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Abstract

Speeches are an important vehicle for central bankers to convey individual views on the preferred policy stance. In this paper, we employ an automated text linguistic approach to create an indicator that measures the tone of the 1,618 speeches delivered by members of the Governing Council (GC) during the period 1999M1−2014M4. We then relate this variable to euro-area and national macroeconomic forecasts. Our key findings are as follows. First, inflation and growth expectations have a positive and significant impact on the hawkishness of a speech. Second, the voiced preferences of national central bankers largely coincide with the level of independence their banks had at the time of the Maastricht Treaty. Third, country-specific macroeconomic conditions matter for speeches delivered inside the central banker's home country but not for those made abroad. Fourth, differences in central banker preferences are the key source of variation in their speeches before the financial crisis, whereas divergent national economic conditions are the main factor in the second part of the sample.

JEL Codes: E52, E58.

Keywords: Central Bank Communication; European Central Bank; Governing Council; Monetary Policy; National Interests; Speeches.

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1 Introduction

Monetary policy in the euro area is set by the Governing Council (GC), which consists of 25 members (as of 2015). Six of these are the members of the Executive Board (EB) in Frankfurt, who are appointed by the European Council. The other 19 are the presidents of national central banks (NCB), who are appointed by their respective governments. Every six to eight weeks, the GC votes on the future course of monetary policy in the euro area.[1]

As with any committee, members of the GC can disagree with each other, perhaps because they have different preferences when it comes to what they believe is appropriate monetary policy. For instance, GC members might disagree on the timing and size of necessary interest rate firming when prices are expected to increase by more than the ECB's inflation objective. Furthermore, in a supranational central bank like the ECB, the preferred monetary policy of GC members may vary due to the member's different home countries, with different business cycles and different economic problems (see also Sturm and Wollmershäuser 2008; Lee and Crowley 2009).

Indeed, Gildea (1992), Meade and Sheets (2005), and Chappell et al. (2008) find this to be true for the Federal Open Market Committee (FOMC). Presidents of the regional Federal Reserve Banks (FRB) and even members of the Board of Governors—who are supposed to represent federal interests—take into account economic conditions in their home region when they vote on the preferred interest rate. Consequently, it is likely that different preferences and national interests play a role in the European Monetary Union, being that it is comprised of largely autonomous states.[2] The latter conjecture is supported by Hayo and Méon (2013), who find that the GC's decision-making process is best described by a scenario in which individual members of the GC follow national objectives and bargain over the interest rate.[3]

However, the GC had never openly acknowledged such disagreements prior to the press conference held after the interest rate decision on 6 September 2012, at which the following was stated during the questions and answer session:[4]

Question: My question regards the vote today. Was it unanimous and, if not, what does it mean? Thank you.

[1] Before 2015, the GC voted once a month on the future course of monetary policy. The accession of Lithuania to the euro area in 2015 triggered a rotation scheme for voting rights in the GC. NCB presidents participate in all meetings but are no longer allowed to vote every time.

[2] Other sources of a disagreement include different information about the state of the economy and the use of different economic models.

[3] In addition, Badinger and Nitsch (2014) find that the ECB's interest rate setting behavior is best described by weights based on national representation in its mid-level management.

[4] http://www.ecb.europa.eu/press/pressconf/2012/html/is120906.en.html.

Draghi: Well, it was not unanimous. There was one dissenting view. We do not disclose the details of our work. It is up to you to guess.

This was a surprising revelation because, until then, *officially*, the GC had always reached decisions by consensus (see also Jung et al. 2010) and had a collegial communication strategy (see also Ehrmann and Fratzscher 2007). Furthermore, unlike many other central banks, the ECB does not disclose individual voting records, meaning that disagreements, if any, are hidden behind a diplomatic veil. Thus, it is impossible for outsiders to observe such disagreements unless GC members express them in interviews or speeches (see also Jansen and de Haan 2006).

Indeed, GC members often make public speeches. During the period 1999M1−2014M4, a total of 1,618 transcripts of speeches by members of the EB and the Presidents of the 11 biggest NCBs in the Eurosystem were stored on the website of the Bank for International Settlements.[5] The content of these speeches can be used as a proxy for the preferences of the monetary policymakers, and also for their voting behaviour (see also Siklos and Bohl 2007). Of course, speeches are nonbinding; any GC member could 'oppose' the committee's position publicly but still vote in line with the GC's decision. In our view, however, such behaviour is very unlikely given the GC's consensus mantra. Consequently, we believe that those GC members who publicly disagree with the committee's position match their words with deeds. This conjecture is supported by Jansen and de Haan (2009), who find that informal statements by GC members are significantly related to upcoming interest rate decisions. Moreover, central bankers are aware that voicing their disagreements publicly might have a negative impact on financial markets in terms of higher volatility and might lead to a lower predictability of future monetary policy decisions. These adverse consequences make subtle differences in speeches even more relevant for revealing differences in monetary policy preferences.

In this paper we analyse the determinants of the tone of speeches by members of the Governing Council. We first use an automated text linguistic approach to create a variable that measures the tone of each speech on a continuous scale from -1 (dovish) to $+1$ (hawkish). Second, we relate this communication indicator to euro-area and national macroeconomic forecasts. The estimated parameters of this reaction function are then indicative of whether the divergence in opinions within the GC is due to different preferences and/or different macroeconomic developments in the euro area. Our prior is, first, that inflation and GDP growth forecasts are positively related to the tone of a speech and, second, that national macroeconomic forecasts significantly explain the tone of a speech in addition to euro area macroeconomic forecasts.

[5]The Bank for International Settlements provides a comprehensive database of all speeches made by central bank officials worldwide. The use of this database has the major advantage that all speeches are translated into English by the same team of translators.

We make three contributions to the literature. First, we create a comprehensive dataset measuring the tone of all speeches by GC members during the period 1999M1−2014M4. No existing dataset covers speeches by all GC members over this entire 15-year period. Ehrmann and Fratzscher (2007) create indicator variables of speeches by GC members based on newswire reports during the period 1999M1−2004M5 and find that financial market returns react to these speeches by moving in the 'intended' direction. Conrad and Lamla (2010) analyse introductory remarks made by the ECB President at monthly press conferences. They cover the period 1999M1−2006M10 and detect an appreciation of the euro against the US dollar in response to statements about increasing risks to price stability.

Our second contribution is that, based on the findings of a comprehensive literature survey conducted by Blinder et al. (2008), we are convinced that this is the first study to investigate determinants of the tone of speeches by GC members.[6] Hayo and Neuenkirch (2013) conduct a similar analysis for FRB presidents and find that regional macroeconomic variables are particularly relevant for speeches made (i) by nonvoting FOMC members, (ii) within the president's home district, (iii) during Ben Bernanke's tenure as Chairman, (iv) during recessions, and (v) during the financial crisis.

Finally, our paper contributes to the literature aimed at opening the black box of the GC's decision-making rule (see, e.g., Cancelo et al. 2011; Hayo and Méon 2013). Discovering this decision rule is of utmost importance to the general public, particularly in light of the crucial role the ECB has taken in the ongoing economic and financial crisis in the euro area. The GC's decisions affect more than 300 million people in the euro area. However, the individual positions of its 25 members, unlike those of fiscal policymakers, are largely unknown. This (non) accountability issue is possibly the reason the GC has decided to publish the minutes of its meetings starting in 2015.

Our key results are as follows. First, inflation and growth expectations have a positive and significant impact on the hawkishness of a speech. Second, different growth expectations across the euro area and different preferences significantly explain discrepancies across speakers. Third, the voiced preferences of NCB presidents largely coincide with the level of independence their central banks had at the time of the Maastricht Treaty; presidents of the least independent central banks take the most dovish tone in their speeches and vice versa. Fourth, country-specific macroeconomic conditions matter for speeches delivered inside the central banker's home country, but not for those made abroad. Fi-

[6] Other papers focus on ECB communication in general (e.g., Jansen and de Haan 2006, 2007; Berger et al. 2011; Bulir et al. 2012), the impact of ECB communication on financial markets (e.g., Jansen and de Haan 2005; Ehrmann and Fratzscher 2007; Rosa and Verga 2007; de Haan 2008; Brand et al. 2010; Conrad and Lamla 2010), the usefulness of ECB communication when predicting future interest rate decisions (e.g., Heinemann and Ullrich 2007; Sturm and de Haan 2011), and the role of ECB communication in the monetary policy transmission process (Neuenkirch 2013).

nally, differences in central banker preferences are the key source of variation in their speeches before the financial crisis, whereas divergent national economic conditions are the main factor in the second part of the sample.

The remainder of this paper is organised as follows. In Section 2, we describe the coding procedure for extracting the tone of speeches by GC members, introduce the explanatory variables, and explain the econometric methodology. Section 3 presents the baseline results. Section 4 contains some further estimates and robustness tests. Section 5 concludes with some policy implications.

2 Data and Empirical Methodology

2.1 Measuring the Tone of Speeches

We create a dataset that covers 1,618 speeches by members of the Governing Council during the period 1999M1−2014M4.[7] We focus on the members of the Executive Board and the presidents of the 11 largest NCBs.[8] The crucial task is to quantify the gist of a speech, that is, what are the speech's implications for the future course of monetary policy. We follow recent practice (e.g., Bligh and Hess 2007; Armesto et al. 2009; Lucca and Trebbi 2009; Apel and Blix Grimaldi 2012; Born et al. 2013; Hansen et al. 2014) and use an automated text linguistic approach to extract the tone of each speech.

In a first step, we collected all words and their frequency of occurrence in our sample of 1,618 speeches with the purpose of identifying those keywords that are directly related to the future course of monetary policy. Furthermore, we searched for keywords that can be used as indirect indicators of monetary policy inclination via the economic outlook. Similar to Apel and Blix Grimaldi (2012), we sorted these keywords into two categories depending on whether they indicate a more hawkish tone or a more dovish tone. Examples are the keywords high∗, strong∗, increas∗, and fast∗, which are indications of a more

[7]Note that this does not include the introductory statement made at the press conferences held after each interest rate decision. In addition, we do not include interviews in our sample since (i) not all of these are recorded on the website of the Bank for International Settlements and (ii) the answers of central bankers during interviews are naturally biased with respect to the questions asked by the journalists.

[8]National Bank of Belgium, German Bundesbank, Central Bank of Ireland, Banco de Espana, Banque de France, Bank of Greece, Banca d'Italia, De Nederlandsche Bank, Austrian Nationalbank, Banco de Portugal, and Suomen Pankki. We do not include the 85 speeches by the President of The Banque Centrale du Luxembourg as there are no macroeconomic forecasts by Consensus Economics available for this country. Data availablity issues or a very low frequency of speeches are also the reasons why we do not include speeches by the Presidents of the Banka Slovenije (2 speeches), Central Bank of Malta (0), Narodna Banka Slovenska (0), Eesti Pank (8), and Latvijas Banka (0). The Lietuvos Bankas became a member of the euro area in 2015, that is, after the end of our sample period.

hawkish tone, whereas their antonyms, low∗, weak∗, decreas∗, and slow∗, convey a more dovish tone.[9]

Next, we searched each of the 1,618 speeches for these words and counted the number of hawkish and dovish words in each speech. Finally, we created a variable measuring the tone of each speech using the following formula:

$$tone_{i,t} = \frac{hawkish_{i,t} - dovish_{i,t}}{hawkish_{i,t} + dovish_{i,t}} \tag{1}$$

Thus, our automated search and word-counting approach creates a continuous variable $tone_{i,t}$ for the speech of central banker i on day t that is bound between -1 (dovish) and $+1$ (hawkish). To avoid extreme values for the communication indicator, we included in our dataset only those speeches containing at least 10 occurrences of our keywords. This leaves a total of 1,202 observations.

Table 1 sets out descriptive statistics for the communication indicator.[10] A couple of things are worth highlighting. First, speeches contain, on average, more hawkish words than dovish ones as the mean is positive throughout all groups. This is also reflected in its maximum value, which takes the value $+1$ despite the fact that we dropped from our analysis all speeches with less than 10 occurrences of keywords. The minimum value, in contrast, is 'only' -0.67. Second, the ECB President is, on average, more hawkish than other GC members and GC members from France, Spain, and Greece, in particular, are more hawkish than Irish and Italian central bankers.

Figure 1 shows the average tone of speeches within a year and the average main refinancing rate within a year over the sample period. The average tone in speeches is more dovish when interest rates are lower and vice versa. The correlation between both series is substantial ($\rho = 0.82$). Consequently, we feel confirmed that our automated search and word-counting approach creates a reasonable indicator for the future course of monetary policy and we can use differences in the indicator across speakers to reveal differences in their near-term monetary policy preferences.

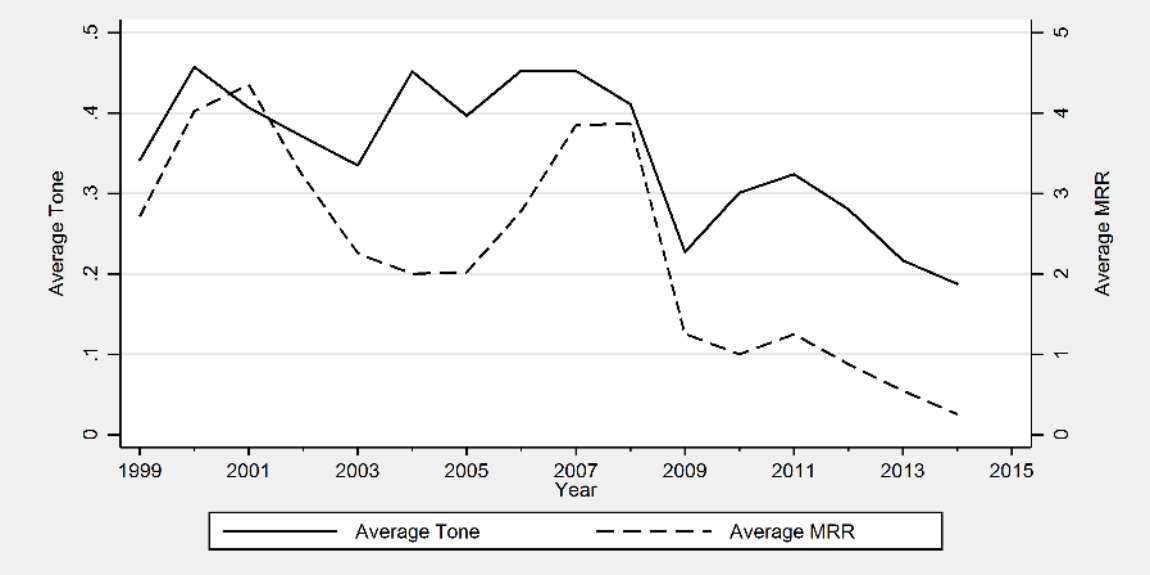
[9]The full list of keywords indicating more hawkish monetary policy is as follows: accelerat∗, better, boom∗, emerg∗, expansion, fast∗, favo(u)rabl∗, firm∗, great∗, high∗, improv∗, increas∗, larger, positive, rais∗, ris∗, stabili∗, stable, strengthen∗, strong∗, subdued, unsustainable, upside, upswing, upturn, upward∗. The list of dovish keywords is: collaps∗, contraction, dampen∗, decelerat∗, declin∗, decreas∗, delay∗, depression, destabili∗, deteriorat∗, difficul∗, diminish∗, disappear∗, downside, downswing, downturn, downward∗, fall∗, fragil∗, low∗, negative, poor, recession∗, slow∗, sluggish, small∗, struggling, sustainable, unfavo(u)rabl∗, unstable, weak∗, worse.

[10]A detailed overview of the number of speeches per year and by position/country can be found in Table A1 in the Appendix.

Table 1: Communication Indicator: Descriptive Statistics

	Mean	S.D.	Min.	Max.	Obs.
Governing Council	0.34	0.31	−0.67	1.00	1202
By Position					
... President	0.47	0.26	−0.40	1.00	222
... Exec. Board (excl. Pres.)	0.32	0.31	−0.58	0.91	389
... NCB Presidents	0.31	0.31	−0.67	1.00	591
By Country					
... Austria	0.37	0.33	−0.50	1.00	76
... Belgium	0.31	0.29	−0.35	0.85	39
... Finland	0.27	0.23	−0.33	0.71	39
... France	0.44	0.28	−0.47	1.00	290
... Germany	0.36	0.29	−0.45	1.00	153
... Greece	0.40	0.30	−0.27	0.91	71
... Ireland	0.20	0.31	−0.53	0.85	60
... Italy	0.22	0.31	−0.64	1.00	225
... The Netherlands	0.38	0.32	−0.67	1.00	99
... Portugal	0.26	0.26	−0.29	0.79	50
... Spain	0.41	0.29	−0.50	0.90	100

Figure 1: Average Tone of Speeches per Year and Average Main Refinancing Rate



Notes: The figure shows the average tone of speeches per year (solid line, left scale) and the average main refinancing rate per year (dashed line, right scale).

A note of caution here. Given that private documents are inaccessible to the general public, empirical studies in politics and psychology mainly use public sources to assess decision makers' views (van Esch 2007). It could be argued that deriving decision makers' beliefs from public sources may be biased given that most public speeches are written by

speech writers and thus might not reflect the speaker's personal views. However, Renshon (2009) shows that analysing public sources leads to the same outcome as analysing private sources. Moreover, de Jong and van Esch (2013) argue that an additional advantage of using public speeches is that they reflect the person's opinion in his or her official role. Finally, a manuscript can be subject to review, implying that there could be a degree of censorship or restraint for which we cannot control. However, in our view, this makes our results even more convincing since speeches might reveal more subtlety in central bankers' views on monetary policy despite the potential censorship.

2.2 Econometric Methodology

The following simple framework motivates our empirical approach (Meade and Sheets 2005; Hayo and Neuenkirch 2013). Central bankers choose their wording based on their preferences as well as on euro-area and country-specific economic conditions:

$$tone_{i,t} = f(\phi_i, E_t x_{t+12}^{EA}, E_t x_{t+12}^{Nat} - E_t x_{t+12}^{EA}) \tag{2}$$

$tone_{i,t}$ is the degree of hawkishness/dovishness of a speech made by central banker i on day t and ϕ_i denotes central banker i's preferences, as expressed in speeches, depending on nationality and/or position within the GC. $E_t x_{t+12}^{EA}$ is a vector of euro-area macroeconomic forecasts available before the time of the speech and, similarly, $E_t x_{t+12}^{Nat} - E_t x_{t+12}^{EA}$ is a vector of 'country-specific macroeconomic forecasts,' defined as differences between national and euro-area macroeconomic forecasts.

A linear representation of this function illustrates the two sources of potential differences across central bankers:

$$tone_{i,t} = \phi_i + \beta_i E_t x_{t+12}^{EA} + \gamma_i (E_t x_{t+12}^{Nat} - E_t x_{t+12}^{EA}) \tag{3}$$

First, national economic forecasts $E_t x_{t+12}^{Nat}$ for the 11 sample countries could be different from the euro-area aggregate $E_t x_{t+12}^{EA}$ and lead to variation in the left-hand-side variable if $\gamma_i \neq 0$. Second, differences in the preferences ϕ_i across central bankers could be another source of variation.

To identify whether these two aspects have any influence on the wording chosen for a central banker' speech, we need to make a couple of assumptions. First, we make uniform each central banker's responsiveness to euro-area forecasts and county-specific forecasts, that is, $\beta_i = \beta$ and $\gamma_i = \gamma$. Preliminary regressions indicate that this assumption is not overly restrictive as we detect no significant differences across central bankers when allowing for heterogeneity in β_i and γ_i, whereas we detect significant differences in the

estimates for ϕ_i.[11] Second, we assume that there are no differences in central bankers' information sets, that is, the forecasts of $E_t x_{t+12}^{EA}$ and $E_t x_{t+12}^{Nat}$ only change over time. Based on these assumptions, we can interpret the coefficient vectors β and γ as weights for euro-area and country-specific information and ϕ_i as measuring country- and position-specific preferences.

In line with the idea of a Taylor (1993) rule, we use inflation forecasts and real GDP growth forecasts to explain the tone of a speech. In addition, the ECB's mandate is Consensus Economics provides monthly forecasts of both variables, separately for the *current calendar year* and the *next calendar year*. To obtain fixed-horizon *12-month-ahead* forecasts, we use the following formula:

$$E_t x_{t+12} = \frac{d}{365} E_{t,d} x_{cy} + \frac{365 - d}{365} E_{t,d} x_{ny} \tag{4}$$

$E_t x_{t+12}$ is the 12-month-ahead forecast and $E_{t,d} x_{cy}$ as well as $E_{t,d} x_{ny}$ are the corresponding forecasts for the current calendar year and the next calendar year. d refers to the days remaining in the respective calendar year on the day the forecast was published, for instance, $d = 262$ for the forecast on 14 April 2014.[12]

Figures A1 and A2 show the 12-month-ahead national inflation and GDP growth expectations and the corresponding measures for the euro area. Inflation and growth expectations in Austria, Belgium, France, Germany, and Italy do not deviate much from corresponding euro-area measures, and the same is true for growth expectations in the Netherlands. In contrast, inflation and growth expectations were substantially higher in Greece and Ireland compared to the corresponding euro-area values before 2008M9 and lower afterward. Similarly, inflation expectations in the Netherlands and Portugal deviate considerably from the euro-area figures during the early sample years. Thus, there are differences in the economic conditions across countries and it remains to be discovered whether GC members take these into account when phrasing their speeches.

Table 2 shows bivariate correlations between the communication indicator and euro-area and country-specific macroeconomic forecasts. All correlations with euro-area forecasts are positive and significant at the 1 percent level. Similarly, we observe a positive and significant correlation between the tone of a speech and the difference between national growth forecasts and the euro-area aggregate. In contrast, country-specific inflation expec-

[11] To conserve space, we do not report these regressions in detail. All omitted results are available upon request.

[12] Note that Consensus Economics forecasts for the euro area became available in 2002M12. We use real-time national GDP weights to aggregate the national inflation forecasts and growth forecasts as a proxy for euro-area forecasts before that date. We checked the validity of this approach by comparing the actual euro-area forecasts and our proxy measure for the period 2002M12−2014M4. The differences between both series are negligible.

tations are not correlated with the communication indicator (at the 10 percent level). To summarise, we have some descriptive evidence that country-specific growth expectations might matter for central bankers when phrasing their speeches.

Table 2: Communication Indicator: Correlation with Macroeconomic Forecasts

	$E_t\pi^{EA}_{t+12}$	$E_t y^{EA}_{t+12}$	$E_t\pi^{Nat}_{t+12} - E_t\pi^{EA}_{t+12}$	$E_t y^{Nat}_{t+12} - E_t y^{EA}_{t+12}$
Governing Council	**0.19**	**0.24**	0.03	**0.15**
By Position				
... President	**0.27**	**0.21**	−0.09	**0.15**
... EB (excl. Pres.)	**0.17**	**0.27**	0.07	**0.15**
... NCB Presidents	**0.20**	**0.20**	0.05	**0.17**

Notes: Bold correlations are significant at the 10 percent level.

To more formally describe the relationship between the tone of a speech and euro-area and country-specific macroeconomic forecasts we estimate the following pooled model via OLS:[13]

$$\begin{aligned} tone_{i,t} &= \alpha^{Nat}_{1i} + \alpha^{Pos}_{2i} + \beta_1 E_t\pi^{EA}_{t+12} + \beta_2 E_t y^{EA}_{t+12} \\ &\quad + \gamma_1(E_t\pi^{Nat}_{t+12} - E_t\pi^{EA}_{t+12}) + \gamma_2(E_t y^{Nat}_{t+12} - E_t y^{EA}_{t+12}) + \mu_{i,t} \end{aligned} \tag{5}$$

The estimates of β_1 and β_2 measure the sensitivity of a speech with inflation expectations $E_t\pi^{EA}_{t+12}$ and GDP growth expectations $E_t y^{EA}_{t+12}$ in the euro area. γ_1 and γ_2 denote the estimates for the corresponding country-specific measures, $E_t\pi^{Nat}_{t+12} - E_t\pi^{EA}_{t+12}$ and $E_t y^{Nat}_{t+12} - E_t y^{EA}_{t+12}$. Fixed effects based on a central banker's nationality and her/his position within the GC are captured by α^{Nat}_{1i} and α^{Pos}_{2i} and provide a proxy for whether there are differences in the average degree of hawkishness across nationalities and positions (ECB President, EB members (excl. ECB President), and NCB presidents).[14]

[13] It is impossible to estimate a 'true' panel model since speeches are not delivered at a regular frequency like, for instance, once a month or once a quarter. This irregular frequency is also why we decided against modelling Equation (5) with a lagged dependent variable.

[14] To capture time variation not related to the cyclical position captured by the macroeconomic forecasts we also included year-fixed effects into Equation (5). In addition, we also investigated whether differences in preferences not related to nationality and position might play a role by adding central banker-fixed effects in addition to country- and position-fixed effects. However, both year-fixed effects and central banker-fixed effects are insignificant. Results are available on request.

3 Empirical Results

3.1 Governing Council

Table 3 presents the results for Equation (5), which is estimated for all members of the Governing Council. The results indicate that speeches by GC members can be explained by a Taylor-type rule as inflation expectations and growth expectations have a positive and significant impact on the degree of hawkishness. Both euro-area indicators significantly explain the communication indicator. In contrast, the coefficient on country-specific inflation expectations is insignificant, leaving growth expectations as the only significant country-specific forecast.

Table 3: Explaining Speeches: Governing Council

	Coefficient	Std. Error	p-value
Constant Term	**0.334**	**(0.047)**	**[0.00]**
$E_t\pi^{EA}_{t+12}$	**0.053**	**(0.019)**	**[0.01]**
$E_t y^{EA}_{t+12}$	**0.047**	**(0.009)**	**[0.00]**
$E_t\pi^{Nat}_{t+12} - E_t\pi^{EA}_{t+12}$	−0.014	(0.025)	[0.57]
$E_t y^{Nat}_{t+12} - E_t y^{EA}_{t+12}$	**0.043**	**(0.015)**	**[0.00]**
Country-Fixed Effects			
Austria	0.009	(0.042)	[0.83]
Belgium	−0.027	(0.049)	[0.58]
Finland	**−0.140**	**(0.044)**	**[0.00]**
France	0.002	(0.032)	[0.95]
Germany			
Greece	0.022	(0.045)	[0.62]
Ireland	**−0.194**	**(0.047)**	**[0.00]**
Italy	**−0.132**	**(0.035)**	**[0.00]**
The Netherlands	−0.070	(0.044)	[0.12]
Portugal	−0.023	(0.052)	[0.66]
Spain	**0.066**	**(0.040)**	**[0.10]**
Position-Fixed Effects			
President			
EB (excl. Pres.)	**−0.135**	**(0.029)**	**[0.00]**
NCB Presidents	**−0.122**	**(0.028)**	**[0.00]**
Observations	1202		
R^2	0.17		

Notes: Estimates of Equation (5). Dependent variable: $tone_{i,t}$. OLS with White (1980) standard errors is used. Bold coefficients are significant at the 10 percent level.

Thus, when it comes to the ECB's primary objective, that is, to 'maintain price stability,' the euro-area measure of inflation expectations is more relevant than the national

indicator.[15] However, in the case of the secondary objective, that is, to 'support the general economic policies', GC members put equal weight on euro-area and country-specific conditions.[16] Consequently, we have evidence that different macroeconomic developments in the euro area play a role in the tone of speeches by GC members.

Turning to the country- and position-fixed effects we see, first, that the ECB President is, on average, more hawkish than other GC members in his speeches. In addition, speeches by Finnish, Irish, and Italian central bankers are more dovish than speeches by German GC members, indicating that differences in preferences might also play a role when central bankers phrase their speeches. Speeches by Spanish GC members are, on average, more hawkish than speeches by central bankers from the reference country (Germany). Finally, the R^2 is in line with the figures of Hayo and Neuenkirch (2013) in the context of the Federal Reserve.

3.2 National Central Bank Presidents

Since the literature finds that central bankers on the 'periphery' are more likely to dissent in interest rate decisions (see, e.g., Gildea 1992; Meade and Sheets 2005) and to voice disagreement in the discussion around interest rate decisions (Meade 2005, 2010) or in speeches (Hayo and Neuenkirch 2013) we re-do the analysis of the previous subsection for a subsample consisting of NCB presidents only. Table 4 sets out the results.

Similar to the results for all GC members, we find that speeches by NCB presidents can be explained by a Taylor-type rule with euro-area inflation expectations, euro-area growth expectations, and country-specific growth expectations being the significant variables. We also observe some differences based on the nationality of central bankers as speeches by the presidents of the Suomen Pankki, Bank of Greece, Central Bank of Ireland, and Banca d'Italia are, on average, more dovish than those by the president of the German Bundesbank.

Next, we relate the estimated country-fixed effects to the level of central bank independence (CBI). We use the indicator by Klomp and de Haan (2009) for economic CBI and total CBI (i.e., the average of economic and political CBI) in the year 1993 to obtain a proxy for a country's preferred level of CBI prior to harmonisation of central bank laws in the aftermath of the Maastricht Treaty. Figure 2 illustrates this relationship.

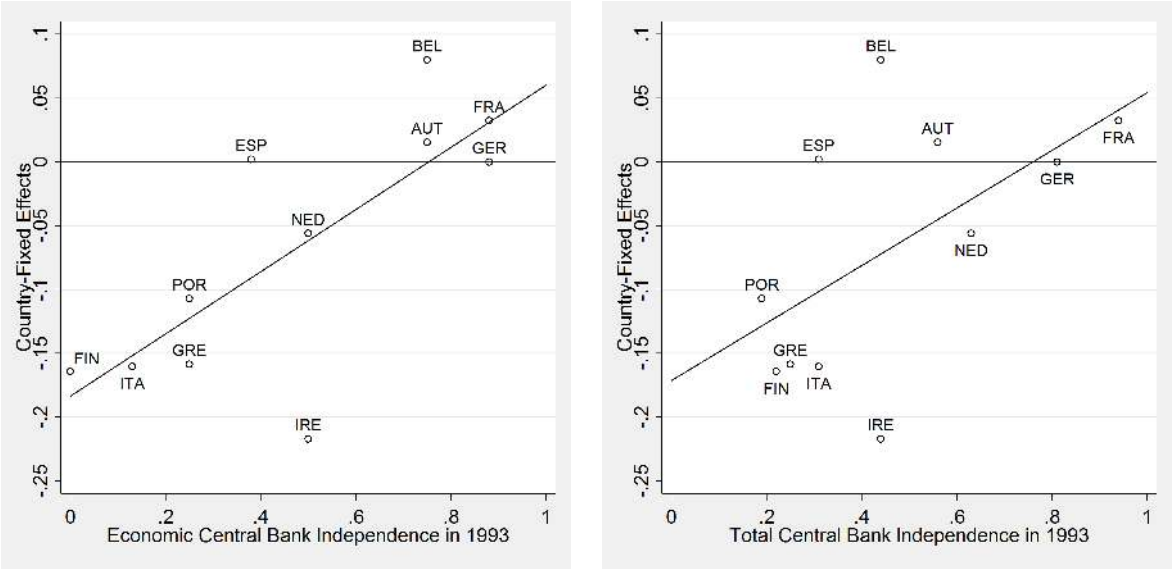
[15] Test for equality of coefficents: F(1,1185) = 5.23 [0.02].
[16] Test for equality of coefficents: F(1,1185) = 0.08 [0.78].

Table 4: Explaining Speeches: National Central Bank Presidents

	Coefficient	Std. Error	p-value
Constant Term	**0.216**	**(0.057)**	**[0.00]**
$E_t\pi^{EA}_{t+12}$	**0.062**	**(0.030)**	**[0.04]**
$E_t y^{EA}_{t+12}$	**0.048**	**(0.014)**	**[0.00]**
$E_t\pi^{Nat}_{t+12} - E_t\pi^{EA}_{t+12}$	−0.019	(0.031)	[0.56]
$E_t y^{Nat}_{t+12} - E_t y^{EA}_{t+12}$	**0.047**	**(0.020)**	**[0.02]**
Country-Fixed Effects			
Austria	0.015	(0.050)	[0.76]
Belgium	0.080	(0.075)	[0.29]
Finland	**−0.164**	**(0.047)**	**[0.00]**
France	0.032	(0.049)	[0.51]
Germany			
Greece	**−0.159**	**(0.069)**	**[0.02]**
Ireland	**−0.217**	**(0.051)**	**[0.00]**
Italy	**−0.160**	**(0.047)**	**[0.00]**
The Netherlands	−0.056	(0.057)	[0.32]
Portugal	−0.107	(0.071)	[0.13]
Spain	0.002	(0.051)	[0.97]
Observations	591		
R^2	0.16		

Notes: Estimates of Equation (5). Dependent variable: $tone_{i,t}$. OLS with White (1980) standard errors is used. Bold coefficients are significant at the 10 percent level.

Figure 2: Country-Fixed Effects and Central Bank Independence



Notes: The figures relate country-fixed effects from Table 4 to the degree of economic central bank independence in 1993 (left) and total central bank independence in 1993 (right).

Both panels of Figure 2 indicate a positive relationship between the estimate of the country-fixed effect, that is, the relative degree of hawkishness with Germany as reference country, and the level of CBI at the time of the Maastricht Treaty. The correlation is substantial for economic CBI ($\rho = 0.75$) and total CBI ($\rho = 0.56$). Notable outliers are the Banco de Espana and the National Bank of Belgium, where the presidents communicate more hawkishly than the pre-Maastricht CBI level suggests they should and the Central Bank of Ireland, where we observe the opposite phenomenon. Nevertheless, both figures imply that the presidents of the least independent central banks (in 1993) are most dovish in their speeches and vice versa. One interpretation of these findings is that the NCBs still follow their old habits despite all the formal reforms undertaken after the Maastricht Treaty. Our findings for communication are also in line with the literature on CBI where a negative relationship between CBI and the level of inflation is documented (see, for instance, Eijffinger et al. 1998).

4 Further Results and Robustness Tests

4.1 Speeches in the Home Country Versus Speeches Abroad

In the case of the Federal Reserve, Hayo and Neuenkirch (2013) find that regional macroeconomic variables are relevant for speeches made within the home district but not for speeches delivered elsewhere. In the following, we test whether GC members also adjust the content of their speeches to the audience and estimate separate models for speeches within the respective home country (Home) and those delivered abroad (Abroad). The results are presented in Table 5.

The estimates for speeches within the home district are very similar to those for the full sample in terms of coefficient size and significance. For speeches outside the home country, country-specific macroeconomic conditions do not matter as only euro-area macroeconomic forecasts are found to significantly explain the degree of hawkishness. Consequently, we have evidence that GC members adjust the gist of their speeches to their audience. If a speech is delivered inside their home country, they put more emphasis on county-specific information than they do in speeches made abroad.

Another interesting finding is that some of the country-fixed effects differ across the locations where speeches were delivered. Irish and Italian central bankers use significantly more dovish words compared to the reference country when they speak within their home country. However, when speaking abroad, the significant difference vanishes. There is a similar shift in the degree of hawkishness for Spanish central bankers. When they deliver their remarks outside Spain, their tone is significantly more hawkish than that of German

central bankers speaking abroad. An alternative interpretation is that German central bankers use relatively more dovish words when they speak outside their home country.

Table 5: Explaining Speeches in the Home Country Versus Speeches Abroad

	Home			Abroad		
	Coeff.	S.E.	p-val.	Coeff.	S.E.	p-val.
Constant Term	**0.313**	**(0.062)**	**[0.00]**	**0.342**	**(0.075)**	**[0.00]**
$E_t\pi^{EA}_{t+12}$	**0.054**	**(0.026)**	**[0.04]**	**0.051**	**(0.030)**	**[0.09]**
$E_t y^{EA}_{t+12}$	**0.041**	**(0.011)**	**[0.00]**	**0.058**	**(0.014)**	**[0.00]**
$E_t\pi^{Nat}_{t+12} - E_t\pi^{EA}_{t+12}$	−0.011	(0.032)	[0.73]	0.016	(0.047)	[0.74]
$E_t y^{Nat}_{t+12} - E_t y^{EA}_{t+12}$	**0.040**	**(0.019)**	**[0.04]**	0.030	(0.026)	[0.24]
Country-Fixed Effects						
Austria	0.078	(0.052)	[0.13]	−0.062	(0.066)	[0.35]
Belgium	−0.035	(0.071)	[0.62]	−0.026	(0.069)	[0.71]
Finland	**−0.182**	**(0.077)**	**[0.02]**	**−0.144**	**(0.059)**	**[0.02]**
France	0.030	(0.048)	[0.53]	−0.014	(0.046)	[0.76]
Germany						
Greece	−0.037	(0.065)	[0.56]	0.067	(0.071)	[0.35]
Ireland	**−0.215**	**(0.055)**	**[0.00]**	−0.053	(0.086)	[0.54]
Italy	**−0.151**	**(0.045)**	**[0.00]**	−0.075	(0.064)	[0.24]
The Netherlands	−0.052	(0.053)	[0.32]	−0.117	(0.088)	[0.18]
Portugal	−0.107	(0.067)	[0.11]	0.035	(0.086)	[0.68]
Spain	0.026	(0.051)	[0.61]	**0.118**	**(0.064)**	**[0.07]**
Position-Fixed Effects						
President						
EB (excl. Pres.)	**−0.088**	**(0.046)**	**[0.06]**	**−0.163**	**(0.040)**	**[0.00]**
NCB Presidents	**−0.099**	**(0.045)**	**[0.03]**	**−0.108**	**(0.043)**	**[0.01]**
Observations	677			525		
R^2	0.18			0.17		

Notes: Estimates of Equation (5). Dependent variable: $tone_{i,t}$. OLS with White (1980) standard errors is used. Bold coefficients are significant at the 10 percent level.

4.2 Explaining Speeches Before and After September 2008

Next, we split our sample timeframe into periods to test whether there are differences in the wording of speeches made before the financial crisis and those made after 15 September 2008. We chose the Lehman bankruptcy as the starting point for the financial crisis subsample as the coordinated interest rate cut on 8 October 2008 was the first clear indication that the financial crisis was affecting the ECB's interest rate policy. Before that date, the ECB had been continuing its gradual tightening policy even though several other central banks had begun to reduce interest rates right after the beginning of the money market crisis in August 2007.

In addition to re-estimating Equation (5) separately for the two subsamples, we augment it by including two additional regressors. First, we include the Eurostoxx 50 Volatility Index to discover whether GC members react to financial market stress when phrasing their speeches (incl. $vstoxx_t$). Second, we add the difference between the 10-year government bond yield and the corresponding German yield to explore whether GC members take into account relative refinancing costs in their home country when making a speech (incl. $i^{Nat}_{t,10y} - i^{Ger}_{t,10y}$). Tables 6 and 7 set out the results.

Several striking results come to light when comparing the pre-crisis and crisis subsamples. First, expected inflation, both euro-area-wide and country-specific, plays a role in GC member speeches only during the crisis episode. This reflects that inflation expectations were well anchored in the euro area before 2008, whereas deflationary risks began to emerge in 2013. Second, euro-area and country-specific growth expectations are significant in both subsamples, albeit with numerically smaller coefficients during the crisis period. Third, in neither subsample do GC members react to financial market stress. Finally, a larger government bond yield spread compared to that of Germany causes GC members to use more dovish words in their speeches.

There are no significant position-fixed effects during the pre-crisis episode, whereas the ECB President is found to be, on average, more hawkish than other GC members during the second subsample. In contrast, differences based on the speaker's nationality play a much larger role before 15 September 2008 as only the country-fixed effects of Finland and Italy are significantly negative in both subsamples.

To summarise, we find more significant differences in preferences before the financial crisis. Afterward, national economic conditions are the major source of variation in speeches, arguably due to the divergent macroeconomic development in the euro area after 2008 (see also Figures A1 and A2). The culmination of this effect is the significant reaction by GC members to the yield spread in their countries compared to that in Germany, which crowds out the effect of the other country-specific macroeconomic variables.

Table 6: Explaining Speeches Before September 2008

				incl. $vstoxx_t$			incl. $i^{Nat}_{t,10y} - i^{Ger}_{t,10y}$		
	Coef.	S.E.	p-val.	Coef.	S.E.	p-val.	Coef.	S.E.	p-val.
Constant Term	**0.286**	**(0.111)**	**[0.01]**	**0.277**	**(0.114)**	**[0.02]**	**0.283**	**(0.127)**	**[0.03]**
$E_t\pi^{EA}_{t+12}$	0.046	(0.035)	[0.18]	0.046	(0.035)	[0.19]	0.047	(0.042)	[0.26]
$E_t y^{EA}_{t+12}$	**0.081**	**(0.023)**	**[0.00]**	**0.082**	**(0.023)**	**[0.00]**	**0.081**	**(0.023)**	**[0.00]**
$E_t\pi^{Nat}_{t+12} - E_t\pi^{EA}_{t+12}$	0.006	(0.045)	[0.89]	0.003	(0.045)	[0.94]	0.006	(0.045)	[0.89]
$E_t y^{Nat}_{t+12} - E_t y^{EA}_{t+12}$	**0.072**	**(0.041)**	**[0.08]**	**0.072**	**(0.041)**	**[0.08]**	**0.072**	**(0.042)**	**[0.09]**
$vstoxx_t$				0.000	(0.002)	[0.78]			
$i^{Nat}_{t,10y} - i^{Ger}_{t,10y}$							−0.006	(0.160)	[0.97]
Country-Fixed Effects									
Austria	0.010	(0.055)	[0.86]	0.011	(0.055)	[0.85]	0.011	(0.060)	[0.86]
Belgium	0.052	(0.072)	[0.47]	0.054	(0.072)	[0.46]	0.053	(0.076)	[0.49]
Finland	**−0.266**	**(0.077)**	**[0.00]**	**−0.265**	**(0.077)**	**[0.00]**	**−0.265**	**(0.082)**	**[0.00]**
France	0.007	(0.049)	[0.89]	0.006	(0.049)	[0.90]	0.008	(0.053)	[0.88]
Germany									
Greece	−0.064	(0.090)	[0.48]	−0.059	(0.092)	[0.52]	−0.062	(0.105)	[0.56]
Ireland	**−0.429**	**(0.117)**	**[0.00]**	**−0.424**	**(0.117)**	**[0.00]**	**−0.427**	**(0.123)**	**[0.00]**
Italy	**−0.225**	**(0.051)**	**[0.00]**	**−0.226**	**(0.051)**	**[0.00]**	**−0.223**	**(0.072)**	**[0.00]**
The Netherlands	**−0.154**	**(0.055)**	**[0.01]**	**−0.156**	**(0.056)**	**[0.01]**	**−0.154**	**(0.060)**	**[0.01]**
Portugal	**−0.245**	**(0.118)**	**[0.04]**	**−0.245**	**(0.118)**	**[0.04]**	**−0.243**	**(0.127)**	**[0.06]**
Spain	−0.045	(0.075)	[0.55]	−0.041	(0.076)	[0.59]	−0.044	(0.077)	[0.57]
Position-Fixed Effects									
President									
EB (excl. Pres.)	−0.076	(0.047)	[0.11]	−0.080	(0.050)	[0.11]	−0.076	(0.048)	[0.11]
NCB Presidents	−0.038	(0.046)	[0.40]	−0.040	(0.047)	[0.39]	−0.038	(0.045)	[0.40]
Observations	578			578			578		
R^2	0.19			0.19			0.19		

Notes: Estimates of Equation (5). Dependent variable: $tone_{i,t}$. OLS with White (1980) standard errors is used. Bold coefficients are significant at the 10 percent level.

Table 7: Explaining Speeches After September 2008

				incl. $vstoxx_t$			incl. $i^{Nat}_{t,10y} - i^{Ger}_{t,10y}$		
	Coef.	S.E.	p-val.	Coef.	S.E.	p-val.	Coef.	S.E.	p-val.
Constant Term	**0.383**	**(0.062)**	**[0.00]**	**0.377**	**(0.064)**	**[0.00]**	**0.370**	**(0.062)**	**[0.00]**
$E_t\pi^{EA}_{t+12}$	**0.054**	**(0.027)**	**[0.05]**	**0.050**	**(0.029)**	**[0.08]**	**0.076**	**(0.029)**	**[0.01]**
$E_t y^{EA}_{t+12}$	**0.030**	**(0.014)**	**[0.03]**	**0.031**	**(0.015)**	**[0.03]**	**0.024**	**(0.014)**	**[0.10]**
$E_t\pi^{Nat}_{t+12} - E_t\pi^{EA}_{t+12}$	**0.061**	**(0.036)**	**[0.09]**	**0.060**	**(0.036)**	**[0.10]**	0.058	(0.036)	[0.11]
$E_t y^{Nat}_{t+12} - E_t y^{EA}_{t+12}$	**0.034**	**(0.020)**	**[0.10]**	**0.033**	**(0.020)**	**[0.10]**	0.014	(0.024)	[0.56]
$vstoxx_t$				0.000	(0.001)	[0.74]			
$i^{Nat}_{t,10y} - i^{Ger}_{t,10y}$							**−0.021**	**(0.011)**	**[0.05]**
Country-Fixed Effects									
Austria	−0.035	(0.060)	[0.56]	−0.037	(0.060)	[0.54]	−0.023	(0.060)	[0.70]
Belgium	−0.058	(0.059)	[0.33]	−0.056	(0.059)	[0.34]	−0.039	(0.059)	[0.51]
Finland	**−0.108**	**(0.063)**	**[0.09]**	**−0.107**	**(0.064)**	**[0.09]**	−0.099	(0.064)	[0.12]
France	−0.024	(0.044)	[0.59]	−0.023	(0.044)	[0.60]	−0.022	(0.044)	[0.61]
Germany									
Greece	−0.048	(0.080)	[0.55]	−0.049	(0.080)	[0.54]	0.037	(0.091)	[0.68]
Ireland	−0.050	(0.072)	[0.48]	−0.050	(0.072)	[0.48]	0.006	(0.075)	[0.94]
Italy	**−0.134**	**(0.053)**	**[0.01]**	**−0.135**	**(0.053)**	**[0.01]**	**−0.115**	**(0.053)**	**[0.03]**
The Netherlands	0.116	(0.113)	[0.31]	0.115	(0.113)	[0.31]	0.113	(0.113)	[0.32]
Portugal	0.036	(0.071)	[0.61]	0.036	(0.071)	[0.61]	0.111	(0.076)	[0.14]
Spain	0.069	(0.055)	[0.22]	0.067	(0.056)	[0.24]	0.082	(0.056)	[0.14]
Position-Fixed Effects									
President									
EB (excl. Pres.)	**−0.188**	**(0.040)**	**[0.00]**	**−0.187**	**(0.040)**	**[0.00]**	**−0.200**	**(0.040)**	**[0.00]**
NCB Presidents	**−0.202**	**(0.043)**	**[0.00]**	**−0.201**	**(0.043)**	**[0.00]**	**−0.209**	**(0.043)**	**[0.00]**
Observations	624			624			624		
R^2	0.11			0.11			0.12		

Notes: Estimates of Equation (5). Dependent variable: $tone_{i,t}$. OLS with White (1980) standard errors is used. Bold coefficients are significant at the 10 percent level.

5 Conclusions

In this paper, we analyse the determinants of the tone of speeches by members of the Governing Council. Using an automated text linguistic approach, we create a variable measuring the tone of all 1,618 speeches delivered by GC members during the period 1999M1−2014M4 on a continuous scale from −1 (dovish) to +1 (hawkish). Next, we relate this communication indicator to euro-area and national macroeconomic forecasts. The estimated parameters of this reaction function are indicative of whether the divergence in opinions within the GC is due to different preferences and/or different macroeconomic developments in the euro area.

Our key results are as follows. First, speeches by GC members can be explained by a Taylor-type rule. Both inflation expectations and growth expectations have a positive and significant impact on hawkishness. Second, the euro-area measure of inflation expectations is more relevant than the national indicator. In contrast, GC members put equal weight on euro-area and country-specific growth expectations, which is evidence that different macroeconomic developments have an influence on the words central bankers choose to employ in their speeches. Different preferences are also a source of variation as speeches by the ECB President are, on average, more hawkish than those by other GC members and communications by Finnish, Irish, and Italian (Spanish) central bankers are more dovish (hawkish) than speeches made by German GC members.

Third, the voiced preferences of NCB presidents largely coincide with the independence level their central banks had at the time of the Maastricht Treaty; that is, the presidents of the least independent central banks (prior to the Maastricht Treaty) make the most dovish speeches and vice versa. One interpretation of these findings is that NCBs still follow their old habits despite all the formal reforms undertaken since the Maastricht Treaty. Fourth, country-specific macroeconomic conditions matter for speeches delivered inside the central bankers home country but not for those made abroad. Finally, differences in central banker preferences are the key source of variation in their speeches before the financial crisis, whereas divergent national economic conditions are the main factor during and after the crisis.

Our results have some policy implications. In January 2015, the GC implemented a rotation scheme for voting at each meeting. Similar to the FRB presidents in the FOMC, NCB presidents will participate in all meetings but will not be allowed to vote every time. Consequently, they will need to rely on instruments other than voting to express their views and make an impact on monetary policy. Speeches and interviews are ways of publicly expressing their disagreement with a decision and of exerting some influence

on their voting colleagues. It remains to be seen if this change in the decision-making process will lead to an increase in voiced disagreement.

Finally, our findings have some implications for central bank watchers. When drawing conclusions with respect to the future course of monetary policy, central bank watchers should be aware that GC members seem to make audience-specific adjustments to the gist of their speeches.

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Appendix

Figure A1: National Versus Euro Area 12-Month-Ahead Inflation Expectations

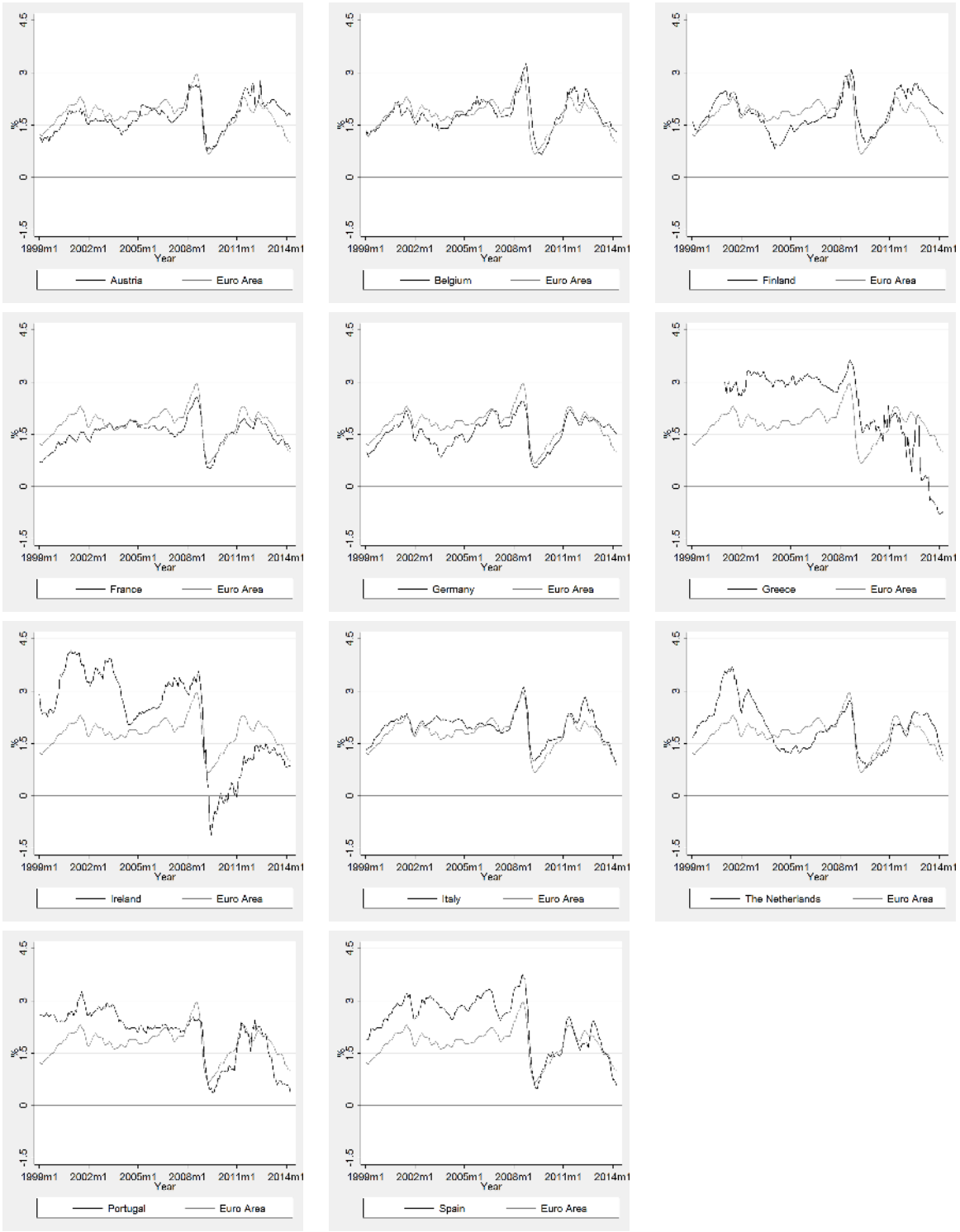

Figure A2: National Versus Euro Area 12-Month-Ahead Growth Expectations

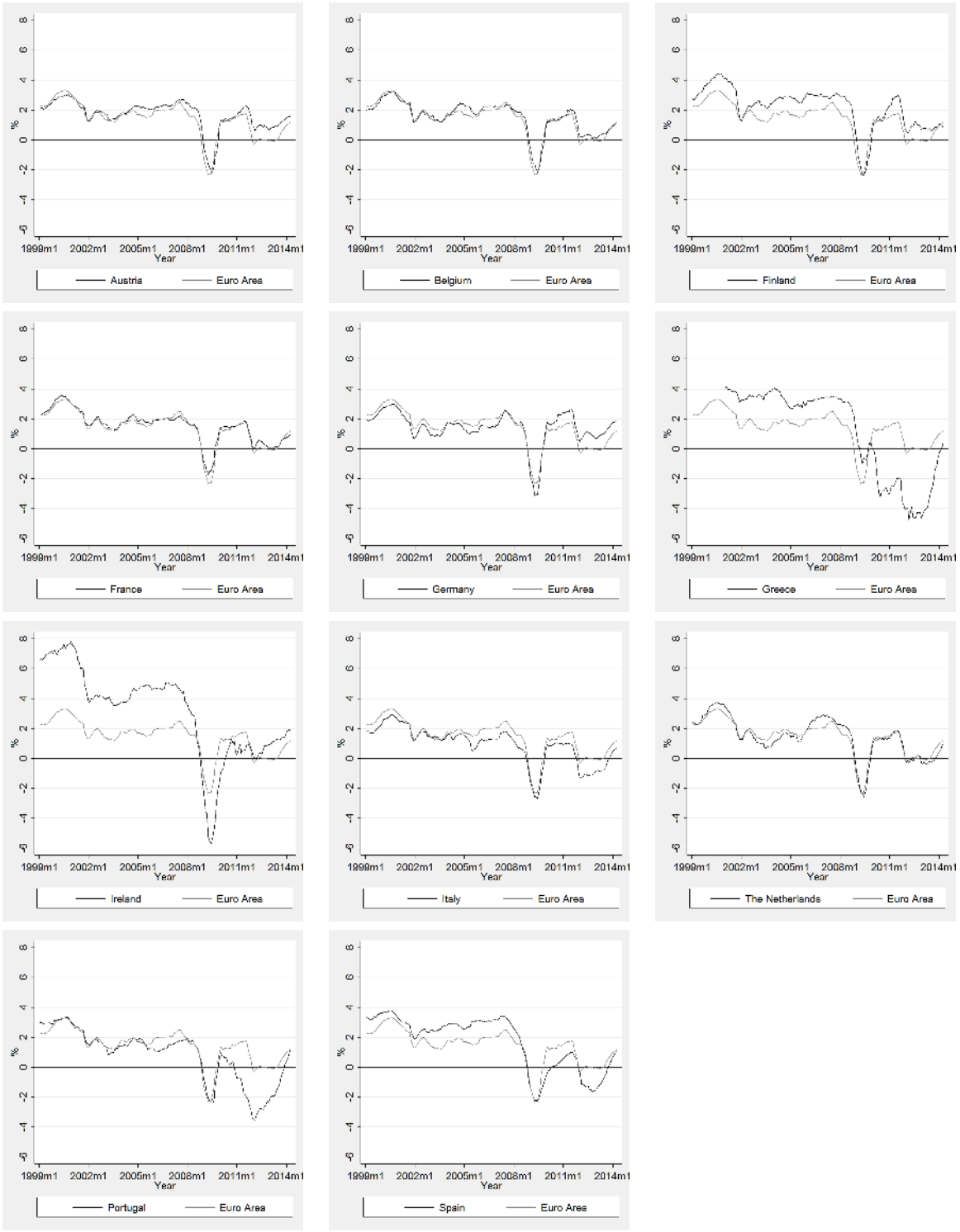

Table A1: Frequency of Speeches per Year and Position/Country

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
By Position																
... President	19	11	4	7	8	20	18	21	18	21	20	15	16	11	7	6
... Exec. Board (excl. Pres.)	7	14	9	3	1	7	6	12	17	59	46	38	56	44	62	8
... NCB Presidents	15	21	15	32	33	43	32	41	54	57	52	53	44	36	43	20
By Country																
... Austria	0	0	0	3	3	5	5	3	5	13	14	10	7	2	3	3
... Belgium	0	0	0	0	0	2	0	1	3	2	1	1	5	10	11	3
... Finland	0	0	0	1	0	2	1	7	7	5	2	3	2	3	5	1
... France	6	12	9	6	5	21	20	24	27	29	27	23	23	23	31	4
... Germany	1	2	3	2	2	8	3	7	8	20	17	16	20	12	25	7
... Greece	0	0	0	1	2	6	7	10	10	15	7	5	1	1	2	4
... Ireland	0	0	0	1	3	3	5	4	5	2	4	9	4	10	8	2
... Italy	15	19	11	12	7	9	9	7	10	24	23	18	24	15	15	7
... The Netherlands	19	11	4	13	13	6	3	4	7	6	7	1	2	3	0	0
... Portugal	0	2	1	2	1	1	0	2	0	0	0	9	9	8	12	3
... Spain	0	0	0	1	6	7	3	5	7	21	16	11	19	4	0	0