Revealing the ECB's Decision Rule

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Very preliminary version.

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Abstract: This paper aims to determine the decision rule that the Governing council of the ECB uses to set interest rates. We construct a Taylor rule for each member of the council, and aggregate the interest rates that they produce using several classes of decision-making mechanisms: chairman dominance, bargaining, voting, and voting with a chairman. We test scenarios where individual members of the council pursue either a national or federal objective. We then compare the interest rate predicted by each scenario with the observed evolution of the euro area's interest rate. We find that the scenario that performs the best is the scenario where individual members follow national objectives, bargain over the interest rate, and their weights are given by the share of their country in the zone's GDP.

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1. Introduction

Like most other central banks, the European System of Central Bank (ESCB) determines monetary policy in the European Monetary Union (EMU) based on decisions by a monetary policy committee. According to Blinder (2004) only New Zealand, Norway, and Malta, and possibly Canada, delegate their monetary policy to a single governor rather than a committee. Decisions in the ESCB are made by the Governing Council, which consists of the central bank governors of member countries, who are appointed by the respective government of the countries, and the six members of the European Central Bank (ECB) Executive Board, who are appointed by the European Council.

Like in any other committee, individual members of the ESCB Governing Council may disagree on monetary policy decisions. Possible reasons for disagreement are that committee members have different information about the state of the economy, different economic models, and different personal backgrounds, resulting in different views about adequate policies. For instance, Gerlach-Kristen (2003), Spencer (2006), Bhattacharjee and Holly (2006), or Besley et al. (2008) document differences between the positions of the members of the Monetary Policy Committee of the Band of England with different personal backgrounds.

Moreover, in a federally-organised central bank, like the ESCB, preferred policy choices of Governing Council members may differ because they represent different countries, with different business cycles and different economic problems. Such differences have been documented for the Federal Reserve Bank's (Fed) Federal Open Market Committee (FOMC) by Gildea (1992), Meade and Sheets (2005), or Chappell et al. (2008). Gildea (1992) finds that the evolution of unemployment in the regions represented by the Fed presidents helps predict their votes in the FOMC. Meade and Sheets (2005) reach similar conclusions, not just for regional Fed presidents but also for members of the Board of Governors, who are supposed to represent only federal interests.

It appears likely that regional interests will play a role in a monetary union such as the EMU that is relatively new and consists of largely autonomous states. Yet, the ESCB's Governing Council has never openly acknowledged such disagreements. On the contrary, it

has officially always reached its decisions by consensus (see ECB press statements). Nevertheless, voting is explicitly envisaged in article 10.2 of the ESCB statutes. To cope with the forthcoming enlargements of the union and the ensuing increased size of the Governing Council, a new rotation principle was developed in 2003 and ratified by EMU member countries in 2004 to replace simple majority voting. It was originally planned to come into existence after EMU increased to 15 members. Interestingly, before it would come to that, the rotation principle was amended in 2009 and it is now envisaged to come into force when the number of EMU member countries reaches 18. Thus, there appears to be a clear reluctance to discard the one-country-one-vote principle, which suggests that member countries fear that monetary policy may be less fitting to their needs in the case that they can no longer cast a vote. In spite of these considerations, the official position of the ESCB is that the members of the council had never resorted to voting to make a decision.

Still, one may doubt that the Governing Council can avoid to vote, when other MPCs vote. Fry et al. (2000) remark that 36 out of the 79 banks in their sample do make their decisions by formal voting. The Bank of England even publishes the voting records of its MPC. Moreover, one could even see a contradiction between the statement that the Governing Council always decides by consensus and the introduction of a new voting rule to accommodate new members. If consensus was the only way to make a decision then voting rules would simply be irrelevant.

Additional doubts are raised by the fact that, unlike other central banks, the ECB does not publish minutes of Governing Council meetings. Potentially existing disagreements are thereby kept behind a diplomatic veil. For outsiders, it is thus impossible to observe disagreements among Governing Council members, nor how such likely disagreements are overcome. In fact, the ECB does not even reveal the actual decision mechanism that it uses to reach its decisions.

Nevertheless, a large body of theoretical contributions emphasises the importance of the decision rule used by monetary policy committees, because the chosen decision rule determines the extent to which symmetric monetary policy impulses by the ECB and asymmetric national shocks affect the economies of the member countries and therefore economic welfare. Some contributions have considered differences in preferences, in the

structure of member economics, or in shocks. For instance, Alesina and Grilli (1992), Montoro (2007), or Riboni and Ruge-Murcia (2010) focus essentially on differences in inflation aversion among committee members. Aksoy et al. (2002), Hefeker (2003), and Arnold (2006) emphasize structural differences across countries. Others, such as von Hagen and Süppel (1994), Matsen and Røisland (2005), or Farvaque et al. (2009), focus on differences in shocks across member countries. The common message of those papers is that decision rules in MPCs matter, especially in a federal monetary union.

However, our knowledge of the actual decision making mechanisms used by the ESCB lags very much behind the sophistication of theoretical contributions. As no information is published on the debates of the Governing Council, its decisions are analysed from an aggregate, namely federal, point of view. Accordingly, most researchers study the ECB's monetary policy by estimating interest rate reaction functions or Taylor rules, relating the economic situation of the euro zone to observed interest rates. There exist a number of studies, which estimate such an aggregate reaction function for the euro area (Gerlach and Schnabel, 2000, Mihov, 2001, Doménech et al., 2002, Fourçans and Vranceanu, 2004, Gerdesmeier and Roffia, 2004, Clausen and Hayo, 2005, Hayo and Hofmann, 2006, Gerlach, 2007). These studies differ a lot in terms of theoretical assumptions, empirical implementation, and, perhaps not surprisingly, also with regard to the results found. More recent studies investigate the issue of asymmetric reactions in the ECB Taylor rule (Surico 2007, Castro 2010, Ikeda 2010) and find some evidence thereof.

Some contributions consider the connection between national interests and the policy of the ECB. The focus is on the question of whether the ECB looks at aggregate euro area only, or may also cater to the needs of particular countries. Heinemann and Huefner (2004) find that regional divergences help explain ECB interest rate decisions, which suggests that the Governing Council does not only look at aggregate data. Other studies find similar evidence and suggest that the ECB places a disproportionately high weight on economic conditions in the bigger EMU member countries, in particular France and Germany (von Hagen and Brückner, 2001, Kool, 2006). In contrast to these findings based on data from the early phase of EMU, Sturm and Wollmershäuser (2008) report that economic conditions in small member countries receive more than proportional weights in actual ECB monetary

policy decisions. Sousa (2009) assumes that national representatives in the Governing Council take into account national perspectives when they vote on interest rate decisions, and discovers evidence that the emergence of voting coalitions is likely. He argues, however, that the current strong strategic position of the Executive Board is sufficient to deter such coalitions to affect the actual conduct of monetary policy. Riboni and Ruge-Murcia (2010) show for five central banks, including the ECB, that the consensus model, i.e. where no member has proposal power and a majority greater than simple majority and is required for a policy change, fits actual policy decisions better than the alternative models, namely agenda setting power, simple majority, and dictator. However, Riboni and Ruge-Murcia (2010) do describe the institutional details of decision making in the euro zone, and simply assume that the ESCB is a collection of representatives of its largest countries. Finally, Bénassy-Quéré and Turkish (2009) consider the aggregation of national interests within the Governing Council. They estimate the counterfactual optimal interest rates that would be set by member countries under monetary policy autonomy based on *a priori* postulated national Taylor rules to simulate the ECB's interest rate path implied by its new rotating decision-making system. However, they cannot compare simulated interest rates to actual ones, because their study is a counterfactual of a mechanism that, so far, has not been implemented. Therefore, their analysis does not tell us anything about the status quo of decision making in the Governing Council and instead analyses what its policy look like if the ECB used the rotation system.

The aim of the present paper is to infer the actual decision voting mechanism from the past decisions made by the ECB using a novel approach. The idea is to estimate national Taylor rules using historical data to produce counterfactual national interest rate paths and an interest rate path corresponding to the rate that would be chosen by a policymaker concerned by the development of the euro zone only. These counterfactual interest rate paths are then aggregated using different decision procedures and various assumptions regarding the preferences of members of the governing council to produce hypothetical interest rates that can be compared to the historical interest rates chosen by the ECB's governing council. We consider four important decision procedures: (i) full chairman dominance, (ii) one man, one vote, (iii) several versions of bargaining, and (iv) agenda-setting power of president, under different assumptions about the behaviour of Executive Board members. By comparing the fit

of hypothetical interest rates to observed one, we can determine the decision rule that best describes the decisions of the ECB.

Our results show that of all the scenarios that we consider, the one that performs the best is the scenario where individual members follow national objectives, bargain over the interest rate, and their weights are given by the share of their country in the zone's GDP.

The rest of the present paper is organised as follows. The next section describes the econometric strategy used to produce counterfactual national interest rates, and the various decision rules applied to aggregate national rates. The third section describes our empirical results, whereas the fourth section contains robustness checks. The last section concludes.

2. Empirical approach

It has become common to operationalise monetary policy actions by a short-term interest rate. This variable is easy to obtain and setting interest rates is perceived to be the common practice of central banks (Borio, 1997). John Taylor's (1993) attempt to describe interest rate setting in terms of a monetary policy reaction function has been widely adopted. In such a so-called 'Taylor rule', the short-term nominal interest rate, representing the central bank's monetary policy instrument, responds to deviations of inflation and output from their target levels. The first step in our analysis consists of constructing counterfactual Taylor rules for the EMU member countries. The central bank's target level for short-term nominal interest rates is modelled as a function of the deviation of current output from its trend and of the expected deviation of inflation from its (constant) target:

$$i^T_t = r^* + \pi^* + \beta(\pi_{t+k} - \pi^*) + \gamma y_t \qquad (1)$$

with: i^T = target nominal interest rate, r^* = long-run real interest rate, y = output gap, π = inflation rate, π^* = target inflation rate, β = inflation weight in the target interest rate, γ = output weight in the target interest rate, k = periods indicating forward-looking behaviour.

The constant of the target interest rate α is then computed as:

$$\alpha = r^* + (1 - \beta)\,\pi^* \qquad (2)$$

The brief review of the literature above suggests that empirical Taylor rule estimates tend to be sensitive to differences in specification and sampling. Therefore, instead of relying on just one particular study, we take an average over three reasonable specifications of the Taylor rule. In terms of empirical Taylor rule estimates we use two comparative studies by Eleftheriou et al. (2006) and Hayo (2007), which cover the EMU countries and apply a comparable methodology across countries. Whereas all national Taylor rule are estimated with a one-year forward looking horizon for the inflation rate in Hayo (2007), Eleftheriou et al. (2006) maximise the fit of the Taylor rule to the actual interest rate series. As a third type of Taylor rule we apply Taylor's (1993) original rule, which as become some sort of benchmark in the literature.

One important methodological issue is that due to changes in the real rate of interest in the EMU period compared to the periods over which the national Taylor rules are estimated, the national Taylor rules contain estimated constant terms that deviate substantially from α estimated for the ECB Taylor rule put forward by Hayo and Hofmann (2006). To compensate for that, we derive the implied long-run real interest rate by re-arranging equation (2) and adjust the national estimates obtained from Eleftheriou et al. (2006) and Hayo (2007) accordingly:

$$r^* = \alpha - (1 - \beta)\, \pi^* \qquad (3)$$

In the analysis below, we use counterfactual national target rate series based on the long-run coefficients β, γ, and adjusted α, and then construct simple arithmetic averages. We interpret the final series as indicators of how national interest rates would have been set if EMU had not come about.

3. Decision rules and scenarios

The literature offers a large array of possible decision rules. We consider four types of rules that can each be adapted to various institutional settings: voting, bargaining, full chairman dominance and voting with a chairman. Those decision rules may be applied in any committee, regardless of the type of the objectives followed by their members. We must

therefore consider various scenarios applying those decision rules to a particular set of objectives.

3.1. Voting

The simplest decision rule is voting. According to article 105 of the constitution of the ECB, it was the official decision rule of the board of governors over our period of study. Moreover, article 105 gave the same weight to all the members of the board vote, according to the one-man one-vote rule. The working of that rule in a monetary union has been investigated since von Hagen and Süppel's (1994) contribution.

As the decision that the Governing council must make has a single dimension, the median voter theorem applies. Accordingly, the interest rate set by the council is simply the median of the interest rates favoured by its members.[1]

When applying that decision rule, we consider that national governors act as representatives of their country of origin. In other words, we assume that they are nationalist. As regards the executive board, we consider two polar scenarios: one in which they are all nationalist, and one where they all embrace a federal view.[2]

We complement the official voting rule by two institutional settings where only a sub-set of the board can vote. In the first setting, only national governors vote, which is in line with the intergovernmental working of the European Council. In the second setting, only the members of the executive board vote, and impose their views on the rest of the board. In that setting, we only consider the scenario where the board is nationalist, because the alternative scenario, where executive board members are federalist would simply replicate the interest rate determined by the euro-wide Taylor rule.

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[1] Note that Greece only joined the governing council in January 2002. The size of the council then rose from 17 to 18 members.

[2] The names and nationality of the members of the executive board are listed in the appendix. In theory, the board could consist of a mix of federalist and nationalist members. To save on space, we do not consider that possibility here. Moreover, our results suggest that scenarios giving more weight to federal views better mimic the actual behaviour of the actual exchange rate.

3.2. Bargaining

We model the outcome of a bargaining process by computing the weighted average of the interest rates favoured by individual members of the governing council. We consider several distributions of bargaining power, corresponding to different weighting mechanisms. In the first distribution, we give all members equal weight. We then weight members by the share of their country's GDP in the zone's GDP.

Again, we allow board members to be either nationalist or federalist, for each distribution of bargaining power.

3.4. The president: full dominance and agenda-setting

The first, and simplest, way to model the role of the president of the ESCB is to assume that he has complete discretion on the interest. Some accounts Alan Greenspan's chairmanship at the Fed suggest that he was influential enough to always impose his view on the FOMC. Modelling chairman full dominance simply consists in assuming that the Governing Council always set the chairman's preferred interest rate.

Another way to model the role of the chairman is to follow Montoro (2007), Farvaque et al. (2009), and Riboni and Ruge-Murcia (2010), and assume that the president of ESCB is an agenda setter. This assumption is in line with Pollard (2003) argument that the role of the president of the ECB is indeed to set the agenda. The president's role is accordingly to put to a vote a given value of the interest rate. The council then chooses between that interest rate and previous period's interest rate by majority voting.

In that framework, the president will announce the interest rate that is the closest to his favourite interest rate under the constraint that there will be a majority in the council to vote for it. In other words, the president will announce the interest rate that is the closest to his favourite interest rate that the median member of the council will prefer to the status quo. Three configurations may thus arise, depending on the relative positions of the chairman's favourite interest rate, the median member of the council's favourite interest rate, and the current interest rate. For conciseness' sake, let us first assume that the optimal interest rate of

the median voter is smaller than the optimal rate of the chairman. The interest rate chosen in the reverse configuration can be deducted by symmetry.

The first configuration appears when the president's optimal interest rate is close to the median voter's optimum and far from the past interest rate. In that case, the median member of the council will prefer the president's optimal interest rate to the status quo. The chairman will then be able to impose his/her optimal interest rate.

In the second configuration, the president's optimal interest rate and the median voter's optimal interest rate lie on opposite sides of the current interest rate. In that case, the median voter has no incentive to vote for an interest rate that is closer to the president's optimum than the current interest rate. Conversely, the president has no incentive to put to a vote an interest rate that is closer to the median member of the council's optimum than the current interest rate. This configuration will result in a status quo, and the adopted interest rate will be the same as previous period's.

In the third case, the president's optimal interest rate is too far from the current interest rate for him to be able to impose it to the median member of the council. This happens more precisely whenever the past interest rate is smaller than the median voter's favourite interest rate, and the difference between the past interest rate and the median voter's favourite interest rate is smaller than the distance between the median voter's interest rate and the chairman's favourite interest rate. The best that the president can achieve is to announce the interest rate that makes the median council member indifferent between that interest rate and the status quo. That interest rate is equal to the median voter's interest rate plus the difference between the median voter's interest rate and past interest rate.

The outcome of that decision procedure can be summarized as follows, if we note i_t^{pdt} the president's optimal interest rate, i_t^M, the median council member's optimal interest rate, i_{t-1} the current interest rate, and i_t the new interest rate:

$$i_t = i_{t-1} \quad \text{if} \quad i_t^M \geq i_{t-1} \geq i_t^{pdt} \quad \text{or} \quad i_t^{pdt} \geq i_{t-1} \geq i_t^M \qquad (??a)$$

$$i_t = 2i_t^M - i_{t-1} \quad \text{if} \quad 2i_t^M - i_t^{pdt} \leq i_{t-1} < i_t^M \quad \text{or} \quad 2i_t^M - i_t^{pdt} \geq i_{t-1} > i_t^M \qquad (??b)$$

$$i_t = i_t^{pdt} \quad \text{otherwise} \qquad (??c)$$

The question once more is how to define the president's optimal interest rate and the optimal interest rates of the other members of the governing council. Here, we assume that governors are all nationalist, and let the executive board, including the president, be alternatively nationalist and federalist.

3.5. Objectives

The official stance of the ECB is that the members of the board should not act as national representatives, but seek to implement the policies that best suit the needs of the euro zone. Such behaviour may be credible for the members of the Executive board, because they are appointed following a federal procedure. According to article 11.2 of the statutes of the ESCB, the members of the executive board are appointed "by common accord of the governments of the Member States at the level of the Heads of State or Government, on a recommendation from the Council after it has consulted the European Parliament and the Governing Council". As they are appointed at the federal level, they are the most likely to follow euro zone-wide objectives.

However, there is no guarantee that they will. Firstly, they have national backgrounds and may have particular ties with their country of origin. A way to avoid national biases would be to hire members of the council who do not originate from a member country, but this possibility is expressly ruled out by article 11.2 of the statutes of the ESCB expressly states that "only nationals of Member States may be members of the Executive Board".

Governors of national central banks are appointed by their countries. They are therefore even more likely than members of the Executive Board to pursue national objectives.

In doubt, we therefore consider that members of the Governing Council of the ESCB can follow either type of objective. Their objective will be referred to as federal, if they seek to implement the policies that best suits the euro zone, and as "national" if they seek to implement the policy that is optimal for their country of origin.

Which kind of objective members of the board pursue is an empirical matter. We will therefore consider various combinations of the two types of members, and determine which one produces the outcome that best fit the observed decisions of the ESCB. We will, however, consider no scenario where the Executive Board is nationalist while national governors are federalist, to avoid adding paradoxical scenarios to the already long list of those we consider.

The case where both governors and members of the Executive board follow federal objectives cannot be ruled out *a priori*, but it would result in a systematic consensus about setting the interest rate to the level that is optimal from the point of view of the euro zone. Decision rules would accordingly be irrelevant, as they would lead to the same policy. We will therefore use those scenarios, referred to as "full federalism" as our benchmark case.

4. Findings

Table 1 below displays the summary statistics of the interest rates produced by each scenario. The means of all simulated interest rates are larger than the Eonia average. Moreover, the difference is significant at any standard level of confidence. On average, the ECB was therefore less hawkish than expected by our counterfactuals.

Nevertheless, ordering scenarios by decreasing interest rate averages leads to a fairly consistent ranking. The scenario that generates the average interest rate closest to Eonia is the bargaining scenario, where both governors and board members are nationalist, and their weight in the negotiations is given by their country's relative GDP size. The two bargaining scenarios, where governors are nationalist and the board federalist follow next. The two scenarios producing the largest interest rates are the ones where the chairman is nationalist.

Table 1: Summary statistics

Decision rule	Preferences	Mean	Standard deviation
Eonia	Eonia	2.98	0.91
Full federalism	Federalist governors and federalist board	3.91	0.72
Chairman dominance	Nationalist chairman	4.70	2.37
One member one vote	Nationalist governors and nationalist board	4.07	1.03
One member one vote	Nationalist governors federalist board	3.95	0.72
Restricted: One governor one vote	Nationalist governors	4.05	1.06
Restricted: One member of the board one vote	Nationalist board	4.07	1.01
Bargaining equal weights	Nationalist governors and nationalist board	4.25	1.02
Bargaining equal weights	Nationalist governors and federalist board	3.83	0.79
Bargaining GDP weights	Nationalist governors and nationalist board	3.77	0.89
Bargaining GDP weights	Nationalist governors and federalist board	3.83	0.78
Chairman	Nationalist governors and nationalist board	4.40	1.57
Chairman	Nationalist governors and federalist board	3.92	0.73

In our sample, a scenario's capacity to reproduce the volatility of the observed interest rate is a more discriminatory criterion, as our simulations produce very different standard deviations of the interest rate. Indeed, four scenarios produce standard deviations that are not statistically distinguishable from the standard deviation of the observed interest rate: Bargaining with GDP weights, national representatives and national governors; voting restricted to a nationalist executive board; bargaining with equal weights, national representatives and national governors; and voting with national representatives and national governors. Five scenarios produce a statistically lower than observed volatility of the interest rate: Full federalism; voting with nationalist governors and a federalist board; a federalist chairman facing nationalist governors and a federalist board; bargaining with GDP weights, nationalist governors and federalist board; and bargaining with equal weights, nationalist

governors and a federalist board. The two scenarios involving a nationalist chairman stand out as producing the largest volatilities. Perhaps unsurprisingly, the volatility of the simulated interest rate is particularly high in the scenario where a single, unchecked nationalist chairman sets the interest rate.

Table 2 complements Table 1 by providing two selection criteria for each scenario, its root mean square error (RMSE) and its mean average error (MAE).

Table 2: Selection criteria

Decision rule	Preferences	RMSE	MAE
Full federalism	Federalist governors and federalist board	1.25	1.04
Chairman dominance	Nationalist chairman	2.36	1.85
One member one vote	Nationalist governors and nationalist board	1.22	1.13
One member one vote	Nationalist governors federalist board	1.23	1.04
Restricted: One governor one vote	Nationalist governors	1.20	1.11
Restricted: One member of the board one vote	Nationalist board	1.20	1.12
Bargaining equal weights	Nationalist governors and nationalist board	1.34	1.29
Bargaining equal weights	Nationalist governors and federalist board	0.99	0.90
Bargaining GDP weights	Nationalist governors and nationalist board	0.91	0.86
Bargaining GDP weights	Nationalist governors and federalist board	0.99	0.91
Chairman	Nationalist governors and nationalist board	1.68	1.43
Chairman	Nationalist governors and federalist board	1.23	1.04

The RMSE criterion and MAE criterion both select the same three best performing scenarios, which are all bargaining scenarios. Bargaining with GDP weights when governors and members of the executive board are nationalist leads to the smallest RMSE and MAE. That scenario outperforms the two bargaining scenarios when governors are nationalist and

members of the board are federalist leads to similar results regardless of the weighting scheme. All three lead to RMSEs and MAEs that are smaller than one, which implies that the average error is below one percentage point.

The RMSE and MAE criteria also concur in selecting the same worst three scenarios. The worst one is again chairman dominance when the chairman is nationalist, which leads to a RMSE of 2.36 and an MAE of 1.85. The one before worst scenario is the one where a nationalist president chairs a nationalist committee. The second before worst is bargaining with equal weights when all the members of the committee are assumed nationalist.

Thus, the best and the worst performing scenarios in our simulations are not affected by outliers, which only have some effect on the ranking of scenarios in between.

Table 3 displays the results of the regressions where the actual interest rate is regressed on the simulated interest rate. At least three criteria can be used to compare the capacity of a given scenario. The first is the overall fit of each regression as measured by its adjusted R-squared. According to that criterion, the scenario that performs the best is the scenario where members of the council are all nationalist and they set the interest weight by bargaining with equal weights. This one national member one weight rule explains more than 80 percent of the observed variance of the euro zone's interest rate. At the other extreme, three scenarios stand out for their very low R-squared. The worst-performing scenario is the full federalist scenario, which an adjusted R-squared equal to 24.3 percent. This is a very interesting finding, as it directly contradicts the official view of the ECB that states that members of the board set the euro zone's interest rate based on the evolutions of the zone as a whole only. Second to worst-performing scenarios are: a federalist chairman setting the agenda for a federalist board and nationalist governors, and voting when the executive board is federalist and governors are nationalist. The former's R-squared does not exceed 30 percent, while the latter's remains below 34 percent. The R-squared of the other scenario range from 67.9 to 77.6.

Table 3: Regression results

Decision rule	Preferences	Simulated interest rate	Constant	R^2	Adj. R^2
Full federalism	Federalist governors and federalist board	0.632 (5.617) ***	0.503 (1.124)	0.251	0.243
One member one vote	Nationalist governors and nationalist board	0.745 (15.46) ***	-0.0532 (0.263)	0.718	0.715
One member one vote	Nationalist governors and federalist board	0.731 (6.990) ***	0.095 (0.226)	0.342	0.335
Restricted: One governor one vote	Nationalist governors	0.728 (15.52) ***	0.0337 (0.172)	0.719	0.716
Restricted: One member of the board one vote	Nationalist board	0.779 (16.92) ***	-0.196 (1.017)	0.753	0.75
Bargaining equal weights	Nationalist governors and nationalist board	0.801 (20.35) ***	-0.428 (2.485) **	0.815	0.813
Bargaining equal weights	Nationalist governors and federalist board	0.956 (14.53) ***	-0.681 (2.648) ***	0.692	0.689
Bargaining GDP weights	Nationalist governors and nationalist board	0.896 (18.17) ***	-0.404 (2.114) **	0.778	0.776
Bargaining GDP weights	Nationalist governors and federalist board	0.955 (14.23) ***	-0.68 (2.592) **	0.683	0.679
Full chairman dominance	Nationalist chairman	0.338 (18.58) ***	1.388 (14.50) ***	0.786	0.784
Chairman	Nationalist governors and federalist board	0.505 (17.66) ***	0.755 (5.655) ***	0.768	0.766
Chairman	Nationalist governors and federalist board	0.682 (6.329) ***	0.3 (0.698)	0.299	0.291

The second criterion is the value of the estimated constant. A scenario exactly replicating the path of the observed interest rate should result in an estimated constant equal to zero. Six scenarios perform well according to this criterion, because their estimated constant is not distinguishable from zero at standard levels of significance: Voting restricted to a nationalist board, unrestricted voting when all the members of the board are nationalist, voting restricted to nationalist governors, unrestricted voting when governors are nationalist and members of the board are federalist, a federalist chairman with a federalist board and nationalist governors, and full federalism. In the latter scenario, however, the estimated constant is large, its insignificance being due to a large standard error.

The four scenarios involving bargaining result in constants that are significantly negative, implying that the scenarios tend to overshoot the interest rate on average. It therefore appears that bargaining scenarios tend to overestimate the interest rate, regardless of the hypotheses made on the preferences of the members of the governing council of the ECB.

Finally, assuming that a federalist chairman is the agenda setter in a council where members of the executive board are federalist and governors are nationalist, and full chairman dominance, result in a constant that is significantly positive at the one-percent level of significance. Those scenarios therefore tend to undershoot the actual interest rate. This may largely be due to the fact that France requested a smaller interest rate than other member countries.

Our favourite criterion is, however, the size of the coefficient of the estimated interest rate, because it measures a simulation's capacity to replicate the changes of the interest rate. A perfect simulation should result in that coefficient being equal to one. We find that all estimated coefficient are smaller than one at any standard level of significance. This finding suggests that the behaviour of the ECB is more prudent than what any of our simulations implies. Marked differences between scenarios, however, appear. Bargaining with equal weights when governors are nationalist and members of the executive board are federalist leads to the highest coefficient, 0.956. That scenario is closely followed by the scenario where nationalist governors and federalist members of the executive board bargain using GDP weights. The coefficient is then 0.955. The two bargaining scenarios where all the members of the governing council are nationalist also produce coefficients that exceed 0.8, although the

scenario assuming GDP weights instead of equal weights performs better, with a coefficient of 0.896 instead of 0.801. They are then followed by the four scenarios where members of the council are assumed to vote, which lead to coefficients ranging from 0.728 to 0.779. The three following rules are the two rules involving a chairman and the full federalist scenario. The coefficient producing the smallest coefficient is that of full chairman dominance. This is intuitive, as the situation of any single country is by construction more volatile than that of the euro zone considered as a whole.

An interesting outcome of the comparison of coefficients is that the ranking of most decision rules is robust to the assumed preferences of the members of the executive council. A tentative interpretation of this finding could be that differences between the evolutions of the countries from where members of the executive council originate are sufficiently close to the evolution of the euro zone as a whole.

The scenario where members of the council bargain, are all nationalist, and have a bargaining power that is given by the size of their country in the euro area's GDP, stands out of those comparisons. It is ranked first according to four criteria. Namely, it produces the mean and the standard deviation of the interest rate that are the closest to the observed interest rate, and leads to the lowest RMSE and MAE. Furthermore, it performs well according to the other two criteria, as it ranks second in terms of R-squared in bivariate regressions and third in terms of the slope coefficient.

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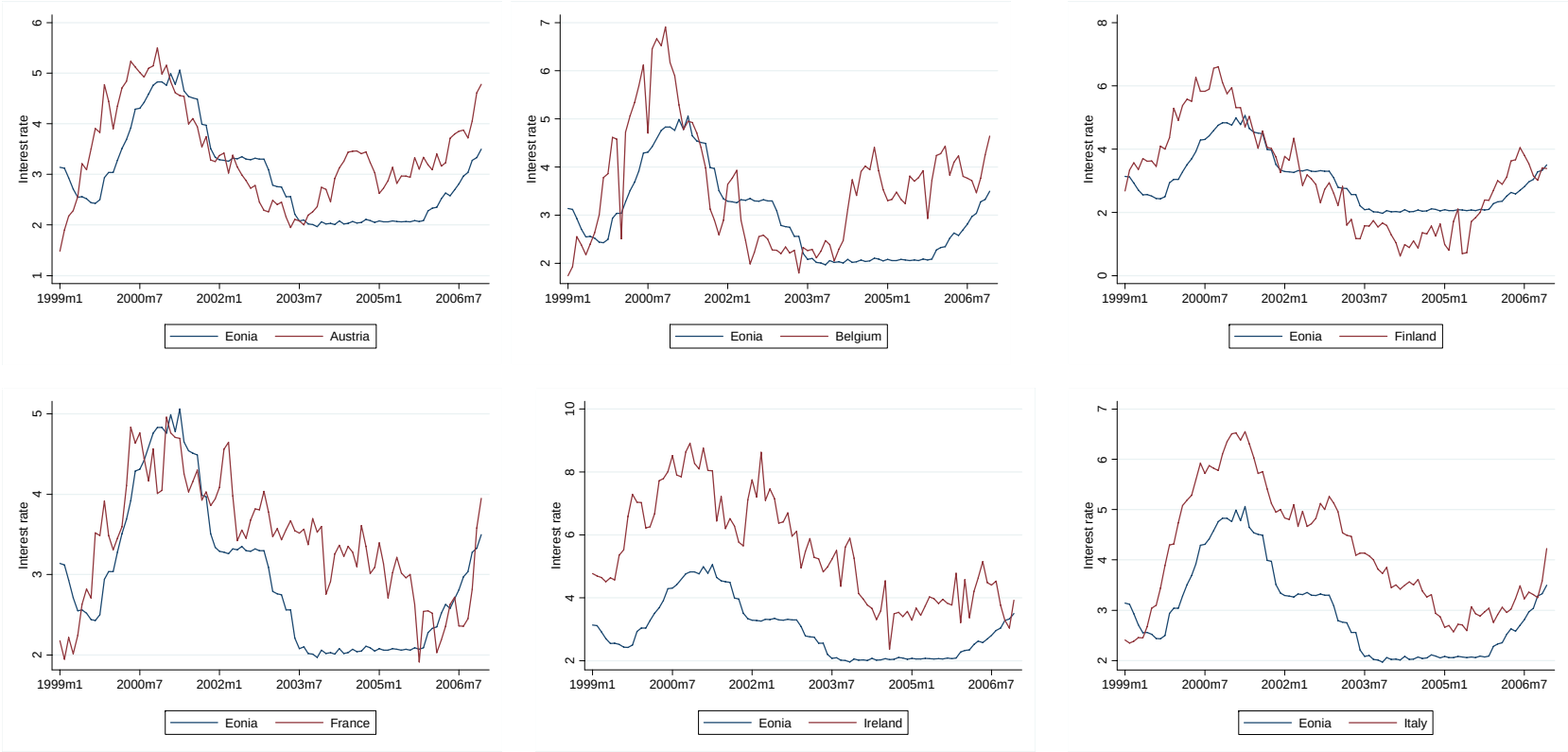
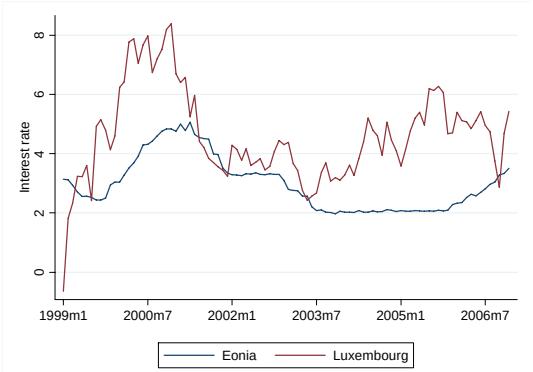
Appendix

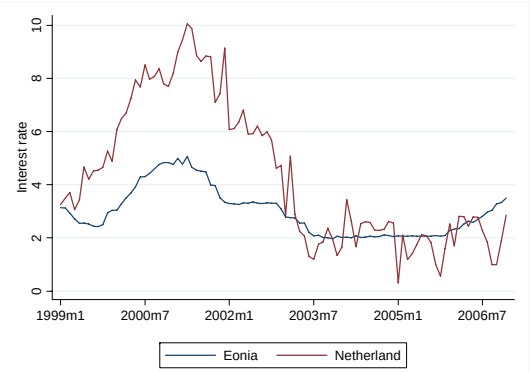
Table A1: Nationalities and identities of the members of the executive board

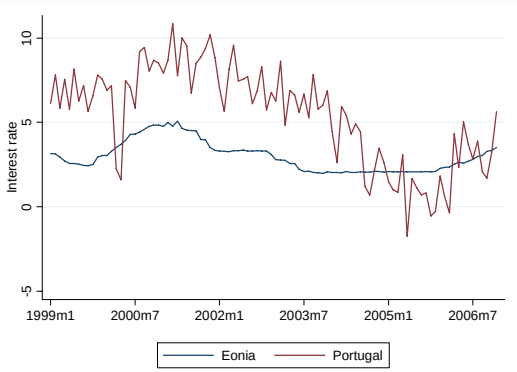
	President	Vice-President	Member	Member	Member	Member
As of January 1999	Dutch (Willem Duisenberg)	French (Christian Noyer)	Spanish (Solans)	Finnish (Sirkka Hämäläinen)	German (Otmar Issing)	Italian (Tommaso Padoa-Schioppa)
As of June 2002	Dutch (Willem Duisenberg)	Greek (Lucas Papademos)	Spanish (Eugenio Domingo Solans)	Finnish (Sirkka Hämäläinen)	German (Otmar Issing)	Italian (Tommaso Padoa-Schioppa)
As of June 2003	Dutch (Willem Duisenberg)	Greek (Lucas Papademos)	Spanish (Eugenio Domingo Solans)	Austrian (Gertrude Tumpel-Guggerell)	German (Otmar Issing)	Italian (Tommaso Padoa-Schioppa)
As of November 2003	French (Jean-Claude Trichet)	Greek (Lucas Papademos)	Spanish (Eugenio Domingo Solans)	Austrian (Gertrude Tumpel-Guggerell)	German (Otmar Issing)	Italian (Tommaso Padoa-Schioppa)
As of June 2004	French (Jean-Claude Trichet)	Greek (Lucas Papademos)	Spanish (González-Páramo)	Austrian (Gertrude Tumpel-Guggerell)	German (Otmar Issing)	Italian (Tommaso Padoa-Schioppa)
As of June 2005	French (Jean-Claude Trichet)	Greek (Lucas Papademos)	Spanish (José González-Páramo)	Austrian (Gertrude Tumpel-Guggerell)	German (Otmar Issing)	Italian (Lorenzo Bini Smaghi)
As of June 2006	French (Jean-Claude Trichet)	Greek (Lucas Papademos)	Spanish (José González-Páramo)	Austrian (Gertrude Tumpel-Guggerell)	German (Jürgen Stark)	Italian (Lorenzo Bini Smaghi)

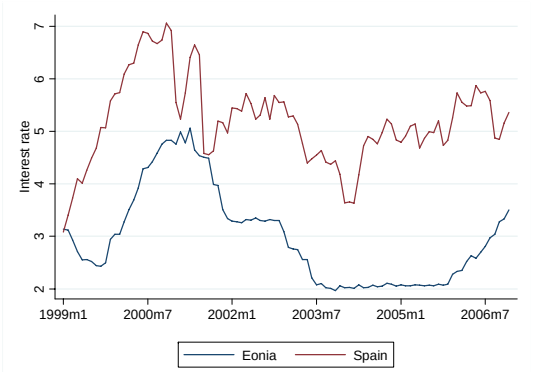
Fig. A1: National interest rates




Interest rate
0
2
4
6
8
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Luxembourg


Interest rate
0
2
4
6
8
10
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Netherland


Interest rate
-5
0
5
10
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Portugal


Interest rate
2
3
4
5
6
7
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Spain

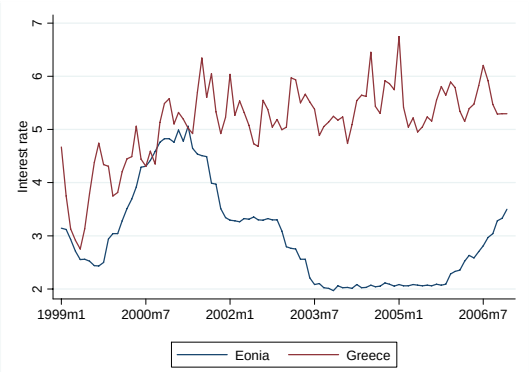
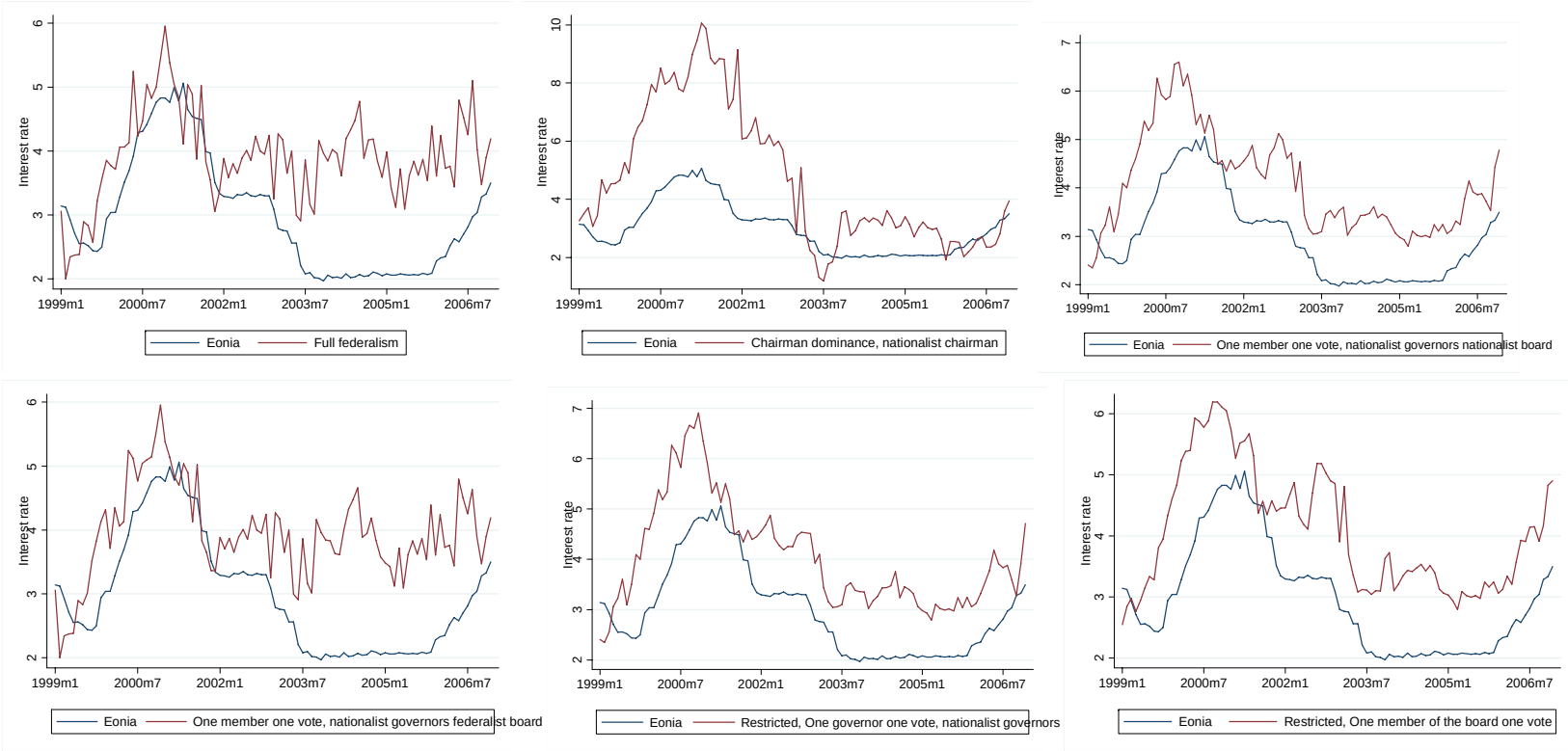
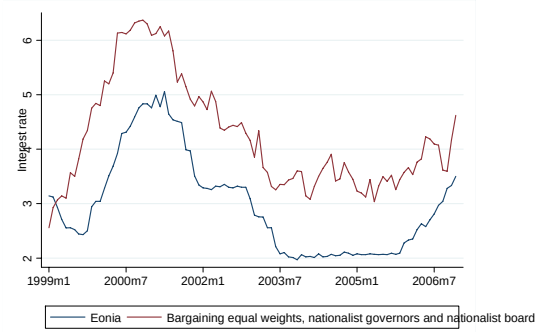
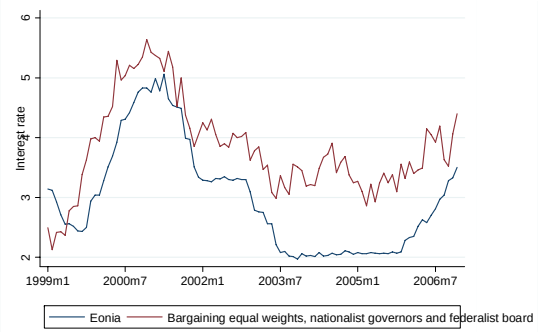
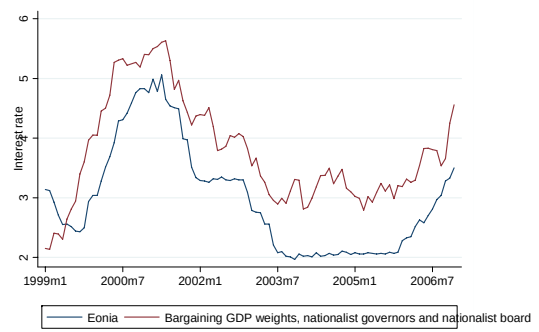

Interest rate
2
3
4
5
6
7
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Greece

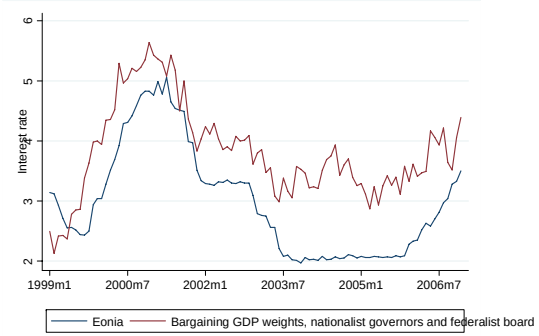
Fig. A2: Interest rates produced by decision rules

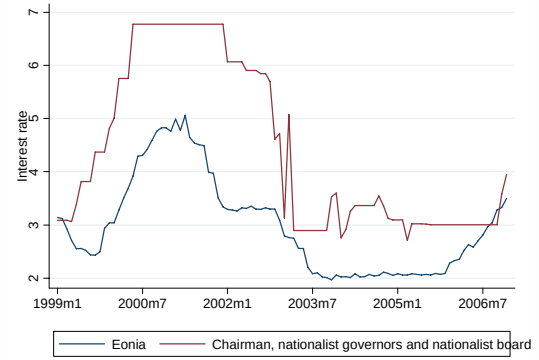


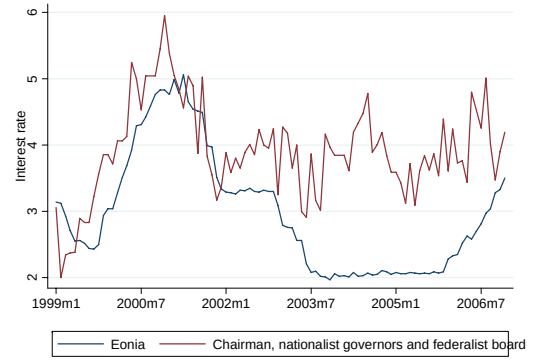

Interest rate
2
3
4
5
6
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Bargaining equal weights, nationalist governors and nationalist board


Interest rate
2
3
4
5
6
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Bargaining equal weights, nationalist governors and federalist board


Interest rate
2
3
4
5
6
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Bargaining GDP weights, nationalist governors and nationalist board


Interest rate
2
3
4
5
6
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Bargaining GDP weights, nationalist governors and federalist board


Interest rate
2
3
4
5
6
7
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Chairman, nationalist governors and nationalist board


Interest rate
2
3
4
5
6
1999m1
2000m7
2002m1
2003m7
2005m1
2006m7
Eonia
Chairman, nationalist governors and federalist board