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# “National influences inside the ECB: an assessment from central bankers' statements”

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# National influences inside the ECB: an assessment from central bankers' statements

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## Abstract

This paper aims at discovering the national influences inside the Governing Council of the ECB for setting interest rates. We use a textual analysis of national newspaper articles related to each European central banker to analyze their expressed preferences. We proceed to a cluster analysis with the results obtained and find that there were favorable conditions for the emergence of coalitions of central bankers according to their common economic concerns. Next, a Taylor rule of each coalition is estimated as well as their desired interest rate. Finally, we assess the contribution of each coalition in setting the interest rate fixed by the ECB. Our results show that the identified coalitions have an influence inside the Governing Council for setting the interest rate, that is approximately equal to their respective economic weight in the euro area.

*Keywords:* Taylor rule, European Central Bank, monetary policy, cluster analysis, decision making process, coalition formation.

*JEL classification:* D78, E52, E58

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## Introduction

Since the eighties, there is a growing need for the central banks to communicate, for transparency and accountability purposes, Blinder et al. (2008) describe this as a “revolution of thinking”. Indeed, central banks nowadays communicate about the economic outlook and the future path of their policy rates. For the FOMC, the “revolution of thinking” was translated into reality by the adoption of the federal funds rate target in February 1994, the publication of fuller statements (the Monetary Policy Report to the Congress) and the voting records of the committee members. Other central banks became more effective in their communication, among them, the Bank of England, the Riksbank and the Norges Bank. Overall, they use the following forms to convey their messages: press releases and reports, such as the Inflation Report of the Bank of England. Concerning the European Central Bank, we can describe its transparency as more limited (Van Der Crujssen et al., 2010). It uses the traditional tools of communication by making a press conference after every meeting, “the Introductory Statement of the President” and by publishing monthly reports, “the Monthly Bulletin”. However, the ECB has never published voting records nor minutes.

This policy has repercussions on financial actors’ views about the ECB: in a survey held by Goldman Sachs in February 2000, in which financial market participants were asked to rate how well they understand the reasoning behind the monetary policy decisions of four central banks, the ECB received the lowest score. Following the same scheme, De Haan et al. (2004) show survey evidence suggesting that private-sector economists do not consider the ECB as transparent.

Therefore, unlike the Fed, empirical studies never used the ECB communication to understand its inner working e.g., to detect dissenting behaviors among the Governing Council members. There are many pieces of evidence to think that dissent may occur inside the Governing Council of the ECB.

First of all, the institutional framework of the ECB may promote dissenting votes: as a two-tier institution, its Governing Council is made up of the 6 members of the Executive Board and the 17 Presidents of national central banks. However, unlike the Fed, each European central banker has a permanent seat in the ECB Governing Council and holds one vote in the decision-making process. The weight of national representatives is then very high within the ECB Governing Council. They hold 17 votes out of 23 (more than 70%). This mode of governance can then promote the presence of national considerations.

Second, the existence of asymmetries among euro area members may likewise generate dissent. Three types of asymmetries have been identified (Mayes and Viren, 2002): the speed and the size of the propagation of monetary policy changes, the different preferences of central bankers and the different position in the business cycle of the members states.

Moreover, countries like Belgium, the Netherlands, Finland and Ireland have strong trade links with non-euro area countries, meaning that they are more sensitive to foreign shocks. The asymmetry problems are obvious in small open economies where monetary policy has a different impact on the tradable sector from the non-tradable ones. In these economies, raising interest

rates to reduce future inflationary pressures will also impact the exchange rate.

According to the literature on the optimum currency areas, the instruments that can overcome the asymmetries problem in a monetary union are labour mobility, wage and price adjustments or fiscal policy (Mongelli, 2002). However the potential for these tools is limited in the Euro area: while the Stability and Growth Pact imposes economic discipline, it hinders the reliance on fiscal policy by the member states. Moreover, Eichengreen and Ghironi (1995) argue that due to the rigid factor mobility, the fiscal options that could be employed are limited.

These difficulties in adjustment processes may create tensions in the decision-making of the ECB: member states can be affected by adverse impacts. As a consequence, most of the existing studies (De Grauwe et al., 1999; De Grauwe and Piskorski, 2001) support the idea that individual countries will vote for the policy that would be best suited to their own needs and that the compromise may be suboptimal. Moreover, Angelini et al. (2008) suggest that the appropriate policy requires that the monetary authorities react to national developments rather than area-wide aggregates. These results suggest that the assessment of euro-area economic conditions must consider national developments.

This is exemplified by the experience of the Fed where differences in regional economic developments lead to differences in voting behavior in the FOMC. Indeed, Meade and Sheet (2005) find that Fed policymakers take into account regional unemployment when setting the interest rate, and conclude that this result may also be relevant for the ECB in light of the regional differences within the euro area.

Therefore, it is more than likely that dissent may exist inside the Governing Council. Hence, analyzing dissent is an important step for understanding monetary policy and its implications for the euro members (Riboni and Ruge-Murcia, 2011).

This paper proposes to fill the gap in the literature using a new method to detect dissenting behaviors inside the Governing Council of the ECB. It analyzes European central bankers' communication through the media to determine if the Governing Council members have different interests and may create coalitions of central bankers. Then, it estimates a Taylor rule for each coalition to determine their respective influence on the decision-making process of the ECB.

Our results show that the identified coalitions of central bankers have an impact inside the Governing Council, that is equal to the economic weight of the countries that they represent, except for a coalition composed of central bankers representing some peripheral countries that seems to be a losing one.

This paper is organized as follows: Section 1 reviews the literature about European Central Bank communication. In section 2, we describe the methodology and the data. Section 3 analyzes the results and finally section 4 integrates the results in a Taylor rules, while section 5 concludes.

## I Background literature

Regarding the existing literature on the European Central Bank communication, empirical studies can be grouped into three main trends. The first one consists of studies assessing the predictive ability of ECB's officials words for future interest rate changes. Indeed, it is well known that the effectiveness of central bank policy depends on how transparent its communication policy with the market is. Blinder and Wyplosz (2005) argue that the main purpose of central bank talk is to help markets think like the central bank, thus to align expectations and to limit uncertainty. Gaspar et al. (2001) find that the collegial communication of the ECB follows this approach and leads to highly predictable policy decisions.

The second group consists of studies examining differences in communication strategies. Blinder et al. (2008) distinguish three types of committees: individualistic, genuinely collegial and autocratically collegial. The authors characterize the Bank of England's MPC (Monetary Policy Committee) as individualistic, the ECB's Governing Council as genuinely collegial and the Federal Reserve's FOMC under Alan Greenspan as autocratically collegial. Those different types of committees have various communication strategies, depending on the rules of each institution. Finally, there is a large literature emphasizing the impact of communication on financial market variables like exchange rates or interest rates (Ehrmann and Fratzscher, 2003). The issue here is to assess to what extent ECB statements influence market expectations. Rosa and Verga (2005) give a first answer by providing a glossary to translate the qualitative information of the press conference into an ordered scale. They find that the signals sent by the ECB can influence the money market interest rates using just words. On the other hand, Jansen and De Haan (2003) study the effects of statements of ECB officials on the volatility of the euro-dollar exchange rate during the first years of EMU. They find that ECB statements have mainly influenced volatility, while the effects on the level of the exchange rate are small and not persistent.

Turning now to the literature about dissent inside central bank committees, there are rich empirical findings about dissent inside the Fed's FOMC and the UK's MPC. Not only does the literature analyze the rate of dissent inside the FOMC, the MPC and other central banks (Meade, 2005; Spencer et al., 2011) but it also investigates its causes.

The main findings point out the importance of central bankers' preferences as robust determinants for dissent inside the FOMC, the MPC and the central banks of the Czech Republic and Hungary (Horvath et al., 2012). Concerning the Fed, the differences could be explained by different regional affiliation of FOMC members. For the MPC, Spencer et al. (2011) finds that outsiders are more likely to dissent than insiders because of the heterogeneity between them.

Another finding by Chappell et al. (2007) is the leading position of the Chairman inside the committee. The authors have documented a specific influence of the chairman of a MPC and find that in the case of the Fed in the Burn's era (1970-1978), the chairman recommendations made the dissent less frequent. This comes to support Maisel's hypothesis (1973) that "a statement by the Chairman early in an FOMC meeting is influential and can transform the debating atmosphere". Moreover, Chappell et al. (2007) support the idea that the bias (wording that

describes the likelihood of policy shifts in the period between one FOMC meeting and the next) associated with a monetary policy provides the Chairman with the tool to make consensus among the committee members.

The appointment procedures constitute also an important way for politicians to control dissent inside the committee: Belden (1989) suggests that the appointment procedures explain the differences of dissenting votes for Bank presidents and Board members inside the FOMC mechanism. Chappell et al. (1993) confirm this finding: the power to make appointments provides an important channel of systematic partisan influence and democratic appointees favor easier monetary policies than traditional Republicans do.

Furthermore, career concerns may also explain dissent. According to Havrilesky and Schweitzer (1990), FOMC members whose career backgrounds are close to administration have a greater propensity to dissent on the side of easing than those who have different backgrounds. The literature about FOMC members assumes that a background as an academic economist leads members to behave less hawkishly. Finally, Farvaque et al. (2011) find that policy makers' background influence inflation and this influence is greater in inflation-targeting countries.

Concerning the ECB, a first step was made by Jansen and De Haan (2006), who studied the comments made by European central bankers on interest rate, inflation and economic growth. They find that they were often contradictory during the first years of the EMU, but they did not introduce the dissent aspect into their analysis.

However, most of the studies that tried to detect dissent inside the Governing Council used a Taylor rule. The aim was to check the significance of national aggregates in the monetary decision-making of the ECB. Among the empirical findings, Heinemann and Huefner (2004) propose a generalized monetary policy reaction function which allows for the influence of regional divergences. Their results offer weak support for an impact of regional divergence in the ECB decision making. Following the same scheme, Ullrich (2006) investigates the possibility of regional influences on the determination of the policy rate, by estimating Taylor-type reaction function for the period 1999-2005, including country-specific variables of the euro zone member states. She does not find evidence that country-specific economic developments influence the decisions of the ECB Governing Council. Sousa (2009) studies if there were favorable conditions for the emergence of voting coalitions among the Governing Council. According to him, alliances were possible among countries with similar interests, but the strategic position of the Executive Board has defeated them. Hayo and Méon (2011) construct a Taylor rule for each member of the council and for the euro area as a whole. They aggregate the interest rates using several classes of decision-making processes: chairman dominance, bargaining, consensus, voting and voting with a chairman. They find that the most plausible scenario is the one in which individual members of the Governing Council follow national objectives and bargain over the interest rate. This finding is contradictory with the official position of the ECB, which claims that all decisions are taken by consensus using euro area wide aggregates.

However, despite these results and given the absence of minutes from the GC meeting, dissent



has never been truly assessed inside the Governing Council. As a consequence, this paper aims to introduce a novel approach to detect dissent inside the Governing Council of the ECB. Instead of making possibly risky assumptions as in the previous studies, we use the media content to build the appropriate framework for a Taylor decision rule.

## II Methodology

### II.1 Central bankers statements

The particular case of the Euro area, where a unique monetary policy is implemented in a multi-cultural and multi-lingual context, gives the national media a prominent role to convey information about the ECB's policy. Indeed, despite the economic integration of the euro area, a pan-European newspaper and a pan-European public still do not exist.

With the exception of the institutional communication tools (press statements and reports), an important part of the ECB communication takes place through newspaper articles and is generally aimed to the broad public. However, European central bankers are generally quoted only in their home country's media. For example, statements of a governor from France or Spain are almost never cited in German newspapers, while the opinion of the president of Bundesbank is highly considered in German media. This suggests that national public opinion about the ECB in the home country may matter for a European central banker, for reappointments purposes or career concerns. In this context, we suppose that national newspapers are a strong tool for European central bankers to convey their personal views about the monetary policy, the economic outlook and their preferences to their national public. Moreover, we consider that this communication tool does not need to have the shape of the official speech of the institutional statements: in other words, the talk of the European central bankers may be more sincere.

Following this reasoning, we collect national newspaper articles where the names of the European central bankers are quoted, using Factiva database and Europresse database (e.g. "El País" for the Spanish central banker, "Le Monde" for the French central banker). National newspapers were chosen according to the following criteria : their large coverage and their seriousness (See Table 9 in the Appendix).

However, it must be noted that media reports on the ECB's members statements may be influenced. A large literature has emphasized this bias. Heinemann and Ullrich (2007) show that the coverage of the ECB policy in the print media is more negative when inflation is relatively high. According to the authors, the media assumes a monitoring role by evaluating the performance of the central bank. Moreover, the ideological bias or political partisanship may play an important role in conveying information, as was shown by Groseclose and Milyo (2005), who exhibit a strong liberal bias among the American media. Turning to the supply side, Baron (2004) presents a theory in which bias originates when journalists have career interests. Mullainathan and Shleifer (2005) interpret this as a slant towards the biases of their own audiences. This is shown by the paper of De Haan et al. (2004): while it is well known

that the German audience is very sensitive to inflation matter, these authors have emphasized that between 1999 and 2000, the Financial Times (FT) paid little attention to money growth, in contrast to the Frankfurter Allgemeine Zeitung (FAZ), for which money should be given a prominent role in the strategy of the ECB.

## II.2 Textual analysis

The approach of this paper consists in providing a textual analysis of the national newspaper articles for three periods, a test for the period 1999-2012 and for the subperiods 1999-2008 and 2008-2012. The reason for this sampling is that we consider 2008 as a crucial year. Not only did four countries joined the euro area since that year (Cyprus, Malta, Slovakia and Estonia), but the global financial crisis started at that time as well.

Using the dedicated ALCESTE software, the aim of this analysis is to exhibit the opinions of the European central bankers about the economic outlook and to check if there are significant differences among their views and the topics they care about. Indeed, researchers in political science have already used this method to measure the policy positions of political actors from their speeches (Gabel and Huber, 2000; Laver et al., 2003).

Unlike most of the textual analysis softwares, ALCESTE does not need any pre-coding reference document with fixed parameters. In this way, it surmounts the difficulties that may emerge from problems of sampling and coding. This software uses a Hierarchical Decreasing Classification (HDC) by relying upon co-occurrence analysis, which is the analysis of frequent word pairs in a text corpus. This method carries out by successive splits of the text. It finds the strongest vocabulary opposition and then it extracts categories of the most representative statements, while being insensitive to meaning. The goal is to quantify a text so as to extract the most significant structures. Research has shown that these structures are closely linked to the distribution of the words in a text (Benzécri, 1982). In our case, it allows to associate to each European central banker a set of topics and to show his tendency to focus on particular economic topics. It is worth noting that ALCESTE generates categories of word lists automatically, but the topics are a subjective construction of the author, following the meaning of the keywords. A more detailed description is given in the appendix.

We start to classify the topics obtained, our premise being that they are common for the Governing Council members. As word lists are ranked in terms of their statistical significance, we allocate to each of the topics a percentage depending on their respective presence (using  $\chi_2$  values) in the newspaper articles. We consider that this percentage reflects the priority that the central banker has for the topic.

It must be noted that all European central bankers and the ECB presidents are concerned with this analysis, except the Executive Board members, for whom the appointment procedures dispersed across time constitute an obstacle for this analysis.

As far as we know, the only studies that deal with this software in our context are those of

Schonhardt-Bailey (2005) and Schonhardt-Bailey & Bailey (2009). In the first study, the author uses textual analysis of the political texts of Bush and Kerry during the 2004 U.S. presidential election to measure their respective ideas about different topics. In the second study, the authors analyze FOMC transcripts to understand the preferences of policymakers from 1979 to 1999 and find that the strategy of the monetary policy changed through time, as well as the role of bank presidents and board governors inside the FOMC.

### III Results

#### III.1 Results of the Hierarchical Decreasing Classification

After processing ALCESTE, the Hierarchical Decreasing Classification allows us to obtain the following topic categories for which all European central bankers have expressed position:

- ECB Gov. : Governance Framework of the ECB
- Econ. News: Economic and Financial news
- National: Explicitly National Considerations
- Policy: Economic Policies
- Crisis: Euro Area Crisis
- Monet. Pol.: Monetary Policy Indicator
- Pol. Sys.: National or European Political System

Table 1: Results for the period 1999-2012

| Country of the CB    | ECB Gov. | Econ. News | National | Policy | Crisis | Monet. Pol. | Pol. Sys. |
|----------------------|----------|------------|----------|--------|--------|-------------|-----------|
| <b>Austria</b>       | 0%       | 27%        | 24%      | 0%     | 0%     | 36%         | 13%       |
| <b>Belgium</b>       | 0%       | 27%        | 40%      | 0%     | 0%     | 9%          | 24%       |
| <b>Cyprus</b>        | 0%       | 21%        | 31%      | 14%    | 15%    | 0%          | 19%       |
| <b>Finland</b>       | 0%       | 19%        | 7%       | 0%     | 0%     | 0%          | 27%       |
| <b>France</b>        | 0%       | 32%        | 37%      | 0%     | 11%    | 10%         | 10%       |
| <b>Germany</b>       | 0%       | 27%        | 4%       | 7%     | 23%    | 0%          | 35%       |
| <b>Greece</b>        | 0%       | 28%        | 15%      | 33%    | 0%     | 0%          | 24%       |
| <b>Ireland</b>       | 0%       | 30%        | 12%      | 19%    | 13%    | 0%          | 17%       |
| <b>Italy</b>         | 12%      | 23%        | 24%      | 5%     | 4%     | 0%          | 28%       |
| <b>Luxembourg</b>    | 0%       | 49%        | 8%       | 0%     | 22%    | 0%          | 21%       |
| <b>Malta</b>         | 17%      | 59%        | 0%       | 24%    | 0%     | 0%          | 0%        |
| <b>Netherlands</b>   | 9%       | 46%        | 0%       | 0%     | 0%     | 0%          | 18%       |
| <b>Portugal</b>      | 0%       | 45%        | 10%      | 13%    | 0%     | 0%          | 33%       |
| <b>Slovenia</b>      | 0%       | 17%        | 37%      | 0%     | 0%     | 0%          | 46%       |
| <b>Spain</b>         | 0%       | 42%        | 23%      | 12%    | 0%     | 0%          | 24%       |
| <b>Slovakia</b>      | 0%       | 43%        | 25%      | 0%     | 0%     | 0%          | 32%       |
| <b>Estonia</b>       | 0%       | 14%        | 0%       | 25%    | 32%    | 0%          | 29%       |
| <b>ECB president</b> | 0%       | 36%        | 0%       | 0%     | 36%    | 15%         | 13%       |

Table 2: Results for the subperiod 1999-2008

| Country of the CB | ECB Gov. | Econ. News | Crisis | Policy | Monet. Pol. | Pol. Sys. |
|-------------------|----------|------------|--------|--------|-------------|-----------|
| Austria           | 0%       | 19%        | 26%    | 0%     | 13%         | 0%        |
| Belgium           | 0%       | 23%        | 12%    | 0%     | 0%          | 26%       |
| Finland           | 0%       | 25%        | 10%    | 11%    | 0%          | 26%       |
| France            | 0%       | 34%        | 31%    | 9%     | 9%          | 17%       |
| Germany           | 0%       | 53%        | 19%    | 20%    | 0%          | 8%        |
| Greece            | 0%       | 40%        | 0%     | 22%    | 18%         | 21%       |
| Ireland           | 0%       | 27%        | 46%    | 0%     | 9%          | 18%       |
| Italy             | 0%       | 21%        | 29%    | 22%    | 6%          | 16%       |
| Luxembourg        | 23%      | 41%        | 0%     | 0%     | 11%         | 25%       |
| Netherlands       | 0%       | 15%        | 37%    | 0%     | 0%          | 0%        |
| Portugal          | 0%       | 19%        | 24%    | 0%     | 0%          | 58%       |
| Spain             | 0%       | 25%        | 24%    | 10%    | 0%          | 41%       |
| ECB president     | 0%       | 49%        | 0%     | 0%     | 17%         | 35%       |

Table 3: Results for the subperiod 2008-2012

| Country of the CB | ECB Gov. | Econ. News | Crisis | Policy | Crisis | Monet. Pol. | Pol. Sys. |
|-------------------|----------|------------|--------|--------|--------|-------------|-----------|
| Austria           | 0%       | 58%        | 11%    | 0%     | 0%     | 0%          | 32%       |
| Belgium           | 0%       | 31%        | 26%    | 0%     | 0%     | 0%          | 13%       |
| Cyprus            | 0%       | 21%        | 31%    | 14%    | 15%    | 0%          | 19%       |
| Finland           | 18%      | 57%        | 0%     | 0%     | 0%     | 0%          | 25%       |
| France            | 0%       | 26%        | 0%     | 0%     | 40%    | 0%          | 17%       |
| Germany           | 0%       | 14%        | 16%    | 0%     | 18%    | 0%          | 52%       |
| Greece            | 0%       | 12%        | 0%     | 21%    | 20%    | 0%          | 47%       |
| Ireland           | 0%       | 20%        | 16%    | 15%    | 23%    | 0%          | 25%       |
| Italy             | 12%      | 10%        | 20%    | 18%    | 10%    | 0%          | 17%       |
| Luxembourg        | -        | -          | -      | -      | -      | -           | -         |
| Malta             | 17%      | 59%        | 0%     | 24%    | 0%     | 0%          | 0%        |
| Netherlands       | 7%       | 43%        | 9%     | 0%     | 0%     | 0%          | 20%       |
| Portugal          | 0%       | 10%        | 38%    | 13%    | 10%    | 0%          | 32%       |
| Slovenia          | 0%       | 17%        | 37%    | 0%     | 0%     | 0%          | 46%       |
| Spain             | 0%       | 24%        | 45%    | 0%     | 11%    | 0%          | 21%       |
| Slovakia          | 0%       | 43%        | 25%    | 0%     | 0%     | 0%          | 32%       |
| Estonia           | 0%       | 14%        | 0%     | 25%    | 32%    | 0%          | 29%       |
| ECB president     | 0%       | 26%        | 0%     | 18%    | 15%    | 0%          | 31%       |

Tables 1-3 above show the percentages allocated to each of the identified topics by each central banker for the three samples. It is worth noting that a percentage of 0% for a topic does not mean that it does not exist in the articles, but that its presence is not significant. Therefore, the latter does not appear after the classification process.

Interestingly, it appears that the European central bankers care about the same topics, but they are not uniformly distributed in their speeches. Moreover, this distribution differs across time as well. For example, the test for the period 1999-2012 shows that the topic “Economic Policies” represents 33% of the articles related to the Greek central banker, while this topic represents

only 7% of the articles related to the German one. This distribution differs depending on the sample as well, thus, the same topic “Economic policies” represents 22% of the articles related to the Greek central banker and 20% for the German one for the subperiod 1999-2008.

We suppose that if the topics are distributed with a close proportion among two central bankers across the samples, it means that they may have the same economic concerns. For example, considering the topic “Explicitly National Consideration” as an indicator of the asymmetry consequences in the euro area, for the period 1999-2012, it represents 15% of the articles related to the Greek central banker and 4% for the German one, as some central bankers may give more weight to national aggregates than others. The core of this paper remains on this idea, knowing that some central bankers may have more national views than others, they may form a coalition to weigh inside the Governing Council and to impose their decisions. Thus, the central bankers that have the closest distribution of the percentages across the samples are the most prone to form a coalition, considering that they may have the same priorities, as revealed by their statements. However, it is important to remind that this assumption does not mean that this group of central bankers support the same monetary policy (a tightening or an easing), but given that they may share common economic concerns (e.g. national considerations, euro area crisis), they may decide to collude so that these concerns are taken into account when deciding for the interest rate to fix.

The aim now is to check if the different percentages obtained with the classification allow us to detect the presence of coalitions of central bankers inside the Governing Council.

### III.2 Cluster analysis results

Since it seems improbable that a single central banker imposes its decision inside the Governing Council, we can consider that if a group of them share common economic concerns, they may form a coalition in order to have more weight inside the Governing Council and to create a winning majority. To identify groups of central bankers that may form coalitions, we use cluster analysis with the percentages of the topics obtained from the Hierarchical Decreasing Classification. Cluster analysis allows to define coalitions that share the same characteristics i.e., with a close distribution of topics among European central bankers’ statements. This process calculates first the Euclidean distance between the topics of each central banker to determine the closest ones. If we consider that there are  $n$  topics, the Euclidean distance between two central bankers  $x$  and  $y$  is:

$$\sqrt{\sum_{i=topic(1)}^{topic(n)} (x_{topic(i)} - y_{topic(i)})^2 + \dots + (x_{topic(n)} - y_{topic(n)})^2}$$

Then, we use the single linkage hierarchical method to determine the distance between the coalitions. This method calculates the distance between two coalitions as the distance between the two closest elements in the two coalitions (Sibson, 1973):

$$D(X, Y) = \min_{x \in X, y \in Y} d(x, y)$$

Where  $X$  and  $Y$  are two coalitions and  $d(x, y)$  is the distance between the two elements in the two coalitions.

Table 4 details the results of the cluster analysis.

Table 4: Results of cluster analysis

|                                      | <b>1999-2012</b>   | <b>1999-2008</b> | <b>2008-2012</b>      |
|--------------------------------------|--------------------|------------------|-----------------------|
| <b>Northern European coalition</b>   | FI-BE-FR-NL        | BE-FI-AT-NL      | AT-NL-FI-BE           |
| <b>Peripheral European coalition</b> | GR-IE-IT           | FR-GR-IT-IE      |                       |
| <b>Southern European coalition</b>   | ES-PT              | PT-ES            | IE-PT-ECB Pr-ES-IT-GR |
| <b>Isolated Central Bankers</b>      | ECB Pr-AT-MT-DE-LU | LU-ECB Pr-DE     | DE-FR-MT              |

According to the results obtained, there are three stable coalitions of central bankers for all the samples.

-Northern European coalition: The Belgian central banker, the Finnish and the Dutch ones.

-Peripheral European coalition: The Greek central banker, the Irish and the Italian ones.

-Southern European coalition: The Spanish central banker and the Portuguese one.

Moreover, three central bankers seem not to belong to any stable coalition across time.

First, the German central banker seems to be isolated. Indeed, this central banker is distant from the identified coalitions for all the samples. Second, the French central banker seems to be unstable as well. For the sample 1999-2012, he belongs to the Northern European coalition, as its country shares many economic characteristics with the countries composing this coalition. Then, when we proceed to the same analysis for the first subperiod 1999-2008, we notice that the French central banker is rather linked to the Southern European coalition. For the second subperiod 2008-2012, the French central banker is isolated from all the identified coalitions. The particular economic situation at this time may explain this result: as France (like Germany) plays a major role inside the euro area, it seems intuitive that its central banker does not need to belong to any coalition. Finally, the Maltese central banker seems to be isolated from the stable coalitions as well, but he may not play an important role inside the Governing Council but rather be a follower for the winning majority.

A number of central bankers from small countries (Cyprus, Estonia, Slovakia and Slovenia) have unstable positions as well (see Table 10 in the appendix for the complete classification). They take part to different coalitions according to the period of the sample. However, there may be a data bias for those central bankers for the period 1999-2012. Indeed, while the data collection for most of the central bankers started in 1999, it starts in 2007-2008 for those ones (when they joined the euro area). Therefore, we must be careful with the interpretation of their positions across the samples.

Finally, the case of the ECB president is very interesting. For the period 1999-2012, he has an independent behavior by being isolated from the other coalitions, thus respecting the statutes of the ECB by having a euro area wide view. However, the subsamples deliver different results. For the subperiod 1999-2008, the ECB president is very close to the German central banker, this may be due to the particular German position inside the Governing Council and its potential influence on the rest of the board members. But for the period 2008-2012, the ECB president belongs to the Southern European coalition. The particular case of those countries after the economic crisis may explain this result. Indeed, the ECB president may have expressed the same concerns as those central bankers during this period.

From the data, we identified the percentages allocated to the different topics for each European central banker. From the cluster analysis, we have defined a number of coalitions for each sample. The aim is to assess the impact of the coalitions on the decision-making process of the ECB.

## IV The Text-Augmented Taylor rule

### IV.1 The model

The Taylor rule is a policy rule developed by Taylor (1993) and has become a popular tool for evaluating monetary policy of central banks. The initial aim was to describe the monetary policy of the Federal Reserve in the US :

$$i_t = r^* + \Pi_t + \beta(\Pi_t - \Pi^*) + \gamma y_t \quad (1)$$

Taylor (1993) suggested the value of  $\beta$  and  $\gamma$ , the relative weights associated by the central bank to inflation and output stabilization respectively, to be equal to 0.5 for the Fed. He obtained the following Taylor rule:

$$i_t = r^* + \Pi_t + 0.5(\Pi_t - \Pi^*) + 0.5y_t = (r^* - 0.5\Pi^*) + 1.5\Pi_t + 0.5y_t \quad (2)$$

where  $i_t$  is the policy interest rate,  $r^*$  the equilibrium real rate,  $\Pi_t$  the rate of inflation,  $\Pi^*$  the inflation target and  $y_t$  the output gap.

According to Svensson (1999), this rule is the optimal reaction function for a central bank with a backward-looking model. However, Sauer and Sturm (2007) show that a successful stabilization policy needs to be forward-looking. The augmented Taylor rule with forward-looking specification was set by Clarida et al. (2000) within a New Keynesian framework. This function allows us to take into account the prospective behavior of central bankers. Currently considered as an important tool for evaluating the monetary policy, it takes the following form:

$$i_t^* = i_t + \beta(E_t[\Pi_{t+k}] - \Pi^*) + \gamma E_t[y_{t+q}] \quad (3)$$

where  $i^*$  is the desired short-term nominal interest rate and  $i$  its long-run equilibrium value.  $E_t[-]$  is the expectation operator conditional on all the information available at time  $t$ . Furthermore, at least since the nineties, central banks worldwide tend to smooth their policy rates. In that case, it is generally considered necessary for the central bank to smooth the variability of its interest rate through time as abrupt changes can induce troubles in bond markets. Hence, the actual short-term nominal interest rate has to be modeled as a weighted average of the lagged interest rate and the desired interest rate:

$$i_t = \rho i_{t-1} + (1 - \rho) i^* \quad (4)$$

Where the parameter  $\rho$  measures the degree of interest rate smoothing.

If we substitute the second formula in the first one, we obtain:

$$i_t = \rho i_{t-1} + (1 - \rho) i + (1 - \rho) \beta (E_t[\Pi_{t+k}] - \Pi^*) + (1 - \rho) \gamma E_t[y_{t+q}] \quad (5)$$

In this paper, we set a Taylor rule for each stable coalition of central bankers<sup>1</sup> and the isolated ones<sup>2</sup> found in the cluster analysis. The reason for this sampling is that the position of the other central bankers is too unstable through the different periods, mainly because of data bias. It is then better not to take them into account in this analysis.

$$i_t = \rho i_{t-1} + (1 - \rho) i + (1 - \rho) \tilde{\beta}_x (E_t[\Pi_{x,t+k}] - \Pi^*) + (1 - \rho) \tilde{\gamma}_x E_t[y_{x,t+q}] \quad (6)$$

where  $x = \{1, \dots, 5\}$  corresponds to the coalitions and the isolated central bankers.  $\Pi_{x,t+k}$  and  $y_{x,t+q}$  are respectively the expected inflation gap and the expected output gap of the countries of the central bankers that compose the coalition. The aim is to estimate the value of the parameters  $\tilde{\beta}_x$  and  $\tilde{\gamma}_x$  for each coalition using the expected data. Those parameters represent the response of the coalitions to a move of their expected inflation gap and their expected output gap respectively.

Next, we determine the desired interest rate of each coalition  $\bar{i}_x$  using the parameters  $\tilde{\beta}_x$  and  $\tilde{\gamma}_x$  found in the previous regressions, this time with the actual data as explanatory variables.

$$\bar{i}_{x,t} = \rho i_{t-1} + (1 - \rho) i + (1 - \rho) \tilde{\beta}_x (E_t[\Pi_{x,t}] - \Pi^*) + (1 - \rho) \tilde{\gamma}_x E_t[y_{x,t}] \quad (7)$$

At last, we make a final estimation, with the interest rate fixed by the ECB as a dependant variable, and the desired interest rate of each coalition and isolated central banker as independent variables. The goal is to quantify their respective share in setting the actual interest rate fixed by the ECB.

$$i_t = \alpha \bar{i}_{1,t} + \delta \bar{i}_{2,t} + \theta \bar{i}_{3,t} + \lambda \bar{i}_{4,t} + \sigma \bar{i}_{5,t} \quad (8)$$

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<sup>1</sup>Northern European coalition, Peripheral European coalition and Southern European coalition

<sup>2</sup>France and Germany



We consider that the parameters  $\alpha$ ,  $\delta$ ,  $\theta$ ,  $\lambda$  and  $\sigma$  represent the contribution of each coalition and isolated central banker for setting the interest rate of the ECB. If the parameter is above the economic weight of the coalition in the euro area, we suppose that this coalition is a winning one, but if it is far below, it can be considered as a losing coalition.

## IV.2 The Data

The quarterly data used to estimate the Taylor rule of each coalition cover the period from January 1999 to December 2011. The interest rate variable is proxied by the three-month Eonia. The inflation rate is measured by the Harmonized Index of Consumer Prices, the output variable is captured by real GDP (for quarterly data). As some studies on the Taylor rule did not consider the problem of the possible presence of unit roots in the time series (Österholm, 2005), in order to have a robust estimation, we test the null hypothesis of non stationarity of our regressors with the ADF test and use first differences in case the null hypothesis is not rejected, in order to exclude the possibility of spurious regressions.

Unlike most of the empirical studies that use ex-post data for setting the Taylor rule, we use survey data. This comes after the critique of Orphanides (2001) who suggests that the appropriate policy function should use real-time data instead of ex-post data. However, as central bankers form expectations to fix the interest rate, the use of survey data seems more reliable as the monetary policy needs some lags to be effective. For this purpose, we follow the lag proposed by Fourçans & Vranceanu (2004), 6 months for the inflation rate and 6 months for the output gap. However, forward-looking variables may be correlated with the error term, leading to biased estimates. Therefore, these variables must be instrumented. Moreover, the instruments used should signal future prices and output developments, while being uncorrelated with the error term. We follow the literature, by using a constant and the lagged independent variables as instruments, lags 1 to 3 of the inflation gap and the output gap. We also consider the lags of some instruments that the ECB may take into account in its monetary policy:

-The money growth M3, as the monetary condition in the euro area is explicitly considered as one pillar by the ECB to set its strategy. Money growth is measured by the quarterly percentage change of M3 in the euro area.

-The exchange rate variable is also important, as the ECB targets “long-run inflation”, a measure of inflation adjusted to remove effects of exchange rate movements for the open economies in the euro area. As exchange rate variable we use the quarterly growth rate of the nominal dollar exchange rate with the euro.

We use the General Method of Moments (GMM) estimator, as it accounts for endogeneity biases and non-spherical errors (Clarida et al., 1999; Siklos and Bohl, 2009). The condition for the validity of the instruments is their exogeneity with respect to the central bank decisions, hence, their uncorrelatedness with the disturbances. We make a Hansen-Sargan test on over-identifying restrictions as we have more instruments than parameters to estimate (Shea, 1997). The null hypothesis is that the instruments are valid (i.e. they are orthogonal to the error term) and the

model is correctly specified. The instruments appear to be robust as the null hypothesis of the validity of instruments cannot be rejected for all the estimations. Moreover, research shows that the use of weak instruments can lead to substantial biases. Stock and Yogo (2002) propose a test of weak instruments based on the F-test value of the first stage regression in a two-stage least square procedure to identify the weak instruments. The instruments seem to be highly relevant regarding the values of the F-test obtained in the estimations.

The inflation rate and the output gap of the countries composing the coalitions are extracted from the European Economy publication from the Directorate General for Economic and Financial Affairs (ECFIN) of the European Commission. Series are published twice a year (in spring and autumn), and include forecasts of output gap and inflation rate with a quarterly profile for each country of the euro area. In this way, European central bankers have real time forecasts for every following period with the corresponding lag used in our model (6 months). Finally, the exchange rate and the monetary aggregate M3 for the euro area are extracted from the Eurostat database.

Concerning the final estimation, we use the Ordinary least squares method. We make a Chow test for each quarter of 2007 and 2008 to check if there is a structural break during that time regarding the euro debt crisis, the null hypothesis of no structural break cannot be rejected for all the estimations. This is confirmed by the CUSUM test that shows the constancy of the coefficients in our model (Figure 1 in the appendix). Moreover, the null hypothesis of normal distribution cannot be rejected as well, then the model fits well the data in our estimation (Figure 2 in the appendix). Finally, the White and the Durbin-Watson test show that the residuals are homoscedastic and uncorrelated. The null hypothesis of homoscedasticity cannot be rejected and the value of the Durbin-Watson statistic is close to 2. Therefore, the OLS method seems to be the most reliable one.

### IV.3 Estimation results

We start by estimating the value of the parameters linked to the inflation gap ( $\beta$ ) and the output gap ( $\gamma$ ) for the stable coalitions and the isolated central bankers. Table 5 below gives the results of the GMM regression.

Table 5: GMM estimation for the period 1999-2012

| Explanatory variable        | Parameter | NEC               | PEC                | SEC               | France            | Germany           |
|-----------------------------|-----------|-------------------|--------------------|-------------------|-------------------|-------------------|
| c                           |           | -0,01<br>(0,22)   | 0,38<br>(0,24)     | 0,03<br>(0,11)    | 0,02<br>(0,1)     | 0,06<br>(0,13)    |
| $i_{t-1}$                   | $\rho$    | 0,76<br>(0,05)*** | 0,84<br>(0,08)***  | 0,90<br>(0,02)*** | 0,91<br>(0,02)*** | 0,94<br>(0,03)*** |
| $E_t[\Pi_{t+2}]$            | $\beta$   | 0,64<br>(0,10)*** | 1,72<br>(0,32)***  | 0,57<br>(0,09)*** | 0,65<br>(0,08)*** | 0,70<br>(0,09)*** |
| $E_t[y_{t+q}]$              | $\sigma$  | 1,27<br>(0,25)*** | -3,09<br>(0,80)*** | 0,12<br>(0,16)    | 0,88<br>(0,15)*** | 0,77<br>(0,23)*** |
| No. of observations         |           | 51                | 51                 | 51                | 51                | 51                |
| J-statistic ( $\rho$ value) |           | 0,63              | 0,79               | 0,64              | 0,43              | 0,80              |

Note that GMM estimates \*/\*\*/\*\* denote significance at the 10%, 5% and 1% level, standard errors in parenthesis.

The results of the GMM estimation show that the parameters  $\beta$  and  $\sigma$  linked to the inflation gap and the output gap respectively have the right sign and are highly significant for most of the explicative variables. Moreover, the inflation parameter does not exceed 1 i.e., the so-called Taylor principle is not fulfilled: the Governing Council moves to accommodate changes in inflation, but does not increase it sufficiently to keep the real interest rate from declining. The only exception for this observation concerns the Peripheral European coalition, for which the parameter  $\beta$  is above one and the parameter  $\sigma$  has the wrong sign. Overall, we can conclude that a rise in the expected inflation gap or output gap leads to a rise of the interest rate inside the Governing Council.

The aim now is to estimate the desired interest rate of each coalition and isolated central banker, using the equation (7) and the parameters  $\beta$  and  $\sigma$  found in the previous regression with actual data as explanatory variables, instead of the expected data as in the previous regression. The results are detailed in the appendix (Table 11). The objective is to show the proximity between the desired interest rate of each group of central bankers with the actual interest rate fixed by the ECB.

Table 6 below shows the results.

Table 6: Average of the difference between the desired interest rate and the actual one

|                                  | NEC  | PEC  | SEC  | France | Germany |
|----------------------------------|------|------|------|--------|---------|
| <b>Average of the difference</b> | 0,25 | 0,51 | 0,72 | -0,12  | -0,33   |

The results obtained come to confirm the findings of previous empirical studies about the desired interest rate of countries in the euro area if national central banks had not given up control over monetary policy. Indeed, except for France and Germany, all the countries tend to have a national target interest rate above the ECB interest rate. Meanwhile for France and Germany, their national interest rate tend to be below the euro one (Hayo, 2007; Moons and Van Poeck, 2007; Mignon et al., 2009). In other words, almost all countries in this simulation would

have experienced more restrictive monetary policies than under the ECB regime. However, this method does not tell us about the influence of each of those coalitions in setting the interest rate. A more efficient method to exhibit their respective weights inside the Governing Council would be to use the Ordinary least squares method, with the Eonia as a dependant variable and the desired interest rate of each coalition and isolated central banker as independent variables. This method enables us to show the contribution of each group of central bankers in setting the interest rate.

Table 7: OLS regression

| <b>Explanatory variables</b>  | <b>Parameter</b> | <b>(1)</b>       |
|-------------------------------|------------------|------------------|
| Constant                      |                  | 0,26<br>(0,11)** |
| Northern European coalition   | $\alpha$         | 0,37<br>(0,16)** |
| Peripheral European coalition | $\delta$         | 0,12<br>(0,01)   |
| Southern European Coalition   | $\theta$         | 0,15<br>(0,71)   |
| France                        | $\lambda$        | 0,40<br>(0,17)*  |
| Germany                       | $\sigma$         | 0,63<br>(0,27)** |
| N of observations             |                  | 50               |
| R squared                     |                  | 0,96             |

The results show that all the coalitions and the isolated central bankers have a significant influence inside the Governing Council for setting the interest rate, their parameters are positive and significant for most of them. In this analysis, the value of each parameter linked to a group of central bankers tells us about its respective influence inside the Governing Council. We notice that the latter can vary considerably among them. We consider that if the value of the parameter is high, it means that the corresponding coalition has a high influence to fix the interest rate. However, it is necessary to harmonize them, thus to be able to make a comparison between this parameter, that represents the contribution of each group of central bankers for fixing the interest rate, with the economic weight of their respective countries inside the euro area.

Table 8 below details the results.

Table 8: Comparison between the parameters and the economic weight of the coalitions

|   | <b>NEC</b> | <b>PEC</b> | <b>SEC</b> | <b>France</b> | <b>Germany</b> | <b>Total</b> |
|---|------------|------------|------------|---------------|----------------|--------------|
| Contribution in setting the interest rate | 19,47%     | 6,32%      | 7,89%      | 21,05%        | 31,58%         | 86,32%       |
| Economic weight                           | 12,07%     | 21,25%     | 12,61%     | 21,26%        | 28,52%         | 95,70%       |
| Difference                                | 7,41%      | -14,93%    | 4,71%      | -0,20%        | 3,06%          | -9,38%       |

We notice that the contribution of the German central banker and the French central banker in setting the interest rate is approximately the same as the economic weight of their respective

countries: as they are the most important economies in the euro area, they seem to be the most influential inside the Governing Council as well. Their share in setting the interest rate of the ECB is 31% and 21% respectively. The same observation holds for the coalitions of central bankers, with the exception of the Peripheral European coalition: their influences inside the Governing Council is not significantly different from their economic weight, the difference lies between 5% and 7%. Finally, the coalition corresponding to the Peripheral European one seems to be a losing one, indeed, its contribution in setting the interest rate is far below its economic weight, the difference between the two of them is significant (-15%).

Therefore, according the results obtained, the isolated central bankers (France and Germany) and the Northern and Southern coalition have an influence inside the Governing Council that is roughly equal to their economic weight in the euro area, however, we can describe the Southern European coalition as a losing one.

## Conclusion

This paper intends to address the question of the impact of national influences inside the Governing Council of the ECB. For this purpose, we make a textual analysis of the European central bankers' comments in the national newspaper articles to reveal their preferences, we then uses a cluster analysis with the results obtained to show if groups of central bankers may collude according their common economic concerns. We set a Taylor rule for each of those coalitions to exhibit their desired interest rate. Finally, we estimate the weight of each of the identified coalitions in setting the interest rate and compare it with their respective economic weight. The results show that the coalitions have an influence inside the Governing Council that is equal to their economic weight in the euro area, except for the Peripheral European coalition that seems to have a weak impact.

Further research should try to model the preferences of the Executive Board members to determine their positions and their weights inside the Governing Council, would the data be available.

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## APPENDIX

### APPENDIX A

Table 9: National newspapers selected

| National newspaper              | Country of origin | Political alignment  |
|---------------------------------|-------------------|----------------------|
| De Telegraaf                    | Netherlands       | Liberalism           |
| Le Monde                        | France            | Center-left          |
| Corriere della Serra            | Italy             | Social liberalism    |
| El pais                         | Spanish           | Center-left          |
| Süddeutsche Zeitung             | Germany           | Liberal-conservative |
| Dirio de Notcia                 | Portugal          | Centrist             |
| Suomen Tietotoimisto            | Finland           | Neutral              |
| Der Standard                    | Austria           | Social liberalism    |
| De Standaard                    | Belgium           | Neutral              |
| Athens news                     | Greece            |                      |
| The Irish Times                 | Ireland           | Social liberal       |
| Postimees                       | Estonia           |                      |
| Cyprus mail                     | Cyprus            | Independant          |
| Luxemburger Wort                | Luxembourg        | Centre-right         |
| Times of Malta                  | Malta             | Centre-right         |
| Slovenka tiskovna agencija      | Slovenia          | Centre-right         |
| SITA Slovenska Tlacova Agentura | Slovakia          | Centre-right         |

Table 10: Results of cluster analysis

|                                      | 1999-2012    | 1999-2008    | 2008-2012                   |
|--------------------------------------|--------------|--------------|-----------------------------|
| <b>Northern European coalition</b>   | FI-BE-FR-NL  | BE-FI-AT-NL  | SI-AT-NL-FI-SK-BE           |
| <b>Peripheral European coalition</b> | GR-IE-CY-IT  | FR-GR-IT-IE  |                             |
| <b>Southern European coalition</b>   | ES-SK-PT     | PT-ES        | CY-IE-PT-ECB Pr-ES-IT-EE-GR |
| <b>Fourth coalition of CBs</b>       | DE-EE-LU-SI  |              |                             |
| <b>Isolated Central Bankers</b>      | ECB Pr-AT-MT | LU-ECB Pr-DE | DE-FR-MT                    |

Table 11: The desired interest rate of each coalition and isolated country

|                | <b>Eonia</b> | <b>NEC</b> | <b>PEC</b> | <b>SEC</b> | <b>France</b> | <b>Germany</b> |
|----------------|--------------|------------|------------|------------|---------------|----------------|
| <b>1999 Q1</b> | 3,98         | 4,42       | 2,22       | 4,04       | 4,14          | 4,11           |
| <b>1999 Q2</b> | 3,77         | 4,31       | 3,91       | 3,96       | 4,08          | 4,00           |
| <b>1999 Q3</b> | 3,79         | 4,10       | 2,29       | 3,78       | 3,90          | 3,85           |
| <b>1999 Q4</b> | 3,38         | 4,14       | 2,93       | 3,75       | 3,88          | 3,83           |
| <b>2000 Q1</b> | 3,06         | 3,75       | 3,03       | 3,36       | 3,46          | 3,42           |
| <b>2000 Q2</b> | 2,61         | 3,06       | 2,34       | 2,98       | 3,09          | 3,10           |
| <b>2000 Q3</b> | 2,46         | 2,78       | 2,54       | 2,54       | 2,63          | 2,61           |
| <b>2000 Q4</b> | 2,83         | 2,64       | 2,05       | 2,43       | 2,57          | 2,49           |
| <b>2001 Q1</b> | 3,28         | 2,98       | 2,23       | 2,79       | 2,93          | 2,93           |
| <b>2001 Q2</b> | 3,97         | 3,29       | 3,77       | 3,26       | 3,35          | 3,31           |
| <b>2001 Q3</b> | 4,44         | 3,97       | 3,92       | 3,97       | 4,03          | 3,98           |
| <b>2001 Q4</b> | 4,81         | 4,45       | 4,23       | 4,43       | 4,45          | 4,48           |
| <b>2002 Q1</b> | 4,84         | 4,77       | 4,53       | 4,76       | 4,86          | 4,79           |
| <b>2002 Q2</b> | 4,75         | 5,06       | 4,61       | 4,77       | 4,88          | 4,87           |
| <b>2002 Q3</b> | 4,33         | 4,70       | 4,21       | 4,63       | 4,74          | 4,76           |
| <b>2002 Q4</b> | 3,61         | 4,23       | 4,25       | 4,17       | 4,25          | 4,29           |
| <b>2003 Q1</b> | 3,28         | 3,51       | 3,24       | 3,50       | 3,58          | 3,57           |
| <b>2003 Q2</b> | 3,33         | 3,39       | 3,16       | 3,23       | 3,29          | 3,30           |
| <b>2003 Q3</b> | 3,30         | 3,51       | 3,31       | 3,29       | 3,38          | 3,37           |
| <b>2003 Q4</b> | 3,23         | 3,47       | 2,29       | 3,28       | 3,33          | 3,33           |
| <b>2004 Q1</b> | 2,77         | 3,56       | 2,89       | 3,19       | 3,23          | 3,22           |
| <b>2004 Q2</b> | 2,44         | 3,02       | 2,56       | 2,70       | 2,78          | 2,76           |
| <b>2004 Q3</b> | 2,07         | 2,65       | 2,22       | 2,37       | 2,43          | 2,41           |
| <b>2004 Q4</b> | 2,01         | 2,30       | 1,64       | 2,02       | 2,12          | 2,06           |
| <b>2005 Q1</b> | 2,02         | 2,11       | 2,00       | 1,99       | 2,03          | 2,01           |
| <b>2005 Q2</b> | 2,04         | 2,28       | 1,37       | 2,02       | 2,05          | 2,06           |
| <b>2005 Q3</b> | 2,05         | 2,30       | 1,94       | 2,00       | 2,08          | 2,08           |
| <b>2005 Q4</b> | 2,08         | 2,26       | 1,53       | 2,02       | 2,12          | 2,06           |
| <b>2006 Q1</b> | 2,07         | 2,48       | 1,45       | 2,02       | 2,14          | 2,14           |
| <b>2006 Q2</b> | 2,07         | 2,29       | 1,71       | 2,00       | 2,14          | 2,13           |
| <b>2006 Q3</b> | 2,07         | 2,30       | 1,71       | 2,02       | 2,08          | 2,12           |
| <b>2006 Q4</b> | 2,15         | 2,41       | 1,97       | 2,07       | 2,17          | 2,15           |
| <b>2007 Q1</b> | 2,40         | 2,68       | 1,00       | 2,17       | 2,24          | 2,20           |
| <b>2007 Q2</b> | 2,64         | 2,70       | 2,64       | 2,41       | 2,49          | 2,44           |
| <b>2007 Q3</b> | 2,94         | 3,02       | 2,63       | 2,66       | 2,72          | 2,69           |
| <b>2007 Q4</b> | 3,37         | 3,30       | 2,63       | 2,94       | 2,99          | 2,96           |
| <b>2008 Q1</b> | 3,61         | 3,41       | 3,88       | 3,32       | 3,37          | 3,42           |
| <b>2008 Q2</b> | 3,86         | 3,54       | 4,27       | 3,55       | 3,53          | 3,58           |
| <b>2008 Q3</b> | 4,05         | 3,62       | 4,28       | 3,78       | 3,78          | 3,83           |
| <b>2008 Q4</b> | 3,95         | 3,38       | 5,12       | 4,02       | 3,92          | 3,94           |
| <b>2009 Q1</b> | 4,05         | 2,97       | 5,06       | 4,01       | 3,86          | 3,79           |
| <b>2009 Q2</b> | 4,00         | 3,91       | 4,14       | 4,17       | 4,11          | 4,09           |
| <b>2009 Q3</b> | 4,25         | 4,57       | 3,89       | 4,17       | 4,11          | 4,10           |
| <b>2009 Q4</b> | 3,15         | 4,18       | 3,92       | 4,24       | 4,25          | 4,25           |
| <b>2010 Q1</b> | 1,38         | 2,96       | 2,61       | 3,03       | 3,03          | 3,09           |
| <b>2010 Q2</b> | 0,77         | 1,75       | 1,45       | 1,34       | 1,37          | 1,45           |
| <b>2010 Q3</b> | 0,36         | 0,73       | 0,88       | 0,73       | 0,77          | 0,80           |
| <b>2010 Q4</b> | 0,36         | 0,65       | 0,97       | 0,34       | 0,39          | 0,39           |
| <b>2011 Q1</b> | 0,34         | 0,47       | 0,25       | 0,29       | 0,43          | 0,41           |
| <b>2011 Q2</b> | 0,35         | 0,29       | -0,61      | 0,28       | 0,34          | 0,35           |
| <b>2011 Q3</b> | 0,45         | 0,31       | 1,06       | 0,31       | 0,37          | 0,37           |

## APPENDIX B

Figure 1: The Cusum test with the OLS residuals

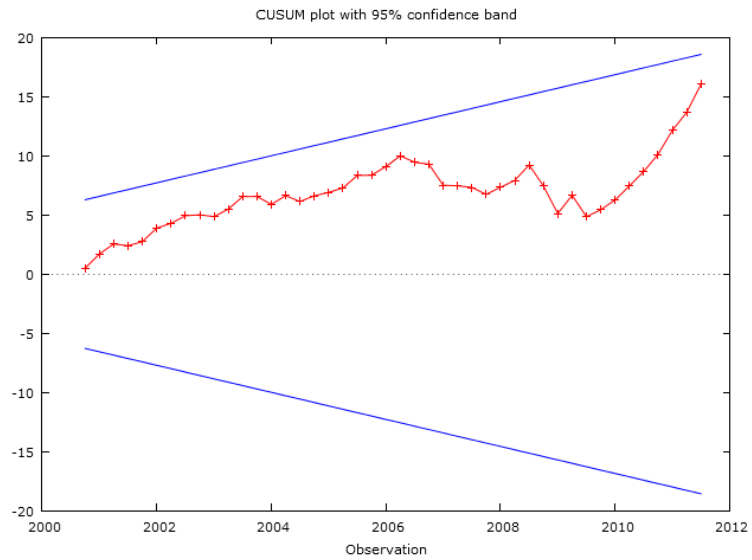
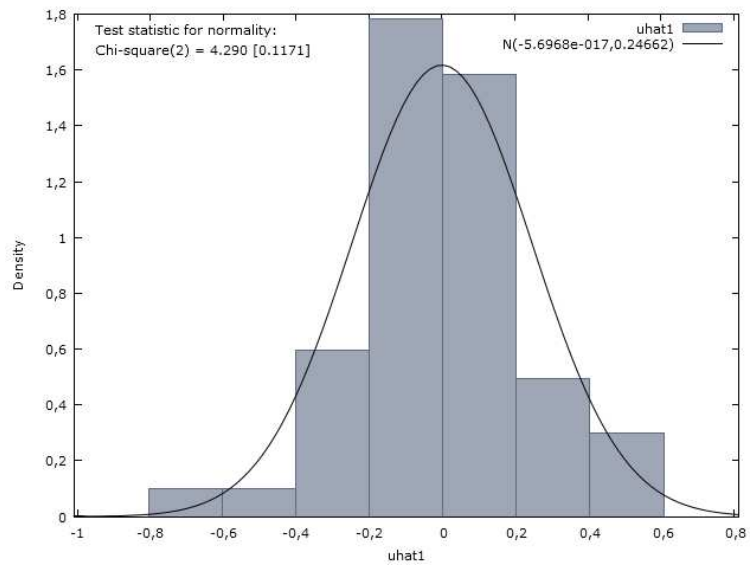


Figure 2: Normality test of residuals



## APPENDIX C

### ALCESTE Methodology

ALCESTE was developed by Max Reinert in 1983 and was mainly used in human and social sciences like sociology, psychology and political science (Reinert et al., 1995; Lahlou, 1996; Schonhardt-Bailey, 2005). This software combines textual and statistical features, it identifies a speaker’s association of ideas and main arguments following his discourse. This can be correlated with others characteristics (political affiliation...). For this purpose, the software relies upon co-occurrence analysis, which is the statistical analysis of frequent word pairs in a text corpus, in order to realize a Hierarchical Decreasing Classification (HDC) process: this process uses a methodology that combines different statistical methods like segmentation, hierarchical classification and dichotomization.

ALCESTE starts by classifying words distribution within a text, to obtain a classification of simple statements and to reveal the keywords, which in turn are distinguished as word classes that reveal different forms of discourses in the speech. ALCESTE uses its dictionary to distinguish the forms of the words and uses the “content words” that carry all the information about the meaning of the discourse. It creates a data matrix to quantify the presence of these content words in the corpus. Then, it uses a Hierarchical Decreasing Classification to identify word classes using these content words. It is worth noting that ALCESTE cannot analyze corpora with multiple discrete topics, therefore the textual data must be consistent and large enough. Following an iterative process, the HDC process decomposes the classes until the iteration fails to result in further divisions.

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