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Effectiveness of Monetary Policy in Euroland

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Abstract

In this paper we analyze the effects of different decision rules in the ECB on monetary stability. We consider a model where asymmetric shocks and divergent propagation of shocks on output and inflation are potential causes of tension within the ECB concerning the conduct of monetary policy. Given divergence of desired interest rates we analyze the effect of different voting procedures within the Governing Council of the ECB. We find that under ECB-rule ECB Board is able to impose its desired interest rate as the Euro-wide interest rate. Large countries benefit from ECB-rule as it implies higher voting power for them at the Governing Council. Our welfare analysis indicates that under particular parameter specifications ECB-rule is strictly preferred to Nationalistic rule.

Keywords: Linear feedback rules, Monetary Policy, ECB.
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1 Introduction

Since January 1, 1999 the European System of Central Banks is solely responsible for the conduct of the monetary policy in the EMU-countries. The Maastricht Treaty provides some general principles about the objectives to be pursued by the ECB as well as about the status of the ECB. According to Art. 105 of the treaty, the primary objective of the ECB is price stability and Art. 107 states that the ECB should be politically independent. The treaty remains, however, silent concerning the precise *modus operandi* of the Governing Council as well as concerning the procedures and sanctions in case of failure to meet these principles for the members of the Governing Council. In short, the conduct of monetary policy is at the discretion of the members of the Governing Council.

Central bank independence is necessary for effective monetary policy. However, the set-up of the Governing Council allows for potential conflicts within this body on the conduct of monetary policy. This potential for conflicts arises from the assignment of seats in the Governing Council. The Governing Council (from now on GC) consists of seventeen representatives, six of which are representing the ECB and the remaining eleven appointed by the EMU members states. Thus, there will be a large representation of different national interests. At this moment it is still unclear how the GC will decide, i.e. whether it will try to establish a consensus or whether it will use a majority voting rule as the preferred decision rule.[1]

Obviously, if all of the member states were identical, the issue of national representation with voting power would not matter. That is, in such a situation, each country would opt for the same interest rate policy and conflicts would not occur. The scope for conflict therefore arises from the structural differences (asymmetries) of the member states. We consider four types of asymmetries which may trigger different desired interest rate policies across countries: (i) countries may have different preferences (different weights attached to the objectives), (ii) countries may be hit by asymmetric shocks, requiring asymmetric policy changes, finally (iii) shocks can be propagated differently across the economies because

[1]The importance of potential conflicts at the ECB Governing Council has been stressed by several scholars. Some recent papers analyze issues relating to the delegation of power to the European Central Bank. See in particular, Bindseil(1996), Bottazzi and Manasse(1998), Brueckner(1997), Von Hagen(1998) and Von Hagen and Sueppel(1994). See also Dornbusch, Favero and Giavazzi(1998) for a general discussion of the issue.

of differences in the economic structures (e.g. labor market structures can differ across countries). Each of these four sources could in principle generate asymmetry in the desired interest rate policies for the member states and therefore generate a conflict within the ECB.

In this paper we analyze the effect of such asymmetries on the effectiveness of monetary policy in the EMU. The remainder of the paper is organized as follows. In section 2 we discuss the asymmetry problem in EMU based on the previous research. In section 3 we derive the optimal desired interest rate policies, taking into account the different sources of asymmetries of countries listed above. We follow the large literature on modelling central bank behavior based on Taylor rules and more in particular we follow Rudebusch and Svensson (1998) and Svensson (1998a) by specifying desired monetary policy for a closed economy by means of a linear feedback rule.[2] Empirically, we analyze the effect of different propagation speeds on the desired interest rate policies. Section 4 sketches alternative voting schemes and section 5 then presents some simulation results conditional on these particular voting procedures within the GC. We consider three cases, a consensus rule a purely majority voting procedure where representatives take a nationalist point of view and an intermediate case. Finally, we conclude in section 6.

2 Evidence on Asymmetries in Euroland

We argued above that differences in the economies of the EMU member states may lead to potential conflicts within the GC. The section above made explicit which differences may play an important role: the preferences across countries, the current economic state, which will be affected by shocks to the system, and the propagation of shocks through the economies. In this subsection we provide a more detailed description of the sources of the asymmetries and how important these differences across countries may be.

First of all, when economic shocks and their effects are symmetric across Euroland, a uniform monetary policy action on the side of the ECB would be sufficient to correct for such disturbances. But if these shocks are not synchronized in terms of the time and the size across countries, there is limited scope for consensus by the conduct of the monetary policy at the GC.

[2] See Svensson (1998b) for a small open economy extension of optimal linear feedback rules.

Secondly, these shock asymmetries are fuelled by the differences in economic structures, i.e. differences in goods, labor and financial markets which leads to asymmetric propagation of these shocks. Numerous studies documented the existence of structural differences across European countries giving rise to asymmetric shocks in the EMU countries. For example, Bayoumi and Eichengreen (1992), using the Blanchard-Quah decomposition, find substantial differences between the supply shocks affecting the core countries (Belgium, Denmark, France, Germany and the Netherlands) and the peripheral countries (Greece, Ireland, Italy, Portugal, Spain and the UK). On the other hand, using panel data for eight EU countries Bayoumi and Prasad (1995) argue that at the European manufacturing industry level, 19% of the volatility in the production can be attributed to country specific factors whereas in the US, regional factors do not play any role in explaining the volatility in the US manufacturing industry. They also point to strong country-specific component in trade and transportation in Europe when compared to United States regions.[3]

There is by now a large and still growing literature concerning the differences in monetary transmission mechanisms across countries. These differences in transmission will be important as they influence the effects of monetary policy changes on the different member states. Recent empirical studies find mixed results on the importance of differences in the transmission mechanism. For instance, Gerlach and Smets (1995) using trivariate vector autoregression find that a change in monetary policy has somewhat larger effects on output in Germany than in France but conclude that in general these differences are not very crucial. On the other hand, Dornbusch, Favero and Giavazzi (1998) find similar impact effect of short run interest rate on output for Germany, France and the UK, less effect for Spain and more effect for Italy and Sweden. A recent study by Giovannetti and Marimon (1998) using a VAR specification claims that in France a monetary shock generated a stronger impact on output than in Germany over the period 1973-1997. Moreover, the impulse response of a monetary shock seems to be more persistent in France than in Germany.

Others have argued that differences may be larger than found by Gerlach and Smets (1995). For instance, Ramaswamy and Sloek (1998) find over the period 1972:1-1995:4 that the full effect of a monetary contractionary shock takes twice as long to occur and are about twice as deep in a first subgroup of countries (Austria, Belgium, Finland, Germany, the

[3]For other studies related to the issue see among others Frankel and Rose (1996), Eichengreen (1997).

Netherlands and the UK) than for the others (Denmark, France, Italy, Spain and Sweden). Kieler and Saarenheimo (1998) agree with the results of Ramaswamy and Sloek (1998) for France, Germany and the UK when they apply the same identification scheme.[4] Hence, there appears to be no consensus on the size and timing of the monetary propagation mechanisms in the European Union countries depending on the model, identification of the monetary shock and the data used. However, studies in the field seem to agree on the fact that monetary transmission mechanisms are different across European countries.

Third source of asymmetry arises from differences in the preferences of the national economic policymakers. Political considerations or country specific monetary policy tradition can be divergent across countries giving an impetus for another potential conflict in the conduct of the monetary policies at the European level. This source of asymmetry is rather hard to quantify as little is known about the weights the individual policymakers attach to output and inflation stabilization. In the following sections, we will treat the preference parameters exogenously.

3 Desired Interest Rate Policies for National Representatives

The previous sections made clear which asymmetries we have in mind. In the following subsections we provide a framework to deal with these potential asymmetries. In addition we test our model empirically and derive country specific optimal feedback rules.

3.1 Accounting for the Asymmetries in Economic States, Transmission Mechanisms and Preferences: Optimal Feedback Rules

From the point of view of the individual country, the optimal interest rate policy is the policy that maximizes the country's objectives. We follow Rudebusch and Svensson (1998) and Svensson (1998a) by modelling the optimal monetary policy as a (linear feedback) interest rate rule.[5]

[4] However, they claim their doubts about the 'correct identification' of the monetary shocks and propose alternatives.

[5] We thus follow a large literature which models the behavior of the central bank policy by means of Taylor rules. As shown by Clarida, Gali and Gertler (1997) and Taylor (1993), among others, interest rate policies of the central banks of the major economic powers is captured very well by these Taylor rules, especially since the 80's when central bank independence increased significantly.

More specifically, we assume that the central bank has a loss function of the following form:

$$L_t = E\left[Y_t' K Y_t\right], \tag{1}$$

where,

$$Y_t' = \left[\bar{\pi}_t, y_t, \Delta i_t\right].$$

Where $\bar{\pi}_t$ denotes the average yearly inflation, y_t the output gap and Δi_t the change in the interest rate level. The preference matrix K is a $3\times\ 3$ diagonal matrix with diagonal elements 1, λ and γ, the weights attached to deviations from the inflation target, output gap target and interest rate changes, respectively. The objective of the central bank is to minimize this loss, i.e. a weighted average of variability in inflation, output gaps and interest rates.[6] The macroeconomic environment in which the central bank operates is modelled by means of a backward-looking Phillips curve, which is given as:

$$\pi_t = \sum_{j=1}^{n} \alpha_{\pi,j}\pi_{t-j} + \alpha_y y_{t-1} + \varepsilon_t, \tag{2}$$

and a partial-adjustment type of IS curve such that:

$$y_t = \sum_{j=1}^{n} \beta_{y,j} y_{t-j} - \beta_i\left(\bar{i}_t - \bar{\pi}_t\right) + \eta_t. \tag{3}$$

where the percentage deviation of output from permanent output capacity is assumed to depend on previous deviations and the real interest rate over the past 12 periods. Note that, $\bar{i}_t$ and $\bar{\pi}_t$ represent a twelve month (moving) arithmetic average of current and past interest and inflation rates, respectively:

$$\bar{i}_t = 1/\left(12\right)\sum_{i=0}^{11} i_{t-i} \quad \text{and} \quad \bar{\pi}_t = 1/12\sum_{i=0}^{11} \pi_{t-i}.$$

This can be rewritten conveniently in its state space representation (cf. Rudebusch and Svensson (1998) and De Grauwe et al. (1998)) as:

[6]Note that equation (1) is in fact a representation of a intertemporal loss function with the discount rate $\delta \rightarrow 1$.

$$X_t = AX_{t-1} + Bi_t + v_t, \tag{4}$$

where X denotes the economic state:

$$X_t = [\pi_t, \cdots, \pi_{t-n}, y_t, \cdots, y_{t-n}, i_{t-1}, \cdots, i_{t-n}].$$

The central bank is assumed to select a linear rule based on the current observed state of the economy:

$$i_t = fX_t. \tag{5}$$

Under this type of rule, the Central bank changes the state space dynamics to

$$X_t = MX_{t-1} + v_t, \quad M \equiv A + Bf. \tag{6}$$

Finally, since the loss function of the central bank can be rewritten as a function of the state of the economy, X_t, the central bank will choose that linear rule f that adapts the state space dynamics such that the loss, i.e. the weighted average of the unconditional variance of the three goal variables is minimal. The optimal linear feedback rule is then given by:

$$i_t = -\left(R + B'VB\right)^{-1}\left(U' + B'VA\right)X_t \tag{7}$$

where the matrix V is defined by:

$$V = Q + Uf + f'U' + f'Rf + M'VM, \tag{8}$$

$$Q = C_X'KC_X, \; U = C_X'KC_i \text{ and } R = C_i'KC_i$$

and defining $e_{n:m}$ as a vector with 1/12 on the entries from position n till m and e_m as a vector containing a 1 on the $m-th$ position and zeros elsewhere, the matrices C_X and C_i are defined as:

$$Y_t = \begin{bmatrix} \bar{\pi}_t \\ y_t \\ i_t - i_{t-1} \end{bmatrix} = C_X X_t + C_i i_t, \text{where } C_X = \begin{bmatrix} e_{1:12} \\ e_{n+1} \\ -e_{n+m+1} \end{bmatrix} \text{ and } C_i = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}. \tag{9}$$

As can be inferred from equation (7) the optimal interest rate rule is conditional on (i) the current state of the economy X_t, (ii) the propagation of shocks in the system, as measured by the matrix A and (iii) the preferences of the country over the three objectives through the matrix K. Furthermore, the shocks hitting the economies may differ across countries. Hence, if any of these four components differs across countries, desired interest rate policy (as measured by the interest rate rule) will also differ.

3.2 Comovements of Output and Inflation Shocks

As discussed in section 2.1, countries are hit by country-specific output shocks. When the economies are similar in their structure, these output shocks will follow similar patterns across countries. If they are not, output shocks hitting the economies will be a new source of tension at the GC. Hence, to complete the analysis we have to account for the comovements of output and inflation shocks across the member states. For that purpose we use the residuals η of the aggregate demand equation (3) and residuals ε of the aggregate supply equation (2) for each country. The pairwise correlation among the residuals for equation (3) can be written as:

$$s_{xy} = \frac{\sum_i \left(\eta_{xi} - \overline{\eta}_x\right)\left(\eta_{yi} - \overline{\eta}_y\right)}{n-1}. \tag{10}$$

For the covariance matrix of the European Union 11 we can write $S = [s_{ij}]$. A particularly useful decomposition of the matrix S is the Cholesky decomposition $S = LL'$,where L is a lower triangular matrix. For the inflation shocks we apply the same procedure.

In the next subsection we assess empirically the asymmetries across member states and their implications on the optimal linear feedback rules.

3.3 Empirical Analysis

The empirical analysis will be based on monthly data. We deliberately took monthly data to filter an interest rate rule which may correspond to what central banks would be doing in reality. That is, since the GC will convene every two weeks, monthly data may be more appropriate than quarterly. Data were taken from the IFS data base and span the period 1979.01-1994.09. The output data are the (log of) industrial production in real terms, (CPI) inflation was computed on a monthly basis and converted in annual rates. For the interest rates we took the short term one month (money market or call money) interest rates, except for Ireland (STF rate), Portugal (lending rate) and Finland (average lending rate). [7] To construct the output gap we applied a Hodrick-Prescott filter, where $\lambda =$ 500000 (equivalent to a linear trend). The transitory component of this filter was then defined as (minus) the output gap.

Figure 1 presents the filtered output gap estimates. As can be seen, the filtered output gap corresponds approximately to the common business cycle component in all of the Euroland countries. Moreover for all but one country (Portugal) filtered output gaps remain around +10 and -10 percent, which in our view corresponds closely to the notion of a output gap. Inflation in the eleven member states over the period 1979 till 1996 is depicted in figure 2.

Then, we estimate equations (2) and (3). Note that we do not impose in advance a particular structure for the lag lengths in the aggregate demand (eq. 2) and aggregate supply (eq. 3) equations. We rely on the Akeike Info Criterion in order to choose lag lengths. After checking for the stability properties of the A and M matrices we chose following lag lengths (former being for the aggregate supply equation, latter being for the aggregate demand equation): Austria (12,11), Belgium (13,25), Finland (20,20), France (31,11), Germany (14,12), Ireland (29,11), Italy (31,15), Luxembourg (11,25), the Netherlands (15,16), Portugal (11,13) and Spain (15,16).

Asymmetric responses with respect to monetary policy can be due to either a different impact of monetary policy, or a different propagation of the change in monetary policy through the economy or both. According to equations (2) and (3) the direct impact of changes in interest rates on output is measured by the parameter β_y, while the effect on inflation is only indirect through the adjustments in the output gap.

This indirect effect can be captured by $\alpha_{\pi,1} \times \beta_i$. Table 1 presents the point estimates of these effects of a change in the interest rate.

As can be seen from table 1, point estimates for the impact factors differ considerably across states. At the high end of the range of impact factors one finds Austria, Belgium, Germany, Italy and Portugal while at the lower end we find countries like Spain and France.

[7] The data set was restricted by the fact that some industrial production (in particular for Portugal) data was not complete from 1995 till now. We also assume that the short run Belgian interest rate applies in Luxembourg.

Table 1: **Effect of a one percent increase in the interest rate on output and inflation**

	Aus	Bel	Fin	Fra	Ger	Ire	Ita	Lux	Net	Por	Spa
Output	-.080	-.263	-.030	-.018	-.050	-.058	-.047	-.105	-.002	-.074	-.010
Inflation	-.0047	.0077	-.0043	-.0015	-.0063	.0004	-.0068	-.0074	-.0002	-.0070	-.0007

The output effect is measured by the direct impact factor β_i. The effect on inflation is computed as $\beta_i \times \alpha_{y,1}$.

Next to differences in the direct impact of changes in monetary policy, countries can differ in the adjustment speed of their economies to shocks. We find significant differences in the adjustment lags for most countries as well. [8]

One way to assess the importance of the global effect of the differences in the transmission mechanism is to analyze the response functions of the output gap and the inflation. These response functions are depicted in Figure 3. If our identification is a plausible one, with respect to policy changes we find systematically stronger impulse responses of output than that of inflation in all countries. As can be seen from this figure, both output and inflation responses differ considerably across countries, although we did not verify this statistically.

Our results are roughly consistent with those of Ramaswamy and Sloek (1998). In line with their findings we observe stronger impacts of changes in monetary policies in countries such as Austria, Belgium, Germany, Ireland and the weakest reactions in countries such as France and Spain. However, our results do not suggest a clear division of Euroland in two set of countries but are more in line with a disperse grouping. Despite these differences, Ramaswamy and Sloek's main conclusion of significant differences of the direct impact and the transmission of shocks across countries is corroborated.

According to equation (7) these asymmetries translate into different optimal interest rate rules for the individual countries. The optimal interest rate rules can be computed conditional on a set of weights attached to the different objectives; Table 2 presents the country specific optimal interest rate rules for the preference triplet $(1, 1, 0.5)$. As can be inferred from this table, optimal interest rate rules differ across countries.[9] Moreover, in

[8] For brevity we do not present the estimation results, but available on request .

[9] Note that the size of the coefficients as well as the differences across feed back rules is in line with the findings of Clarida, Gali and Gertler who also find significant differences in the observed Taylor rules of the central banks of France and Germany.

line with the findings of others, for instance Peersman and Smets (1998), we find that the output coefficient is much larger than the coefficient on inflation.[10]

4 Voting Rules

The monetary policy decisions will be taken by the Governing Council of the ECB which consists of seventeen representatives. Six members represent the ECB board and will probably take a EMU-wide view. The other eleven members are appointed by each of the individual member states.

To evaluate the effects of the voting procedures on the macroeconomic performance we consider three scenario's. The first one is denoted by the Consensus rule and describes the scenario in which the Governing council opts to strike a consensus in its decisions. The second one is labeled the ECB-rule in which we allow for some nationalistic considerations on the part of the eleven individual country representatives. More precisely, we consider the case where the (six) representatives of the ECB take an Euro-wide perspective while the (eleven) country representatives take a nationalistic point of view. In this case we assume that the ECB president has the prerogative to propose the interest rate policy and that this proposal will be accepted unless there is opposition of a majority, i.e. at least nine countries oppose the proposal of the ECB president. If such a majority occurs we assume that in a second round the ECB president breaks the majority by proposing the desired interest rate of the median country (i.e. the ninth). Finally, in the third scenario all seventeen representatives take a nationalistic perspective. In De Grauwe et al. (1998) we argue that the outcome of these voting procedures will be a median voter outcome.

The Euro-wide and nationalistic points of view differ according to the set of countries taken into account in the loss function and hence in the optimal linear interest rate rule. In the nationalistic case the representative takes only into consideration the loss function of the country which he represents. As a result the optimal (desired) interest rate (rule) for the representative of country j is given by

[10]Note that a larger coefficient on the output gap is not equivalent to a larger weight on output stabilisation. Whatever the preferences over output- or inflation stabilisation, the weight on the output variable will remain relatively large because of the fact that inflation stabilisation can only be attained by output stabilisation, see section 2.1.

Table 2: **Optimal feedback rule** ($\lambda = 1$, $\gamma = 0.5$)

	Aus	Bel	Fin	Fra	Ger	Ire	Ita	Lux	Net	Por	Spa
	interest rate response to inflation										
π_t	.047	.070	.091	.198	.072	.039	.282	.053	.007	.103	.033
π_{t-1}	.042	.055	.089	.112	.053	.029	.218	.044	.005	.074	.031
π_{t-2}	.040	.060	.077	.144	.055	.033	.145	.041	.005	.082	.031
π_{t-3}	.035	.073	.087	.122	.047	.028	.165	.038	.005	.055	.035
π_{t-4}	.040	.052	.083	.106	.043	.024	.181	.037	.004	.058	.032
π_{t-5}	.038	.057	.076	.096	.041	.025	.172	.032	.004	.058	.033
π_{t-6}	.037	.056	.067	.093	.037	.023	.157	.025	.014	.048	.032
π_{t-7}	.030	.055	.058	.085	.038	.027	.137	.023	.002	.030	.030
π_{t-8}	.028	.058	.062	.075	.034	.028	.114	.014	.002	.033	.026
π_{t-9}	.024	.039	.061	.079	.027	.022	.102	.008	.001	.020	.022
π_{t-10}	.022	.028	.047	.054	.021	.021	.124	.004	.001	.015	.018
π_{t-11}	.017	.024	.042	.093	.017	.022	.101	.000	.001	.000	.015
π_{t-12}	.000	.005	.031	.093	.009	.020	.078	.000	-.001	.000	.010
π_{t-13}	.000	.000	.019	.078	.004	.027	.103	.000	-.001	.000	.007
π_{t-14}	.000	.000	.013	.079	.000	.020	.078	.000	.000	.000	.005
π_{t-15}	.000	.000	.017	.073	.000	.024	.075	.000	.000	.000	.000
π_{t-16}	.000	.000	.012	.049	.000	.022	.083	.000	.000	.000	.000
π_{t-17}	.000	.000	.005	.053	.000	.019	.071	.000	.000	.000	.000
π_{t-18}	.000	.000	.014	.028	.000	.021	.078	.000	.000	.000	.000
π_{t-19}	.000	.000	.017	.030	.000	.020	.056	.000	.000	.000	.000
π_{t-20}	.000	.000	.000	.029	.000	.020	.060	.000	.000	.000	.000
π_{t-21}	.000	.000	.000	.001	.000	.018	.044	.000	.000	.000	.000
π_{t-22}	.000	.000	.000	.009	.000	.012	.007	.000	.000	.000	.000
π_{t-23}	.000	.000	.000	.014	.000	.010	.037	.000	.000	.000	.000
π_{t-24}	.000	.000	.000	.004	.000	.007	.000	.000	.000	.000	.000
π_{t-25}	.000	.000	.000	-.001	.000	.007	.003	.000	.000	.000	.000
π_{t-26}	.000	.000	.000	-.004	.000	.007	.018	.000	.000	.000	.000
π_{t-27}	.000	.000	.000	-.023	.000	.003	.024	.000	.000	.000	.000
π_{t-28}	.000	.000	.000	-.020	.000	.006	.019	.000	.000	.000	.000
π_{t-29}	.000	.000	.000	-.032	.000	.000	.045	.000	.000	.000	.000
π_{t-30}	.000	.000	.000	-.015	.000	.000	.028	.000	.000	.000	.000
	interest rate response to output										
y_t	.419	.244	.668	.493	.470	.263	.406	.360	.010	.652	.270
y_{t-1}	.284	.221	.302	.224	.236	.169	.251	.204	.004	.040	.097
y_{t-2}	.176	.148	.131	.080	.063	.091	.174	.162	.001	.138	.020
y_{t-3}	-.044	.089	-.005	-.019	-.011	.052	.095	.038	-.001	-.086	.015
y_{t-4}	-.085	.114	-.005	-.012	-.026	.026	-.025	.002	-.004	.109	-.009
y_{t-5}	-.069	.065	-.156	-.085	-.031	-.010	-.025	.040	-.003	-.073	-.042
y_{t-6}	-.097	.019	-.049	-.113	-.029	-.062	-.028	-.012	-.002	.002	-.021

Table 2: **Optimal feedback rule (continued)**

	Aus	Bel	Fin	Fra	Ger	Ire	Ita	Lux	Net	Por	Spa
	interest rate response to output (continued)										
y_{t-7}	-.007	.019	-.055	-.113	-.050	-.015	.030	-.037	-.002	-.076	-.043
y_{t-8}	-.003	-.005	-.062	-.072	-.094	-.002	-.017	-.110	-.004	.036	-.063
y_{t-9}	.016	-.049	-.074	-.046	-.026	-.009	-.016	-.028	-.004	-.027	-.050
y_{t-10}	.038	-.009	-.042	.021	-.071	.019	-.057	.008	-.002	.041	-.030
y_{t-11}	.000	.040	.105	.000	.050	.000	-.057	.042	.003	-.118	-.044
y_{t-12}	.000	.038	-.052	.000	.000	.000	-.073	.045	-.005	.103	-.172
y_{t-13}	.000	.065	-.050	.000	.000	.000	-.059	.012	-.004	.000	-.094
y_{t-14}	.000	.059	.005	.000	.000	.000	.002	-.019	-.003	.000	-.037
y_{t-15}	.000	.081	-.051	.000	.000	.000	.000	.003	-.002	.000	-.025
y_{t-16}	.000	.062	-.051	.000	.000	.000	.000	-.019	.000	.000	.000
y_{t-17}	.000	.024	.044	.000	.000	.000	.000	-.040	.000	.000	.000
y_{t-18}	.000	-.017	-.102	.000	.000	.000	.000	-.062	.000	.000	.000
y_{t-19}	.000	-.008	-.134	.000	.000	.000	.000	-.041	.000	.000	.000
y_{t-20}	.000	-.043	.000	.000	.000	.000	.000	-.040	.000	.000	.000
y_{t-21}	.000	-.096	.000	.000	.000	.000	.000	.021	.000	.000	.000
y_{t-22}	.000	-.072	.000	.000	.000	.000	.000	-.003	.000	.000	.000
y_{t-23}	.000	-.108	.000	.000	.000	.000	.000	-.049	.000	.000	.000
y_{t-24}	.000	.044	.000	.000	.000	.000	.000	.047	.000	.000	.000
	interest rate response to past interest rates										
i_{t-1}	.725	.611	.791	.851	.766	.797	.796	.702	.997	.678	.911
i_{t-2}	-.030	-.057	-.017	-.009	-.022	-.016	-.016	-.035	-.000	-.040	-.003
i_{t-3}	-.027	-.053	-.016	-.008	-.020	-.015	-.015	-.032	-.000	-.037	-.003
i_{t-4}	-.025	-.049	-.014	-.007	-.018	-.013	-.013	-.029	-.000	-.034	-.003
i_{t-5}	-.022	-.044	-.012	-.006	-.016	-.011	-.012	-.025	-.000	-.030	-.002
i_{t-6}	-.019	-.039	-.011	-.005	-.013	-.009	-.010	-.022	-.000	-.026	-.002
i_{t-7}	-.016	-.033	-.009	-.004	-.011	-.007	-.008	-.018	-.000	-.022	.002
i_{t-8}	-.012	-.026	-.007	-.003	-.008	-.006	-.007	-.014	-.000	-.017	.001
i_{t-9}	-.009	-.020	-.005	-.002	-.006	-.004	-.005	-.011	-.000	-.013	.001
i_{t-10}	-.006	-.013	-.003	-.001	-.004	-.003	-.003	-.007	-.00à	-.009	.001
i_{t-11}	-.003	-.006	-.002	-.001	-.002	-.001	-.002	-.003	-.000	-.004	.000

$$d_{j,t} = i_{j,t} = -\left(R_j + B_j' V_j B_j\right)^{-1}\left(U_j' + B_j' V_j A_j\right) X_{j,t}, \;\; j = 1, ..., 11. \tag{11}$$

In the case of a Euro-wide perspective, the representative takes into account the macro-economic situation in the whole union. We model this by assuming that such a representative would form the desired interest rate (rule) as a weighted average of the desired interest rates of the individual countries:

$$d_{EMU,t} = \sum_{j=1}^{n} w_j d_{j,t}. \tag{12}$$

The weights represent the weight assigned to the country in the general loss function.[11] Equation (12) can be interpreted as a short cut to an Euro-wide optimal policy rule. As Gerlach and Schnabel (1998) show, the weighted average of Euro interest rates can be replicated well by a simple Taylor-rule on Euro aggregates of inflation and output. Therefore, we can interpret equation (12) as an approximation to an optimal linear interest rate rule for the Euro as a whole.

5 Simulation Results

In this section we look at the effect of decision rules, i.e. voting procedures, on the effectiveness of monetary policy and macro-economic stabilization. In order to simulate Euroland's environment we make the following assumptions. First, we assume that the macro-economic environment does not change in the member states after the start of EMU. That is the matrix A is assumed to remain valid in the Euroland environment as well. Second we assume that the structure of output shocks remains the same. Finally we assume that the shocks to the inflation equation become the same for all countries. The simulations are based on the triplet of preference parameters $(1, 1, .5)$. Results of an earlier study for alternative weights can be found in De Grauwe et al. (1998).

[11] In the simulations we take the capital share (renormalized as to add up to 1) of every central bank in the ECB as the weight for the country. These weights are assumed to be a function of the countries population and GDP as a fraction of the aggregate EMU population and GDP. The weights are for Austria 0.0299, Belgium 0.0366, Finland 0.0177, France 0.2138, Germany 0.3093, Ireland 0.0106, Italy 0.1896, Luxemburg 0.0019, The Netherlands 0.0542, Portugal 0.0244 and Spain 0.1119.

5.1 Effectiveness of Monetary Policy

Here, we will first look at the interest rate process itself. Table 3 presents some statistics for the resulting interest rates for different preference configurations.

Some results stand out. First, there is almost no difference between the two first scenario's, i.e. the consensus rule and the ECB rule. That is, in case the ECB rule applies in the GC, the proposal of the ECB representatives is almost always accepted (in about 99.5 percent of the cases). Since the ECB-representatives propose the Euro-wide average, the outcome of the ECB-rule scenario and the consensus scenario is almost always identical. This result points to the fact that the existing asymmetries in the shocks and the propagation are not strong enough to create situations where nine or more countries would oppose the ECB proposal. More precisely, the asymmetries are not strong enough to create sufficiently skewed distributions for desired interest rates such that at least nine countries desired interest rates are at the same side of the weighted average of the desired interest rates.

Second, under the ECB rule, the correlation between decided, i.e. Euro interest rates, and desired interest rates tend to be the highest for the larger countries, i.e. Germany, France, Italy and Spain. These correlations tend to decrease when one goes from an ECB rule to a purely nationalistic rule. A possible explanation of this finding goes as follows. Since the ECB proposal is almost always accepted, the weights used to compute the Euro-wide desired interest rate determine to a large extent the correlation of the desired and decided interest rates. Since the weight is higher for the larger countries, obviously, their desired interest rates will have a higher correlation with the final decided interest rate. Under the purely nationalistic case, the Euro-wide desired interest rate is no longer used since all representatives take a nationalistic point of view. The weights of the countries is now only determined by the number of representatives of each of the countries. Since larger countries have at most two representatives their weight now declines to at most 2/17, which in most cases smaller is than the weight in the average Euro-wide desired interest rate. Therefore, correlations tend to decrease for the larger countries as one turns from an ECB rule to a purely nationalistic type of rule.

Third, preferences seem to matter for the correlations between desired and decided interest rates. The correlations tend to decrease as more weight is put on output stabilization. This fact can be explained by noting that when the weight on output stabilization increases, the parameters in the optimal linear feedback rule tend to increase for output and decrease for the past interest rates. As such, asymmetric shocks in the real economy (i.e. the output equation) get a larger weight, while the common components, i.e. past interest rates, decrease. Thus, desired interest rates across countries will differ more and these differences are to be aggregated into one Euro-wide interest rate. The latter will therefore contain more asymmetric components and hence be correlated less with each of the individual desired interest rates.

Table 3: **Correlation between Desired and Decided Interest Rates**

	Aus	Bel	Fin	Fra	Ger	Ire	Ita	Lux	Net	Por	Spa	ECB
ECB Rule ($\lambda = 1, \gamma = .5$)	58	2	57	84	82	73	85	42	98	29	92	99.6
Nat. Rule ($\lambda = 1, \gamma = .5$)	67	34	72	89	65	75	75	59	95	47	86	-
ECB Rule ($\lambda = 5, \gamma = .5$)	31	25	37	64	79	45	72	44	96	.13	75	98.5
Nat. Rule ($\lambda = 5, \gamma = .5$)	45	40	51	79	45	56	72	29	96	14	77	-
ECB Rule ($\lambda = .2, \gamma = .5$)	90	42	80	85	94	90	90	82	99	41	99	99.6
Nat. Rule ($\lambda = .2, \gamma = .5$)	84	60	73	88	86	91	73	79	99	39	97	-

Finally, we assess the effectiveness of monetary policy under the alternative voting procedures. In order to do so, we construct a hypothetical benchmark for each economy. More precisely we calculate the loss for each economy under the assumption that each country could set monetary policy optimally (that is use the country specific optimal linear feedback rule). Obviously this is only a hypothetical benchmark because we neglect all sorts of external factors which may influence country-specific macro-economic performance, and hence losses. The benchmark case however gives us an idea of the areas where Euro-wide monetary policy may fail and where it may be effective. Table 4 presents the summary statistics (variances) for the benchmark, the ECB-rule and the purely nationalistic case.

As can be inferred from table 4, monetary policy is relatively effective under the ECB-rule in controlling inflation variability. Compared to the benchmark case inflation variability is not affected much by this voting procedure. For some countries, inflation variability even decreases. The ECB-rule, however, is less successful in stabilizing output relative to the benchmark case. Output variability increases quite strongly for most of the countries. The failure of the ECB-rule to stabilize output can also be seen from the variability of the interest rate. Again, compared to the benchmark case, interest variability decreases substantially for most countries. This decrease in interest variability can be attributed to the fact that the interest rate under the ECB-rule is a weighted average of desired interest rates. Such an average will tend to cancel out the asymmetries in the country-specific desired interest rates.

Under the nationalistic rule, monetary policy is less effective than under the ECB rule. Taking policy preferences as $(1, 1, 0.5)$country losses generally tend to increase as compared to the ECB-rule. Higher interest rate volatility does not translate into an improvement in the welfare across the board. This is due to the fact that the weights in the averaging procedure become more equal, resulting in an even less effective monetary policy.

Table 4: **Loss Function**

	Aus	Bel	Fin	Fra	Ger	Ire	Ita	Lux	Net	Por	Spa
	$\lambda = 1,\ \gamma = 0.5$										
Benchmark											
π	.0020	.0005	.0065	.0031	.0041	.0008	.0052	.0029	.0018	.0603	.0029
y	.0840	.0970	.1251	.0853	.0934	.1689	.0984	.1712	.0851	1.3137	.1054
R	.0126	.0048	.0426	.0153	.0184	.0151	.0260	.0218	.0003	.2992	.0117
Loss	.0922	.1000	.1530	.0961	.1067	.1773	.1166	.1851	.0868	1.5236	.1142
Weighted Loss	.1416										

	$\lambda = 1,\ \gamma = 0.5$										
ECB Rule	Aus	Bel	Fin	Fra	Ger	Ire	Ita	Lux	Net	Por	Spa
π	.0021	.0060	.0141	.0059	.0084	.0008	.0170	.0082	.0018	.2138	.0029
y	.1410	.2865	.2169	.0954	.1202	.2019	.1033	.2632	.0851	2.0924	.1179
EMU R	.0039	.0039	.0039	.0039	.0039	.0039	.0039	.0039	.0039	.0039	.0039
Loss	.1450	.2944	.2330	.1033	.1306	.2047	.1222	.2733	.0887	2.3082	.1228
Weighted Loss	.1824										
Nationalistic											
π	.0004	.0002	.0036	.0006	.0015	.0002	.0015	.0006	.0002	.0135	.0006
y	.1180	.2120	.2095	.0952	.1244	.1981	.1057	.2430	.0851	1.9678	.1171
EMU R	.0775	.0775	.0775	.0775	.0775	.0775	.0775	.0775	.0775	.0775	.0775
Loss	.1571	.2509	.2518	.1345	.1646	.2371	.1460	.2824	.1241	2.0201	.1565
Weighted Loss	.2022										

6 Conclusions

In this paper we analyzed the effects of different voting procedures in the Governing Council of the ECB on the economic conditions and the welfare in the different member states. In order to do so, we allowed current asymmetries in shocks and their propagation to remain at the level which they have today. At this moment it is difficult to know whether asymmetries will increase or decrease in the future.

In order to assess the possible tensions that may arise from the existing asymmetric conditions across countries we derived the implied desired interest rates based on the optimal linear feedback rules as proposed by Rudebusch and Svensson (1998). Different voting procedures were then applied within the Governing Council to arrive at an interest rate for the whole of Euroland. We find that the correlation between the actual decided interest rate and the country-specific desired interest rates is generally highest for the larger countries, such as Germany, France, Italy and Spain.

From monetary effectiveness perspective, our simulations seem to indicate that voting procedures do matter. The strict nationalistic case, i.e. the scheme where each representative votes are the basis of national interests is clearly inferior to the two alternatives considered. We argued that this feature comes from the fact that decided interest rates incorporates more equally the desired interest rates of all countries, rendering it ineffective for stabilization purposes. In contrast, if the ECB-board members take a strict Euro-wide perspective, monetary policy is more effective in terms of welfare losses.

This paper neglects some important features of European money markets. For instance, in the estimation of inflation and output equations we neglected the real exchange rate as a possible cause of output or inflation movements. Obviously this external source of economic fluctuations may be of considerable importance for small open economies. Incorporating the real exchange rate along the lines of Peersman and Smets (1998) seems an interesting way to account for these external forces. However, it would also increase the dimension of the state space considerably, which is already large in the current setting. We plan to pursue this route of research in the near future. Second, the optimal desired interest rate for euro land as a whole has not been derived. Instead we assumed that a proxy for this variable was given by the weighted average of the desired interest rates of the countries. The optimal desired interest rate could theoretically be obtained in much the same way as the national desired interest rates. Here the curse of dimensionality strikes again however. At the end of the day, however, we would like to argue that the approach we took is a reasonable approximation for the ECB optimal linear feedback rule.

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Figure 1: Output Gap

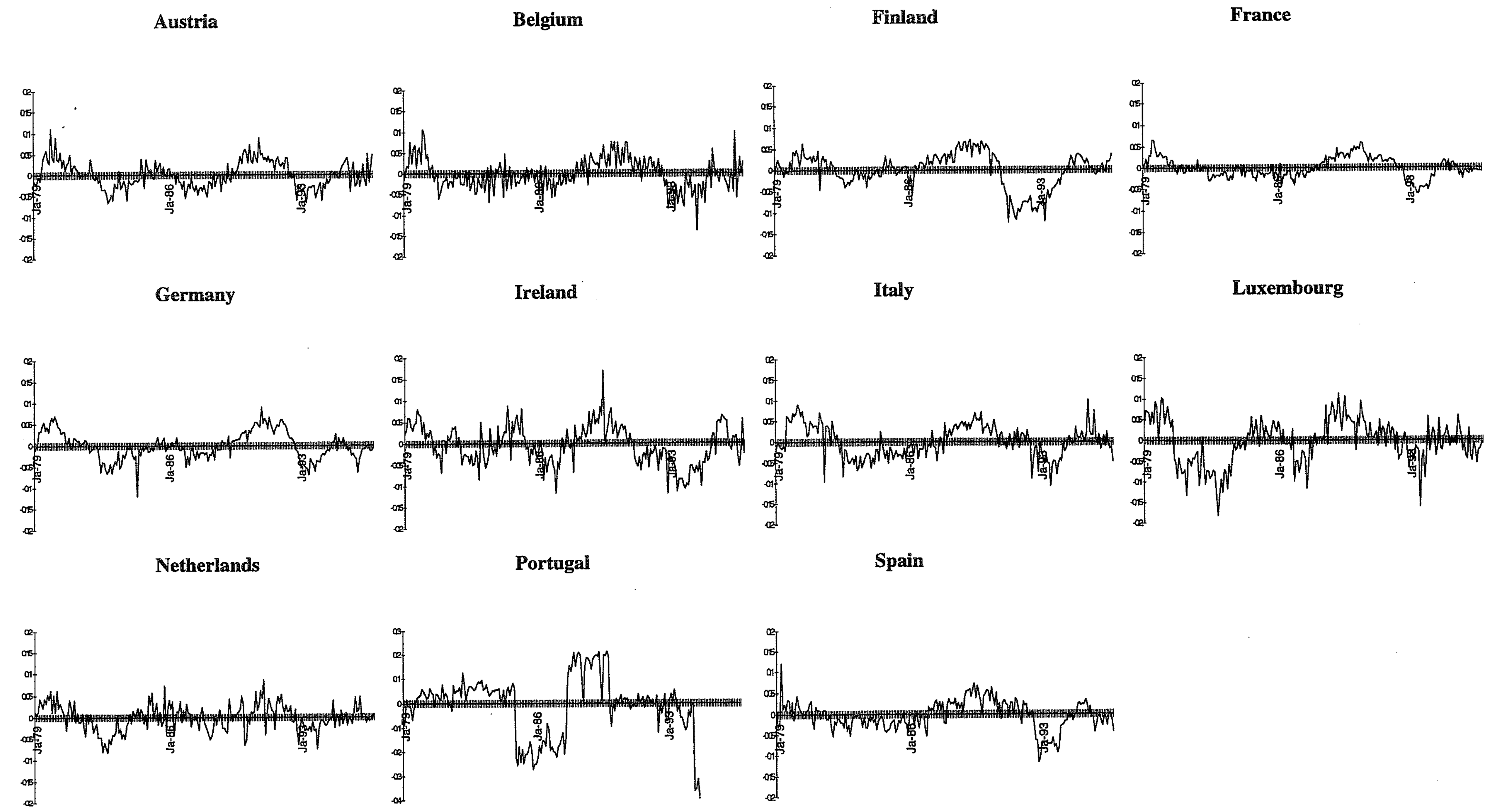

Figure 2: Inflation

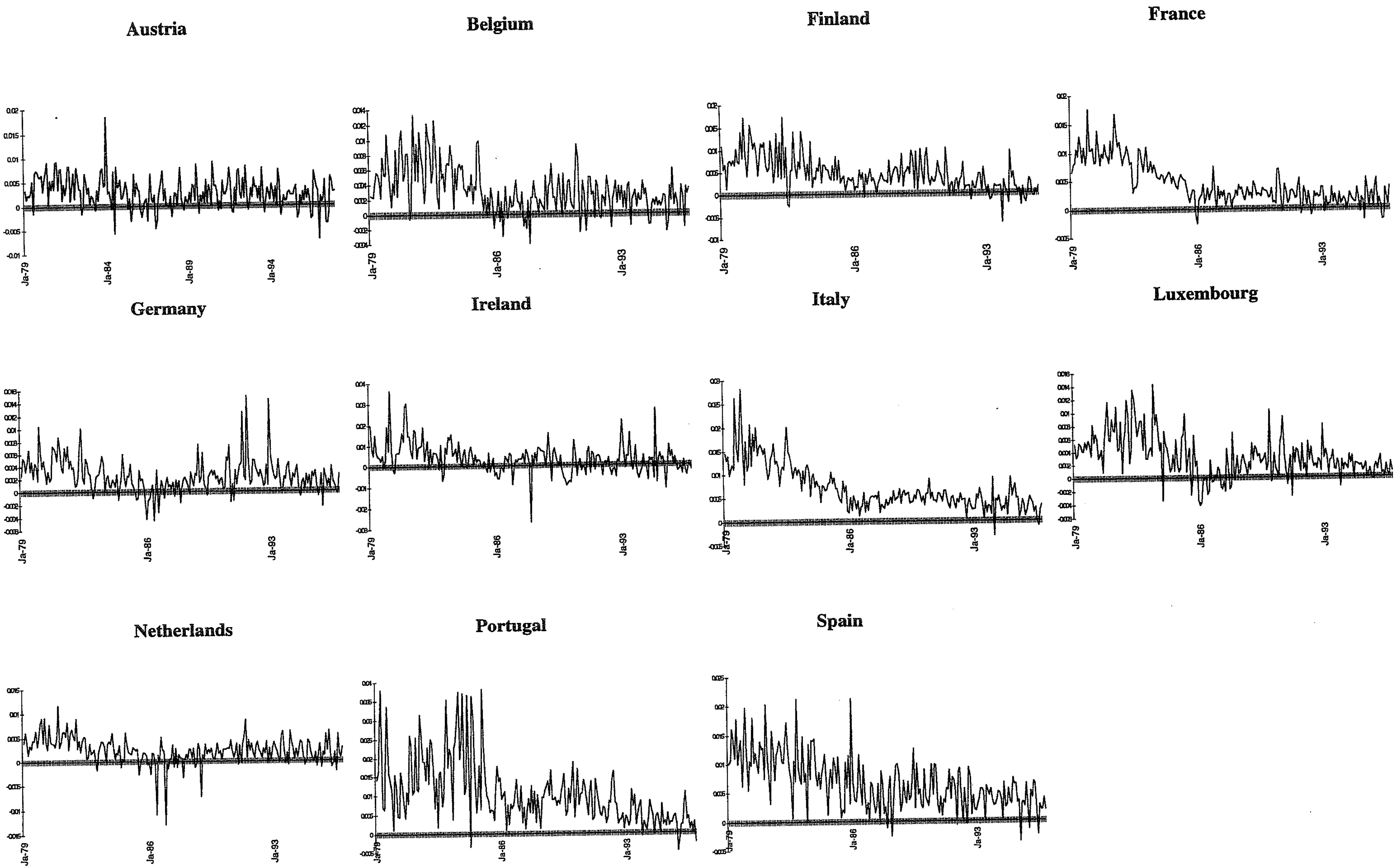

Figure 3: Output and Inflation reactions with respect to a 1% increase in the interest rate (lags in inflation and output equations, respectively, between brackets)