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Policy Evaluation for the European Monetary Union Using a Global Macroeconomic Model

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1. Introduction

On January 1, 1999, Stage Three of the European Monetary Union (EMU) has started. Eleven member states of the European Union (EU) have joined EMU, replacing their national currencies by the euro. This implies a transfer of responsibility for monetary policy from national central banks to the European Central Bank (ECB) in Frankfurt. A large body of literature is available on the arguments in favor of and against this institutional change and on its possible consequences for European economies (see, e.g., [1], [2], [3], [4], and [5]). Some of this work also addresses the question what the loss of monetary sovereignty implies for the design of stabilization policies. In the present paper, it is intended to contribute to this question by comparing outcomes of policy reactions to an external shock under different policy regimes using game theory and a large numerical macroeconomic model of the global economy. This paper is based upon the results in [8] and focuses on the effects of various demand shocks.

In Section 2, some theoretical issues concerning the design of macroeconomic policies are briefly discussed. The model used, the McKibbin-Sachs Global Model (MSG2 Model), is described in Section 3. Section 4 explains the simulation experiments conducted and discusses how different monetary regimes for Europe are modeled within the MSG2 Model. In Section 5, some results of simulating monetary and fiscal policies in Europe under these alternative monetary and fiscal regimes are presented. Some concluding remarks are given in Section 6.

2. The Main Issues: “Rules or Discretion?” and “Does Cooperation Pay?”

There are still two fundamental questions in the theory of international economic policy: First, should stabilization policies aiming at influencing macroeconomic aggregates be conducted in a discretionary way or according to some fixed rules (e.g., Friedman's constant money growth rule for monetary policy, the annually balanced budget rule for fiscal policy)? Second, in an international context, should policy-

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makers of different countries pursue their own objectives individually, or should they cooperate so as to arrive at a joint policy design?

In a Keynesian framework, optimal discretionary policies are never worse and usually considerably better than the best fixed rule. Moreover, internationally coordinated optimal policies are never worse and usually at least slightly better than individually optimal policies of different countries. These results hold irrespective of the objective functions used and can be derived theoretically by using methods of optimum control and dynamic game theory. A different situation arises if one departs from the Keynesian assumptions and uses a more neo-classical macroeconomic approach. In the presence of rational (forward-looking) expectations of the private agents, the economy is no longer characterized by a dynamic system with a causal time structure, as is required for standard optimum control problems. In this case, the problem of time-inconsistency of optimal stabilization policies may arise, and this may reverse the results derived from the Keynesian models: Fixed rules may dominate optimal discretionary behavior, and international cooperation may be counterproductive. Although these results are well known for more than one decade, there is no consensus about the conditions under which fixed rules are better than discretionary policies and individually optimal policies are better than cooperative ones.

The theoretical reasons for the results of New Classical Macroeconomics are by now well understood: Although an optimal intertemporal discretionary policy should be a first-best solution, it will not be carried out if policy-makers have the possibility to re-optimize at a later point of time. If private-sector agents have rational expectations, they anticipate that announced policies, even if optimal at the initial time, will not remain so later on. If the government manages to commit itself to a credible rule, which usually must be simple and easily supervised, it can convince households and firms that it will follow this rule, and this may yield better results than the best available time-consistent discretionary policy. Similarly, cooperation between different policy-makers in an international context, which can be interpreted as joint maximization of an objective function containing the objective variables of all policy-makers involved, may be time-inconsistent, with strong incentives for each player to deviate from the joint policy agreed upon. Moreover, international policy coordination can reduce welfare, if cooperation makes it easier for rational policy-makers to engage in inflationary monetary expansion. Such a situation can be interpreted as a coalition of different countries' policy-makers against strategically acting private agents (see [9]).

These problems in the theory of stabilization policy and the arguments about rules versus discretion and international cooperation versus political competition are of great relevance for an analysis of how stabilization policies can, shall, and will be designed in Europe under alternative monetary regimes. In the past, the European Monetary System (EMS) has been the prevailing exchange rate system in Europe. Although this system again has been subject to different interpretations, during the last years the European Exchange Rate Mechanism (ERM) has been increasingly interpreted as a system of unilateral exchange rate pegs of member countries' currencies to the Deutschmark. The EMS can therefore be interpreted as a combination of a rule-based system (fixed exchange rates) with the possibility of either discretionary or rule-based monetary policy to be designed by the German Bundesbank (the informal center of the system). The EMS was closer to a non-cooperative than to a cooperative arrangement, in particular with respect to fiscal policies which were not coordinated except for the convergence criteria for entering EMU.

EMU, on the other hand, resembles more a cooperative than a non-cooperative environment for policy-making. Monetary policy is conducted by one institution, the ECB, with its particular instruments and objectives, which are framed by European-wide interactions of central bankers (and to some extent other political agents, such as the EU Council). Although fiscal policies remain in the hands of national policy-makers, there are strong endeavors to implement a more cooperative approach to fiscal policy-making, such as plans for harmonizing (some) taxes or bringing public expenditures more in line through the Pact for Stability and Growth (which could be interpreted as a rule-based policy regime) or through joint programs enhancing employment and growth in a more discretionary manner. Anyway, yet it is not clear whether these efforts at coordinating fiscal policies in EMU will succeed. Therefore, EMU may be characterized by joint monetary policies combined with either cooperative or non-cooperative fiscal policies.

3. The McKibbin-Sachs Global Model

The McKibbin-Sachs Global Model (MSG2 Model) is a dynamic, intertemporal, general-equilibrium model of a multiregion world economy. It is based on micro-economic foundations by assuming that economic agents maximize intertemporal objective functions. The model exhibits a mixture of classical and Keynesian properties: expectations are assumed to be formed in a rational way, but various rigidities are taken into account by allowing for deviations from fully optimizing behavior. In particular, nominal wages are assumed to adjust slowly in the major industrial economies (except for Japan); due to this wage stickiness, extended periods of unemployment can be present in these economies. Nevertheless, the model solves for a full intertemporal equilibrium in which agents have rational expectations of future variables. As a model with theoretically constrained long-run properties, it can display how the short-run adjustment of the world economy to exogenous shocks depends upon the long-run adjustment. The theoretical structure of the model as well as a listing of its equations is given in [7]; additional documentation can be found at HTTP://WWW.MSGPL.COM.AU/. A brief description can also be found in [8].

The version of the MSG2 Model used in this paper, consists of models of the following countries and regions: USA, Japan, Germany, United Kingdom, France, Italy, Austria, the rest of the former European Monetary System (REMS), the rest of the OECD (ROECD), Central and Eastern European economies (CEE), non-oil developing countries, oil-exporting countries, and the former Soviet Union. For the latter three regions, only the foreign trade and external financial aspects are modeled, whereas the industrial countries and regions are fully modeled with an internal macroeconomic structure. The MSG2 Model is fitted to macroeconomic data by a mix of calibration techniques for CGE models and econometric time-series estimates. The model is solved in linearized form, with the linearization taking place at a point in time (1992, in our case) instead of along some reference path. The baseline is updated to 1997.

4. Policy Reactions to an Exogenous Shock - Simulation Layout

4.1 Basic Concepts

Various exogenous shocks are imposed under different assumptions regarding economic policy arrangements in Europe in order to analyze the reactions of the global economy and in particular of the European economies upon these shocks.

First, a baseline solution of the dynamic model is calculated. This solution can be seen as a stable adjustment path towards the long-run growth path. Therefore, it can be interpreted as an optimal path of the economy. For the baseline run, all exogenous variables are kept at constant values or constant growth rates. The resulting projection serves as a benchmark for the economic performance of each policy-maker and for the world economy as a whole. The next step is to simulate different shocks on the exogenous variables and to analyze the time paths of selected key variables.

To compare the welfare effects of different policy actions for one or several countries, a single measure of economic performance for each of these countries is needed. Such a measure can be the intertemporal welfare losses due to the simulated shock. For computational ease, an additively separable quadratic welfare loss function is imposed. The welfare losses in each period are equal to the sums of the weighted quadratic differences between the actual values and the optimal values for each of the target variables. Next, the welfare losses in each period have to be discounted to their present values (using a fixed rate of time preference, which is assumed to be 10 percent) and to be summed up over the time horizon (102 years in the simulations, from 1999 to 2100) to get the total welfare loss, taking into account the dynamic nature of the optimization problem. The target variables in the simulations described here are: inflation, real GDP, the current account and the budget deficit. All target weights are set to 0.25, producing an equally weighted and standardized objective function. As mentioned above, the baseline values of the target variables are considered as their optimal values. Note that this implies that the welfare losses in the baseline scenario have to be zero.

For the scenarios without active macroeconomic policy, it is assumed that the instrument variables of the policy-makers in all countries are set at the same values as in the baseline solution ("no-policy" or fixed-policy simulations). In this case, the calculation of the welfare effects is straightforward: First, the dynamic model is solved subject to the exogenous shock. Then, the values of the objective functions are calculated.

In the simulations with dynamic optimization, the policy-makers of the member countries of the EMU (or the former EMS) are considered as players in a dynamic game, namely Germany, France, Italy, Austria and REMS (which is considered as a single country in this paper). The players set the values of their respective instrument variables in each period. In the "non-cooperative" cases, they do so by minimizing their welfare loss functions subject to the dynamic model and given the optimizing behavior of the other players. This leads to a Nash-Cournot equilibrium of the dynamic game. In the "cooperative" cases, a joint welfare loss function, which is a weighted sum of the individual objective functions, is minimized subject to the dynamic model. This is equivalent to assuming a European dictator, who minimizes overall welfare losses of the players involved, and can be interpreted as the result of an agreement between the policy-makers of the five countries. It corresponds to the collusive solution in game theory, because all players get equal weights in the joint objective function. Variations of these weights were tried, but gave qualitatively similar results.

Due to the rational expectations of the private-sector agents, some complications might arise for the resulting dynamic games. Consequently, the problem of time-inconsistency has to be taken into account. Time-inconsistency means that at a future time point, re-optimization results in time paths of the instruments which are different from the optimal open-loop policy. The presence of forward-looking private agents can be interpreted as the presence of another (implicit) player in the dynamic game. Therefore, the solution of a standard optimum control problem may not be carried out. The solution algorithm DYNGAME, which is used to solve the MSG2 Model, calculates strongly time-consistent, closed-loop policy rules; hence its solutions do not suffer from the time-inconsistency problem. This has to be kept in mind when interpreting the results of the dynamic simulations involving strategic policy optimization: When optimization by one or more players is assumed, time-consistent (credible) optimal policies are calculated, which may be inferior to unconstrained (but time-inconsistent) optimal policies.

In order to explore the effects of alternative monetary regimes and fiscal policy arrangements, it is necessary to focus on the monetary and fiscal policy interactions in Europe. In particular, it is assumed that the USA, Japan, ROECD, the UK (which is assumed to remain outside EMS and EMU), and CEE keep the values of their instrument variables (money supply and government expenditures) at the respective baseline values in all simulations. This means that they do not react on either the exogenous shocks or the policy response of European countries to these shocks. It is not pretended that this assumption is a realistic forecast about what might be done by the policy-makers of these countries; instead, it is made in the present context in order to isolate the effects of alternative European policies on macroeconomic variables.

4.2 Policy Scenarios: EMS and EMU

For all exogenous shocks investigated, five scenarios have been simulated (see Table 1). First, in scenario 1 ("No-Policy Scenario"), a "no-policy" solution is determined, where the values of fiscal policy variables of all countries and those of money supply of Germany are kept at baseline values. The other EMS countries are assumed to peg their exchange rates to the Deutschmark in a loose way, i.e., the EMS is interpreted as an extended DM-zone. This is a way of modeling the EMS which differs from [6], where the EMS is characterized as managed floating. Given the convergence achieved in the meantime, one might come closer to reality by assuming a DM peg for the EMS. For this reason, the alternative of freely floating exchange rates in Europe is not considered here either. It is assumed, however, that European currencies (or the euro) float freely against the other currencies such as the US dollar or the yen.

Whereas the first scenario corresponds to a system of completely fixed rules, the second and third scenario combine rules with discretionary policy-making within the framework of the EMS ("Scenarios emulating EMS"). In scenario 2, it is assumed that the German Bundesbank does not react on the shocks, i.e., it keeps German money supply at its baseline values. All European countries, however, pursue active fiscal policies by optimizing their respective objective functions in a non-cooperative way. Scenario 3 also assumes active non-cooperative European fiscal policies, but in addition active monetary policy of Germany, which targets German inflation, i.e. it keeps German inflation rates at their baseline values. This might be considered as a more adequate stylized picture of the EMS, with the German Bundesbank providing an anchor for price stability in Europe by pursuing the goal of national inflation targeting in the center country of the EMS, and the other countries "importing" price stability by pegging their exchange rates to the Deutschmark.

Table 1. Overview of policy scenario assumptions.

	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**
	No-Policy Scenario	Scenarios emulating EMS		Scenarios emulating EMU	
ECB					
Monetary policy	— (no ECB)	— (no ECB)	— (no ECB)	Target European inflation	Target European inflation
Germany					
Monetary policy	Fixed policy	Fixed policy	Target German inflation	— (Euro)	— (Euro)
Fiscal policy	Fixed policy	Non-cooperative optimization	Non-cooperative optimization	Non-cooperative optimization	Cooperative optimization
Rest of EMS/EMU					
Monetary policy	Peg to DM	Peg to DM	Peg to DM	— (Euro)	— (Euro)
Fiscal policy	Fixed policy	Non-cooperative optimization	Non-cooperative optimization	Non-cooperative optimization	Cooperative optimization

Scenarios 4 and 5 ("Scenarios emulating EMU") are meant to model EMU by assuming that the exchange rates between the EMS/EMU countries (Germany, France, Italy, Austria, REMS) are completely fixed. Moreover, we assume that the ECB targets a European average rate of inflation by using European money supply to keep the European rate of inflation at its baseline values. For fiscal policies, it is assumed that the EMU countries use government expenditures in an active (discretionary) way to optimize their objective functions. In scenario 4, they do so in a non-cooperative way, whereas in scenario 5, fiscal policies are set in a cooperative way. Thus the two scenarios may serve to evaluate possible advantages or disadvantages of coordinating and harmonizing fiscal policy-making within EMU. In contrast to the asymmetric core-periphery structure of the EMS, EMU is modeled as a symmetric institutional arrangement by assuming the ECB to target the average European inflation rate.

4.3 Shocks

Several exogenous shocks have been imposed on the model. Here in particular, temporary negative productivity shocks and temporary negative demand shocks are considered, which may be country specific (affecting only Germany, in the present case), regional (affecting the EMS/EMU countries), or global (affecting all countries modeled explicitly). The discussion in Section 5 focuses mainly on the European demand shock, as the productivity shock has been explained in detail in [8].

A productivity shock can be interpreted as a temporary inward shift of the production possibility frontiers of all countries. In particular, total factor productivity is assumed to fall by 4 percent the first year (1999, in our simulation), 3 percent in the second year (2000), 2 percent in the third year (2001), and 1 percent in the fourth year (2002) as compared to the baseline of the model. The results of the productivity shocks are described in [8] and are not given here in detail. From elementary macroeconomic theory, it is well known that supply shocks and demand shocks have different effects on output, the price level and other aggregate variables. Therefore, we consider here negative demand shocks shifting the aggregate demand curve to the left. In particular, we simulate the consequences of a temporary exogenous decrease of real private consumption. In these simulations, autonomous real private consumption is assumed to fall by 6 percent in the first year (1999), 4.5 percent in the second, 3 percent in the third, and 1.5 percent in the fourth year as compared to the baseline of the model. Again, the country-specific (Germany), the regional (EMS/EMU) and the global variant of this shock are simulated for all five policy scenarios.

5. Simulation Results

5.1 European Demand Shock

In this section, the response of selected main economic indicators upon an European-wide temporary reduction of private consumption is investigated. Lack of space precludes a more detailed discussion of the other results (for demand shocks of different scope) that are, above all, very similar from the qualitative point of view and differ mainly in the intertemporal structure of the economic effects. In all scenarios under consideration, output losses of up to 3 percent (of the baseline GDP) can be observed. This can be attributed to the effects of a shift of the aggregate demand curve, which generally results in an output reduction in combination with disinflation (a reduction of inflation or even the overall price level in the affected economies). Different policy setups (scenarios), however, result in different magnitudes of price and output effects.

In the "no-policy" scenario (1), real GDP initially drops by about 2.5 percent in the directly affected European countries. The international transmission of this shock is clearly negative for the UK, while the USA and Japan face even small improvements in terms of total output (GDP). Spillovers (in this case: output gains) to the USA are higher than to Japan, but do not exceed 0.4 percent of baseline GDP for either country.

The inflation rate is reduced by up to 1.4 percentage points for all directly affected countries in Europe.

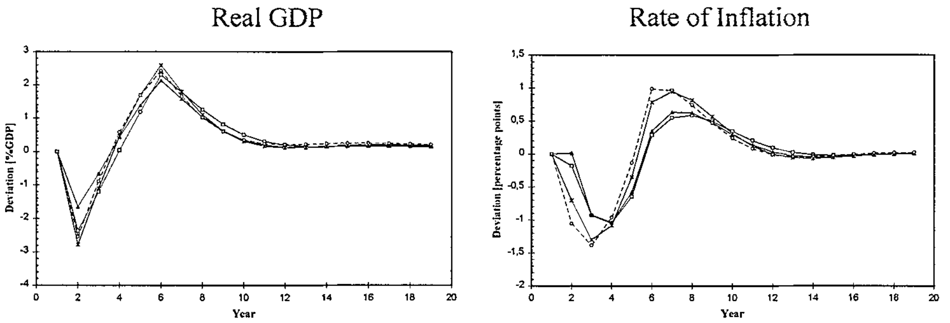

Figure 1. Scenario 1 (“no- policy”), GDP and inflation
[square - Germany, triangle - Austria, star - France, circle - Italy].

Welfare losses are distributed approximately equally among the five European countries under consideration; the REMS faces a higher increase of the values of the welfare loss function than Germany, but the differences are small. After 10 years, these welfare losses are close to zero, due to the temporary nature of the shock and the discounting of losses in future periods.

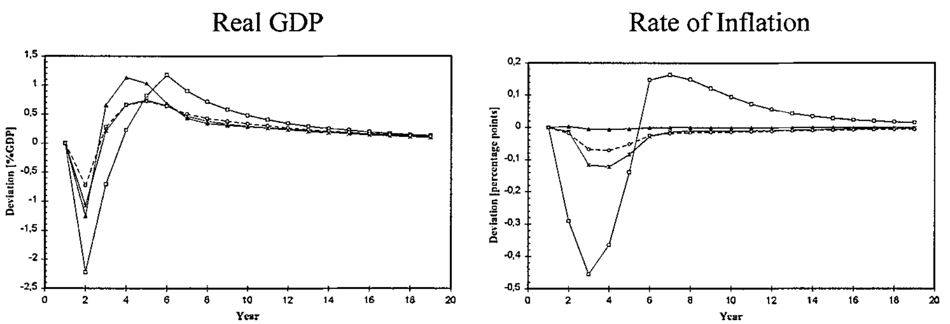

Figure 2. Scenario 2 (“EMS”), GDP and inflation
[square - Germany, triangle - Austria, star - France, circle - Italy].

In scenario 2 (“EMS”) and scenario 3 (“EMS with active monetary policy in Germany”), stabilization of both output and inflation can be observed. The time paths of the key indicators are very similar in these scenarios for the European shock. However, this is not true for the asymmetric German shock and especially for the demand shock affecting all regions of the model, where significantly different effects can be observed. In the case of Germany pursuing (non-cooperative) active fiscal and monetary policy (scenario 3), inflation targeting can be characterized as completely successful.

The overall welfare losses in the EMS scenarios are significantly lower than in the fixed policy scenario, but Germany faces higher welfare losses than before, which might be attributed to the fact that Germany can now be regarded as providing the monetary anchor for the whole EMS. Thus, spillovers to Germany are strong, and in the case of a symmetric shock, Germany now has to carry the burden of providing additional stability to the whole EMS. Introducing active monetary policy in the EMS (i.e., switching from scenario 2 to scenario 3) can be identified as advantageous in terms of total welfare losses, even if the target variable is German inflation and not European inflation. Note that this does not necessarily follow from theory, and [8] shows that this result does not hold in general for a European productivity shock.

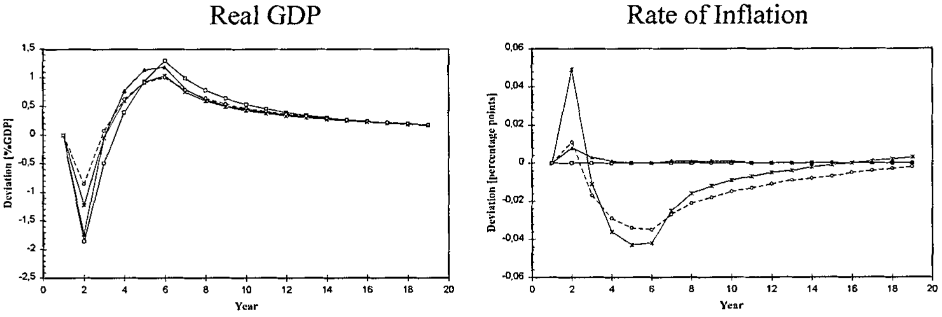

Figure 3. Scenario 3 ("EMS, German policy"), GDP and inflation
[square - Germany, triangle - Austria, star - France, circle - Italy].

The non-cooperative measures taken by the fiscal policy makers of the countries under consideration are expansionary at the beginning of the optimization period (during the time of the shock) and then switch to a restrictive strategy, counteracting the overshooting which can be observed after the transitory shock without policy intervention. Thus, the effects of the negative demand shock are effectively damped by counter-cyclical fiscal policy. As expected, the same pattern is shown by monetary policy.

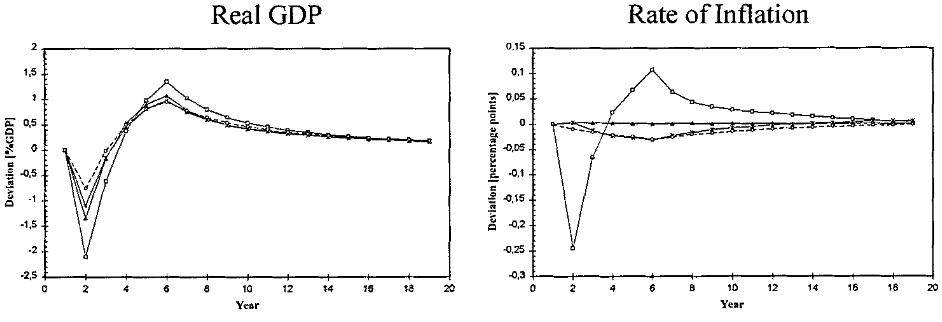

Figure 4. Scenario 4 ("non-cooperative EMU"), GDP and inflation
[square - Germany, triangle - Austria, star - France, circle - Italy].

In contrast to the previous scenarios, scenario 4 ("non-cooperative EMU") introduces the European Monetary Union, but in conjunction with non-cooperative fiscal policies in the member states. The results here are similar to the EMS scenario with active inflation targeting in Germany, but the ECB now acts in a more restrictive way to stabilize European inflation than did the Bundesbank in the previous scenario with the objective of German inflation. As a result, the price levels (and thus the inflation rates) inside the EMU remain nearly unchanged from their baseline values. On the other hand, overall welfare losses and especially welfare losses for Germany are higher.

Even better results, both in terms of GDP and inflation, arise from scenario 5 ("cooperative EMU"). Overall welfare losses are lowest in the cooperative EMU setup, and a Pareto improvement upon the non-cooperative optimization results can be observed (the welfare losses of all regions with active economic policies are lower, thus no country is better off in the non-cooperative case). On the other hand, the distribution of the welfare improvements is not equal: Germany, France and Italy benefit more than Austria and the REMS. Nevertheless, economic disturbances in this scenario phase out significantly faster now, which, of course, is the source of the reduction in total welfare losses.

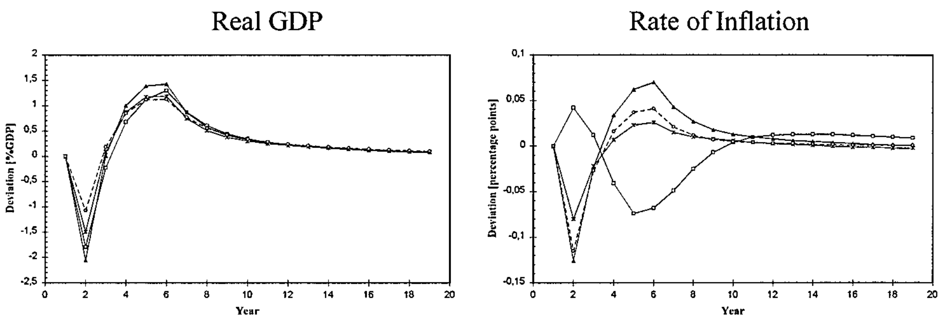

Figure 5. Scenario 5 ("cooperative EMU"), GDP and inflation
[square - Germany, triangle - Austria, star - France, circle - Italy].

5.2 Other shocks

The effects of the other demand shocks (Germany-specific and worldwide consumption shocks) are roughly comparable to the results described; however, the specific time paths of both instruments and targets may differ significantly. Thus, different values of the objective function can be observed. Here, only the results with respect to the welfare effects will be shown. For the temporary negative productivity shock, the expected stagflation scenario emerges: GDP drops below the baseline values while inflation is higher than before. This leads to the well-known policy dilemma based upon the trade-off between output and inflation (at least in the short run). For further details concerning the results of the productivity shocks refer to [8].

5.3 Implications for European Economic Policies

The values of the standardized objective function (sum of welfare losses for Germany, France, Italy, Austria and REMS) for all scenarios are presented in Table 2. For the demand shocks discussed in this paper, several conclusions concerning the design of economic policy and the choice of institutional arrangements can be drawn.

For the demand shocks, the scenario with policy cooperation inside the EMU (scenario 5) dominates all other scenarios in terms of overall welfare losses. It can also be seen that the "no-policy" setup generally produces unsatisfactory results. Apart from that, a stable order of effectiveness (as measured by the values of the objective function) cannot be derived for the different scenarios, since the welfare losses strongly depend on the nature and on the scope of the imposed shocks. These findings are in contrast to the results for the temporary negative supply shock. For this type of exogenous disturbance, the "no-policy" scenario 1 always gives the best results. But here, too, the "cooperative EMU" always dominates the "non-cooperative EMU" scenarios.

Table 2. Welfare results of different scenarios
(OF – values of the objective function, R – ranking).

	Scenario									
	1		2		3		4		5	
Shock	OF	R	OF	R	OF	R	OF	R	OF	R
Productivity										
Europe	21.1	1	35.2	3	37.0	4	42.5	5	32.6	2
World	26.9	1	48.5	4	46.4	3	55.2	5	41.7	2
Germany	4.3	1	5.7	2	42.9	5	14.1	4	6.0	3
Demand										
Europe	37.9	5	27.6	3	25.8	2	28.6	4	23.3	1
World	48.9	4	53.3	5	25.4	2	36.9	3	15.0	1
Germany	27.6	4	23.0	3	38.7	5	17.8	2	12.5	1

To sum up, the "optimal" institutional and policy design strongly depends on the nature of the occurring shocks. Of course, it is not possible to switch from one institutional setup to another policy scenario in the presence of different shocks. Furthermore, it might not be easy to forecast the prevailing nature of future shocks to the European economies; in fact, it might be quite realistic to assume the occurrence of both supply side and demand side shocks. If it is taken into account that the EMU has already started and that there are no intentions or even provisions in the legal framework to leave the monetary union, the policy recommendation from this paper is easy: economic policy cooperation in the EMU always dominates the outcomes of non-cooperative EMU-setups. On a more general level, an easy solution for the two basic questions in the theory of economic policy could be suggested: For demand shocks, cooperation and discretionary active economic policies could be advantageous, while for supply shocks, fixed rules might be better in terms of policy effectiveness.

6. Concluding Remarks

The "optimal" design of monetary and fiscal policies in Europe cannot be derived easily. The optimization experiments in this analysis have shown that the ranking of different institutional setups for European policy making in terms of total welfare is not stable with respect to different types of shocks and different geographical magnitudes of these shocks. In the case of a temporary negative demand shock, cooperative fiscal policy-making in the EMU turns out to be the most appropriate reaction. For a temporary negative productivity shock, fixed rules ("no-policy") might be a better response than optimal time-consistent (active) policies, but still cooperation does pay, given the existence of the EMU.

Of course, more simulation results are required to check for the robustness of these conclusions. Apart from using alternative models (including econometric and CGE models), more extensive investigations of alternative shocks (including shocks from outside Europe and permanent shocks) and additional policy scenarios (both for the ECB and European finance ministers and for policy-makers outside Europe) are required to validate our findings. These will be subjects ofour further research.

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References

[1] Allsopp, C. & Vines, D. (Eds.), Macroeconomic Policy after EMU, Oxford Review of Economic Policy **14**, No. 3. (1998).

[2] Begg, D., von Hagen, J., Wyplosz, C. & Zimmermann, K.F. (Eds.), EMU: Prospects and Challenges for the Euro, Oxford: Basil Blackwell (1998).

[3] De Grauwe, P, The Economics of Monetary Integration, 3rd ed., Oxford: Oxford University Press (1997).

[4] Gros, D. & Thygesen, N., European Monetary Integration, 2nd ed., Harlow: Longman (1998).

[5] Kenen, P.B., Economic and Monetary Union in Europe, Cambridge: Cambridge University Press (1995).

[6] McKibbin, W.J. & Bok, T., Which Monetary Regime for Europe? Discussion Paper, Washington, D. C.: The Brookings Institution (1995).

[7] McKibbin, W.J. & Sachs, J.D., Global Linkages, Washington, DC: The Brookings Institution (1991).

[8] Neck, R., Haber, G. & McKibbin, W.J., Macroeconomic Policy Design in the European Monetary Union: A Numerical Game Approach, Empirica **26**, 319–335 (1999).

[9] Rogoff, K., Can International Monetary Policy Cooperation be Counterproductive? Journal of International Economics **18**, 199–217 (1985).