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From EMS to EMU: Are We Better Off?

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Center for Economic Studies
Discussions Paper Series (DPS) 99.21
http://www.econ.kuleuven.be/ces/discussionpapers/default.htm

**November 1999**

DISCUSSION
PAPER

# From EMS to EMU: Are We Better off?

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**Abstract**

In this paper we compare the stabilising properties of the EMU to those of a ERM system, controlled by Germany. We find that in general the EMU will provide more stabilisation than the EMS system. However, these results only apply if the ECB can effectively control monetary policy. In the case that the ECB-representatives do not coordinate and take a nationalistic point of view, the EMS regime is preferred by various countries.

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# 1 Introduction

A fixed exchange rate system or a monetary union among sovereign states requires a coordination scheme for monetary policy. In the literature one often refers to this need of coordination as the $n-1$ problem. In practice most coordination mechanisms turn out to be of the asymmetric type, where one country decides about the monetary policy and the $n-1$ others adapt such that the exchange rate remains fixed. The ERM was undoubtedly such an asymmetric coordination mechanism dominated by Germany.[1] By adopting the European Monetary Union, the monetary coordination scheme has changed quite drastically. The conduct of monetary policy is now in the hands of the Governing Council of the ESCB, a body where all countries have their representative and where the ECB is also represented by the Executive Board. So at first sight the coordination scheme has become more symmetric than it was in the years preceding EMU.

The purpose of this paper is to analyze the effects of this shift in monetary coordination mechanism on macro-economic performance. Put differently, we study the question whether the transition from ERM to EMU helps to improve the stabilizing properties of monetary policies. Related to this is the question which countries loose and which countries win. A naive first guess to answer these questions may be formulated as follows: since each country is now officially represented in the Governing Council, monetary policy will be partially determined by the economic conditions in these countries, not only by German economic conditions. Therefore, with the exception of German, monetary policy will be more adapted to the situations in each of the countries and thus generate more macro-economic stability. This answer however ignores the aggregation problem which the Governing Council is facing. Since all countries are represented in this body, some sort of aggregation of country-specific desires will be necessary. If these desires are sufficiently divergent, one can expect that the interest rate (the instrumental variable of monetary policy) will be very inert and hence ineffective to be used as a stabilizing tool.[2] Little or no macro-economic stabilisation must be expected in that case. On the other hand, however, the ERM-regime in which Germany controls monetary policy may even be less attractive. To the extent that countries face opposite economic conditions to the German ones, German control over monetary policy renders the latter even more ineffective in stabilizing the economies of the other countries.

The remainder of the paper is organized as follows. In section 2 we set out the optimal monetary policy reaction for a typical central bank and discuss the different types of asymmetries in the model that play a role in this optimal policy. We use the standard framework

[1] See for example De Grauwe (1997).

[2] An example of the inertia could be observed in the beginning of EMU, i.e. 1999. Then, some member countries, such as Ireland, Portugal and others needed some interest rate increases while others such as Germany, Belgium ... asked for interest rate cuts. The ECB found itself captured in between these demands and did not alter interest rates at all or only marginally.

of Rudebusch and Svensson to find the optimal linear feedback rules for interest rates. We proceed in section 3 by estimating the optimal interest rate rules and discuss the substantial asymmetry in these policy reactions across countries. In section 4 we describe our economic and institutional framework for the simulations in order to analyze the impact of alternative voting schemes and asymmetric economic structures. In section 5 we discuss implications of majority voting in the Governing Council on the macro-economic stability under both the EMU scenario and the ERM scenario. Finally, section 6 concludes.

## 2 Model for Propagation of Monetary Policy

To make the model similar in structure to the one used by central banks we follow Rudebusch and Svensson (1998) in focusing on the following three features: (1) the policy instrument used by the central bank is the short-run interest rate ($i$), (2) the model is defined in terms of the output gap and (3) a standard autoregressive type of Phillips-curve is used.[3] More formally, we assume that inflation ($\pi$) is determined by the output gap ($-y$) with a one period lag and past inflation rates:

$$\pi_{t+1} = \sum_{j=1}^{n} \alpha_{\pi,j} \pi_{t+1-j} + \alpha_y y_t + \varepsilon_{t+1}. \tag{1}$$

We decompose output into a permanent and a transitory component. We interpret the permanent component of output as the output capacity of an economy. The transitory component $y$ therefore measures the temporary over- or underutilisation of the output capacity. 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. More formally:

$$y_{t+1} = \sum_{j=1}^{m} \beta_{y,j} y_{t+1-j} - \beta_i \left( \bar{i}_t - \bar{\pi}_t \right) + \eta_{t+1}, \tag{2}$$

where $\bar{i}_t$ and $\bar{\pi}_t$ denote a twelve month (moving) arithmetic average of current and past interest and inflation rates, respectively:

$$\bar{i}_t = 1/(12) \sum_{i=0}^{11} i_{t-i} \quad \text{and} \quad \bar{\pi}_t = 1/12 \sum_{i=0}^{11} \pi_{t-i}. \tag{3}$$

Note that equations (1) and (2) imply a specific transmission mechanism in response to changes in the policy instrument. More specifically, a change in the interest rate first affects the output gap and subsequently, with a one period lag, affects the inflation rate indirectly

[3] Note that the autoregressive type of Phillips curve is backward looking instead of the (theoretically) more standard, forward looking, version. Empirical evidence suggests that the former may, from an empirical point of view, be superior to the latter. For instance, Fuhrer (1997) finds that the backward looking version is much closer to the empirically observed inflation dynamics than the forward looking version.

(through the effects of interest rate changes on the output gap). Evidently, transmission of interest rate changes to output and inflation will be determined by the parameter values $\alpha_{\pi,j}$ and $\beta_{y,j}$ $j = 1, ..., 11$.[4]

The state of the economy and its dynamics can be summarized by the state space representation of (1) and (2). Denoting the state of the economy by $X_t$, an $(n + m + 11) \times 1$ vector of the inflation rates, the output gaps and the interest rate, its dynamics can be reformulated as:[5]

$$X_{t+1} = AX_t + Bi_t + v_{t+1} \tag{4}$$

The central bank has as objective to minimize its intertemporal loss function which is defined in terms of the time $t$ expected difference between (yearly) inflation, the output gap $(-y)$ and their targeted values, $c_1$ and $c_2$, respectively. Moreover, some degree of interest smoothing is assumed for the central bank. Formally, we assume the following minimization problem:

$$\min_{i_t} \sum_{j=0}^{+\infty} \delta^j E_t \left[ (\bar{\pi}_{t+j} - c_1)^2 + \lambda (y_{t+j} - c_2)^2 + \gamma (i_{t+j} - i_{t+j-1})^2 \right]. \tag{5}$$

If the frequency of meetings in the ECB is sufficiently high such that the discount rate $\delta \to 1$, it can be shown that the above minimization problem can be restated in terms of an unconditional loss function (see Rudebusch and Svensson, 1998):

$$\min_{i_t} E[L_t] = Var[(\bar{\pi}_t - c_1)] + \lambda Var[(y_t - c_2)] + \gamma Var[\Delta i_t]. \tag{6}$$

Again, following Rudebusch and Svensson (1998) we write the target variables, $\bar{\pi}_t$, $y_t$ and $i_t - i_{t-1}$ in function of the state variable $X_t$ :

$$Y_t = \begin{bmatrix} \bar{\pi}_t \\ y_t \\ i_t - i_{t-1} \end{bmatrix} = C_X X_t + C_i i_t. \tag{7}$$

The loss function can now be rewritten as[6] :

[4] In order to satisfy the natural rate hypothesis a restriction of the $\alpha$ coefficients of the form

$$\sum_{j=1}^{n} \alpha_{\pi,j} = 1$$

should be imposed. In the empirical section we use the unrestricted coefficient estimates for which the summed coefficients are in most cases reasonably close to and insignificantly different from 1. A formal test for long run neutrality is presented in table 1 in the appendix.

[5] See Rudebush and Svensson (1998) or De Grauwe et al. (1998) for a more elaborated formulation of the state-space representation.

[6] Note that in what follows we have implicitly deducted the mean from each of the target variables. In the empirical section we deal with this issue by doing the econometric analysis on the demeaned series.

$$L_t = E\left[Y_t' K Y_t\right], \text{where } K = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \lambda & 0 \\ 0 & 0 & \gamma \end{bmatrix}. \tag{8}$$

Given the empirical evidence that central banks base their interest rate policy on current (and previous) values of output and inflation we consider the class of linear feedback rules,i.e. linear rules based on the current economic states:

$$i_t = fX_t \tag{9}$$

where $f$ denotes a $1 \times (n + m + 11)$ vector. Using the above relations and substituting the linear feedback rule we obtain the dynamics of the state variable, taking into account the actions of the central bank (on interest rates), as:

$$X_{t+1} = MX_t + v_{t+1},\ M = A + Bf \tag{10}$$

and for the goal variables:

$$Y_t = CX_t,\ C = C_X + C_i f. \tag{11}$$

Note that according to equation (10) the central bank can change the dynamics of the economic state by conditioning its interest rate policy on the current state of the economy. The optimal linear feedback rule is then defined as that interest rate rule that generates a state-space dynamics that minimizes the loss function (8) . Under the assumptions made so far, Rudebusch and Svensson (1998) show that the optimal (linear) policy rule is given by:

$$i_t = -\left(R + B'VB\right)^{-1}\left(U' + B'VA\right)X_t \tag{12}$$

where the matrix $V$ is defined by:

$$V = Q + Uf + f'U' + f'Rf + M'VM \tag{13}$$

$$Q = C_X' K C_X,\ U = C_X' K C_i \text{ and } R = C_i' K C_i.$$

Inspection of the optimal linear feedback rule $f$ shows that the optimal feedback rules (interest rate policies) can diverge across countries for three reasons. First, the economic conditions, as summarized by the state variable, $X$, can differ and hence require different policy actions. Second, the impact differential of interest changes, $B$, and different transmission speeds across countries, incorporated in $A$, can demand different policy reactions. Third, country-specific preferences over inflation, output and interest rate smoothness (entering through $K$) may vary

across countries. If individual member-states will try to pursue their own optimal economic policies within EMU, divergent (country-specific) differences in economic state, transmission mechanisms and preferences over the three goal variables are a potential source of conflict in the conduct of the European monetary policy.

## 3 Estimation Results and Optimal Feedback Rules

In the following we present our results of aggregate demand and supply estimations formalized in equations (1) and (2) over the period 1979.1 and 1994.09. Then, we proceed to derive the optimal feedback rules in accordance with Rudebusch and Svensson (1998). All output, inflation and interest rate data are obtained from the IMF International Financial Statistics. The output gap is generated via (log-)linearly detrended industrial production figures.[7] For monthly inflation we use the first difference of the (log) CPI indices. Finally, short run interest rates are monthly call money and money market rates on an annual basis (Note the exceptions of STF rate for Ireland, average lending rate for Finland and lending rate for Portugal). Since there was already a Monetary Union between Luxembourg and Belgium before the establishment of the EMU, we assume Belgian short run interest rates apply in Luxembourg.

In comparison to our previous paper (De Grauwe et al. 1998), the basic difference in the econometric part of analysis is that rather than imposing *ad hoc* lag lengths for the autoregressive component of aggregate demand and supply equations we rely on the Akaike Information Criterion to select the most reasonable lag length.[8] Lag lengths differ across countries considerably (see table 8), implying different degrees of size and timing of output and inflation adjustment processes.[9] We check the stability of the matrix A, i.e. the stability of autonomous part of the state space representation. Maximal and minimal eigenvalues of A matrix stay less than 1 in absolute value.[10]

Propagation of the monetary policy into inflation and output across countries is presented in figure 1. As is clear from figure 1 countries react differently with respect to changes in the monetary policy (interest rate). Consistent with the empirical literature we find stronger output reactions with respect to policy changes than the inflation reactions. We can subdivide output reactions into three groups. First, monetary policy seems to have significant effect on output in Austria, Belgium, Luxembourg and Portugal. Second, output gap seems to

[7] More precisely, we apply the Hodrick Prescott filter with a very high $\lambda = 500,000$, which is basically equivalent to linear detrending.

[8] By choosing the lag lengths we took care of the stability properties of the A and M matrices in order to generate the optimal feedback rules. Hence, with some AIC suggested lag structures we observed unstable state space representation. In that case, we opted for the closest alternative suggestion. Chosen lag structures are tabulated in Table 8.

[9] Estimated coefficients are not presented but available upon request.

[10] The eigenvalues of the A matrix are tabulated in table 9.

respond to monetary policy changes in Finland, France, Germany, Ireland and Italy as well, but to a limited extent. Finally, in Netherlands and Spain policymakers seem to be absolutely ineffective when they decide to use monetary tool to correct for undesired output fluctuations. Inflation reactions are weak and long lasting across the board, indicating the price sluggishness in the EMU countries. We find significant price puzzle in Belgium and Luxembourg and to a smaller extent in Ireland.

Then, we derive the optimal feedback rules for each individual country as a function of reduced form economic dynamics and policymakers' preferences. Hence we assume exogenous preferences of country specific policymakers. We choose three sets of preference possibilities, representing different preferences regarding stabilisation of output (high, medium and low).[11] We tabulate optimal output, inflation and interest rate smoothing coefficients under alternative preference specifications throughout figures 2 to 4.

A first observation is that, in line with our previous findings ( De Grauwe et al. 1998) optimal output coefficients are substantially larger than optimal inflation coefficients.[12] Also in line with previous research is the fact that interest rate smoothing coefficients are systematically higher than both inflation and output coefficients. A look at the first interest smoothing coefficients in table 1 indicates that three large countries, France, Netherlands and Spain are those which heavily prefer to smooth interest rates rather than output or inflation stabilisation.

Finally it is important to note that the application of the optimal feedback rules to determine the interest rate level will not result in an unstable economic environment. More specifically, the eigenvalues of the $M$ matrix are all smaller than 1 for all countries.[13]

Table 1: **Interest Rate Smoothing: First Parameters on Past Interest Rates in the Optimal Feedback Rules**

| **Aus** | **Bel** | **Fin** | **Fra** | **Ger** | **Ire** | **Ita** | **Lux** | **Net** | **Por** | **Spa** |
|---|---|---|---|---|---|---|---|---|---|---|
| intermediate output stabilization | | | | | | | | | | |
| 0.725 | 0.611 | 0.790 | 0.850 | 0.765 | 0.796 | 0.795 | 0.702 | 0.997 | 0.677 | 0.911 |

[11] High desire to stabilize output ($\lambda = 5, \gamma = 0.5$), medium desire to stabilize output ($\lambda = 1, \gamma = 0.5$) and low desire to stabilize output ($\lambda = 0.2, \gamma = 0.5$).

[12] This is essentially a feature of the monthly data. Inflation responses after one month is much smaller than one would observe in the quarterly data. Recent empirical literature vastly focused on the monetary transmission asymmetries across European countries. For evidence on the transmission of monetary shocks in Europe see among others Dornbusch, Favero and Giavazzi (1998), Giovannetti and Marimon (1998), Kieler and Saarenheimo (1998) and Ramaswamy and Sloek (1998). For G7 evidence, see Clarida, Gali and Gertler (1997), Peersman and Smets (1997) and Kim (1999).

[13] For the eigenvalues of the M matrices see table 9.

# 4 The Framework for Simulations

In this section we will conduct a simulation exercise in order to compare the present EMU regime with the EMS monetary arrangement. We recognize two types of asymmetries, an economic and an institutional one. The economic asymmetries were sketched in the previous sections and have to do with differences in transmission mechanisms, differences in preferences, and asymmetric shocks. The institutional asymmetries arise from the decision modes that will be assumed.

## 4.1 Economic Asymmetries

Let us start with the economic asymmetries. For that purpose we need to take into account three types of asymmetries across countries. First, we will use the asymmetries across countries in the speed and the size of the propagation of monetary policy changes. In the previous sections we have estimated the structure of these asymmetries for each individual country. Second, preferences can differ. Throughout the simulations we will treat them exogenously. Third, economic states can differ across countries as a result of the country-specific inflation and output shocks, which may be correlated across countries.[14] In order to recover the structure of the shocks we assume that product, labor and financial market institutions will not immediately change in terms of their structure. Thus, the past structure of inflation and output shocks correlations are assumed to remain the same for some time.[15]

## 4.2 Institutional Asymmetries

The Governing Council of the ECB consists of seventeen members. Six are members of the Executive Board of the ECB (ECB-Board for short) and originate from Finland, France, Germany, Italy, Netherlands and Spain. Eleven members are governors of the national Central Banks (one for each country). Following De Grauwe et al. (1998) we allow for two alternative points of view a member of the Governing Council can take. The first one assumes that the member takes a nationalistic point of view. The optimal desired interest rate for a member of country $j$ is then:

$$d_{t,j} = -\left(R_j + B_j' V_j B_j\right)^{-1}\left(U_j' + B_j' V_j A_j\right) X_{t,j}, j = 1, ...., 11. \tag{14}$$

[14] For recent evidence on the macroeconomic fluctuations in different European economies see Bayoumi and Prasad (1995) and Ballabriga, Sebastian and Vallés (1999). For evidence in the G7 countries, see for example Kwark (1999).

[15] Residuals of estimations (1) and (2) will serve for our purpose. Let $S_1$ denote the variance-covariance matrix of residuals of the aggregate demand estimation (2). Then, Cholesky decomposition of the variance-covariance matrix is $S_1 = L_1 L_1'$, $L$ being the lower triangular of $S_1$. Thus, in line with De Grauwe et al. (1998) we can recover the covariance structure by the vector of shocks $\varepsilon = [\varepsilon_{1,t}, .....\varepsilon_{11,t}] = L\xi_t$ where $\xi \tilde{} (0, 1)$. For the inflation shocks we apply the same procedure. Hence, our statistical framework is complete.

where the subscript $j$ represents the variable relevant for country $j$. If the member takes an EMU-wide perspective he will consider the situation in the union as a whole and construct a desired interest rate most apt to the EMU-wide state of the economy. We assume, as a short cut, that this desired interest rate can be represented as a weighted average of the country-specific desired interest rates:

$$d_{t,EMU} = \sum_{j=1}^{11} w_j d_{t,j}, \tag{15}$$

where $w_j$ is the weight attached to country $j$, which is taken as the normalized share of the capital of the national central banks in the ECB.[16] We will assume that decisions are made by majority voting and we will apply the median voter theorem [17]. The attitudes that each of the members in the Governing Council takes take also matters for the final outcome. We assume two alternative voting schemes which we label the ECB rule and the nationalistic rule, respectively.

- ECB Rule: The governors of the national central banks (eleven of the members of the Governing Council) take a nationalistic perspective (i.e. use $d_{t,j}$) while the six ECB-board members take an EMU wide perspective (i.e. $d_{t,EMU}$). In this case, the ECB-board aggregates individual desired interest rates and proposes this average as the policy to be implemented. Majority voting (median voter) is then applied. In this case the six members of the ECB-board always vote the same way.

- Nationalistic Rule: All members of the Governing Council (the 11 representatives of the individual central banks and the 6 members of the ECB-board) take a nationalistic perspective. Majority voting is then applied.[18]

These two rules are then compared to alternative of a fixed exchange rate system with Germany as the anchor country. We label this alternative the EMS rule:

- EMS Rule: Germany's desired interest rate becomes the Euro-wide interest rate and is applied to all other countries. Thus, this is equivalent with "dictatorship" where $d_{t,j}$ (with j = Germany) always prevails.

[16] These weights are a function of the country's population and GDP in EMU-wide population and GDP. As such they can be taken as relevant proxies for the weight each country gets in the decision taken by a representative with an EMU-wide perspective. 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.

[17] Median voter models have also been considered by others as a likely outcome of the voting procedure, see for instance Von Hagen (1998).

[18] Note that the current ECB-board will consist of Dutch, French, Finnish, German, Italian and Spanish central bankers.

# 5 Simulation Results

In this section we present our simulation results for the ECB Rule, Nationalistic Rule and EMS Rule under three different preference schemes high output stabilization ($\lambda = 5, \gamma = 0.5$), low output stabilization ($\lambda = 0.2, \gamma = 0.5$), and intermediate output stabilization ($\lambda = 1, \gamma = 0.5$). Our procedure is as follows: We start our simulations by assuming that all economies are initially in the steady state. In a first step, shocks in the output gap arrive and have the same correlation structure as the shocks observed over the estimation period. Country specific output gaps are calculated by using the estimated coefficients of aggregate demand equation and the country specific output shocks. The obtained output gaps feed into our aggregate supply equations together with autoregressive inflation components and inflation shocks. Here, we use again the estimated coefficients of the aggregate supply equation (1) for each individual country in order to account for country specific inflation. In a second step, using optimal feedback rules, the members of the Governing Council, determine their own desired interest rates. In the third step, according to each decision rule we designed, the Governing Council decides about the unique, Euro-wide interest rate.[19] This interest rate is then used for the calculation of moving averages of real interest rates for each individual country and so on.

## 5.1 Who Decides about the EMU-wide Interest Rate?

Before doing the welfare comparison between the EMU-type arrangements and the EMS, we use the simulations to shed some light on the behavior of (simulated) interest rates in the two EMU rules (ECB-rule and nationalistic rule). Table 2 contains the fraction of times that the country's optimal desired interest rate was implemented. As can be seen from this table, in the ECB-rule the interest rates are most often (between 81% to about 94%) determined by the ECB-Board. So, as long as the ECB-Board takes an EMU-wide perspective and uses some average of country-specific desired interest rates the ECB-Board effectively controls monetary policy even if all governors only care for the interests of their own country. This result suggests that the observed asymmetries in the propagation mechanisms across EMU-countries are not strong enough to create situations where at least nine countries would oppose the ECB-Board proposal. Note also that if the ECB-Board proposal is overruled it is very likely to be replaced by the optimal interest rate of a country with a very high interest rate smoothing coefficient (The Netherlands, Spain or France).

If the ECB-Board members also take a nationalistic point of view and thus support the optimal interest rate of their home country this buffer of six ECB-Board members disintegrates. The consequence of this disintegration is that the median voter must now be a specific

[19] Obviously, with the Benchmark Rule each member country can keep their desired interest rate. Thus, here we have eleven interest rates.

country and no longer an average of country-specific demands. As can be seen from the table, the countries that become the median voting country most frequently are those countries that opt strongly for interest rate inertia: The Netherlands, Spain, France. This result is easily explained. Since countries set the interest rates to stabilize the economy, some countries will be opting for higher interest rates, others will opt for lower interest rates. The countries that will have the stronger preferences for larger interest rate changes are those whose economies respond to the changes in interest rates. For countries where the economy does not or only marginally react to changes in monetary policy, there is not much scope for macro-economic stabilisation through interest rate policy. These countries can be interpreted to opt for financial stability, which is formalized by the relatively large coefficient on the interest rate smoothing in the optimal feedback rule. These countries are of course the countries that opt for no change in the interest rate and hence tend to be located in the middle of the spectrum of desired interest rate changes.

Table 2: **Voting power: fraction of times that the country is the median voter**

| | **Aus** | **Bel** | **Fin** | **Fra** | **Ger** | **Ire** | **Ita** | **Lux** | **Net** | **Por** | **Spa** | **ECB** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low output stabilisation ($\lambda = .2$, $\gamma = .5$) | | | | | | | | | | | |
| ECB Rule | 0.7 | 0.6 | 1.0 | 1.0 | 2.0 | 1.0 | 0.2 | 0.8 | 7.4 | 0.5 | 3.7 | 81.3 |
| Nat. Rule | 4.8 | 3.6 | 4.4 | 8.2 | 9.9 | 6.1 | 5.1 | 4.1 | 33.2 | 1.1 | 19.6 | - |
| | Intermediate output stabilisation ($\lambda = 1, \gamma = .5$) | | | | | | | | | | | |
| ECB Rule | 0.3 | 0.2 | 0.4 | 0.7 | 0.8 | 0.5 | 0.2 | 0.3 | 3.4 | 0.3 | 1.0 | 92.0 |
| Nat. Rule | 4.4 | 2.9 | 5.4 | 11.8 | 9.5 | 4.9 | 7.7 | 3.6 | 34.6 | 1.0 | 14.3 | - |
| | High output stabilisation ($\lambda = 5, \gamma = .5$) | | | | | | | | | | | |
| ECB Rule | 0.3 | 0.0 | 0.3 | 1.0 | 0.3 | 0.6 | 0.2 | 0.2 | 1.6 | 0.2 | 0.2 | 95.2 |
| Nat. Rule | 6.0 | 3.6 | 5.7 | 15.5 | 7.2 | 4.0 | 10.0 | 2.9 | 33.6 | 1.1 | 10.4 | - |

Table 3 then presents the correlations between the desired (country-specific) interest rates and the decided EMU-wide interest rate. In the case of the ECB Rule it is not surprising that the correlation between desired and decided interest rate is the highest for the ECB Board. Across preference configurations, the correlation is almost perfect, which reflects the fact that in the simulations the ECB-Board effectively decides about the conduct of monetary policy. For the countries involved, the correlations tend to be highest for the larger countries, France, Germany, Spain and Italy (because of their large weight in the averaging procedure) and for those countries that opt for strong interest rate inertia (The Netherlands). Also, in the nationalistic scenario, the correlation between desired and decided interest rates tend to decrease quite substantially for the larger countries and to increase for the smaller ones.

Table 3: **Correlation between desired and actual interest rates.**

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

### 5.2 Welfare Analysis: Will EMU Do Better than the EMS?

In this section we compare the EMU-regimes with the EMS from a welfare point of view. We obtain this welfare analysis by comparing the losses generated in these different monetary regimes. Since these losses measure the degree to which monetary policies are capable of stabilizing the target variables (output, inflation and interest rate) they can also be interpreted as measuring the effectiveness of monetary policies. In figures 5 to 6 we plot the losses which occur under each of these possible regimes. Throughout tables 4 to 7 we translate these figures into relative losses.

Insert tables and figures (16)

A first conclusion that can be drawn from these tables is that in most of the preference constellations, the ECB rule clearly dominates the EMS-rule. We observe that all countries, except Germany, prefer the ECB arrangement over the EMS arrangement. Only when the preference for output stabilisation is very low there are two small countries (Austria and Belgium) preferring the EMS-rule over the ECB-rule. In this sense the naive answer provided in the introduction to this paper is valid. Note however that the ECB rule assumes that only the national governors take a nationalistic perspective while the six ECB Board members, which are almost always the median voter, take an EMU-wide perspective. The economic conditions of all countries are therefore taken into account according to fixed and time invariant weights. Some partial reflection of the country-specific desires in the policy of the Governing Council is thereby guaranteed.

The assumption of all six ECB-Board members taking an EMU-wide perspective is not innocuous. It basically determines the superiority of the ECB-rule over the EMS rule. When all the members of the Governing Council take a nationalistic view, the median voter's desired interest rate is no longer some average of country specific desires but the desired interest rate of some (different across time) country. When monetary policy would be conducted under

this scenario, the EMS type of arrangement starts to dominate for several countries. Except for an extremely high weight on output variability the EMS would be clearly preferred by Germany France Spain and some other smaller core countries such as the Netherlands. This observation is fairly robust across preference configurations. Apparently, decision procedures seem to matter a great deal for the success of the EMU.

Table 4: **Relative Losses in percentage (Intermediate Output Stabilisation)**

| | **Aus** | **Bel** | **Fin** | **Fra** | **Ger** | **Ire** | **Ita** | **Lux** | **Net** | **Por** | **Spa** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EMS/ECB | 114 | 113 | 113 | 120 | 82 | 108 | 127 | 121 | 108 | 114 | 107 |
| EMS/NAT | 105 | 133 | 104 | 92 | 65 | 93 | 106 | 117 | 77 | 130 | 84 |
| ECB/NAT | 92 | 117 | 93 | 77 | 79 | 86 | 84 | 97 | 72 | 114 | 78 |

Preference specifications are $\lambda = 1, \gamma = 0.5$.

Table 5: **Relative Losses in percentage (Low Output Stabilisation)**

| | **Aus** | **Bel** | **Fin** | **Fra** | **Ger** | **Ire** | **Ita** | **Lux** | **Net** | **Por** | **Spa** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EMS/ECB | 90 | 86 | 104 | 116 | 77 | 100 | 151 | 113 | 106 | 114 | 106 |
| EMS/NAT | 78 | 121 | 95 | 80 | 66 | 77 | 142 | 107 | 63 | 170 | 72 |
| ECB/NAT | 86 | 140 | 91 | 69 | 85 | 77 | 94 | 94 | 59 | 149 | 68 |

Preference specifications are $\lambda = 0.2, \gamma = 0.5$.

Table 6: **Relative Losses in percentage (High Output Stabilisation)**

| | **Aus** | **Bel** | **Fin** | **Fra** | **Ger** | **Ire** | **Ita** | **Lux** | **Net** | **Por** | **Spa** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EMS/ECB | 141 | 243 | 112 | 130 | 83 | 108 | 119 | 137 | 108 | 113 | 114 |
| EMS/NAT | 159 | 261 | 106 | 109 | 65 | 99 | 106 | 135 | 90 | 128 | 96 |
| ECB/NAT | 113 | 107 | 95 | 84 | 78 | 91 | 89 | 98 | 83 | 114 | 86 |

Preference specifications are $\lambda = 5, \gamma = 0.5$.

# 6 Conclusions

In this paper we analyzed alternative ways to coordinate monetary policy in Europe. We compared the present EMU-regime with the EMS-regime in which one country, Germany dictated the monetary policies for the other EMS-countries. In order to do so we constructed simple models of the eleven countries in EMU and derived the optimally desired monetary policies. We took into account asymmetries in shocks, in the transmission of shocks and in preferences.

Our main results can be summarized as follows. First, except fro Germany, all EMU-countries profit from the entry into Euroland in the sense that they come closer to their

Table 7: **Relative Losses in percentage (Low Interest Rate Smoothing)**

| | Aus | Bel | Fin | Fra | Ger | Ire | Ita | Lux | Net | Por | Spa |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EMS/ECB | 113 | 126 | 109 | 122 | 83 | 108 | 125 | 131 | 108 | 114 | 108 |
| EMS/NAT | 109 | 141 | 103 | 95 | 64 | 94 | 105 | 126 | 81 | 132 | 88 |
| ECB/NAT | 96 | 112 | 94 | 78 | 78 | 88 | 84 | 97 | 75 | 116 | 81 |

Preference specifications are $\lambda = 1, \gamma = 0.25$.

optimally desired monetary policies (interest rates) than under the preceding EMS-regime. This welfare gain increases with the desire of the EMU-countries to stabilize output.

Second, the welfare gain of EMU only holds if the ECB-Board takes a euro-wide perspective, i.e. if the ECB-Board targets a euro-wide average of inflation and output. If all the members of the Governing Council (including the ECB-Board) were to take a nationalistic perspective (a quite unrealistic assumption) some countries may actually prefer the previous EMS-regime rather than the present EMU.

Third, large countries have the greatest impact on the monetary policy of the ESCB (which is not really surprising). However, smaller countries (e.g. the Netherlands) turn out to have a surprisingly large influence in that on average they come very close to the actually implemented policies. The reason is that these countries attach a great importance to financial stability (interest rate smoothing) and correspondingly less to output stabilisation.

It goes without saying that our analysis must be interpreted with some caution. We have made some assumptions which may be questioned. A first one relates to the assumption that the economic structures in each of the countries is not fundamentally affected by the introduction of EMU. This assumption exposes us to the Lucas critique. There is no simple way to circumvent this critique. Only time will tell us how important it is. Second, we assumed majority voting and applied the median voter theorem. Thus, we completely neglect strategic interactions that may arise over time. We plan to analyze the scope for strategic interaction in the near future.

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# 7 Appendix

Table 8: **Lag Lengths of Autoregressive Representation for Each Country**

| | Aus | Bel | Fin | Fra | Ger | Ire | Ita | Lux | Net | Por | Spa |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AS Equation | 12* | 13* | 20* | 31* | 14* | 29* | 31* | 11 | 15* | 11 | 15* |
| AD Equation | 11 | 25* | 20 | 11* | 12* | 11* | 15 | 25* | 16 | 13* | 16 |

$*$ denotes that the best lag structure applied as suggested by AIC.

Table 9: **Maximum and Minimum Eigenvalues of Matrices A and M**

| | Aus | Bel | Fin | Fra | Ger | Ire | Ita | Lux | Net | Por | Spa |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MaxA | .97 | .97 | .98 | .98 | .97 | .96 | .999 | .95 | .96 | .98 | .99 |
| MinA | -.84 | -.93 | -.93 | -.91 | -.79 | -.95 | -.95 | -.94 | -.95 | -.97 | -.88 |
| low output stabilization | | | | | | | | | | | |
| Max M | .96 | .98 | .94 | .94 | .94 | .96 | .91 | .95 | .999 | .94 | .98 |
| Min M | -.84 | -.93 | -.94 | -.91 | -.79 | -.95 | -.95 | -.94 | -.95 | -.97 | -.88 |
| intermediate output stabilization | | | | | | | | | | | |
| MaxM | .96 | .98 | .97 | .96 | .95 | .96 | .95 | .95 | .997 | .97 | .99 |
| MinM | -.84 | -.93 | -.93 | -.91 | -.79 | -.95 | -.95 | -.94 | -.95 | -.97 | -.88 |
| high output stabilization | | | | | | | | | | | |
| Max M | .96 | .98 | .97 | .97 | .95 | .96 | .98 | .97 | .99 | .99 | .99 |
| Min M | -.84 | -.93 | -.94 | -.91 | -.79 | -.95 | -.95 | -.94 | -.95 | -.97 | -.88 |

**FIGURE 1: OUTPUT AND INFLATION REACTIONS W.R.T. 1% INCREASE IN THE INTEREST RATE (LAGS OF INFLATION AND OUTPUT ARE GIVEN BETWEEN BRACKETS)**

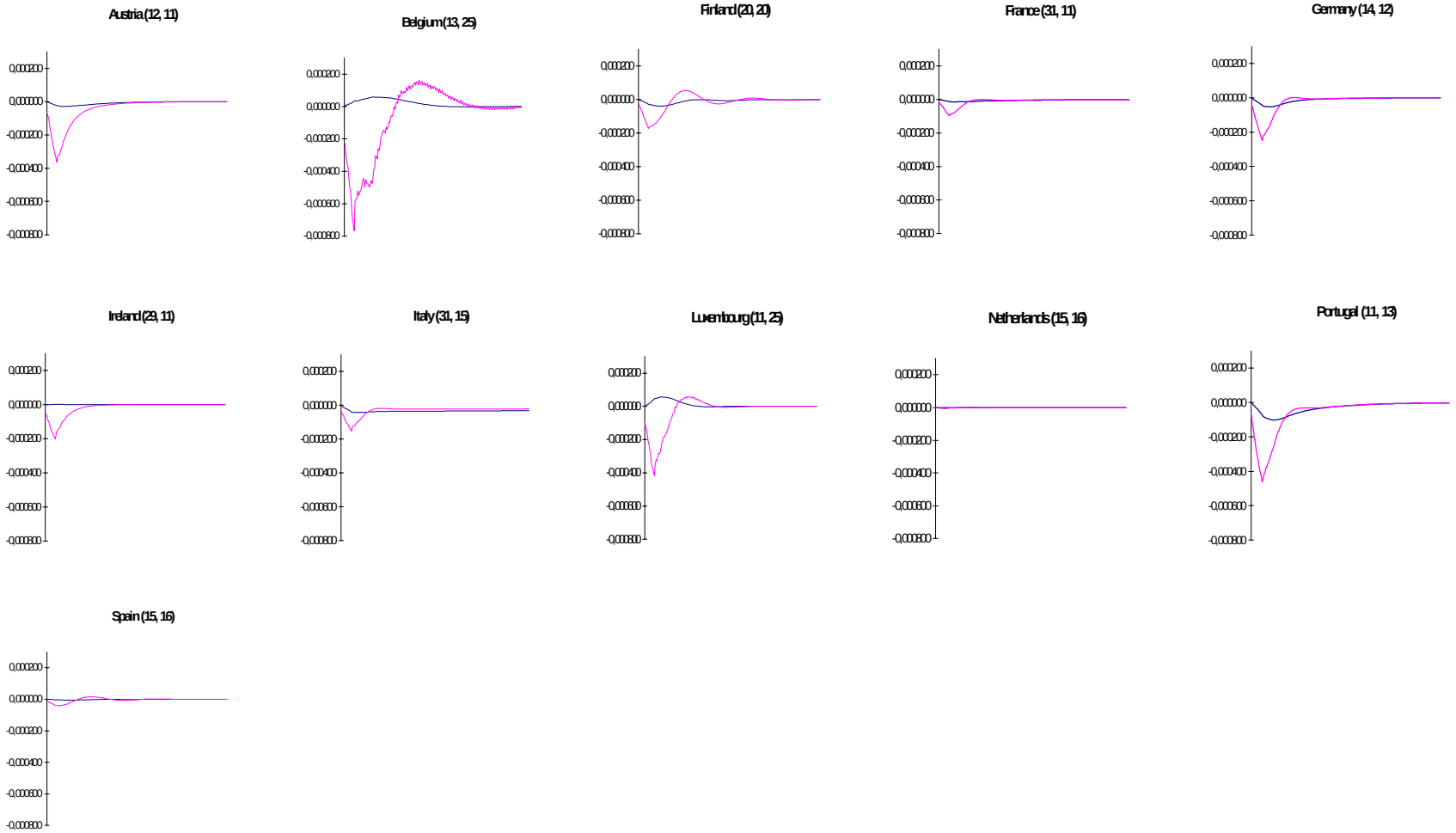

**FIGURE 2: OPTIMAL FEEDBACK RULE COEFFICIENTS FOR INFLATION**

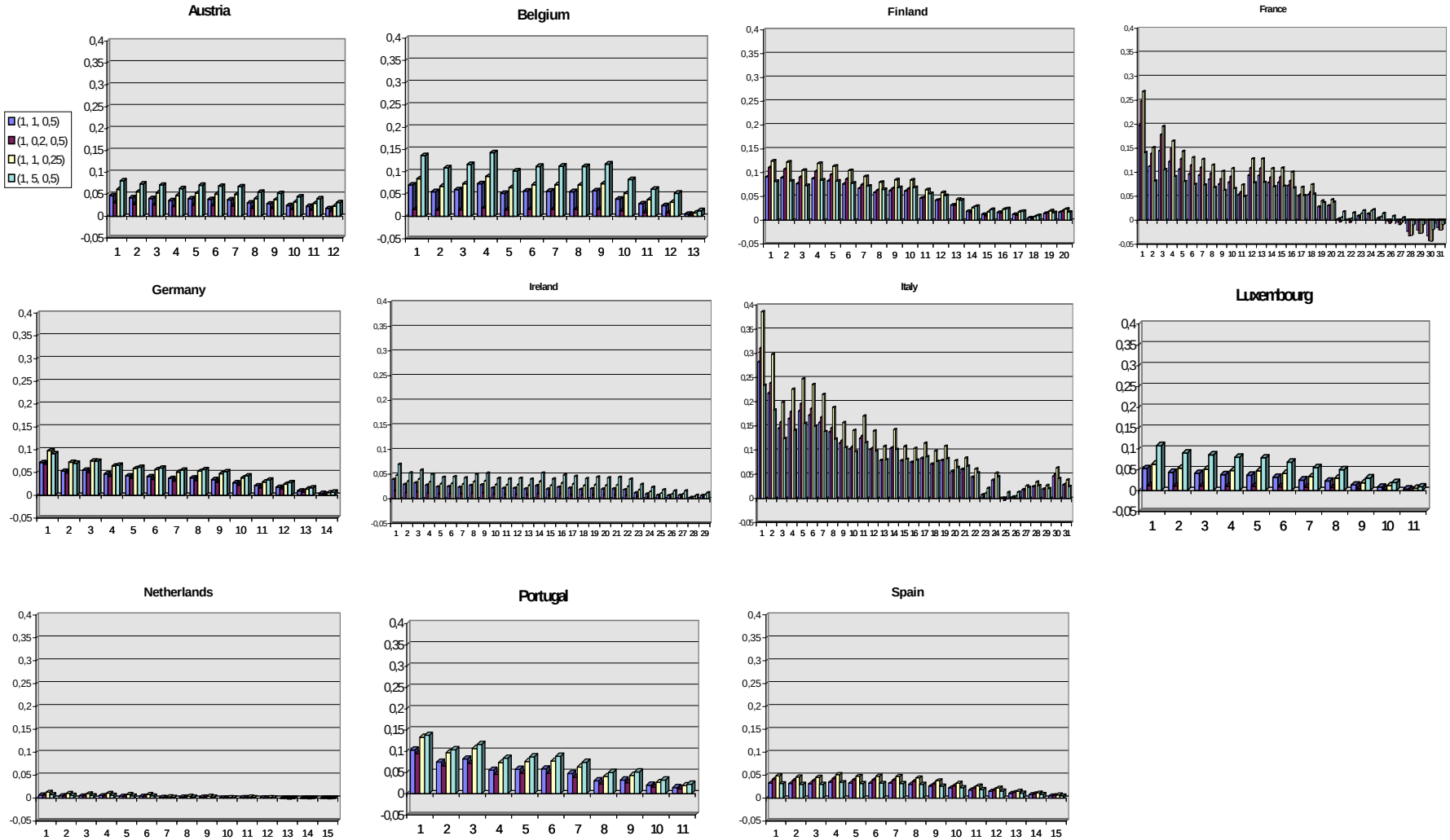

**FIGURE 3: OPTIMAL FEEDBACK RULE COEFFICIENTS FOR OUTPUT**

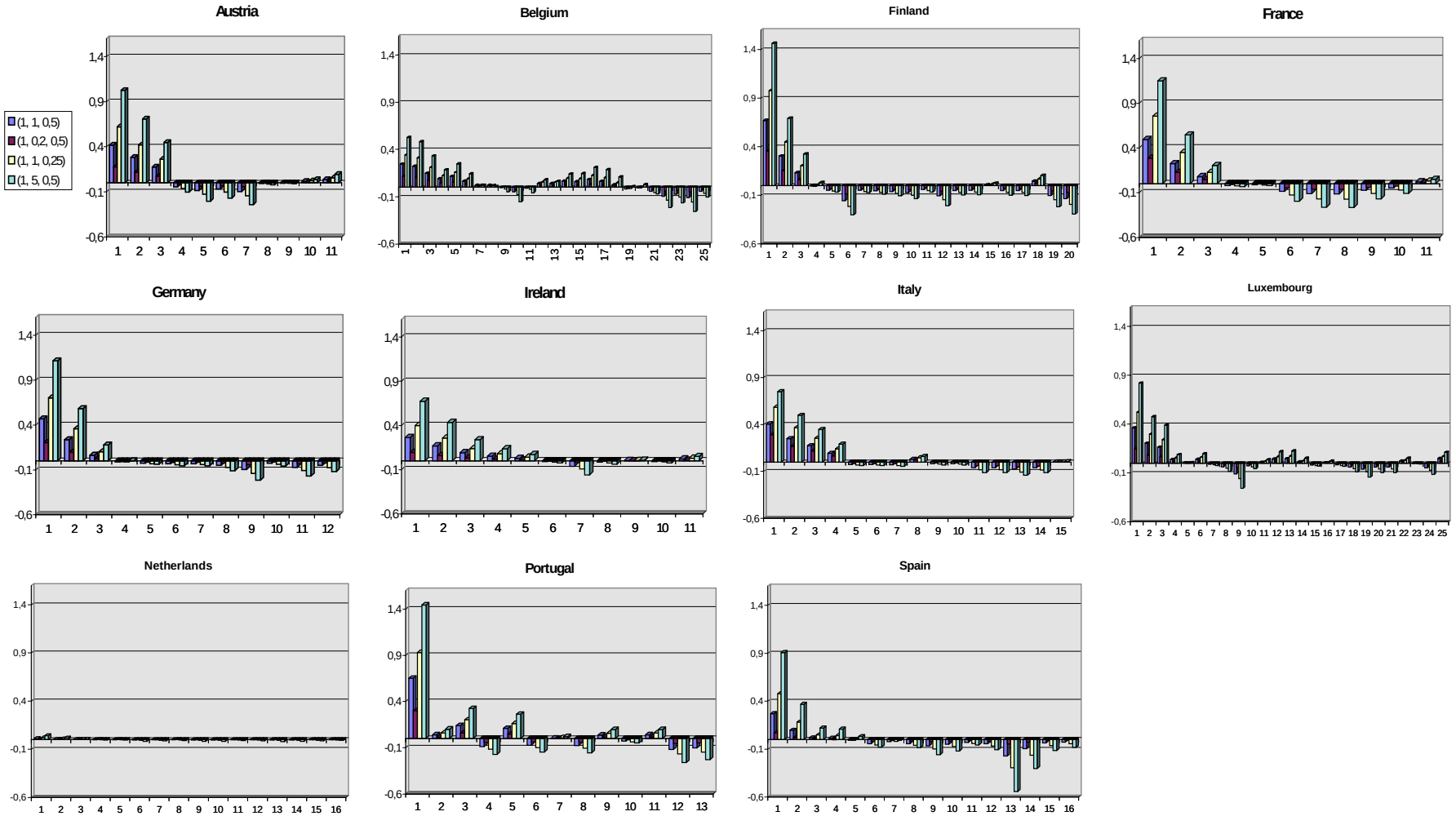

**FIGURE 4: OPTIMAL FEEDBACK RULE COEFFICIENTS FOR INTEREST RATE SMOOTHING**

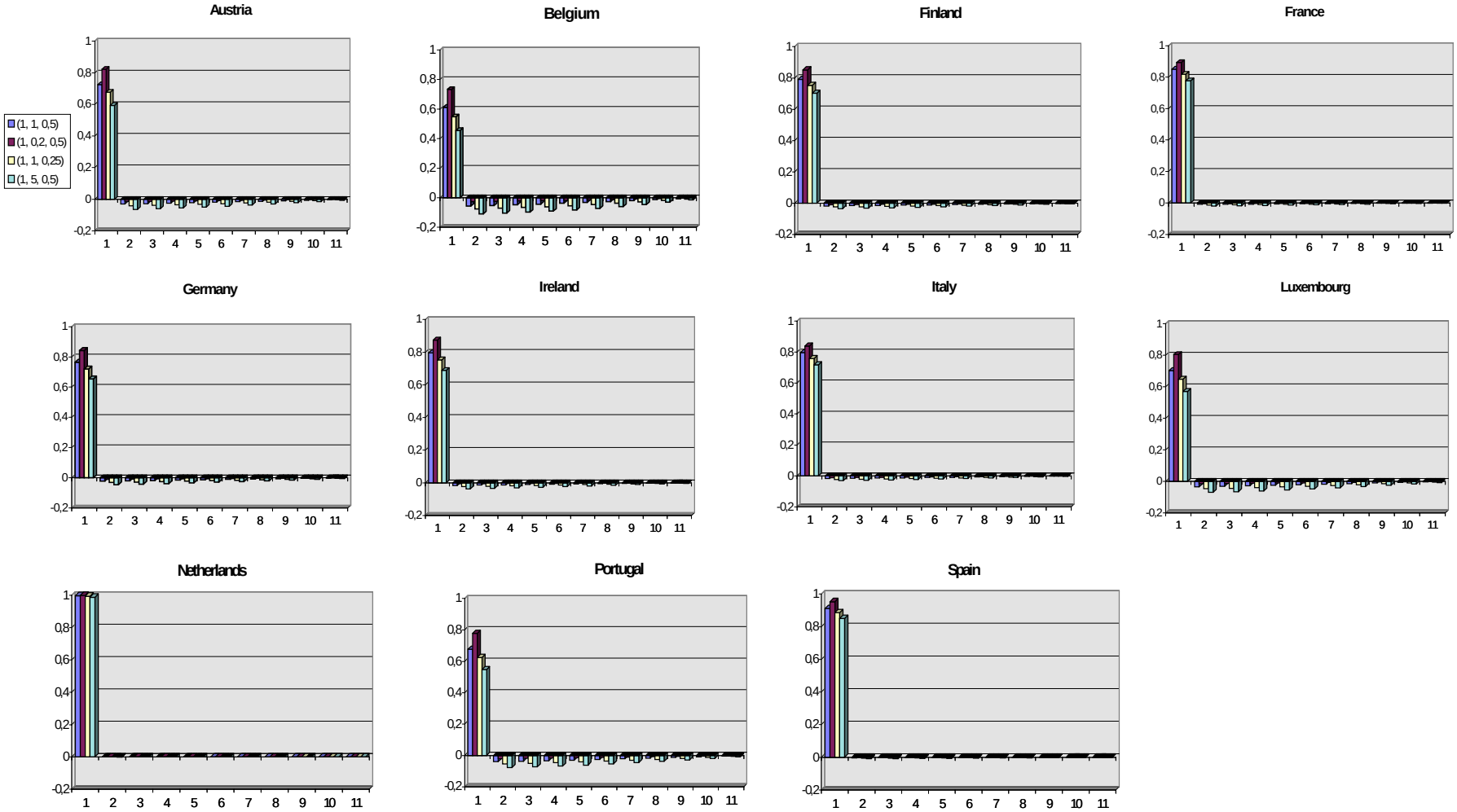

**FIGURE 5: WELFARE LOSSES UNDER DIFFERENT PREFERENCES**

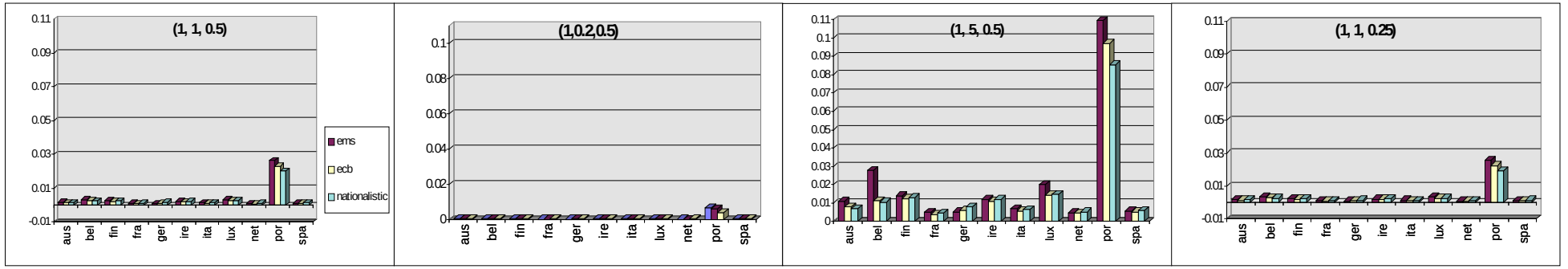

**FIGURE 6: WELFARE LOSSES UNDER DIFFERENT PREFERENCES FOR EACH COUNTRY**