origin, while in the top row are the respondents to the shock. Values in the matrix represent the average cumulated spillover effect. The cumulative impact is bound between 0 and 1. A value of 0.5 means that the response variable will be impacted in the same direction with an intensity of 50% the initial unexpected shock in the impulse variable. In the last column we have the aggregated impact sent (Sum OUT) by each row variable and on the bottom row the aggregated spillover received (Sum IN) by each column variable. The bottom-right cell (in bold) shows total spillover in the system (by dividing this value to the total number of non-diagonal cells, i.e. 7x6, we obtain the contagion index of the core and peripheral group for the two different periods. The "Net" row represents the net spillover of each variable (Net Spillover=Sum OUT-Sum IN).

Figure 1
Economic Sentiment Indicator (ESI) EU



Notes to Figure 1
European Commission, Directorate-General for Economic and Financial Affairs (DG ECFIN): The Economic Sentiment Indicator (ESI) is a composite indicator made up of five sectoral confidence indicators with different weights: Industrial confidence indicator, Services confidence indicator, Consumer confidence indicator, Construction confidence indicator Retail trade confidence indicator. Surveys are defined within the Joint Harmonised EU Programme of Business and Consumer Surveys. The economic sentiment indicator (ESI) is calculated as an index with mean value of 100 and standard deviation of 10 over a fixed standardised sample period. Data are compiled according to the Statistical classification of economic activities in the European Community
(source: http://ec.europa.eu/eurostat/web/products-datasets/-/teibs010).

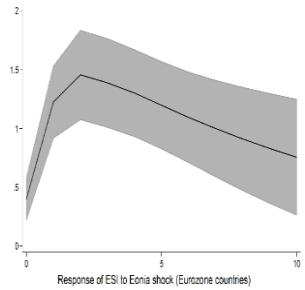
Figure 2
Roots of Companion Matrix

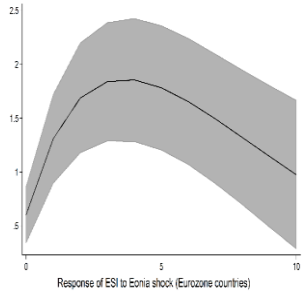


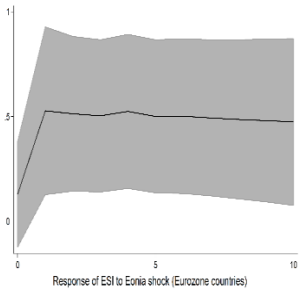
Notes to Figure 2
The stability of the Panel VAR requires the moduli of the eigenvalues of the dynamic matrix to lie within the unit circle. Panel VAR satisfies stability condition as all eigenvalues lie inside the unit circle.

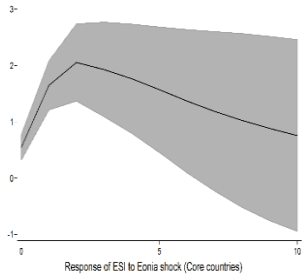
Figure 3
Impulse Response Functions: Response of ESI sentiment to Eonia shock

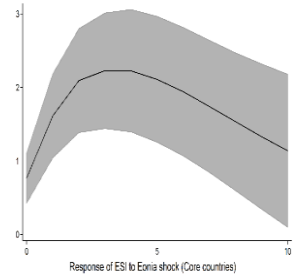
2007 - 2012 **2007 - 2010** **2010 - 2012**

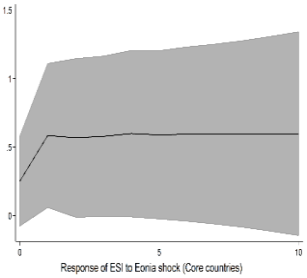


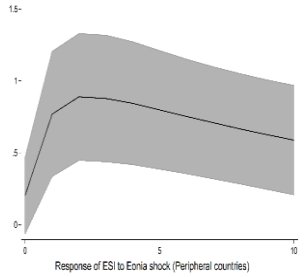


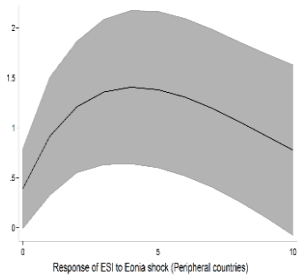












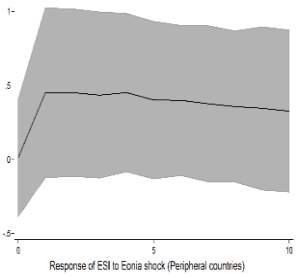


Figure 4
Impulse Response Functions: Response of ESI sentiment to Fed funds rate shock

2007 - 2012	2007 - 2010	2010 - 2012