The euro exchange rate during the European sovereign debt crisis – dancing to its own tune?[1]

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Abstract

This paper studies the determinants of the euro exchange rate during the European sovereign debt crisis, allowing a role for macroeconomic fundamentals, policy actions and the public debate by policy makers. It finds that the euro exchange rate mainly danced to its own tune, with a particularly low explanatory power for macroeconomic fundamentals. Among the few factors that are found to have affected changes in exchanges rate levels are policy actions at the EU level and by the ECB. The findings of the paper also suggest that financial markets might have been less reactive to the public debate by policy makers than previously feared. Still, there are instances where exchange rate volatility was increasing in response to news, such as on days when several politicians from AAA-rated countries went public with negative statements, suggesting that communication by policy makers at times of crisis should be cautious about triggering undesirable financial market reactions.

JEL-codes: E52, E62, F31, F42, G14

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Introduction

The global financial crisis and the subsequent European sovereign debt crisis had substantial effects on global exchange rate configurations (see, e.g., Fratzscher 2009). Compared to the years 2007-2009, the turbulence in foreign exchange markets has recently resided somewhat at the global level, but the exchange rate of the euro against many currencies has remained extremely volatile during the entire European sovereign debt crisis. Compared to the implied volatilities in the early years of European Monetary Union (EMU), those experienced during 2010 and 2011 would have been judged as extreme, amounting to a 3-standard deviation event in the case of the euro-U.S. dollar exchange rate, a 4-standard deviation event in the case of the exchange rates against the British pound and the yen, and a 10-standard deviation event in the case of the euro-Swiss franc exchange rate.[6]

Several commentators have attributed the evolution of the euro exchange rate not only to the economic fundamentals, but also to the public controversy about the European sovereign debt crisis and the required policy actions. In particular, there had been the concern that the heated public debate among policy makers could instil unnecessary volatility in financial markets, to an extent that the European Central Bank (ECB) President Jean-Claude Trichet , on July 18th, 2011, stressed the "absolute need to improve 'verbal discipline'" and asked governments "to speak with one voice on such complex and sensitive issues as the crisis."[7]

Against this background, the current paper studies the determinants of the euro exchange rate and in particular its volatility during the European sovereign debt crisis. It allows for a role of macroeconomic fundamentals on the one hand, for actions and statements by policy makers on the other hand, and furthermore analyses the role of rating agencies' decisions. To study the role of the public debate on exchange rate developments, the paper develops a unique database covering more than 1100 public statements about the sovereign debt crisis by policy makers at the national European and at the international level, covering the period from October 1st, 2009 until November 30th, 2011.

The paper first demonstrates the enormous intensity of the public debate about the European sovereign debt crisis, which involved politicians in virtually all countries of the euro area, central bankers, as well as policy makers at the IMF and the European Union level. The intensity of the public debate as well as its controversy has evolved in accordance with the severity of the crisis: with increasing government bond spreads of the countries under an EU/IMF adjustment programme, the number of statements has

[6] These figures are based on daily implied volatilities for the years 2002-2006 and 2010-2011.
[7] See Financial Times Deutschland, 18 July 2011

grown substantially, as well as the dispersion of views that got expressed. Generally, the level of dispersion across statements is found to be rather high, pointing to a very heated public debate.

The paper also shows that there is generally very little explanatory power for fundamentals and the public discourse in describing the *changes in the euro exchange rate* (i.e. that the exchange rate was mainly "dancing to its own tune"). Among the many variables tested, only two macroeconomic announcements and decisions taken at the European Union level and by the European Central Bank (ECB) appear to have had substantive effects (even though, of course, it should be clear that these actions had not been targeting a change in the exchange rate). Furthermore, it is also extremely difficult to explain the *volatility of the exchange rate* – also here, all but two potential determinants appear unimportant. On the one hand, the ECB's actions have had *dampening effects* on exchange rate volatility; on the other hand, public statements by politicians in AAA-rated countries are consistently found to have *increased* volatility. Interestingly, this increase was strongest if their statements expressed rather homogeneous (and negative) views, whereas it was less pronounced, the more dispersed their communication was.

Splitting the statements in terms of their content, the paper finds that effects on the euro's volatility were primarily, if not exclusively, triggered by comments about rescue packages to euro area countries and their likelihood and conditions, about a possible default of a country, or about private sector involvement in case of a default. None of the other types of statements that we distinguish, namely those about the ECB's monetary policy, the EU's policy response to the crisis, structural measures or fiscal policy measures to be taken by countries under stress, are found to have affected the exchange rate or its volatility in a systematic fashion.

Using quantile regressions, the paper also shows that the volatility-dampening effect exerted by the ECB's actions was fairly general, whereas the increase in volatility due to statements by politicians from AAA-rated countries was particularly pronounced in times when volatility was already at its peak. Fortunately, it is precisely under those circumstances that statements by politicians from countries under stress managed to reduce volatility.

The main conclusions from the paper are therefore that the exchange rate was mainly dancing to its own tune, and that financial markets might have priced assets somewhat more independently from the public debate than previously feared, but that politicians' statements have had some effects on exchange rate volatility. This suggests that communication strategies by policy makers in crises times should be particularly cautious about triggering undesired financial market reactions. At the same time, the low

explanatory power of the various potential determinants suggests that the euro exchange rate and its volatility were even harder to explain during the European sovereign debt crisis than in normal times.

The paper proceeds as follows: Section 2 provides an overview of the related literature. The data and the econometric methodology are explained in Section 3. Section 4 reports how the public debate on the European sovereign debt crisis has evolved over time, and Section 5 presents the results regarding the determinants of the euro exchange rate and its volatility during the European sovereign debt crisis. These results are subjected to several robustness tests in Section 6. Section 7 concludes.

2. Literature review

The current paper relates to several strands of the literature. The first focuses on the effects of scheduled and unscheduled macroeconomic announcements on exchange rates. Andersen et al. (2003) show that exchange rates tend to react quickly to news, that timeliness of the news matters, and that U.S. macroeconomic announcements tend to be more influential than their German and European counterparts. In a similar vein, Faust et al. (2007) argue that the effect of macro announcements on exchange rates and other asset prices depends on the source of the shock and on the way it changes the public perception of the state of the economy. These findings from studies with high-frequency data are broadly confirmed by studies using daily data, such as Ehrmann and Fratzscher (2005), Johnson and Schneeweis (1994), Kim (1998) or Kim (1999). Furthermore, Evans and Lyons (2005) emphasise the effect of news on order flow and show how the response of currency markets to news takes days rather than minutes to fully work itself out.

A second strand of the literature analyses effects of communication by policy makers on exchange rate returns and volatility. There is ample evidence that communication by central banks about monetary policy affects exchange rates: Sager and Taylor (2004) as well as Conrad and Lamla (2010) find this to be the case for the ECB's communication, and Melvin et al. (2009) for the Bank of England. Furthermore, several studies have documented how oral exchange rate interventions affect exchange rate returns and volatilities. Whereas Jansen and De Haan (2005) only find effects of ECB interventions on the euro's conditional volatility, Fratzscher (2006) finds substantial effects of ECB communications on both the spot and forward euro-dollar exchange rate returns.

A third strand of the literature that is highly relevant for the current paper analyses the effects of news and statements by politicians during the European sovereign debt crisis. These papers construct databases containing public statements like we do in the current paper, but follow different paths. Beetsma et al. (2013) construct a news variable using the Eurointelligence daily newsflash, and code the content in a very similar fashion to ours. They find that the quantity of news matters, as more news tend

to increase government bond spreads of the peripheral countries. Also the content of news is found to be important, with bad news explaining upward pressures on spreads. Similarly, Mohl and Sondermann (2013) construct variables related to politicians' statements based on the frequency of statements reported by news agencies, without differentiating their content. This paper finds that more statements are correlated with increasing spreads and heightened conditional volatility, particularly when made by politicians from AAA-rated countries. However, as we will argue later, public statements may be endogenous to the developments in government bond yields, such that these papers are more likely to identify correlation rather than causality.

Mink and de Haan (2013) also compile a news variable about the European sovereign debt crisis (identified by looking up the news on days that saw large changes in Greek government bond yields), but avoid the endogeneity problem by analysing the impact of news on bank stock prices. The paper finds that news about financial support measures for Greece affect bank stocks, even for banks without exposure to Greece or other peripheral euro zone countries. Finally, Kilponen et al. (2012) document more than 50 policy initiatives related to the resolution of the European sovereign debt crisis, and show that several of these affected government bond spreads – for instance, decisions on support packages and the EFSF typically decreased spreads.

A related approach is followed by Baker, Bloom and Davis (2012), who compile a monthly index of policy-related economic uncertainty, using inter alia the frequency of news media references to economic policy uncertainty and a measure of forecaster disagreement over future government purchases and inflation. Their VAR estimates show that an increase in policy-related uncertainty is followed by persistent and significant declines in U.S. aggregate output, employment, and private investment.

Finally, this paper also relates to a literature that studies the effect of rating agencies on financial markets. Afonso et al. (2012) find a significant response of bond yield spreads to rating changes for the case of negative announcements as well as evidence of contagion from lower-rated countries, especially when approaching non-investment grade, to higher-rated countries. Arezki et al. (2011) focus on the effects of sovereign rating announcements during the European sovereign debt crisis. Using a VAR analysis, they also conclude that sovereign rating downgrades have significant spillover effects across countries, which are particularly strong when the downgrade refers to countries with a lower investment-grade rating or below. Looking at changes in CDS spreads, Kiff et al. (2012) find that rating changes and credit warnings do have an impact, although most of the incremental information value is transmitted through negative credit warning rather than actual rating changes.

3. Data and methodology

The euro exchange rate and its volatility

We are interested in explaining the evolution of the euro exchange rate and its volatility during the European sovereign debt crisis. Our dataset therefore starts October 1st, 2009,[8] and ends on November 30th, 2011. The frequency of the data is daily, as we need to be able to identify the timing when news reach the financial markets, which is not feasible at a higher frequency for the public statements. Even though newswire reports typically have a precise time stamp when issued, this time stamp cannot be recovered ex post any longer, such that we can only identify the day of a given statement, but not the time within a given day.

Due to the bilateral nature of exchange rates, an analysis of the exchange rate of a given currency pair requires modelling all potential determinants in both economies. To avoid this complication, and to give a more robust effect of the events in the euro area, we model the first principal component of the euro exchange rate returns against the major currencies, namely the U.S. dollar, the British pound, the Swiss franc and the Japanese yen.[9] Of course, we test to what extent our results are robust to using bilateral exchange rate returns directly.

Beyond the spot exchange rates (as provided by Bloomberg), we also study the behaviour of the bid price of 3-month implied volatilities to get a more direct measure of exchange rate uncertainty and volatility. These data are also sourced from Bloomberg, and as with the spot exchange rate returns, we use the first principal component of the implied volatilities of the above-mentioned currencies against the euro. Among several possible measures of volatility we use implied volatility because it reflects best the uncertainty related to the expected path of the exchange rate.

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[8] The start date is selected to lie two weeks before Greek Prime Minister George Papandreou in his first parliamentary speech disclosed the country's severe fiscal problems on October 16th, 2009. Immediately afterwards, on November 5th, 2009, the Greek government revealed a revised budget deficit of 12.7% of GDP for 2009. It also coincides with end-September 2009 when the original Irish blanket guarantee (CIFS) has been extended from 1 year to 2 years.

[9] Other possibilities would have been to use a trade-weighted exchange rate or the euro exchange rate against the IMF's Special Drawing Rights. Both options are similar to our approach, as they also simply take a weighted average of spot exchange rates. However, it is important to note that we will not only define the first principal component of exchange rate returns, but also of implied volatilities. In light of the fact that there are meaningful markets for implied volatility for only a few currencies, we decided for the first principal component of the euro exchange rate returns against the major currencies. For a related approach see Engel et al. (2012), who extract common factors from a cross-section of exchange rates against the U.S. dollar and show that the factors can be usefully employed in forecasting the exchange rate.

Table 1 provides an overview of the estimation of the first principal components of the exchange rate returns and the implied volatilities. The first principal component for the exchange rate returns explains 56.9% of their overall variance, the first factor of the implied volatilities 52.2%. As can be seen in Table 1, in both cases all four exchange rates have positive factor loadings.

Table 1 here

Due to a somewhat different number of trading days for spot exchange rates and implied volatilities, we have a sample size of 519 observations for the former, and 564 observations for the latter.

As to the potential determinants of the euro exchange rate and its volatility, we differentiate three types – i) public statements by policy makers; ii) actions at the EU level and by the ECB, as well as rating announcements by the three largest rating agencies (Fitch, Moody's and Standard&Poor's), and iii) announcements of macroeconomic data.

Potential determinant 1: The public debate about the European sovereign debt crisis

For the first group of potential determinants, public statements by policy makers, we first assembled a list of potential speakers. These comprise i) the presidents, prime ministers, finance ministers and economy ministers of all euro area countries, as well as the leaders of the parliamentary opposition; ii) the Managing Director of the IMF; iii) the presidents of the European Council and the European Commission, as well as the Commissioners for Economic and Monetary Affairs; iv) all members of the ECB's Governing Council (i.e. the members of the ECB's Executive Board as well as all Governors of the National Central Banks of the euro area countries); and v) a group of other speakers that might be suspected to affect markets and have been relatively vocal during the European sovereign debt crisis, namely George Soros, Warren Buffett and Mohamed El-Erian, the CEO of PIMCO, a global investment management firm and one of the world's largest bond investors[10].

To identify the relevant statements by these speakers, we used reports by Reuters News as contained in Factiva, and extracted all database entries containing a reference to the name of the speaker and a broad set of keywords.[11] From all hits obtained, we extracted those containing statements by the relevant

[10] For the complete list of speakers, see Table A1 in the annex.

[11] The search words were (in alphabetical order): aid; austerity; bailout; bank involvement; bond purchases; debt crisis; debt reduction; default; downgrade; European Financial Stability Facility (EFSF); European Financial Stability Mechanism (EFSM); European Stability Mechanism (ESM); euro bonds; euro zone bond; fiscal consolidation; government bonds; government debt; guarantee; haircut; investor involvement; negative outlook; private sector involvement; programme; private sector involvement (PSI); rating; reform; reforms; reprofile; reprofiling; rescue; restructure; restructuring; restructuring; securities market programme (SMP); sovereign debt; support programme; troika.

speakers that are related to the European sovereign debt crisis, carefully avoiding double counting and making sure that we include only the first report about a given statement.

Given the breadth of the keywords, we furthermore classified the statements into five different topics. The first group, which we label "financial support", contains statements about rescue packages to euro area countries and their likelihood and conditions, about a possible default of a country, or about private sector involvement in case of a default. The second one, labelled "ECB policies", relates to the ECB's standard and non-standard policies, including its Securities Market Programme (SMP) and changes in its collateral rules. The third group is called "EU policies" and includes statements about how the European sovereign debt crisis might be solved by means of policies at the European Union level, such as the establishment of the ESM, the EFSF, the fiscal compact, issuance of Eurobonds, etc. This category also includes statements that a country under stress should/ should not, or might/might not exit the euro area. Another category of statements discusses measures to be taken at the country level, such as structural reforms (excluding fiscal policy measures). It also includes statements about the severity of the crisis for single countries, and is labelled "country measures". Finally, the last group collects all statements about fiscal policy, i.e. everything that relates to setting and achieving public budget goals, and is called "fiscal reform".

Table 2 provides some summary statistics about the statements that we extracted. In total, our database includes 1165 statements. The breakdown into speaker groups shows that most statements were made by politicians from Germany (189), the central banks (157 by members of the ECB's Executive Board, and 178 by Governors of the National Central Banks of the euro area) and by EU officials (123). Table 2 also provides a breakdown by topic, and reveals that the bulk of all statements falls into the "Financial support" category (480), followed by comments about "EU policies" (271). Statements about "Fiscal reform" and "Country measures" are roughly equally represented, with 192 and 179 occurrences each, whereas there are only 58 statements about the ECB's policies (most of which were made by speakers from the central banking community).

Table 2 here

While a variable that measures the occurrence of a statement (in the form of a dummy variable) can be immediately used as an explanatory variable for the exchange rate volatility (i.e. in the variance equation of our EGARCH models, or when explaining implied volatilities), it is not apt for measuring the effect of communications on the level of the exchange rate (i.e. in the mean equation of our EGARCH models). To also allow for such a test, we classified each statement, depending on whether it contains "positive" or "negative" news about the European sovereign debt crisis and its resolution. To give an

example, when a finance minister confirms that fiscal policy is on track, and agreed budget cuts will be achieved, this is coded as positive news. Support for further EU policies, such as the fiscal compact, would also be coded as positive news, whereas a statement suggesting the exit of a country from monetary union would be classified as negative news. Of course, there are also neutral statements, which are then coded accordingly:

$$s_{speaker,t} = \begin{cases} +1 & positive\ news \\ 0 & neutral\ statement \\ -1 & negative\ news \end{cases}$$

Table 2 also provides an overview of the statement content. Of the 1165 statements in the database, we coded the majority, namely 626, to be positive, 448 as negative, and 91 as neutral.

A number of issues are worth noting about this data extraction exercise and the subsequent coding. First, due to the use of Reuters News to extract the statements, we clearly take a financial market perspective, as there might be public statements that are not reported by the newswires and as such do not necessarily reach financial markets. For the purposes of the analysis in this paper this should not be an issue, given that we are interested in the reaction of financial markets to the public debate, and as such only want to focus on those statements that could be priced by markets. Still, this also implies that our database most likely does not cover the complete public debate, its evolution and its controversy.

Second, the search was conducted in English only. We might therefore not have discovered all statements, if these were made and reported upon exclusively in other languages. However, due to the extensive coverage of this topic by newswires, this issue should not be problematic.

Third, a key difficulty is clearly how to ensure that the classification of statements is done correctly. It is important to stress that this classification is based on our own judgment and reading of the reports and thus does not rule out a wrong classification in some cases. In line with the techniques of content analysis (e.g. Holsti 1969), we had different individuals classify the statements independently and discarded those that are not unanimous. However, a unanimous classification was generally achieved, given that in the vast majority of cases, the wording of statements was extremely clear. The appendix provides a number of statements contained in our database along with our classification, allowing the interested reader to cross-check our classification.

Once we had identified all relevant statements and classified them one by one, we aggregated them into various groups of speakers. This is due to the fact that if we were to include one variable per speaker,

the econometric model would very quickly lack degrees of freedom, given the large number of speakers (namely 95) that are recorded in our dataset. An aggregation of some sort is therefore required. Of course, there are several ways of aggregating these types of data, each with advantages and disadvantages. For instance, when aggregating the statements by politicians to the country level, one could give larger weights to the head of government than to ministers, and larger weights to ministers than to the leader of the opposition. However, it is doubtful whether a researcher can identify the appropriate weights, and these might very well differ across countries and over time, given that the influence of a particular person in the debate might not only depend on her position on the job and in the debate, but also on how the debate and the standing of the person evolves, etc. We therefore decided for an unweighted aggregation of all speakers within a given group of speakers by just taking the sum of all $s_{speaker,t}$ on each given day t, for all speakers that are part of the group. We have done such aggregation for all EU officials, for the members of the Executive Board of the ECB and of the remaining group of National Central Bank Governors, for the other speakers (el-Erian, Buffett and Soros), and for politicians (excluding the National Central Bank Governors) at the country level as well as at the level of country groups.

Note that this aggregation implies that if there are two statements on a given day, one coded as +1, one as -1, the aggregation is equal to zero. We will use this variable to test for effects on the exchange rate – to check for the reaction of volatilities, we will use a summation of the number of statements in a given speaker group (in the example above, there were two statements, such that this variable would equal two). For robustness, we will also use {-1,0,+1}-variables that report the sign of the aggregated views in the mean equation, and a dummy variable that is equal to one on days when there was at least one statement by speakers of the group in the variance equation.

A final note regarding the construction of these data is that we ensured that there would be no statement recorded on days of policy actions by the EU or the ECB (as described below). On such days, there are typically a large number of statements by politicians or central bankers that comment the decision. In order not to confuse the effect of the two types of variables, we decided not to include any statement made on a decision day.

Potential determinant 2: Actions and decisions by policy makers and rating agencies

Of course, we would expect that not only the public debate has affected the euro exchange rate and its volatility, but also (and in particular) the various decisions and actions by policy makers, as well as the

various rating announcements by rating agencies. To cover these, we have constructed the following variables.

A variable covering decisions, actions and events that had large repercussions at the European level. As with the communications variable, we have generated one dummy variable that measures whether an action has taken place on a given day, as well as a "signed" variable, where any action that might have helped overcome the European sovereign debt crisis is coded as +1, and actions that might have complicated the crisis coded as -1.[12] In a similar vein, we have collected and subsequently coded all decisions by the ECB.[13] Finally, rating and outlook changes by each of the three major rating agencies are also part of our database. The coded version takes the value +1 for improvements in the rating or the outlook, and -1 for deteriorations. We cover all euro area sovereign ratings actions, including changes in outlook. The data have been sourced directly from the websites of Standard&Poor's, Moody's and Fitch Ratings.

Potential determinant 3: Macroeconomic news

We also examine the response of the exchange rate to major macroeconomic data releases. However, financial markets should not respond to the component of these announcements that is expected (Kuttner 2001).[14] We do therefore construct the unexpected component of macroeconomic data releases as the realised value of the macroeconomic data release on the day of the announcement less the financial market expectation for that realised value. The data on financial market expectations are the median response in respective polls by Money Market Services among financial market participants. This approach is standard in the literature, and the data have been shown to pass standard tests of forecast rationality and provide a reasonable measure of ex-ante expectations of the data release (among others, see Andersen et al. 2003).

[12] For a detailed exposition of the various EU actions that are covered, see Table A2 in the annex. There are three events that are coded as -1, namely on 02-Sep-11, when the 5th EU/IMF/ECB review mission to Greece left Athens unexpectedly, on 09-Sep-11 when Jürgen Stark resigned from the ECB's Executive Board and on 01-Nov-11 when Greek prime minister Papandreou announced his intention to hold a referendum over the rescue package, including the 50% private haircut. As these are very different in nature than the other EU decisions, we have tested for robustness of our results to using these three events independently. We find that results are robust, as the effects estimated for these three events on the one hand and all other decisions on the other hand are very similar to the effects estimated for a variable that integrates all decisions and events.

[13] For a detailed exposition of the various ECB actions that are covered, see Table A3 in the annex.

[14] Note that we cannot calculate corresponding surprise measures for the actions and the statements, as naturally there are no market surveys for these types of variables. Especially with regard to statements, we would expect that the largest part of them are surprising to markets – even if the view of a certain speaker is known to the public, the mere fact that a speaker feels compelled to make a(nother) statement about the European sovereign debt crisis might be news to the public.

Our dataset includes a large set of macroeconomic announcements, including releases of unemployment, industrial production, inflation, PMI, trade balance and retail sales for the large countries of the euro area as well as for the euro area itself, as well as a few other releases that are known to move financial markets, such as the Ifo index for Germany. Of this large battery of announcements, eventually only two turned out to be statistically significant, and remain in our econometric model, namely the releases for German and Italian industrial production data.[15]

Furthermore, we estimated our models including macroeconomic surprises for the United States, as well as the first principal component of the interest rate differential of the United States, Japan, the United Kingdom and Switzerland relative to the euro area, in order to control for macroeconomic developments abroad. Neither of these turned out to be statistically significant, and we therefore decided to drop them from the econometric models. Another possibility could have been to add the evolution of government bond spreads of the countries under stress to the model. This would amount to studying a different question, namely whether or not our determinants have affected the euro exchange rate above and beyond their effects on spreads. Importantly, as we will show in the robustness section, our main results remain qualitatively unchanged also when adding the first principal component of bond spreads of Greece, Portugal and Ireland relative to Germany to the regression.

The econometric methodology

As mentioned above, we are interested in the evolution of the exchange rate and its volatility. A natural econometric methodology for this purpose is to use an ARCH-type model. In more detail, we estimate an exponential GARCH (EGARCH) model, following Nelson (1991). An EGARCH(1,1) model is sufficient to address the non-normality of the data, in particular the serial correlation and heteroskedasticity of the daily exchange rate changes. It is also necessary, given that the EGARCH terms are often found to be statistically significant. The conditional mean equation is formulated as

$$r_t = c_1 + \alpha_1 r_{t-1} + \sum_i \beta_{s,i} s_{i,t} + \sum_j \beta_{a,j} a_{j,t} + \sum_k \beta_{m,k} m_{k,t} + \mu_t, \quad (1)$$

[15] This is a common finding in the literature using European macroeconomic announcement data, see e.g. Ehrmann et al. (2011). Even more, Egert and Kocenda (2012) show that financial markets react to fewer announcements during the financial crisis than previously.

with r_t as the first principal component of the change in euro exchange rate against the four major currencies and r_{t-1} as its lagged value.[16] Variables *s*, *a,* and *m* denote the coded variables for statements, actions and macro news surprises, respectively, where *s* is estimated for *i* speaker groups (which will be varying over different estimated models), *a* is estimated for the EU, the ECB and the rating agencies, and *m* for German and Italian industrial production. The *a* and *m* variables will be included in all of the models. Conditioned on the information set of last period (I_{t-1}), we assume the distribution of the disturbance to be $\mu_t \mid I_{t-1} \sim (0, h_t)$. Hence, we express the conditional variance, h_t, as

$$\log(h_t) = c_2 + \kappa_1\left(\left|\frac{\mu_{t-1}}{\sqrt{h_{t-1}}}\right| - \sqrt{2/\pi}\right) + \kappa_2\left(\frac{\mu_{t-1}}{\sqrt{h_{t-1}}}\right) + \kappa_3 \log(h_{t-1}) + \sum_i \gamma_{s,i}\, s^*_{i,t} + \sum_j \gamma_{a,j}\, a^*_{j,t} + \sum_k \gamma_{m,k}\, m^*_{k,t} \qquad (2)$$

Here, statements, actions and macro news surprises are entered as dummy variables that take the value one on the days of actions or macro releases, and zero otherwise (hence the different notation with the stars). As mentioned above, with regard to the statement variables, we will work with two variants – the first takes the sum of all statements by a certain speaker group on a given day, the second takes the value of one on days when there was a statement by someone belonging to the respective speaker group, and zero otherwise. The first variable, i.e. the sum of statements, is our preferred measure, as it accounts not only for the occurrence of statements, but also for the intensity of the debate.

The model is estimated via maximum likelihood, using the BHHH and BFGS algorithms for optimization. Note that the model is estimated for all business days in the sample, i.e. also for days when neither a statement is recorded, nor a decision is taken, nor macroeconomic news is released. The corresponding variables are equal to zero on such days.

What hypotheses do we entertain? For the mean equation, the most straightforward hypothesis relates to the macroeconomic announcements. Better-than-expected news about industrial production should lead to an appreciation of the euro. For actions and statements, the hypothesis is less clear cut. The variables are coded as +1 for news that should help to overcome the crisis, and as -1 for more negative news on the crisis resolution. How the euro exchange rate should be affected depends on the scenario that agents have in mind. For instance, in the case of a break-up of the euro area, the euro could appreciate if the countries under stress were to leave. Alternatively, it could depreciate if the countries with strong macroeconomic performance were to exit. In the former case, we would expect that the β-coefficients are larger than zero.

[16] Adding further controls, such as day of the week effects, does not affect our results.

With regard to the variance equation, we do not necessarily have a prior for each variable in isolation – statements or actions as well as macro news can either increase or decrease volatility. In the former case, we would expect to find positive γ-coefficients, in the latter case, they should be negative.

The advantage of this model is that it allows estimating jointly how the various determinants affect the exchange rate and its volatility. As will be seen below, most of the interesting results relate to how the various determinants affect volatility. To corroborate these results, and to study volatility in more detail, we therefore also try to explain the principal component of the implied volatility of the euro against the four major currencies. For that purpose, we use quantile regressions, as these allow studying whether the uncovered relationship depends on the level of exchange rate volatility. The corresponding regression model is provided as equation (3), where v_t is the principal component of the implied volatility of the main currencies, and all regressors share the notation of equation (1). Note that the estimated parameters as well as the regression residual are now conditional on θ, the conditional quantile of v_t:

$$v_t = c_{1,\theta} + \alpha_{1,\theta}\, v_{t-1} + \sum_i \gamma_{s,i,\theta}\, s^*_{i,t} + \sum_j \gamma_{a,j,\theta}\, a^*_{j,t} + \sum_k \gamma_{m,k,\theta}\, m^*_{k,t} + \xi_{t,\theta}\,, \tag{3}$$

Having specified the data and the econometric methodologies, we will now move on to studying the results.

4. The evolution of the public debate during the European sovereign debt crisis

A first interesting question that can be answered with the help of the database on statements is how the public debate has evolved over time. Figure 1 plots 20 days moving average of the number of statements on a given day against a set of financial market variables – the euro exchange rate, its changes, implied volatility, and furthermore the principal component of the government bond spreads of Greece, Ireland and Portugal against Germany.

Several interesting insights emerge. First, starting with rather few recorded public statements at the very beginning of our sample (7 and 10 statements in October and November 2009), there is a clear upward trend while the European sovereign debt crisis unfolds (e.g. 60, 69 and 52 statements in March, April and May 2010). This increase corresponds mainly to the flow of news from Greece. On 3 March 2010 the Greek government announced additional fiscal measures, including a rise of VAT and indirect taxes. In April 2010, Greece started talks with the EU and the IMF regarding a multi-year programme.

On 3 May 2010 a 3-year programme for Greece worth €110bn was unveiled. Finally, on 10 May 2010 an agreement about the ESM was reached and the ECB started its Securities Markets Programme (SMP). After some cooling off, the debate intensified substantially at the end of 2010 and beginning of 2011 (see also Mohl and Sondermann 2013). The peak of the intensity is reached in between May and October 2011, with a maximum of 107 statements in September 2011. The second intensification starts roughly at the time of approval of the €78 bn rescue package for Portugal in May 2011 and includes the period in which the private sector involvement in Greek debt restructuring has been negotiated. On 21 July 2011 the EU announced a €109 bn package for Greece and asked for a 21% haircut on private holdings of the Greek debt. In September, the Greek government announced further fiscal measures, but on 26 October 2011 the restructured bailout offer for Greece, worth €130 bn and including 50% haircut on privately-held Greek debt, is made by the EU partners. This period ended with an unexpected call for a referendum by PM Papandreou on 31 October 2011 and his replacement by Lucas Papademos on 10 November 2011.

The intensity of the debate closely mirrors the severity of the crisis. As shown in Figure 1, when comparing government bond spreads with the number of statements, and as corroborated in Table 3 which shows the correlation between the number of statements and the various financial market variables, there are more statements when spreads are large. At a daily frequency, the correlation coefficient stands at 0.37. At such a high frequency, this is a substantial correlation – when calculating the correlation coefficient at the monthly frequency, it increases to 0.71. This finding suggests that the public debate surrounding the European sovereign debt crisis has been endogenous to its evolution as mirrored by increasing government bond spreads. This, in turn, implies that an event study that measures the effect of public statements on yields or spreads might suffer from problems of endogeneity.

Less of an endogeneity problem arises when studying the reaction of the euro exchange rate and its volatility, as shown in the charts of Figure 1 and by the correlations in Table 3. The correlation between the euro exchange rate and the number of statements is -0.17, and the one between implied volatility and the number of statements is 0.14, i.e. substantially below the one for government bond spreads. Although we cannot exclude that some statements reacted to exchange rate movements, we consider this rather unlikely, given that the focus of the debate at the time clearly was the evolution of government bond yields.[17]

[17] We are also comforted by the way results come out. For instance, we find that negative statements by politicians in AAA-rated countries increased exchange rate volatility (without systematically generating exchange rate

Figure 1 and Table 3 here

While the number of statements measures the frequency of statements and thus one dimension of the intensity of the debate, another important dimension is clearly how controversial the debate has been. To get at this question, we calculate the following dispersion measure, borrowed from Jansen and de Haan (2006) and Ehrmann and Fratzscher (2007):

$$\Omega_t = \frac{\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\left|s_{i,t} - s_{j,t}\right|}{1/2 \cdot \left(N^2 - D\right)} \qquad (4)$$

with *N* as the number of statements in a given day *t*, *s* the statements classified as {-1,0,+1}, and a dummy *D* with *D=0* if *N* is an even number and *D=1* if it is odd. This normalisation allows us to obtain a dispersion measure that lies strictly between zero and one, with $\Omega_t = 0$ if no dispersion is present (i.e., all statements share the same tone) and $\Omega_t = 1$ if there is a maximum of degree of dispersion across statements (for instance a case of two statements, one coded as +1, the other as -1).

Not unexpectedly, the number of statements and their dispersion are highly correlated – according to Table 3, their correlation coefficient is equal to 0.63. This overestimates the true correlation, for two reasons. First, there are many days in the sample without statements, for which both variables are zero by definition. Second, in case there is only one statement on a given day, dispersion is bound to be equal to zero, but is not necessarily meaningful. It is therefore useful to also calculate the correlation of dispersion and the number of statements excluding i) all days without any statements, and ii) also days with only one statement. The correlation falls to 0.55 and 0.36, respectively, but is still relatively high. To avoid this problem it is useful to define dispersion as a 20 days moving average, which is what is done in Figure 2. The figure shows that with increasing severity of the crisis, especially as measured by the government bond spreads, dispersion increases substantially- only towards the end of the sample it came down somewhat, from a peak in early 2011.

Figure 2 here

Finally, it is also revealing to look at the level of dispersion. For the 304 days in our sample when there was more than one statement, the average level of dispersion is 0.52, pointing to a rather contentious debate.

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changes as such). If these communications had been endogenous to exchange rate developments, politicians should have provided positive rather than negative statements in order to calm down markets.

5. Determinants of the euro exchange rate and its volatility during the European sovereign debt crisis

Having seen how intense and controversial the public debate about the European sovereign debt crisis has been, let us now turn to studying its effects on the euro exchange rate and its volatility. The results of our first EGARCH estimations are provided in Table 4, separately for the mean equation and for the variance equation.

Table 4 here

The table contains results from 5 different models. As mentioned previously, the largest part of variables remains constant across these models, which differ only with regard to the variables on the public statements. Model (1) enters these variables at a rather aggregated level. It differentiates politicians of three country groups, namely those that were AAA-rated throughout our sample (Austria, Finland, France, Germany, Luxembourg and the Netherlands), those that were under stress at some point of our sample (Spain, Ireland, Italy, Greece and Portugal), and all remaining countries ("Other countries").[18]

Looking at the results for the mean equation, it turns out that most of the potential determinants did not exert any meaningful effect on the exchange rate. There is some weak effect stemming from ECB statements, which is only estimated at the 10% significance level, and not consistently across models, and furthermore small in magnitude. This is in line with the fact that there is no clear hypothesis how these variables should affect the exchange rate as such – it might very well depend on the scenario that financial markets had in mind had the crisis aggravated. Also, it is important to note that these findings do not exclude the possibility that there have been several important, market-moving, statements. This has most certainly been the case. What is tested for here, however, is different, and related to the hypothesis that the large number of statements and the public disagreement among speakers has had negative market repercussions. This, it seems, has not been the case overall.

In contrast, EU and ECB actions, as well as macro news, have affected the euro exchange rate substantially. These effects are estimated to be statistically significant, are consistent across a wide range of models, estimated with the expected sign, and are economically meaningful (even though, of course, it should be clear that these actions had not been targeting a change in the exchange rate).

[18] The group of AAA-rated countries includes Luxembourg, the prime minister of which is also president of the euro group. As he might make statements in either one of the two capacities, we have tested whether our results are robust to excluding his statements, and found this to be the case.

Interestingly, the effects of news about Italian industrial production are twice as important as those for Germany (the coefficients indicate the magnitude of the exchange rate response to a one standard deviation shock in each announcement, which are very similar in size), which is consistent with markets attaching more importance to developments in Italy for the evolution of the euro against the background of concerns that a poor macroeconomic performance in Italy might aggravate the crisis. The effects are found to be of macroeconomic significance. For instance, an EU action that is coded as +1 leads to a euro exchange rate appreciation against the U.S. dollar by 0.44 percent on the day of the announcement.[19]

Interestingly, EU and ECB actions also had substantial effects on exchange rate volatility – albeit with different outcomes. Whereas EU actions tended to weakly increase volatility, those of the ECB have led to a reduction in exchange rate volatility, which we interpret as a sign that ECB actions have helped removing uncertainty and calming markets.[20] Of the various statement variables, there is some volatility-reducing effect triggered by statements of politicians in the euro area countries under stress, but this effect is only weakly statistically significant, and not entirely consistent across models. What is intriguing, however, is that statements by politicians in AAA-rated countries have actually *increased* the euro exchange rate volatility, suggesting that these on average instilled uncertainty into markets. The importance of statements by this particular speaker group might be due to market perceptions that politicians of these countries are pivotal to overcoming the crisis, given that any crisis resolution measure lacks credibility without their endorsement.

This result immediately raises a number of questions, e.g. whether it is driven by some particular speaker groups or whether it depends on the content or the tone of the statement. In what follows, we therefore conduct further analyses which might help us better understand this finding.

Of course, the aggregate of AAA-rated countries contains a set of very heterogeneous nations, especially with regard to their size. For that reason, model (2) takes the larger countries of this group, France and Germany, out of the aggregate and includes them separately. Model (3) combines France and Germany on the one hand, and the remaining countries on the other hand. Interestingly, the results of model (1) disappear – politicians from France and Germany in isolation or as a country group do not exert the

[19] The figure is derived as follows: when running a regression of the first principal component on the U.S. dollar, the factor describes 78% of the variance and has a regression coefficient of 0.41. An increase in the first principal component of 1.084 triggered by an EU action therefore appreciates the U.S. dollar by 1.084*0.41=0.44.

[20] The economic interpretation is somewhat complicated. For example a negative coefficient of -1.4 for the ECB actions means that the residual decreases by 0.5 units ($\sqrt{e^{-1.4}}$) by using the variance equation of the EGARCH model (equation 2 above). This is a sizable drop given the standard deviation of the mean equation of about 0.4. In addition there are dynamic effects through the autoregressive lags in the variance equation.

same effects as politicians from all AAA-rated countries together, suggesting that the contributions of the entire country group have mattered for financial markets, rather than those of the large countries within that group.

Model (4) re-groups the AAA-rated countries into one block, and splits the group of countries under stress into those under an EU/IMF adjustment programme, namely Greece, Portugal and Ireland, thus leaving Italy and Spain as a separate country group. It turns out that the previous finding of some volatility reduction was due to statements by politicians from the programme countries, with statements by Spanish and Italian politicians not being influential on average.

The last model in Table 4, model (5), re-estimates model (1), but replaces the statement variables by a dummy variable (as described above, providing the balance of views expressed in the statements as a {-1, 0, +1}-variable in the mean equation, and a {0,1}-dummy indicating whether there has been at least one statement by a speaker in a given group in the variance equation). Most effects are extremely robust; in particular, the volatility-increasing effect of statements by politicians from AAA-rated countries remains. One interesting change is that statements by the politicians from other countries now seem to have contributed to lowering volatility, and with large effects.

These findings clearly show how difficult it is to explain exchange rate movements, in particular at crisis times. There are only very few relevant determinants (remember that we have also tested for a large number of macroeconomic news releases, only two of which turned out to be important), and of the few that matter, the most interesting ones explain the variance rather than the mean of the exchange rate movements. Accordingly, we will now move on to explaining the principal component of the implied volatility of the euro against the four major currencies. Table 5 reports the corresponding results. The first column contains results from an OLS regression, whereas columns (5) to (8) show the quantile regression results, separately for the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles.

Table 5 here

Several interesting results emerge. First, the coefficient on the own lag varies strongly across the various quantiles. At low levels of volatility, the coefficient is estimated at around 0.9. With increasing volatility, it rises substantially and monotonically, reaching levels around 1 (and therefore non-stationary behaviour) at the end of the spectrum. Second, looking at the effects of actions on volatility, the previous finding that EU actions increase volatility is clearly state-dependent, as it emerged in particular during times when volatility was already elevated – the coefficient is positive and statistically significant at the 90th and 95th percentile. In contrast, the volatility-reducing effect of ECB actions is much more evenly spread, as we find negative and often statistically significant coefficients for the OLS

regression and for all quantiles. Interestingly, we now also find that rating agencies' announcements tended to increase volatility significantly at the 90th percentile, i.e. when exchange rate volatility was already high, even though the coefficient is comparatively small.

The previous finding that statements by politicians in AAA-rated countries increase volatility is borne out also when looking at implied volatilities. The OLS results show such a finding, as do the quantile regressions – importantly, however, the effect is found when volatility is already high, namely at the 95th percentile. A counteracting force under these circumstances might have come about due to statements by politicians in the countries under stress – their volatility-dampening effect is found for the exact same percentile.

The evidence so far has pointed to an influential role of politicians in AAA-rated countries in affecting the euro exchange rate volatility: unfortunately, these effects have, on average, been increasing volatility, suggesting that they did not contribute to easing market tensions and removing uncertainty. Given the large number of topics that was talked about, it should be interesting to split the previous evidence by topic, in order to understand better which parts of the debate have triggered these effects. The corresponding evidence is reported in Tables 6 and 7, for EGARCH models and quantile regressions, respectively.

Tables 6 and 7 here

For parsimony, we decided to only include the statements originating from politicians in the AAA-rated countries. To test whether results are robust to excluding all other statements, model (1) in Table 6 repeats the benchmark model, but without all other speaker groups. As can be seen, results are extremely robust. This gives us a basis to continue our analysis by splitting the statements according to topics, as done in model (2) for the standard definition of the statement variables, and in model (3) for their dummy version. It is apparent that the volatility-enhancing effects were primarily triggered by statements of the "financial support" category, i.e. by statements about rescue packages to euro area countries and their likelihood and conditions, about a possible default of a country, or about private sector involvement in case of a default. None of the other categories appears to have exerted significant effects.

These findings are corroborated in Table 7, which confirms that the "financial support" category statements have heightened volatility, and this in times when volatility was already large: significant coefficients are found for the 90th and 95th percentiles only.

Table 6 also tests hypotheses related to the direction of the statements and the dispersion among speakers. Model (4) of Table 6 splits the statement variable into one that counts the number of positive statements on a given day, and another one counting the negative statements. While this does not affect results in the mean equation (neither determines exchange rate returns), the results in the variance equation show that the volatility increase found for statements by politicians in AAA-rated countries stems from negative statements, whereas the sum of positive statements does not generate volatility in a statistically significant fashion.

Another hypothesis is tested in model (5) of Table 6, namely whether the disagreement among politicians of the AAA group mattered in how strongly volatility was affected. The effects could potentially go both ways: On the one hand, if these speakers are perceived to be the ones that can come to rescue, it should lower uncertainty if they agree among themselves. On the other hand, given that this group of politicians has often been rather critical of the possible rescue packages, their being unanimously against a certain type of solution could increase uncertainty about the future course of the European sovereign debt crisis and the euro area as such, which in itself could increase volatility. To test this hypothesis, we have included the aggregate of all statements by politicians from AAA-rated countries as well as the dispersion measure introduced in Section 4. The coefficients can now be interpreted in a straightforward manner: if dispersion is zero, each statement increases volatility by 0.25, and significantly so; with increasing dispersion, the effect on volatility declines, up to a negative, but insignificant coefficient of -0.30 in the case of complete dispersion.

A natural question that arises now is whether agreement among the speakers is generally volatility-enhancing, or whether this is the case in particular if there is agreement on negative positions. This question is taken up in the last model in Table 6, model (6). It differentiates days where all speakers agreed on a negative message (by means of a dummy variable that is equal to one when there were at least two statements on a given day, and all recorded statements on that day were negative) from all other days with statements (with a dummy variable for days with mixed statements, or alternatively with only positive statements). The results are remarkable: on days with unanimously negative statements, volatility is substantially larger than on days without statements, as well as than on days with positive or mixed statements.

To summarise these findings, it is evident that the euro exchange rate and its volatility are very hard to explain during the crisis. Of the few important factors, decisions and actions at the EU level and by the ECB stand out as having affected the exchange rate and its volatility. In particular the ECB actions have helped reducing volatility. With regard to the public debate, despite the large coverage of our database, it is difficult to find a consistent pattern as to how statements have affected financial markets. The main

exception is statements by politicians in AAA-rated countries, which unfortunately tended to increase volatility, implying that they were not helpful in lowering uncertainty and calming financial markets, and particularly so in periods when volatility was already at extreme levels. For this effect to show up, it is important to take into account the statements by politicians from all AAA countries, which were more influential if they were expressing similar views across speakers, and especially if these views were negative. In particular statements about rescue packages to euro area countries and their likelihood and conditions, about a possible default of a country, or about private sector involvement in case of a default have triggered financial market reactions.

6. Robustness

We have subjected our results to a large battery of robustness tests. Table 8 reports the results for the variance equation of our EGARCH models. The bulk of the tests replace the dependent variable, given that we decided to model the principal component of the changes in the euro exchange rate against the four major currencies. Models (1) to (3) replace this variable by the spot exchange rate of the euro against the U.S. dollar, the Japanese yen and the British pound, respectively. As can be seen, the major finding that the statements by politicians from AAA-rated countries is not necessarily robust – it is present for the Japanese yen, but not for the other two currency pairs. This is not overly surprising, however – as we noted at the outset, when modelling a bilateral exchange rate, it is important to properly account for developments in *both* economies, even when including "foreign" variables like macroeconomic news and interest rates. Unfortunately, the EGARCH model for the Swiss franc had convergence problems, such that results are not provided here. This might have to do with the fact that the Swiss National Bank set, and successfully defended, a minimum exchange rate at CHF 1.20 per euro starting in September 2011, i.e. towards the end of our sample, when the public debate was particularly intense. This might distort the statistical properties of the series and therefore generate the convergence problems.

At the same time, this might also warrant a robustness test where we do not include the Swiss franc into the principal component analysis that we had conducted to generate our dependent variables. Model (4) therefore uses the first principal component of the U.S. dollar, the Japanese yen and the British pound only, and we find the main results to be robust – as is also the case if we exclude in model (5) the Japanese yen from the principal component, only keeping the U.S. dollar, the Swiss franc and the British pound (on the grounds that the Japanese yen was the only bilateral exchange rate that we found to be significantly affected).

Table 8 here

Subsequently we enlarged the currencies that enter our principal component to furthermore include the exchange rates against the Australian dollar, the Canadian dollar, the Swedish krona and the Norwegian krone. Results are provided in model (6), and are found to be robust.

Models (7) and (8) run panel EGARCH models, where we first include the U.S. dollar, the British pound and the Japanese yen,[21] and then expand the set to also include the other currencies available to us. Of course, this approach increases the number of observations substantially. While the volatility-dampening effect of ECB actions disappears, all other results are robust – only in the case of the panel EGARCH model with eight currencies do we find other speaker groups to matter, namely the EU officials and the group of politicians from "other" countries.

The next two models are estimated using the original dependent variable, and vary the explanatory variables. First, we drop all statements by Jean-Claude Juncker, who might speak either in his capacity as prime minister of Luxembourg (and we assigned his statements to this capacity in the benchmark definition), or as president of the euro group. As can be seen from model (9), the results are robust to this modification. Furthermore, as we had found that not all statements matter equally, but that it has been in particular those collected in our "financial support" category that got reflected in exchange rate volatility, model (10) re-estimates the benchmark model, but only including this type of statements. Also here, as usual, we find only those statements by politicians in the AAA-rated countries and in the countries under stress to matter.

The results from a final robustness test are reported in column (11). As previously discussed, the econometric model could have been enlarged by adding measures of stress in the euro area or some of its countries, or measures of risk aversion, which themselves might have driven the euro's developments or its volatility. We decided against this, as we wanted to estimate the direct effect of our determinants on the exchange rate, not the effect they might have had via other variables. As the results in column (11) show, our results are virtually unchanged when we add the first principal component of bond spreads of Greece, Portugal and Ireland relative to Germany (as a measure of stress) and the VIX (as a measure of general risk aversion) to the regression. Interestingly, the measures themselves are both highly statistically significant, with higher spreads and higher VIX increasing exchange rate volatility.

[21] Including also the Swiss franc once again led to convergence problems.

These robustness tests confirm the difficulty in explaining the euro exchange rate during the European sovereign debt crisis, which was in large part unaffected by the public debate.

7. Conclusions

The euro exchange rate has been very volatile during the European sovereign debt crisis, and several commentators have argued that part of this volatility has been due to an uncontrolled public debate led primarily by policy makers. In the light of this, the current paper has tested which factors have affected the euro exchange rate and its volatility over the years 2009-2011, allowing a role for macroeconomic fundamentals, for policy actions and for the public debate by policy makers.

The paper finds that the euro exchange rate developments and its volatility are extremely difficult to explain. Of a large battery of macroeconomic fundamentals, only very few seem to have had an influence on the exchange rate. Actions at the EU level and by the ECB, however, have affected the exchange rate itself as well as its volatility (even though, of course, it should be clear that these actions had not been targeting a change in the exchange rate). In particular ECB actions have contributed to lowering the euro's volatility, suggesting that they have helped reducing economic uncertainty and calming markets.

In order to measure the effects of the public debate, the paper has constructed a unique dataset covering more than 1100 statements by nearly 100 potentially relevant speakers, at the country as well as at the international level. The paper has documented how the public debate has intensified and become more controversial in line with the severity of the crisis. Of the various speaker groups, only few are found to have affected the exchange rate, with all effects being confined to the euro exchange rate volatility. Statements by politicians from AAA-rated countries have in general increased volatility, especially in times when the volatility was already elevated. Especially their statements about rescue packages to euro area countries and their likelihood and conditions, about a possible default of a country, or about private sector involvement in case of a default have been affecting markets.

The findings of the paper suggest that financial markets might have been less reactive to the public debate by policy makers than previously feared. Still, there are instances where markets reacted with increased volatility, such as on days when several politicians from AAA-rated countries went public with negative statements, suggesting that communication by policy makers in crises times should be cautious about triggering unwanted financial market reactions.

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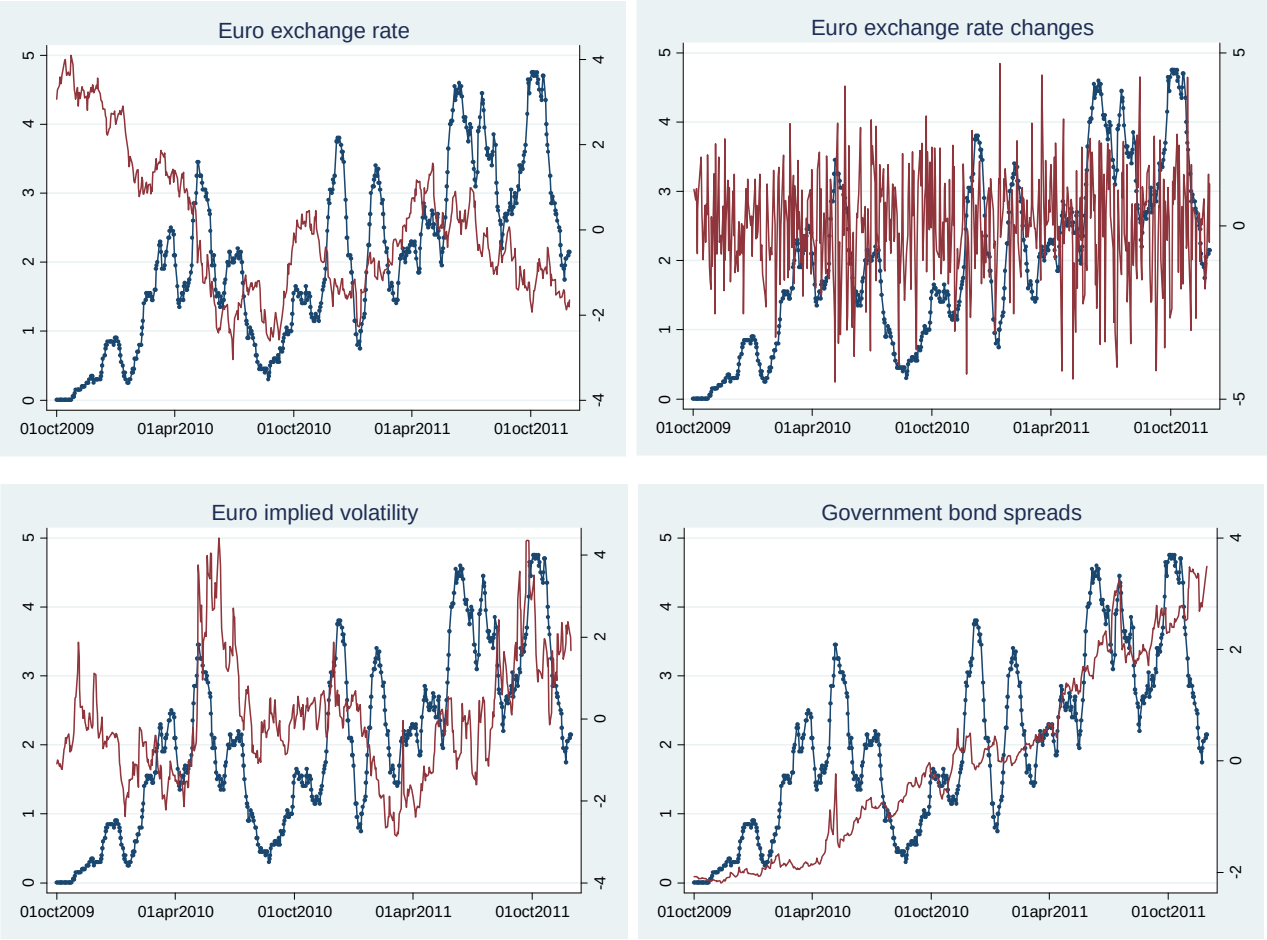
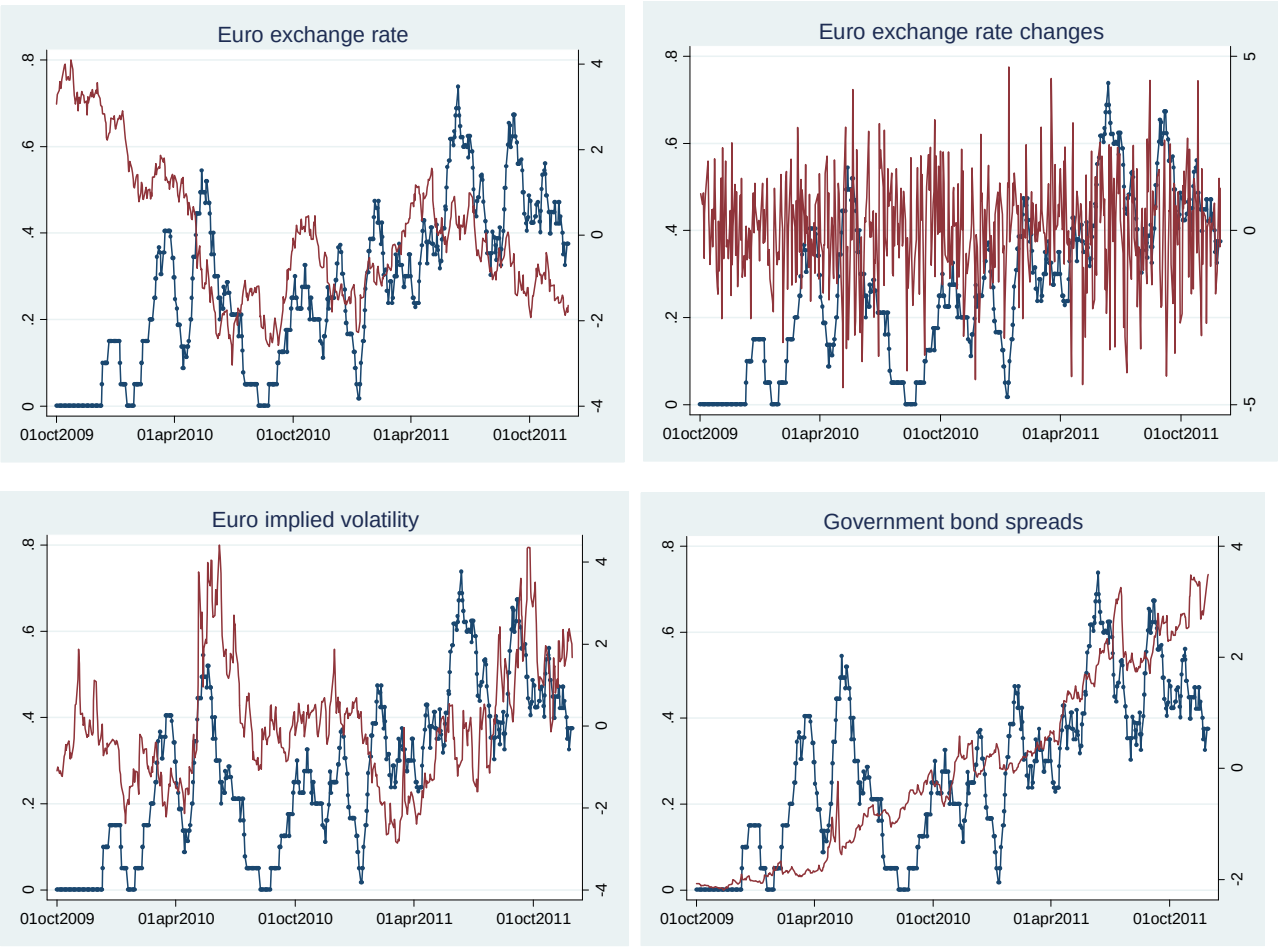
Figure 1: The number of statements and financial market developments



Note: The figure shows the number of all statements recorded in our database as a moving average of 20 working days (blue dotted line, left axis) and the evolution in various financial markets as specified in the header of each chart (red solid line, right axis). Based on daily data.

Figure 2: Dispersion among statements and financial market development



Note: The figure shows the dispersion among all statements recorded in our database as a moving average of 20 working days (blue line with dots, left axis) and the evolution in various financial markets as specified in the header of each chart (red solid line, right axis). Based on daily data.

Table 1: Factor loadings in principal component analysis

	Exchange rate returns	Implied volatilities
USD	0.59	0.64
JPY	0.45	0.18
GBP	0.38	0.41
CHF	0.55	0.63

Note: The table shows the factor loadings for the first principal components of exchange rate returns (left panel) and implied volatilities (right panel), including the US dollar (first row), the Japanese yen (second row), the British pound (third row) and the Swiss franc (fourth row).

Table 2: Summary statistics for public statements

Total	1165
By country/speaker group	
Austria	18
Belgium	11
Cyprus	4
Estonia	4
Finland	28
France	68
Germany	189
Greece	72
Ireland	40
Italy	32
Luxembourg	53
Netherlands	17
Portugal	62
Slovakia	30
Spain	40
ECB Executive Board	157
NCB Governors	178
EU officials	123
IMF	20
Other	19
By coding	
Positive	626
Negative	448
Neutral	91
By topic	
ECB policies	58
EU policies	271
Fiscal reform	192
Financial support	480
Country measures	179

Note: The table shows the number of public statements contained in the database and a breakdown by speaker groups, coding and topics. Note that some statements were classified into several topics, such that the sum of statements by topic exceeds the total number of statements.

Table 3: Correlations between the number of statements and financial market developments

	Number of statements	Dispersion of statements	Euro exchange rate	Euro exchange rate changes	Euro implied volatility	Government bond spreads
Number of statements	1.000					
Dispersion of statements	0.629	1.000				
Euro exchange rate	-0.169	-0.107	1.000			
Euro exchange rate changes	-0.019	-0.023	0.044	1.000		
Euro implied volatility	0.143	0.057	-0.432	-0.055	1.000	
Government bond spreads	0.374	0.292	-0.485	-0.005	0.300	1.000

Note: The table shows correlation coefficients between the number of statements, the dispersion among these statements, the first principal component of the euro spot exchange rate, the first principal component of the changes in the euro spot exchange rate, the first principal component of the euro's implied volatility (all three measures calculated against the U.S. Dollar, the UK Pound, the Swiss Franc and the Japanese Yen), and the first principal component of the Greek, Portuguese and Irish 10-year government bond spreads relative to Germany. Based on daily data.

Table 4: The effect of statements and actions on the euro exchange rate, EGARCH models

		(1)	(2)	(3)	(4)	(5)
Mean equation						
Lag		0.026	0.024	0.024	0.028	0.036
		(0.047)	(0.048)	(0.048)	(0.047)	(0.046)
Statements						
ECB		0.156*	0.144	0.144	0.154*	0.213
		(0.093)	(0.093)	(0.092)	(0.092)	(0.144)
NCB		-0.007	0.004	0.004	-0.008	0.053
		(0.116)	(0.117)	(0.115)	(0.115)	(0.151)
all AAA		-0.051	--	--	-0.048	-0.014
		(0.082)	--	--	(0.082)	(0.120)
Of which	*AT, FI, LU, NL*	--	0.131	0.131	--	--
		--	(0.169)	(0.169)	--	--
	FR	--	-0.122	--	--	--
		--	(0.215)	--	--	--
	GE	--	-0.121	--	--	--
		--	(0.121)	--	--	--
	FR, GE	--	--	-0.121	--	--
		--	--	(0.099)	--	--
ES, IE, IT, GR, PT		-0.145	-0.125	-0.125	--	-0.138
		(0.099)	(0.101)	(0.101)	--	(0.098)
Of which	*IE, GR, PT*	--	--	--	-0.137	--
		--	--	--	(0.127)	--
	ES, IT	--	--	--	-0.161	--
		--	--	--	(0.184)	--
EU officials		-0.043	-0.048	-0.048	-0.042	-0.003
		(0.139)	(0.142)	(0.141)	(0.138)	(0.158)
IMF		0.449	0.397	0.398	0.457	0.435
		(0.303)	(0.286)	(0.286)	(0.302)	(0.302)
Other countries		-0.321	-0.346	-0.345	-0.332	-0.355
		(0.282)	(0.275)	(0.272)	(0.289)	(0.268)
Others		-0.156	-0.147	-0.147	-0.144	0.077
		(0.232)	(0.231)	(0.225)	(0.233)	(0.278)
Actions						
EU		1.084**	1.083**	1.082**	1.088**	1.091**
		(0.496)	(0.484)	(0.484)	(0.494)	(0.503)
ECB		0.829**	0.826**	0.826**	0.827**	0.808*
		(0.399)	(0.399)	(0.399)	(0.395)	(0.413)
Rating agencies		0.191	0.173	0.172	0.193	0.186
		(0.123)	(0.123)	(0.122)	(0.124)	(0.122)
Macro news						
Industrial Production GE		0.561**	0.587**	0.587***	0.546**	0.536**
		(0.224)	(0.228)	(0.227)	(0.229)	(0.216)
Industrial Production IT		0.922***	0.958***	0.960***	0.905***	1.020***
		(0.197)	(0.195)	(0.193)	(0.194)	(0.189)

Table 4 (cont.): The effect of statements and actions on the euro exchange rate, EGARCH models

		(1)	(2)	(3)	(4)	(5)
Variance equation						
Statements						
ECB		0.003	-0.019	-0.019	0.007	-0.106
		(0.093)	(0.104)	(0.094)	(0.097)	(0.176)
NCB		0.060	0.074	0.074	0.054	0.168
		(0.129)	(0.134)	(0.130)	(0.129)	(0.194)
all AAA		0.176**	--	--	0.177**	0.376**
		(0.079)	--	--	(0.080)	(0.151)
Of which	*AT, FI, LU, NL*	--	0.283	0.283	--	--
		--	(0.176)	(0.174)	--	--
	FR	--	0.126	--	--	--
		--	(0.225)	--	--	--
	GE	--	0.133	--	--	--
		--	(0.114)	--	--	--
	FR, GE	--	--	0.131	--	--
		--	--	(0.095)	--	--
ES, IE, IT, GR, PT		-0.203*	-0.187	-0.187	--	-0.181
		(0.116)	(0.125)	(0.120)	--	(0.115)
Of which	*IE, GR, PT*	--	--	--	-0.235*	--
		--	--	--	(0.133)	--
	ES, IT	--	--	--	-0.133	--
		--	--	--	(0.192)	--
EU officials		-0.004	-0.018	-0.018	-0.006	-0.034
		(0.147)	(0.152)	(0.149)	(0.152)	(0.160)
IMF		-0.335	-0.370	-0.371	-0.319	-0.303
		(0.550)	(0.505)	(0.505)	(0.547)	(0.520)
Other countries		0.263	0.262	0.263	0.275	0.281
		(0.258)	(0.268)	(0.265)	(0.259)	(0.253)
Others		-0.518	-0.633*	-0.635*	-0.527	-0.911**
		(0.351)	(0.365)	(0.351)	(0.352)	(0.454)
Actions						
EU		0.738*	0.703	0.703	0.739*	0.799*
		(0.448)	(0.435)	(0.434)	(0.446)	(0.456)
ECB		-1.438**	-1.425**	-1.425**	-1.466**	-1.386*
		(0.716)	(0.718)	(0.717)	(0.714)	(0.724)
Rating agencies		-0.294	-0.331	-0.331	-0.280	-0.334
		(0.213)	(0.219)	(0.217)	(0.214)	(0.217)
Macro news						
Industrial Production GE		-0.265	-0.254	-0.255	-0.229	-0.208
		(0.441)	(0.449)	(0.449)	(0.443)	(0.429)
Industrial Production IT		-0.350	-0.353	-0.354	-0.369	-0.352
		(0.332)	(0.354)	(0.354)	(0.354)	(0.329)
Observations		519	519	519	519	519

Note: The table shows results from EGARCH models for the mean equation (1) and the variance equation (2). Benchmark model (1) contains all statements aggregated by speaker groups. Model (2) splits the statements by the politicians from AAA-rated countries into France, Germany and the remaining countries, model (3) into France and Germany on the one hand, and the remaining countries on the other hand. Model (4) splits the politicians from countries under stress. Model (5) re-estimates the benchmark model, aggregating the statement variables into dummy variables (-1,0,+1) indicating the balance of views in the mean equation, and {0,1} indicating the occurrence of at least one statement by the speaker group in the variance equation. ***/**/* denote statistical significance at the 1%/5%/10% level. According to complementary regressions, when the four exchange rates are regressed individually on the first principal component, a 1 percent increase in the factor is associated with the appreciation of the US dollar by 0.41 percent, the Japanese yen by 0.48 percent, the British pound by 0.26 percent and the Swiss franc by 0.28 percent. In the mean regression the impact of the statements, actions or macro news on the euro exchange rate vis-à-vis the four currencies can be found by multiplying the coefficient of interest with the respective complementary regression coefficient.

Table 5: The effect of statements and actions on implied volatility, OLS and quantile regressions

	(1) OLS	(2) Q05	(3) Q10	(4) Q25	(5) Q50	(6) Q75	(7) Q90	(8) Q95
Lag	0.961***	0.875***	0.897***	0.937***	0.965***	0.993***	1.039***	1.066***
	(0.014)	(0.016)	(0.022)	(0.013)	(0.015)	(0.017)	(0.032)	(0.029)
Statements								
ECB	-0.028	-0.005	-0.019	0.006	-0.015	-0.049*	-0.044	-0.080*
	(0.020)	(0.054)	(0.037)	(0.019)	(0.017)	(0.027)	(0.038)	(0.046)
NCB	0.038*	0.042	0.015	0.066**	0.018	0.047	0.069	0.075
	(0.023)	(0.033)	(0.035)	(0.028)	(0.022)	(0.035)	(0.053)	(0.060)
all AAA	0.040*	0.029	-0.001	-0.000	0.024	0.031	0.074	0.144**
	(0.023)	(0.024)	(0.024)	(0.022)	(0.017)	(0.022)	(0.062)	(0.069)
ES, IE, IT, GR, PT	-0.030	-0.049	-0.015	0.010	0.000	0.028	-0.043	-0.121***
	(0.023)	(0.041)	(0.040)	(0.031)	(0.022)	(0.026)	(0.035)	(0.039)
EU officials	0.063	-0.072	-0.041	0.014	0.068*	0.063	0.129	0.102
	(0.042)	(0.064)	(0.061)	(0.056)	(0.036)	(0.048)	(0.081)	(0.103)
IMF	-0.026	-0.053	0.041	-0.014	-0.053	-0.098	0.008	-0.128
	(0.073)	(0.136)	(0.130)	(0.087)	(0.104)	(0.132)	(0.179)	(0.158)
Other countries	0.083	-0.002	0.082	-0.029	-0.004	0.056	0.210	0.249
	(0.053)	(0.085)	(0.068)	(0.064)	(0.059)	(0.093)	(0.189)	(0.217)
Others	0.007	0.065	0.087	0.011	0.056	0.019	-0.153	-0.086
	(0.058)	(0.135)	(0.094)	(0.073)	(0.093)	(0.086)	(0.149)	(0.176)
Actions								
EU	0.073	-0.576**	-0.442	-0.080	0.045	0.054	1.092**	0.941**
	(0.172)	(0.276)	(0.317)	(0.222)	(0.135)	(0.336)	(0.524)	(0.393)
ECB	-0.393***	-0.229	-0.415*	-0.565**	-0.247	-0.253	-0.396***	-0.579***
	(0.143)	(0.208)	(0.226)	(0.279)	(0.245)	(0.163)	(0.133)	(0.142)
Rating agencies	0.053	0.007	0.073	0.019	0.049	0.129	0.169**	0.112
	(0.045)	(0.076)	(0.082)	(0.048)	(0.051)	(0.081)	(0.081)	(0.080)
Macro news								
Industrial Production GE	-0.043	-0.019	-0.041	-0.071	0.015	-0.029	0.024	-0.102
	(0.066)	(0.097)	(0.103)	(0.106)	(0.078)	(0.079)	(0.123)	(0.158)
Industrial Production IT	-0.168***	0.125	0.005	-0.073	-0.164***	-0.181***	-0.317***	-0.439***
	(0.055)	(0.112)	(0.076)	(0.053)	(0.055)	(0.063)	(0.081)	(0.082)
Observations	564	564	564	564	564	564	564	564
(Pseudo) R^2	0.931							

Note: The table shows results from OLS (model (1)) and quantile regressions following equation (3) (models (2) to (8), providing results for the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles). All variables are defined as in the benchmark model of Table 4. ***/**/* denote statistical significance at the 1%/5%/10% level. According to complementary regressions, when the four implied volatilities are regressed individually on the first principal component, a 1 percent increase in the factor is associated with an increase in the US dollar volatility by 0.88 percentage points, the Japanese yen volatility by 0.68 pp., the British pound volatility by 0.94 pp. and the Swiss franc volatility by 0.11pp. The impact of the statements, actions and macro news on the euro volatility rate vis-à-vis the four currencies can be found by multiplying the coefficient of interest with the respective complementary regression coefficient.

Table 6: The effect of statements by AAA-rated countries on the euro exchange rate, by topic, EGARCH models

		(1)	(2)	(3)	(4)	(5)	(6)
Mean equation							
Lag		0.023	0.030	0.034	0.026	0.023	0.031
		(0.045)	(0.046)	(0.046)	(0.046)	(0.045)	(0.045)
Statements							
All		-0.031	--	--	--	-0.014	--
		(0.076)	--	--	--	(0.083)	--
Of which	*Positive*	--	--	--	-0.015	--	-0.034
		--	--	--	(0.186)	--	(0.098)
	Negative	--	--	--	0.037	--	0.007
		--	--	--	(0.112)	--	(0.117)
Of which	*Financial Support*	--	0.054	0.122	--	--	--
		--	(0.160)	(0.202)	--	--	--
	ECB policies	--	0.508	0.454	--	--	--
		--	(2.579)	(1.292)	--	--	--
	EU policies	--	-0.172	-0.140	--	--	--
		--	(0.138)	(0.172)	--	--	--
	Country measures	--	-0.006	0.001	--	--	--
		--	(0.312)	(0.320)	--	--	--
	Fiscal reform	--	0.070	-0.056	--	--	--
		--	(0.312)	(0.311)	--	--	--
Actions							
EU		1.080**	1.067**	1.037**	1.093**	1.096**	1.107**
		(0.486)	(0.483)	(0.475)	(0.480)	(0.489)	(0.471)
ECB		0.882**	0.877**	0.812**	0.856**	0.873**	0.788*
		(0.399)	(0.400)	(0.389)	(0.398)	(0.407)	(0.417)
Rating agencies		0.205*	0.215*	0.222*	0.198*	0.207*	0.199
		(0.120)	(0.125)	(0.124)	(0.119)	(0.121)	(0.124)
Macro news							
Industrial Production GE		0.551**	0.531**	0.462*	0.518**	0.523**	0.509*
		(0.221)	(0.229)	(0.268)	(0.231)	(0.243)	(0.270)
Industrial Production IT		0.897***	0.953***	0.923***	0.925***	0.911***	1.003***
		(0.193)	(0.187)	(0.175)	(0.210)	(0.204)	(0.272)

Table 6 (cont.): The effect of statements by AAA-rated countries on the euro exchange rate, by topic, EGARCH models

		(1)	(2)	(3)	(4)	(5)	(6)
Variance equation							
Statements							
All		0.171**	--	--	--	0.246***	--
		(0.066)	--	--	--	(0.081)	--
Of which	*Positive*	--	--	--	0.152	--	--
		--	--	--	(0.105)	--	--
	Negative	--	--	--	0.234**	--	--
		--	--	--	(0.094)	--	--
Of which	*Positive or disputed*	--	--	--	--	--	0.251**
	negative	--	--	--	--	--	(0.118)
	Unanimously negative	--	--	--	--	--	1.010***
		--	--	--	--	--	(0.357)
Of which	*Financial Support*	--	0.248*	0.514***	--	--	--
		--	(0.128)	(0.191)	--	--	--
	ECB policies	--	-0.196	-0.130	--	--	--
		--	(17.851)	(5.379)	--	--	--
	EU policies	--	0.146	0.157	--	--	--
		--	(0.116)	(0.155)	--	--	--
	Country measures						
		--	-0.124	-0.015	--	--	--
		--	(0.345)	(0.306)	--	--	--
	Fiscal reform						
		--	0.044	-0.130	--	--	--
		--	(0.220)	(0.251)	--	--	--
All comments - dispersion		--	--	--	--	-0.550**	--
		--	--	--	--	(0.250)	--
Actions							
EU		0.731	0.699	0.726*	0.743*	0.771*	0.767**
		(0.456)	(0.449)	(0.437)	(0.444)	(0.449)	(0.387)
ECB		-1.376*	-1.446**	-1.388**	-1.380**	-1.293*	-1.076*
		(0.719)	(0.708)	(0.678)	(0.694)	(0.717)	(0.640)
Rating agencies		-0.254	-0.237	-0.259	-0.288	-0.270	-0.277
		(0.206)	(0.221)	(0.205)	(0.203)	(0.208)	(0.171)
Macro news							
Industrial Production GE		-0.377	-0.352	-0.169	-0.324	-0.237	-0.123
		(0.416)	(0.417)	(0.388)	(0.417)	(0.418)	(0.342)
Industrial Production IT		-0.250	-0.306	-0.263	-0.269	-0.299	-0.320
		(0.281)	(0.291)	(0.288)	(0.298)	(0.290)	(0.294)
Observations		519	519	519	519	519	519

Note: The table shows results from EGARCH models for the mean equation (1) and the variance equation (2). Model (1) contains all statements by politicians from AAA-rated countries. Model (2) splits the statements according to topics. Model (3) re-estimates this model, aggregating the statement variables into dummy variables (-1,0,+1) indicating the balance of views in the mean equation, and {0,1} indicating the occurrence of at least one statement by the speaker group in the variance equation. Model (4) splits the statements into positive and negative statements. Model (5) contains all statements by politicians from AAA-rated countries and their dispersion, measured according to equation (4). Model (5) separates days where all speakers agreed on a negative message ("Unanimously negative") from all other days with statements ("Positive or disputed negative"). ***/**/* denote statistical significance at the 1%/5%/10% level. According to complementary regressions, when the four exchange rates are regressed individually on the first principal component, a 1 percent increase in the factor is associated with the appreciation of the US dollar by 0.41 percent, the Japanese yen by 0.48 percent, the British pound by 0.26 percent and the Swiss franc by 0.28 percent. In the mean regression the impact of the statements, actions or macro news on the euro exchange rate vis-à-vis the four currencies can be found by multiplying the coefficient of interest with the respective complementary regression coefficient.

Table 7: The effect of statements by AAA-rated countries on implied volatility, by topic, OLS and quantile regressions

	(1) OLS	(2) Q05	(3) Q10	(4) Q25	(5) Q50	(6) Q75	(7) Q90	(8) Q95
Lag	0.960***	0.867***	0.893***	0.932***	0.959***	0.984***	1.042***	1.049***
	(0.013)	(0.017)	(0.019)	(0.014)	(0.014)	(0.016)	(0.031)	(0.033)
Statements								
Financial Support	0.038	-0.008	-0.023	-0.014	0.012	0.031	0.140**	0.101*
	(0.030)	(0.031)	(0.034)	(0.022)	(0.026)	(0.049)	(0.060)	(0.052)
ECB policies	0.156	0.485	0.265	0.110	-0.152	0.247	-0.090	-0.440
	(0.222)	(0.367)	(0.343)	(0.297)	(0.304)	(0.294)	(0.312)	(0.310)
EU policies	0.060	0.026	-0.015	0.040	0.048*	0.072*	0.073	0.270
	(0.037)	(0.041)	(0.040)	(0.034)	(0.028)	(0.037)	(0.123)	(0.175)
Country measures	0.052	-0.093	-0.090	0.079	0.104*	0.060	-0.146	0.493
	(0.082)	(0.120)	(0.141)	(0.151)	(0.058)	(0.081)	(0.286)	(0.344)
Fiscal reform	0.077	0.065	0.027	0.011	0.073	0.103	0.154	0.240
	(0.061)	(0.042)	(0.053)	(0.100)	(0.072)	(0.078)	(0.178)	(0.205)
Actions								
EU	0.070	-0.569**	-0.434	-0.091	0.032	0.041	1.080**	1.006**
	(0.172)	(0.274)	(0.314)	(0.212)	(0.132)	(0.343)	(0.531)	(0.409)
ECB	-0.396***	-0.194	-0.396*	-0.534**	-0.274	-0.234	-0.401***	-0.535***
	(0.142)	(0.208)	(0.219)	(0.269)	(0.234)	(0.165)	(0.145)	(0.158)
Rating agencies	0.057	0.024	0.085	0.024	0.078	0.089	0.238***	0.214***
	(0.046)	(0.090)	(0.076)	(0.048)	(0.053)	(0.094)	(0.082)	(0.079)
Macro news								
Industrial Production GE	-0.041	0.011	-0.043	-0.054	-0.004	-0.032	-0.027	-0.120
	(0.066)	(0.095)	(0.096)	(0.103)	(0.068)	(0.102)	(0.094)	(0.096)
Industrial Production IT	-0.167***	0.097	0.044	-0.090*	-0.132**	-0.181***	-0.295***	-0.378***
	(0.057)	(0.066)	(0.069)	(0.052)	(0.060)	(0.066)	(0.082)	(0.091)
Observations	564	564	564	564	564	564	564	564
(Pseudo) R^2	0.930							

Note: The table shows results from OLS (model (1)) and quantile regressions following equation (3) (models (2) to (8), providing results for the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles). All variables are defined as in model (1) of Table 6. ***/**/* denote statistical significance at the 1%/5%/10% level. According to complementary regressions, when the four implied volatilities are regressed individually on the first principal component, a 1 percent increase in the factor is associated with an increase in the US dollar volatility by 0.88 percentage points, the Japanese yen volatility by 0.68 pp., the British pound volatility by 0.94 pp. and the Swiss franc volatility by 0.11pp. The impact of the statements, actions and macro news on the euro volatility rate vis-à-vis the four currencies can be found by multiplying the coefficient of interest with the respective complementary regression coefficient.

Table 8: Robustness tests, variance equation of EGARCH regressions

	(1) US$	(2) JPY	(3) GBP	(4) PC without CHF	(5) PC without JPY	(6) PC broad	(7) Panel	(8) Panel broad	(9) without Juncker	(10) Financial Support statements	(11) Additional controls
Variance equation											
Statements											
ECB	-0.065	-0.013	-0.098	0.012	-0.068	-0.107	-0.044	-0.010	0.018	-0.026	0.001
	(0.112)	(0.088)	(0.105)	(0.100)	(0.096)	(0.100)	(0.044)	(0.013)	(0.087)	(0.121)	(0.098)
NCB	0.065	0.038	-0.083	0.043	0.111	0.074	0.030	-0.003	0.034	0.113	0.085
	(0.132)	(0.120)	(0.143)	(0.135)	(0.131)	(0.131)	(0.060)	(0.020)	(0.125)	(0.174)	(0.128)
all AAA	0.098	0.163**	-0.016	0.132*	0.156**	0.201**	0.105***	0.025***	0.172**	0.248*	0.173**
	(0.081)	(0.070)	(0.086)	-0.071	(0.076)	(0.088)	(0.034)	(0.009)	(0.086)	(0.141)	(0.081)
ES, IE, IT, GR, PT	-0.107	-0.378***	-0.429***	-0.269**	-0.222*	-0.139	-0.262***	-0.023**	-0.199*	-0.293**	-0.256**
	(0.114)	(0.121)	(0.117)	(0.115)	(0.114)	(0.100)	(0.049)	(0.010)	(0.113)	(0.123)	(0.123)
EU officials	0.093	0.198	0.057	-0.008	-0.036	0.007	0.110	0.052**	0.027	0.107	-0.075
	(0.169)	(0.147)	(0.202)	(0.153)	(0.153)	(0.143)	(0.072)	(0.023)	(0.148)	(0.208)	(0.169)
IMF	-0.029	-0.395	-0.520	-0.122	-0.162	-0.347	-0.152	0.065	-0.397	-0.414	-0.144
	(0.506)	(0.545)	(0.539)	(0.640)	(0.499)	(0.489)	(0.235)	(0.050)	(0.560)	(0.565)	(0.627)
Other countries	0.106	-0.023	0.158	0.216	0.252	0.321	-0.010	-0.072**	0.321	0.071	0.182
	(0.269)	(0.257)	(0.294)	(0.272)	(0.243)	(0.240)	(0.126)	(0.030)	(0.261)	(0.349)	(0.273)
Others	-0.756*	-0.194	0.243	-0.314	-0.406	0.285	-0.121	-0.037	-0.477	-0.959	-0.443
	(0.409)	(0.416)	(0.367)	(0.354)	(0.301)	(0.362)	(0.161)	(0.052)	(0.337)	(0.618)	(0.335)
Actions											
EU	0.782*	0.399	0.600	0.669	0.911*	0.347	0.574**	0.171***	0.750*	0.502	0.599
	(0.445)	(0.569)	(0.579)	(0.430)	(0.526)	(0.390)	(0.278)	(0.062)	(0.439)	(0.353)	(0.443)
ECB	-0.926	-0.486	-1.209	-1.326*	-1.445**	-1.402**	-0.360	0.084	-1.393*	-1.189*	-1.995***
	(0.735)	(0.872)	(0.874)	(0.683)	(0.703)	(0.619)	(0.367)	(0.097)	(0.724)	(0.673)	(0.706)
Rating agencies	-0.108	-0.062	0.188	-0.176	-0.274	0.343**	-0.023	-0.041	-0.304	-0.300*	-0.269
	(0.205)	(0.225)	(0.202)	(0.218)	(0.198)	(0.169)	(0.110)	(0.028)	(0.206)	(0.179)	(0.224)
Macro news											
Industrial Production GE	-0.235	0.138	0.027	-0.182	-0.338	-0.251	-0.088	-0.126*	-0.264	-0.158	-0.046
	(0.394)	(0.369)	(0.381)	(0.458)	(0.457)	(0.320)	(0.175)	(0.071)	(0.439)	(0.356)	(0.429)
Industrial Production IT	-0.400	-0.423	0.267	-0.383	-0.157	0.287	-0.254	0.142*	-0.383	-0.100	-0.242
	(0.343)	(0.354)	(0.389)	(0.331)	(0.387)	(0.369)	(0.204)	(0.076)	(0.344)	(0.287)	(0.34)
Additional controls											
Govt. Bond spreads GR, IE,	--	--	--	--	--	--	--	--	--	--	0.203**
PT vs. GE	--	--	--	--	--	--	--	--	--	--	(0.092)
Vix	--	--	--	--	--	--	--	--	--	--	0.045***
	--	--	--	--	--	--	--	--	--	--	(0.015)
Observations	519	519	519	519	519	519	1,557	4,152	519	519	519

Note: The table shows results from EGARCH models for the variance equation (2), testing for the robustness of the results of the benchmark model in Table 4. Models (1) to (6) replace the dependent variable by the bilateral spot exchange rate against the U.S. dollar (1), the Japanese yen (2), the British pound (3), the principal component of the changes in the euro exchange rate against the U.S. dollar, the Japanese yen and the British pound (4), the principal component of the changes in the euro exchange rate against the U.S. dollar, the Swiss franc and the British pound (5), the principal component of the changes in the euro exchange rate against the U.S. dollar, the Swiss franc, the Japanese yen, the British pound, the Australian dollar, the Canadian dollar, the Swedish krona and the Norwegian krone (6). Model (7) estimates a panel EGARCH model of the changes in the euro exchange rate against the U.S. dollar, the Swiss franc and the British pound, model (8) against the U.S. dollar, the Swiss franc, the Japanese yen, the British pound, the Australian dollar, the Canadian dollar, the Swedish krona and the Norwegian krone. Model (9) excludes statements by Jean-Claude Juncker, model (10) only includes statements in the "financial support" category. Model (11) contains two additional control variables, the first principal component of bond spreads of Greece, Portugal and Ireland relative to Germany (as a measure of stress) and the VIX (as a measure of general risk aversion). ***/**/* denote statistical significance at the 1%/5%/10% level.

Annex: Examples of statements and their coding

Date: 10.05.2010. Speaker: A. Merkel, Chancellor, Germany.
German commentaries on euro debt crisis May 10 (Reuters) - German Chancellor Angela Merkel said on Monday her cabinet aims to push through Germany's part in a $1 trillion emergency rescue package to stabilise the euro quickly despite suffering a major election defeat on Sunday.
Statement category: EU policies. Coding: +1.

Date: 28.01.2011. Speaker: M. Kiviniemi, PM Finland.
Finland PM: not ready for any more European bailouts DAVOS, Switzerland, Jan 28 (Reuters) - Finland is not ready to join a bailout of any more European countries, Prime Minister Mari Kiviniemi said on Friday, adding that the euro zone's bailout facility had sufficient funds. "We are not ready for any bailouts of the other European countries," Kiviniemi told Reuters Insider at the World Economic Forum in Davos.
Statement category: EU policies. Coding: -1.

Date: 18.06.2010. Speaker: G. Tumpel-Gugerell, ECB Executive Board Member.
ECB's Tumpel-Gugerell: Bond buying results good VIENNA, June 18 (Reuters) - The European Central Bank's bond-buying programme has had good results, Executive Board member Gertrude Tumpel-Gugerell said on Friday.
Statement category: ECB policies. Coding: +1.

Date: 18.06.2010. Speaker: J.-M. Gonzalez-Paramo, ECB Executive Board Member.
ECB crisis measures are only temporary- Gonzalez-Paramo FRANKFURT, June 18 (Reuters) - The European Central Bank's extra crisis-fighting measures cannot remain in place for too long because of the risk to inflation, Executive Board member Jose Manuel Gonzalez-Paramo said on Friday.
Statement category: ECB policies. Coding: -1.

Date: 10.12.2009. Speaker: G. Soros.
Soros sure Greece won't be allowed to default -Sky LONDON, Dec 10 (Reuters) - Billionaire investor and philanthropist George Soros said on Thursday he was sure the Greek government would not be allowed to default on its debts despite growing budgetary difficulties and market concerns. "There has to be pressure on Greece to put its house in order but I'm sure that Greece will not be allowed to default. The same applies to the United Kingdom," Soros told Sky News television.
Statement category: Financial support. Coding: +1.

Date: 30.12.2009. Speaker: W. Schäuble, Finance Minister, Germany.
German FinMin: EU aid for Greece would be misplaced BERLIN, Dec 30 (Reuters) - European Union countries would show "misplaced solidarity" if they gave financial aid to fellow bloc member Greece, German Finance Minister Wolfgang Schaeuble said in a newspaper interview released on Wednesday. "It would be misplaced solidarity if we were to support Greece with financial help," Schaeuble told Germany's Boersen Zeitung in an early release of an interview to run in its Thursday edition.
Statement category: Financial support. Coding: -1.

Date: 10.06.2010. Speaker: J. L. R. Zapatero, PM Spain.
Spain PM sees wide parliamentary support for job reform MADRID, June 10 (Reuters) - Spain's Prime Minister Jose Luis Rodriguez Zapatero said on Thursday that he was confident that a labour reform would receive majority backing in parliament. "It's going to be a substantial labour reform for our market, and I'm confident it will have majority support in parliament," Zapatero told reporters on an official visit to Italy.
Statement category: Country measures. Coding: +1.

Date: 12.08.2011. Speaker: M. Rutte, PM the Netherlands.
Dutch PM: Greece, Italy economic reform too slow AMSTERDAM, Aug 12 (Reuters) - The Dutch Prime Minister Mark Rutte said on Friday euro zone countries such as Greece and Italy have not reformed their economies quickly enough to boost growth. "There are too many countries where debt and deficits have run too high. There are too many countries, such as Greece and Italy, where there was either no implementation of reforms to strengthen the growth engines, or it was too late," Rutte told reporters.
Statement category: Country measures. Coding: -1.

Date: 29.12.2009. Speaker: C. Stavrakis, Finance Minister, Cyprus.
Cyprus unveiled a fiscal consolidation package NICOSIA, Dec 29 (Reuters) - Cyprus unveiled a fiscal consolidation package on Tuesday aimed at generating savings and additional revenue of 500 million euros annually to curtail growing deficits, Finance Minister Charilaos Stavrakis said on Tuesday. The package includes changing valuations used to tax real estate -- unchanged since 1980, stamping out tax evasion and closer monitoring of a civil service payroll. Authorities will also pursue changes to pension contributions in the public sector, Stavrakis said.
Statement category: Fiscal reform. Coding: +1.

Date: 03.03.2010. Speaker: G. Papandreu, PM Greece
Greek PM says extra measures needed for survival ATHENS, March 3 (Reuters) - Greek Prime Minister George Papandreou said on Wednesday an extra set of austerity measures decided by the cabinet earlier in the day had been necessary for the debt laden country's survival. "The decisions were not just a choice but a necessity for the survival of our country and our economy," Papandreou told reporters without giving any details on the measures. (Reporting by Harry Papchristou; Writing by Ingrid Melander)
Statement category: Fiscal reform. Coding: -1.

Table A1: Complete list of included speakers

Names of speakers			
Almunia (EU)	Frattini (IT)	Merkel (DE)	Sarkozy (FR)
Ansip (EE)	Frieden (LU)	Mersch (NCB)	Schaeuble (DE)
Baroin (FR)	Gabriel (DE)	Miklos (SK)	Silva Pereira (PT)
Barroso (EU)	Gaspar (PT)	Mitterlehner (AT)	Socrates (PT)
Berlusconi (IT)	Honohan (NCB)	Napolitano (IT)	Soini (FI)
Bini Smaghi (ECB)	Juncker (LU)	Noonan (IE)	Soros
Bonello (NCB)	Katainen (FI)	Nowotny (NCB)	Stark (ECB)
Bos (NL)	Kazamias (CY)	Noyer (NCB)	Stavrakis (GR)
Bruederle (DE)	Kees de Jager (NL)	Ordonez (NCB)	Strauss-Kahn (IMF)
Buffett	Kenny (IE)	Orphanides (NCB)	Teixeira (PT)
Campa (ES)	Kiviniemi (FI)	Papaconstantinou (GR)	Tremonti (IT)
Cavaco Silva (PT)	Knot (NCB)	Papademos (ECB)	Trichet (ECB)
Coelho (PT)	Koehler (DE)	Papandreou (GR)	Tumpel (ECB)
Coene (NCB)	Kranjec (NCB)	Paramo (ECB)	Urpilainen (FI)
Constancio (ECB)	Lagarde (FR)	Provopoulos (NCB)	van Rompuy (EU)
Costa (NCB)	Lagarde (IMF)	Quaden (NCB)	Vanhanen (FI)
Cowen (IE)	Leite (PT)	Radicova (SK)	Venizelos (GR)
da Silva (PT)	Lenihan (IE)	Rajoy (ES)	Weber (NCB)
Draghi (NCB)	Leterme (BE)	Rehn (EU)	Weidmann (NCB)
El Erian (PIMCO)	Ligi (EE)	Reynders (BE)	Wellink (NCB)
Faymann (AT)	Liikanen (NCB)	Roesler (DE)	Westerwelle (DE)
Fekter (AT)	Lipsky (IMF)	Rutte (NL)	Wulff (DE)
Fico (SK)	Lipstok (NCB)	Salgado (ES)	Zapatero (ES)
Fillon (FR)	Makuch (NCB)	Samaras (GR)	

Note: The table shows the names of the speakers covered in our dataset, along with their affiliation in brackets.

Table A2: Overview of the covered EU actions and events

Date	Description
25 March 2010	Euro area Heads of State agree to offer, together with the IMF, financial support to Greece in the form of coordinated bilateral loans
03 May 2010	Announcement of an economic adjustment programme for Greece
10 May 2010	Agreement on the European Stabilisation Mechanism (ESM)
29 November 2010	Announcement of an economic adjustment programme for Ireland
07 December 2010	Decision on financial assistance to Ireland
14 February 2011	Agreement about ESM lending capacity of €500 bn
24 March 2011	European Council agrees on the Euro Plus pact
16 May 2011	Official approval of the €78 bn bailout package for Portugal
17 June 2011	Iincrease in effective lending capacity of EFSF to €440 bn
20 June 2011	Finance ministers agree to broaden the EFSF mandate
04 July 2011	Decision to disburse the fifth tranche of the Greek rescue package (€12 bn)
22 July 2011	Agreement about €109 bn of new funds for the Greek package and a private sector involvement of 21%
02 September 2011	The 5th EU/IMF/ECB Review Mission to Greece has left Athens unexpectedly
09 September 2011	Jürgen Stark resigns from the ECB's Executive Board
27 October 2011	Restructuring of the second rescue package for Greece: increase in financing to €130 bn and in private sector involvement to 50%
01 November 2011	Greek PM Papandreou announced his intention to hold a referendum over the rescue package, including the 50% private haircut
08 November 2011	"Six-pack" approved by the European Council

Note: The table shows the EU actions and events that are covered in the corresponding variable.

Table A3: Overview of the covered ECB actions

Date	Description
27 January 2010	Discontinuation of temporary swap lines with the Federal Reserve
10 May 2010	Securities Market Programme, fixed-rate tender procedure with full allotment in the regular 3-months LTROs, a 6-month LTRO with full allotment, reactivation of temporary swap lines with the Federal Reserve
17 December 2010	Swap facility agreement with the Bank of England
21 December 2010	Extension of the swap agreements with the Federal Reserve until 1 August 2011
07 April 2011	Increase in policy interest rates by 25 bps
29 June 2011	Extension of the swap agreements with the Federal Reserve until 1 August 2012
07 July 2011	Increase in policy interest rates by 25 bps and suspension of the minimum credit rating threshold for collateral eligibility applied to instruments issued or guaranteed by the Portuguese government
25 August 2011	Extension of liquidity swap arrangement with the Bank of England up to 28 Sep 2012
15 September 2011	Decision to conduct three additional operations providing USD liquidity in the form of fixed-rate tenders with full allotment

Note: The table shows the ECB actions that are covered in the corresponding variable.