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ECONOMIC POLICY COORDINATION IN THE EMU
How Much Scope will there be within the Framework of the Stability and Growth Pact?

Fritz Breuss*) and Andrea Weber)**

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Abstract

With a large-scale econometric world model we derive policy multipliers and the parameters for the utility functions for 10 EMU countries and for the ECB. The gains from cooperation are calculated by comparing two equilibria, a Nash and a cooperative equilibrium. The cooperative equilibrium is the result of the maximization of a weighted utility function for Euroland as a whole with the targets output gap and inflation. In the case of a „full“ cooperation, where the 10 EMU countries coordinate their fiscal policy with the monetary policy of the ECB the welfare gains are very large for the whole Euro zone. However the strong fiscal and monetary policy impulses as a result of this optimization procedure lead, firstly, to a violation of the fiscal targets (budget deficit, public debt) of the Stability and Growth Pact which limits the room for manoeuvre of fiscal policy of the EMU member states in stage III of EMU. Secondly, we find that not in all countries cooperation leads to welfare gains, a result which is not Pareto efficient. Therefore, by considering these two constraints (Pareto optimality and SGP objectives) the constrained optimization results in a solution in case of „full“ cooperation which drives most countries back to the Nash position of the baseline. In addition, a „partial“ cooperation in which the ECB stays aside and only the fiscal policies of the EMU member countries are taking part, leads to a very small welfare improvement and violates again (only to minor degree the Pareto optimality condition). The optimal fiscal policy impulses are very modest.

JEL Classification: C70, E52, E58, E62
Keywords: EMU, policy coordination, fiscal and monetary policy, Stability and Growth Pact.

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1. Introduction

The new policy regime of EMU justifies to raise the old question whether policy coordination makes countries better off. On the one hand the Maastricht Treaty demands economic policy coordination in Article 99[1]. On the other hand the division of responsibility of economic policy making in EMU is unique. An independent European Central Bank (ECB) is responsible for the monetary policy for Euroland, whereas the EMU member countries still are the indivudal actors of the fiscal policy. However, the Stability and Growth Pact (SGP) limits fiscal expansion. These specific rules of the policy game imply different combinations for possible cooperations: either the EMU member countries cooperate in pursuing their fiscal policy and/or they cooperate with each other and with the ECB. The primary target for the ECB is to maintain price stability. Presently the most urgent target for the EMU member countries is full employment. However, reading the Articles of the TEC concerning coordination and those of the SGP (in particular Council Regulation (EC) No 1466/97 of 7 July 1997 on the strengthening of the surveillance of budgetary positions and the surveillance and „coordination“ of economic policies) one gets the impression that coordination in the EMU primarily has a negative or passive connotation (medium-term objective of „sound budgetary positions close to balance or in surplus“). Normally, economic policy coordination aims at improving the economic position of a group of countries (positive or active connotation).

Several authors have already dealt with economic policy cooperation in EMU. However, most of them either used theoretically calibrated models (*Krichel-Levine-Pearlman*, 1996) or heavily stylized models (*Hughes-Hallet*, 1998). In each case two countries are combined with one ECB. *Huizinga-Nielsen* (1998) ask whether policy coordination of fiscal deficits is necessary at all and under which theoretical conditions it may make sense. *Karner* (1999) analyses within a game-theoretic model with three countries and one ECB the outcome of the maximization of intertemporal utilities of countries and of the ECB (the latter also maximizes the levels of debt of the EMU countries?). *Van Aarle-Engwerda-Plasmans-Weeren* (1999) calibrate a two-country EMU with one ECB in the style of a New Keynesian disequilibrium model with unemployment. *Rolf* (1996) analyses game-theoretically the different aspects of cooperation within a fiscal solidarity union („fiscal federalism“) in the EMU. Non-cooperation would lead to higher optimal debts. *Levine* (1997) studies theoretically the

[1] In this paper we already refer to the new Articles of the Treaty establishing the European Community (TEC) à la Amsterdam, because it came into power on May 1, 1999.

possible interactions of EMU-„ins“ and „outs and the consequences of the delegation of monetary policy to an independent central bank. The empirical evidence on international economic policy coordination is generally neither overwhelmingly positive, nor are the gains very high (see for a recent survey *Mooslechner-Schürz* (1999). *McKibbin* (1997) in his review mentions gains from 0.5 to 1 percent of GDP at most.

We deal with the possible outcome of coordinating economic policy in the EMU. This means on the one hand full coordination of fiscal and monetary policy between the EMU member states and the ECB and on the other hand only fiscal policy coordination among the EMU member states. The special problem of the policy interaction of the „ins“ of EMU and the „pre-ins“ is not addressed here. In order to derive welfare gains from policy cooperation in EMU, we apply a large-scale econometric model (Oxford Economic Forecasting – OEF – World model). This allows us to quantify welfare gains with real-world data and leads therefore to realistic policy conclusions. In doing so, we follow the classic approach by *Oudiz-Sachs* (1984). They did this exercise with two world models for three countries (USA, Japan and Germany). We do it with one world model for the specific policy constellation of EMU (11 countries plus the ECB).

After describing the framework of economic policy in EMU (chapter 2) we present evidence on policy multipliers of fiscal and monetary policy in EMU member countries. This gives an idea of the economic interdependencies in EMU (chapter 3). In chapter 4 we describe the strategy to measure welfare gains from cooperation. With the help of the large-scale econometric world model the concrete welfare gains of cooperation are derived under different scenarios: full cooperation (EMU countries plus ECB) and only cooperation among the EMU countries.

2. The New Policy Responsibility in EMU and Rules of Cooperation [2]

Compared to the benchmark country USA one has the impression that the European Union seems to have planned to create an EMU with an asymmetric economic policy framework. Whereas in the USA both, monetary and fiscal policy are centralised and they dispose of an

[2] This chapter follows *Breuss* (1999).

Table 1: The Framework of Economic Policy in EMU with „ins“ and „pre-ins“

Monetary Policy	Fiscal (Budgetary) Policy	Incomes and Wage Policy
11 Euro-„ins“		
centralised (ESCB and ECB are responsible) Art. 105 and Protocol 18, Art. 2: ESCB and ECB: Primary objective: *price stability*; support of the general economic policies with a view of the objectives of the Community (Art. 2)	***decentralised*** (governments of the Member States are responsible) restricted by the *Stability and Growth Pact:* Deficit < 3% of GDP (clarification of the excessive deficit procedure of Art. 104 in Reg. (EC) 1467/97); *no Fiscal Federalism* in the EU *no bail-out* (Art. 103(1)) (and declaration by the ECOFIN Council, Point 6, May 1, 1998) Economic policy *coordination* („economic policies as a matter of common concern“: Art. 99) *Multilateral surveillance* (Art. 99(3) and (4) and Reg. (EC) 1466/97): *Stability programmes* before March 1, 1999, thereafter annually	***decentralised*** (Social Partners in the Member States are responsible) Resolution of the European Council on growth and employment 97/C 236/02) and the Commission's Recommendation for Broad Guidelines of the Economic Policies of the Member States and the Community (II/144/98, 13.5.98) suggest a "productivity oriented wage policy" which is enough "flexible" to make the labour markets more efficient (Mundell's precondition for an optimum currency area - OCA)
4 *Euro-„pre-ins“*		
decentralised (National central banks - NCB - are responsible) new *exchange-rate mechanism* in stage III of EMU - *ERM2* („hub and spokes“ model): Euro is the anchor - standard fluctuation band +/-15% against the Euro (participation in ERM2 is voluntary: Resolution of the European Council 97/C 236/03)	***decentralised*** (Member States are responsible) obligation to *avoid excessive deficits* (Art. 104 and Art. 116(4); each EU member is obliged to a stability oriented economic policy and to economic policy *coordination* („economic policies as a matter of common concern“: Art. 99) *Multilateral surveillance* (Art. 99(3) and (4) and Reg. (EC) 1466/97): *Convergence programmes* before March 1, 1999, thereafter annually.	***decentralised*** (Social Partners in the Member States are responsible)

The Articles refer to the Treaty establishing the European Community (TEC) à la Amsterdam

inter-state transfer mechanism (fiscal federalism) which seems to be appropriate to cushion asymmetric or idiosyncratic shocks, the coming EMU is build upon an asymmetric architecture concerning economic policy.

According to the ideal architecture of economic policy laid down in the Treaty establishing the European Community (TEC) the EMU framework combines a centralised monetary policy (under the responsibility of the ECB) with decentralised fiscal or budgetary policies (under the responsibility of national governments, subject to Community rules on budgetary discipline, as the Stability and Growth Pact) and decentralised structural policies and wage setting (see *Table 1*).

Table 1: The Framework of Economic Policy in EMU with “Ins” and “Pre-ins”

This ideal Euro world implies a simple and clear assignment of policies: the single monetary policy would, given the primary objective of preserving price stability, be able to provide a common response to aggregate economic development (see *European Commission*, 1997B), whereas decentralised budgetary policies and other national economic policy instruments would be available for responding to country-specific circumstances (or shocks).

After the Decision of the Council of the European Union, meeting in the composition of Heads of States or Government of May 3, 1998, the EMU started on January 1, 1999 with eleven countries. Based on Article 99(2) of the TEC the *European Commission* (1998, p. 4) has put forward "Broad Guidelines of the Economic Policies of the Member States and the Community" for the "ins" and the "pre-ins" of the EMU, which were confirmed by the Council Recommendation 98/454/EC of 6 July 1998. In its "growth and stability-oriented macroeconomic policy mix" scenario the Commission stresses that the overall macroeconomic *policy mix at the euro-zone level* (for the "ins") will result from the interaction of the common monetary policy on the one hand and with the average budgetary development and wage trends in the participating countries, on the other. According to this script for an ideal economic world in Euroland of 11 EU Member States, in the framework of the Treaty, supplemented by the Stability and Growth Pact and the Amsterdam European Council resolution on 'Growth and Employment', the responsibilities are allocated as follows:

- The *single monetary policy* in the euro-area will be under the responsibility of the independent ECB and ESCB. In conformity with Article 105(1), the primary objective of

monetary policy will be to maintain price stability and, subject thereto, to support the economic objectives of the Union, including, in particular, sustained, non-inflationary, growth and high level of employment, as laid down in Article 2 of the Treaty.

- *Budgetary policy* will remain in the responsibility of national governments but will be subject to the rules of the Treaty (Article 101 to 104) and the Stability and Growth Pact, which emphasises the need to have a budgetary position close to balance or in surplus in normal economic conditions and clarifies the key Treaty provisions on budgetary policy. National governments will have to coordinate their budgetary policies in the framework of the Broad Economic Policy Guidelines (Art. 99).
- *Wage setting* will remain in the responsibility of the social partners at the national, regional, sectoral or even at a more decentralised level following their respective traditions. As underlined in the Amsterdam Resolution on "Growth and employment" (97/C 236/02), the social partners are responsible for reconciling high employment with appropriate wage settlements and for setting up a suitable framework for the wage formation process. Since they have an important bearing on the overall macroeconomic policy mix, aggregate wage developments are of general interest." (*European Commission*, 1998, p. 4).

For the countries not participating initially in the euro-zone (the *"pre-ins"*) the *European Commission* (1998, p. 5) stresses that "the need for stability-oriented and convergent macroeconomic policies will be equally strong, especially if they participate in the ERM2, as countries with a derogation are expected to. The strong economic and monetary interdependence between the euro-area countries and the Member States not as yet adopting the euro and the need to ensure further convergence and a smooth functioning of the single market, will require that all Member States are included in the co-ordination of economic policies."

The EU in general and the EMU in particular bases its *procedure of policy coordination* on a set of principles (layed down in the Treaty and in the SGP): monitoring and controlling which results in a rolling agenda establishing an annual cycle for the „mainstream“ coordination process (see *Italianer*, 1999, p. 20). There are several forms of coordination: (a) procedural framework (participation in the Council (Ecofin) of 15 Member States, the Commission and the president of the ECB); Euro-11 group only on the „ins“ of EMU, formality, assistance, decision rules), (b) exchange of information (indicators, definitions), (c) common analytical framework (models, policy impact, forecasts), (d) monitoring (performance, policy intentions,

early warning, multilateral surveillance), (e) take account of policy interactions with others (expression of preferences) and (f) joint determination of policies (regularly, discretionary; see *Italianer*, 1999, p. 5).

The provisions concerning economic policy coordination are ruled in the TEC in general and in the Stability and Growth Pact (SGP)[3] for stage three of the EMU in particular. Article 99(1) says that the „Member States shall regard their economic policies as a matter of common concern and shall *coordinate* them within the Council ...“. „The Council shall, acting by a qualified majority on a recommendation from the Commission, formualte a draft for the *broad guidelines* of the eocnomic policies of the Member States and the Community, and shall report its finding to the European Council.“ (Article 99(2)). Article 99(3) rules the monitoring procedure for closer cooperation of economic policies and sustained convergence of the economic performance of the Member States with a system of *multilateral surveillance.* The SGP (Council Regulation (EC) No 1466/97) then sets out the rules covering the content, the submission, the examination and the monitoring of *stability programmes* (for the „ins“ of EMU) and the *convergence programmes* (for the „pre-ins“ of EMU) – to be submitted to the Commission annually for a medium-term period of three years – „as part of the multilateral surveillance by the Council so as to prevent, at an early stage, the occurrence of excessive general deficits and to promote the surveillance and coordination of economic policies.“

The *scope of coordination* in EMU – according to *Italianer* (1999, p.10) - can comprise monetary policy, fiscal or budgetary policy, exchange rate policy, labour markets (wage setting, structural aspects, active policies), tax policies, social security systems, product markets (goods, services), capital marktes. We restrict our analysis to the two major policy insruments, namely monetary and fiscal policy.

The next question concerns the *levels of coordination* in EMU. *Italianer* (1999, p. 13-15) identifies three EU levels for coordination: (1) The highest coordination level in the EU is that of the Heads of State and Government, in particular through the European Council (of which the president of the European Commission is also a member) that meets in presence of Ecofin

[3] The *Stability and Growth Pact (SGP)* consists of two Council Regulations and two Resolutions of the European Council Council Regulation (EC) No 1466/97 of 7 July 1997 on the strengthening of the surveillance of budgetary positions and the surveillance and coordination of economic policies (OJ L 209, 02/08/1997 p. 1); Council Regulation (EC) No 1467/97 of 7 July 1997 on speeding up and clarifying the implementation of the excessive deficit procedure (OJ L 209, 02/08/1997, pp. 6-11); Resolution of the European Council on the Stability and Growth Pact, Amsterdam, 17 June 1997 (OJ C 236, 02/08/1997, p. 1); Resolution of the European Council on growth and employment, Amsterdam, 16 June 1997 (OJ C 236, 02/08/1997, p. 3).

Ministers when issues of relevance to EMU are discussed. (2) At the Ministerial level, the main co-ordinating bodies are the Council and the Euro-11 group. For matters related to EMU and taxation, the most relevant Council formation is that of Economic and Finance Ministers (Ecofin), while for employment policies the Employment/Social Affairs Council takes the lead. The ECB president is invited to the Ecofin and also to the more informal Euro-11 group. In the latter national delegations are restricted to two persons (the Minister plus the relevant member of the Economic and Financial Committee). The European Commission is present both at the Council (Ecofin) and the Euro-11 meetings. The social partners are involved in the coordination process at Ministerial level through the participation of the main European employers‘ and employees‘ organisations in the so-called European Social Dialogue. (3) The Senior officials level consists of several committees. In the EMU area, the most important is the Economic and Financial Committee (since January 1, 1999 the sucessor of the Monetary Committee, according to Article 114(2) TEC), which has advisory and preparatory functions in preparing the Council meetings. It is composed of two representatives of each EMU member state (one from the administration – finance ministry, one from the national central bank) and two Commission and ECB representatives each. So it is a body for informal dialogue between officials from the economic and moneatry poles. In addition there are other committees for different purposes (the Economic Policy Committee, the Employment Committee, the Banking Advisory Committe, the Banking Supervision Committee, the Code of Conduct Group business taxation, the Committee on Monetary, Financial and Balance of Payments Statistics).

The Treaty and the SGP always speak of economic policy „coordination“. This is the more rigorous form of economic cooperation, involving a complicated procedure of mutually agreed guidelines and commitments how to conduct monetary and fiscal policies, as layed down in the Treaty. A narrower form of interaction, often used in game theory, is the notion of economic „cooperation“ in contrast to non-cooperation. In a game-theory context this latter notion is more adequate, also it does not cover the more complicated form of coordination as those of the EMU[4]. Athough we aim at studying the implications of different scenarios of cooperation in EMU, technically speaking we have to restrict our calculations to the more narrow form of economic policy cooperation.

[4] For a survey of the different definitions of coordination and cooperation in the literature, see *Mooslechner-Schürz* (1999), p. 3-4.

Table 2: Policy Multipliers for Output, Inflation, and Unemployment in Euroland (EMU)[a]

Country acting, and policy	Belgium (B)			Germany (D)			Spain (E)			France (F)			Ireland (IRL)		
	y	p	u	y	p	u	y	p	u	y	p	u	y	p	u
I. Fiscal Policy [b]															
Belgium (B)	**0.26**	**0.77**	**-0.10**	0.02	0.01	-0.01	0.00	0.00	0.00	0.02	0.01	0.00	0.03	0.02	-0.01
Germany (D)	0.05	0.05	-0.02	**0.81**	**0.30**	**-0.50**	-0.08	-0.04	0.02	-0.02	-0.04	0.01	0.04	0.02	-0.02
Spain (E)	0.01	-0.01	0.00	0.00	-0.02	0.00	**0.78**	**0.18**	**-0.23**	0.03	-0.01	0.00	0.01	0.00	0.00
France (F)	0.07	0.12	-0.02	0.03	-0.01	-0.02	0.03	-0.01	-0.01	**0.79**	**0.41**	**-0.07**	0.06	0.02	-0.03
Ireland (IRL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.52**	**0.11**	**-0.20**
Italy (I)	-0.01	-0.08	0.01	-0.03	-0.03	0.01	-0.07	-0.03	0.02	-0.01	-0.03	0.01	-0.06	-0.01	0.02
Netherlands (NL)	0.01	-0.02	-0.01	-0.01	-0.01	0.01	-0.02	-0.01	0.01	-0.02	-0.02	0.00	-0.01	0.00	0.01
Austria (A)	0.00	0.00	0.00	0.02	0.01	-0.01	-0.01	-0.01	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00
Portugal (P)	0.01	0.01	0.00	0.01	0.00	0.00	0.03	0.01	-0.01	0.01	0.01	0.00	0.01	0.00	0.00
Finland (FIN)	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
II. Monetary policy [c]															
European Central Bank (ECB)	0.44	1.38	-0.16	0.53	0.36	-0.30	0.63	0.28	-0.17	0.47	0.42	-0.07	0.81	0.27	-0.29

Country acting, and policy	Italy (I)			Netherlands (NL)			Austria (A)			Portugal (P)			Finland (FIN)		
	y	p	u	y	p	u	y	p	u	y	p	u	y	p	u
I. Fiscal Policy [b]															
Belgium (B)	0.01	0.00	0.00	0.04	0.02	-0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00
Germany (D)	0.03	-0.03	-0.01	0.07	0.03	-0.02	0.14	0.00	-0.05	-0.07	-0.03	0.03	-0.03	-0.01	0.01
Spain (E)	0.01	-0.01	0.00	0.00	-0.01	0.00	0.00	-0.01	0.01	0.06	0.03	-0.03	-0.01	-0.01	0.00
France (F)	0.04	-0.02	-0.01	0.03	0.01	-0.01	-0.01	-0.02	0.00	-0.01	0.01	0.01	-0.05	0.00	0.01
Ireland (IRL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Italy (I)	**1.03**	**0.61**	**-0.31**	-0.03	-0.01	0.01	0.00	-0.02	0.00	-0.12	-0.07	0.05	-0.07	-0.03	0.02
Netherlands (NL)	-0.02	-0.02	0.01	**0.87**	**0.34**	**-0.20**	-0.01	-0.01	0.00	-0.03	-0.02	0.01	-0.02	-0.01	0.01
Austria (A)	0.01	0.00	0.00	0.01	0.00	0.00	**0.46**	**0.10**	**-0.16**	-0.01	-0.01	0.00	-0.01	0.00	0.00
Portugal (P)	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	**0.71**	**0.67**	**-0.31**	0.01	0.00	0.00
Finland (FIN)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	**0.71**	**0.24**	**-0.21**
II. Monetary policy [c]															
European Central Bank (ECB)	0.44	0.46	-0.12	0.54	0.23	-0.11	0.51	0.27	-0.13	0.78	0.60	-0.32	0.61	0.32	-0.17

Source: Own calculations with the Oxford Economic Forecasting Model (OEF model: Emerging Market Model, December 1998).

a. The table gives multipliers averaged over two years (1999-2000); y = real GDP (measured as a percentage deviation from a baseline); p = inflation rate (measured as a percentage-point deviation from a baseline); u = unemploymente rate (measured as a percentage-point deviation from a baseline).

b. Fiscal policy (responsibility rests on the EMU member states) is measured by the increase of real government spending of one percent of real GDP.

c. Monetary policy (responsibility rests on the ECB) is measured by a one percentage-point decrease of short-term interest rate (uniform in all EMU countries).

EMU = Economic and Monetary Union.

Table 3: Policy Multipliers for Government Budget, Gross Public Debt, and Current Balance in Euroland (EMU)[a] (Implication for the US-Dollar/Euro Exchange Rate)

Country acting, and policy	Belgium (B)			Germany (D)			Spain (E)			France (F)			Ireland (IRL)		
	d	b	cb	d	b	cb	d	b	cb	d	b	cb	d	b	cb
I. Fiscal Policy [b]															
Belgium (B)	**-1.01**	**0.39**	**-0.28**	0.01	-0.02	0.02	0.00	0.00	0.01	0.00	-0.02	0.02	-0.01	-0.01	0.02
Germany (D)	-0.02	-0.08	0.18	**-0.71**	**0.09**	**-0.45**	-0.05	0.09	0.09	-0.05	0.05	0.09	-0.13	0.10	0.13
Spain (E)	-0.01	0.01	0.03	-0.01	0.01	0.02	**-0.87**	**0.30**	**-0.55**	0.00	-0.01	0.03	-0.02	0.03	0.04
France (F)	0.00	-0.14	0.17	-0.01	-0.01	0.07	-0.01	-0.02	0.08	**-0.55**	**-0.01**	**-0.55**	-0.07	-0.04	0.10
Ireland (IRL)	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**-1.02**	**0.77**	**-0.54**
Italy (I)	-0.03	0.06	0.01	-0.03	0.05	0.06	-0.03	0.07	0.07	-0.04	0.04	0.05	-0.09	0.10	0.07
Netherlands (NL)	0.00	-0.01	0.03	-0.01	0.02	0.01	-0.01	0.03	0.02	-0.02	0.03	0.03	-0.02	0.03	0.01
Austria (A)	0.00	0.00	0.01	0.01	-0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01	-0.01	0.01	0.01
Portugal (P)	0.00	-0.02	0.02	0.00	-0.01	0.01	0.00	-0.03	0.01	0.00	-0.01	0.00	0.00	0.00	0.01
Finland (FIN)	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01
II. Monetary policy [c]															
European Central Bank (ECB)	0.22	-1.32	0.50	0.29	-0.74	-0.06	0.19	-0.67	-0.25	0.28	-0.65	-0.11	0.34	-0.83	-0.11

Country acting, and policy	Italy (I)			Netherlands (NL)			Austria (A)			Portugal (P)			Finland (FIN)			US-$/ Euro
	d	b	cb	d	b	cb	d	b	cb	d	b	cb	d	b	cb	
I. Fiscal Policy [b]																
Belgium (B)	-0.01	0.00	-0.01	0.04	-0.07	0.02	0.00	-0.01	-0.01	-0.02	0.01	0.01	0.00	0.00	0.02	**0.06**
Germany (D)	-0.13	0.08	-0.04	0.07	-0.16	0.13	0.03	-0.13	0.15	-0.20	0.24	0.15	-0.03	0.03	0.10	0.50
Spain (E)	-0.03	0.02	-0.01	0.01	-0.01	0.02	-0.01	0.01	0.02	0.01	-0.05	0.09	-0.01	0.02	0.02	0.16
France (F)	-0.08	0.02	-0.02	0.04	-0.08	0.05	-0.03	0.03	0.04	-0.09	0.09	0.11	-0.02	0.04	0.07	0.45
Ireland (IRL)	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00
Italy (I)	**-0.92**	**-0.89**	**-0.68**	-0.02	0.01	0.04	-0.02	0.01	0.07	-0.17	0.25	0.07	-0.04	0.06	0.04	0.43
Netherlands (NL)	-0.02	0.05	-0.01	**-0.26**	**-0.45**	**-0.34**	-0.01	0.02	0.02	-0.04	0.07	0.02	-0.01	0.01	0.01	0.11
Austria (A)	-0.01	0.00	0.00	0.00	-0.01	0.01	**-1.00**	**0.74**	**-0.50**	-0.02	0.02	0.01	0.00	0.01	0.01	0.05
Portugal (P)	0.00	-0.01	0.00	0.01	-0.01	0.01	0.00	0.00	0.00	**-0.59**	**-0.16**	**-0.46**	0.00	0.00	0.01	0.02
Finland (FIN)	-0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	-0.01	0.01	0.01	**-0.86**	**0.52**	**-0.73**	0.03
II. Monetary policy [c]																
European Central Bank (ECB)	0.39	-1.21	0.14	0.43	-0.78	-0.05	0.27	-0.63	-0.24	0.82	-1.58	-0.18	0.25	-0.55	-0.02	-2.19

Source: Own calculations with the Oxford Economic Forecasting Model (OEF model: version Emerging Market Model, December 1998).

a. The table gives multipliers averaged over two years (1999-2000); d = government budget ratio (measured as an absolute deviation from a baseline in percent of GDP);
b = gross public debt ratio (measured as an absolute deviation from a baseline in percent of GDP);
cb = current account ratio (measured as an absolute deviation from a baseline of the current account balance as a percent of GDP).

b. Fiscal policy (responsibility rests on the EMU member states) is measured by the increase of real government spending of one percent of real GDP.

c. Monetary policy (responsibility rests on the ECB) is measured by a one percentage-point decrease of short-term interest rate (uniform in all EMU countries).

EMU = Economic and Monetary Union.

3. Economic Interdependencies in EMU

The first way to evaluate the macroeconomic interdependencies is to study the evidence on policy multipliers. For this purpose we apply a large-scale world macromodel (*OEF*, 1999). It encompasses 10 EMU countries (only Luxembourg is left out), as well as the major OECD countries. For the purpose of studying policy multipliers we only look at interdependencies within the EMU area. The simulation horizon is 1999-2001. Euroland is already modeled insofar as the 10 EU countries participating in the EMU have fixed bilateral exchange rates starting with 1Q1999 according to the conversion rates fixed on December 31, 1998. In addition, the ECB is emulated by assuming the same short-interest rate levels in Euroland. And the Euro is already anticipated and calculated against third country currencies, like the US-Dollar (USD) or the British Pound (GBP). So when simulating shocks one already anticipates the monetary behaviour of the European Central Bank (ECB). Its monetary policy reaction function follows something like a Taylor rule: the short-term interest rate adjusts in response both to the gap between a target for the stock of money and its actual value and to the gap between potential output and actual output.

Table 2: Policy Multipliers for Output, Inflation, and Unemployment in Euroland (EMU)

Table 3: Policy Multipliers for Government Budget, Gross Public Debt, and Current Balance in Euroland (EMU) with implications on the US-Dollar/Euro Exchange Rate.

We compare a fiscal policy stimulus with a monetary policy expansion. Fiscal policy expansion is measured by an increase of real goverment spending of one percent of GDP, executed individually by each of the 10 EMU member countries (Luxemburg excluded). Monetary expansion (done for the whole EMU area by the ECB) is measured by a one percentage-point decrease of short-term interest rate (uniform in all EMU countries).

As expected from a Mundell-Fleming type world macro model the own policy multipliers after a fiscal shock are large compared to the spill-overs to partner countries. The latter are mostly positive in sign. The two-years short-term GDP multipliers range from 0.3 (in Belgium) to 1.0 (in Italy). Inflation goes up, unemployment decreases (see *Table 2*). The budget deficit increases, as well as public debt. The current account deteriorates (see *Table 3*). Monetary policy (done centrally by the ECB for the whole EMU area) has a positive impact

on real GDP and inflation, and reduces unemployment (see *Table 2*). However, the impact on budget deficit and public debt is positive. The results as far as the current account is concerned are mixed (see *Table 3*). As in the theoretical Mundell-Fleming model, fiscal policy expansion leads to an appreciation of the Euro agains the US-Dollar. Accordingly, the monetary expansion results in a depreciation of the Euro (see *Table 3*).

The fact that the size of the fiscal policy multipliers varies within the EMU from country to country is of course the consequence of a still not fully harmonized economic performance of the EMU members. Neither is the business cycle of all EMU members synchronized, nor are the responses of the economies similar to identical policy shocks. Differences in policy multipliers may also add to the catalogue of conditions which identify an optimum currency area (OCA). In addition to labour market flexibility (Mundell's criterium), a similar impact of policy impulses in a group of countries indicates that these countries would belong to an OCA rather than countries which react differently. But even within the so-called DM core, consisting of countries whose currencies more or less moved alongside the DM in the last decade, namely Austria, Belgium, France, the Netherlands and of course Germany, policy responses are not as similar as one would expect (see *Table 2*).

4. Coordination of Fiscal and Monetary Policy in EMU

In following *Oudiz-Sachs* (1984), our strategy for measuring the gains from coordination is to compare two equilibria: one in which each country plus the ECB pursues optimal policies taking as given the action of the others („noncooperative" or „Nash" equilibrium; in our empirical example the baseline is identified as the „Nash" equilibrium), and one in which the authorities „bargain" over a coordinated package of policies („bargaining" or „cooperative" equilibrium).

4.1 A Model for the Nash Equilibrium

For the empirical evaluation of the gains from cooperation we use the classic Tinbergen targets- and-instruments framework (see *Oudiz-Sachs*, 1984, pp. 59 ff.). We consider a static

model, where the economy is represented by a set of multipliers. These multipliers link various „targets“ of each country to policy instruments. The multipliers are taken from the OEF world model for the period 1999-2001.

The strategy is as follows: In a n-country world $T^i = (T_1^i, ...T_m^i)$ is the vector of country i‘s targets. The baseline or „central variant“ projection of T^i, T^{Bi} is taken from a simulation of the OEF world model. The policy controls for country i are the elements of vector $C^i = (C_1^i, ...C_l^i)$. The authorities in country i maximize a welfare function $U^i(T^i)$.
The matrix Γ containes the multipliers linking the overall vector of controls $C = (C^1, C^2, ..., C^n)$ to the overall vector of targets $T = (T^1, T^2, ..., T^n)$, so that

$$T = C\Gamma + T^B . \tag{1}$$

When $C = 0$ then $T = T^B$, the baseline corresponds to the situation where no additional policy actions are taken.

Next we assume that the baseline is a Nash equilibrium for the n countries. The optimal policy for each country i, given the actions of the others, is $C^i = 0$ and consequently $T^i = T^{B^i}$. This assumption allows us to identify the key parameters of each country’s utility function. Finally we find the cooperative equilibrium as the solution to a bargaining problem. A common utility function, which is given by the weighted sum of the coutries‘ utility functions, is optimised.

We adopt this framework to model the EMU. In the monetary union policy instruments are split between the ECB who is in charge of monetary policy for the union as a whole and the EMU member countries who control their own fiscal policy.
We consider $n = 10$ *EMU countries*, who’s targets T^i are the value of the output gap (Q_t^i) and inflation as a deviation from target (p_t^i) over the years 1999 to 2001. Their only policy instrument is fiscal policy. *Fiscal policy* is measured by an increase in real government spending of one percent of real GDP sustained over the period 1999 to 2001. We write this as

$$T^i = (Q_{1999}^i, Q_{2000}^i, Q_{2001}^i, p_{1999}^i, p_{2000}^i, p_{2001}^i), \qquad i = 1,...,10 \tag{2}$$

$$C^i = G^i \tag{3}$$

The *ECB* is modelled in our empirical analysis as a synthetic 11th EMU „country“. This means that the targets of the ECB are the GDP-weighted averages of those of the 10 EMU countries. *Monetary policy* is pursued centralized by the ECB

$$T^{ECB} = (Q_{1999}^{ECB}, Q_{2000}^{ECB}, Q_{2001}^{ECB}, p_{1999}^{ECB}, p_{2000}^{ECB}, p_{2001}^{ECB}) \tag{4}$$

$$C^{ECB} = M^{ECB} \tag{5}$$

The target variables are GDP-weighted sums of the same variables of the 10 EMU member countries: $Q^{ECB} = \sum_{i=1}^{10} g_i Q^i$ and $p^{ECB} = \sum_{i=1}^{10} g_i p^i$ with $g_i =$ GDP weights.

Monetary policy is measured by a one percentage-point decrease of the short-term interest rate uniform in all countries, sustained over three years.

4.2 Derivation of the Utility Function Parameters

The assumption that the baseline is a Nash equilibrium gives us a first oder condition on the utility function for every country: $\frac{\partial U^i}{\partial G^i} = 0$ and for the ECB: $\frac{\partial U^{ECB}}{\partial M^{ECB}} = 0$. The derivatives can be calculated by

$$\frac{\partial U^i}{\partial C^i} = u_1^i \left(\frac{\partial Q^i}{\partial C^i} \right) + u_2^i \left(\frac{\partial p^i}{\partial C^i} \right) = 0, \qquad i = 1,...,11 \tag{6}$$

From now on the notation is identical fro the EMU member countries and the ECB ($i = 11 = ECB$).

The policy multipliers (such as $\frac{\partial Q^i}{\partial C^i}$ and $\frac{\partial p^i}{\partial C^i}$) are taken from the OEF model, the marginal utilities with respect to output and inflation u_1^i and u_2^i remain to be determined. The utility functions can be normalized by setting $u_1^i = 1$ for all $i = 1,...,11$, so that we are left with one equation for every unknown u_2^i. As output and inflation are targeted over a period of three years (see equation (2)), we have to assume a parametric specification af the utility function.

We specify the *utility functions* for the i *EMU member countries* as discounted sums of annual quadratic utilities[5], with a fixed time discount factor, $d = 0.1$:

[5] Although, in fact we calculate utility over a three-years time horizon, we still are not dealing with a full-fledged interemporal optimization problem but with a quasi-static planning environment. In a intertemporal environment,

Table 4: Partial Derivatives of National Utility Functions at Nash Equilibrium (u_1, u_2) and Utility Function Parameters (m_i, f_i)

Country		**Output** u_1	**Inflation** u_2	**Output** m_i	**Inflation** f_i
Belgium	B	1	-0.264	0.424	0.056
Germany	D	1	-1.126	0.136	0.229
Spain	E	1	-2.288	0.036	0.408
France	F	1	-1.093	0.069	0.276
Ireland	IRL	1	-2.474	0.181	0.264
Italy	I	1	-0.953	0.036	0.175
Netherlands	NL	1	-1.032	0.358	0.184
Austria	A	1	-1.739	0.140	0.375
Portugal	P	1	-0.309	0.177	0.030
Finland	FIN	1	-1.683	0.145	0.302
ECB[a]	ECB	1	-0.687	0.074	0.137

[a] ECB is the „11th EMU member country“. The respective parameters are derived from a weighted utility function with GDP weights of the EMU member countries.

the current target variables are functions, via rational expectations, of future policy variables. Then the logic of optimizing our utility function would be called into question, as *Kydland-Prescott* (1977) first explained. The time incosistency problem would arise when the private sector takes action dependent on anticipations of future policies. The OEF world model used in our exercise to calculate the policy multipliers is not based on rational expectations.

$$U^i = -\sum_{t=1999}^{2001} \frac{1}{2}(1+d)^{(1999-t)}\left[m_i (Q_t^i)^2 + f_i (p_t^i)^2\right], \qquad i = 1,...,11 \qquad (7)$$

In matrix notation the utility can be written as

$$U^i = -\frac{1}{2} T^i R_i T^{iT}, \qquad i = 1,...,11 \qquad (8)$$

where R_i is a diagonal matrix containig the country specific parameters:

$$R_i = \begin{bmatrix} m_i & 0 & 0 & 0 & 0 & 0 \\ 0 & (1+d)^{-1} m_i & 0 & 0 & 0 & 0 \\ 0 & 0 & (1+d)^{-2} m_i & 0 & 0 & 0 \\ 0 & 0 & 0 & f_i & 0 & 0 \\ 0 & 0 & 0 & 0 & (1+d)^{-1} f_i & 0 \\ 0 & 0 & 0 & 0 & 0 & (1+d)^{-2} f_i \end{bmatrix} \qquad (9)$$

Now the parameters m_i and f_i are determined by the normalizing condition and the first order condition in equation (6):

$$\frac{\partial U^i}{\partial Q^i} = u_1^i = -\sum_{t=1999}^{2001} (1+d)^{(1999-t)} m_i Q_t^i = 1 \qquad (10)$$

$$\frac{\partial U^i}{\partial C^i} = -\sum_{t=1999}^{2001} (1+d)^{(1999-t)} m_i Q_t^i \frac{\partial Q_t^i}{\partial C^i} - \sum_{t=1999}^{2001} (1+d)^{(1999-t)} f_i p_t^i \frac{\partial p_t^i}{\partial C^i} = 0. \qquad (11)$$

The results of the derivatives of the national utility functions at the Nash equilibrium (u_1^i, u_2^i), as well as the derived utility function parameters (m_i, f_i) are presented in *Table 4*. A high value of m_i signifies that the country has a priority for the output target in its utility function, which is the case for Belgium, Ireland and the Neatherlands. The inflation target is more important (indicated by high values of f_i) for Germany, Austria, Finland, Spain and of course for the ECB.

Table 4: Partial Derivatives of National Utility Functions at Nash Equilibrium and Utility Function Parameters

Table 5: Cross-Country Gains from Fiscal and Monetary Expansion at Nash Equilibrium ($\partial U^i / \partial C^j$)[a]

i = rows *j* = columns	**B**	**D**	**E**	**F**	**IRL**	**I**
B	0	0.010	0.004	0.006	0.002	0.015
D	0.001	0	0.024	0.046	0.000	0.062
E	0.001	0.055	0	0.052	0.000	0.059
F	0.005	0.049	0.026	0	0.000	0.054
IRL	-0.024	-0.100	-0.007	-0.059	0	-0.100
I	0.007	0.046	0.018	0.041	0.000	0
NL	-0.007	-0.032	-0.010	-0.038	0.006	-0.073
A	-0.005	0.072	0.024	0.042	0.000	0.045
P	-0.012	-0.085	0.017	-0.051	0.005	-0.155
FIN	-0.020	-0.049	0.002	-0.044	0.003	-0.043
ECB[b]	-0.007	0.124	0.063	0.084	0.004	0.041

i = rows *j* = columns	**NL**	**A**	**P**	**FIN**	**ECB**
B	0.0040	0.000	0.001	0.002	-0.077
D	0.011	-0.001	0.004	0.005	-0.429
E	0.018	0.011	0.008	0.003	-0.502
F	0.018	0.008	0.002	0.002	-0.355
IRL	-0.020	-0.008	0.002	-0.004	-0.100
I	0.009	0.005	0.002	0.003	-0.252
NL	0	-0.003	0.001	-0.006	0.150
A	0.008	0	0.002	0.000	-0.432
P	-0.008	-0.007	0	-0.005	0.431
FIN	-0.004	-0.007	0.007	0	-0.124
ECB[b]	0.021	0.012	0.003	0.011	0

[a] The policy actions of the countries in the columns (C^j, fiscal and monetary policies) have an impact on the utility of the countries in the rows (U^i). Fiscal policy is independently executed by each of the 10 EMU countries. Monetary policy in the EMU is centrally executed by the ECB for the whole EMU area.

[b] The utility of the ECB (U^{ECB}) is measured by a weighted utility function with GDP weights of the EMU member countries.

One has, however, to keep in minde that the parameters of the utility functions are dependent both on the baseline and the policy tradeoffs the countries are confronted with. And of course, the parameter are time-dependend. In our case we use the period 1999-2001. In an other period or business-cycle phase they could be different.

By setting $u_1^i = 1$ we normalized the marginal utility of a GDP increase (relative to the baseline) sutained for three years to equal 1. So u_2^i measures the welfare cost, in GDP equivalents, of a one percentage point increase in inflation held for three years. A value of $u_2^i = -2$, for example, means that on the margin, policy makers are indifferent between a one percentage point rise in inflation and a sustained GDP loss of two percent relative to baseline. In the empirical analysis the values of u_2^i for many countries is about 1. Small rises in inflation are equivalent to a one percent GDP loss for Belgium, Portugal and the ECB ($u_2^i < 1$).

Having these marginal weights, one can examine the scope for policy coordination. In a first step, we consider the effect on utility of country i of a rise in G in country j. By assumption, the own-effects of policy actions are zero at the Nash equilibrium. Then we get the *cross-country gains from fiscal and monetary expansion at the baseline* (at *Nash equilibrium*). Formally, the utility of country i is influenced by policy action of country j by:

$$\frac{\partial U^i}{\partial C^j} = -T^{Bi} R_i \Gamma_{ji}^T, \tag{12}$$

where Γ_{ji} is the block matrix of Γ which contains the multipliers of country i's targets with respect to country j's controls. The results are presented in *Table 5*. The cross-country gains (spill-over effects) are very low, in some cases even negative.

Table 5: Cross-Country Gains from Fiscal and Monetary Expansion at Nash Equilibrium

4.3 Evaluation of the Cooperative Equilibrium

We remember that in the *Nash equilibrium* the maximization problem for country i was given by

$$\max_{C_i} U^i(T^i) \tag{13}$$

$$\text{s.t. } T^i = (C^1,...,C^{10},C^{ECB})\Gamma_i + T^{Bi} \tag{14}$$

where Γ_i is the block matrix of Γ which contains the policy multipliers of country i ‘s targets with respect to policy actions of all countries and the ECB. By construction the optimal solution of the maximisation is given by $C^N = (0,...0)$ and $T^N = (T^{B1},...,T^{BECB})$.

A *cooperative equilibrium* corresponds to the case where all the countries act jointly so as to maximize a collective utility function. This collective utility function is assumed to be a weighted average of each country’s own utility function.

$$U^C(w^1,w^2,.....w^{11}) = \sum_{1=1}^{11} w^i U^i \tag{15}$$

The weights granted to each country in the cooperative process are denoted by $w^1,w^2,.....w^{11}$. For the practical process of cooperation the question arises which are the correct weights. Remembering the complicated framework of coordination described in chapter 2, one must conclude that the final level of coordination in EMU is the Council (the Ecofin). In the Council for a qualified majority the votes are weighted according to Article 205(2) TEC. That means the large countries have 10 votes, the medium-sized countries 5 votes and the small countries have votes from 2 to 4 votes. In total there are 87 votes. For most of the measures taken under the cooperation procedure a qualified majority is needed. That means the most plausible weighting scheme for a EMU-wide utility function is those according to the voting power of the EMU member countries in the Ecofin. Taking ECB as a large country an re-weighting on the basis of the 10 EMU member countries we get our weighting scheme for the EMU-wide utility function.

Equation (15) can be expressed alternatively in matrix notation as:

$$U^C(w^1,w^2,.....w^{11}) = -\frac{1}{2} TR_C(w^1,w^2,.....w^{11})T^T \tag{16}$$

with

$$R_C(w^1, w^2, \ldots\ldots, w^{11}) = \begin{bmatrix} w^1 R_1 & & & & & 0 \\ & w^2 R_2 & & & & \\ & & \cdot & & & \\ & & & \cdot & & \\ & & & & \cdot & \\ 0 & & & & & w^{11} R_{11} \end{bmatrix} \tag{17}$$

The *cooperative equilibrium* is thus the solution of the following optimisation problem:

$$\max_C U^C(w^1, w^2, \ldots\ldots w^{11}) = -\frac{1}{2} T R_C(w^1, w^2, \ldots\ldots w^{11}) T^T \tag{18}$$

$$\text{s.t.} \quad T = C\Gamma + T^B \tag{19}$$

The solution to this problem (if there are no constraints or if they are not binding) can be derived analytically and is given by

$$C^C = -T^B R_C \Gamma^T (\Gamma R_C \Gamma^T)^{-1} \tag{20}$$

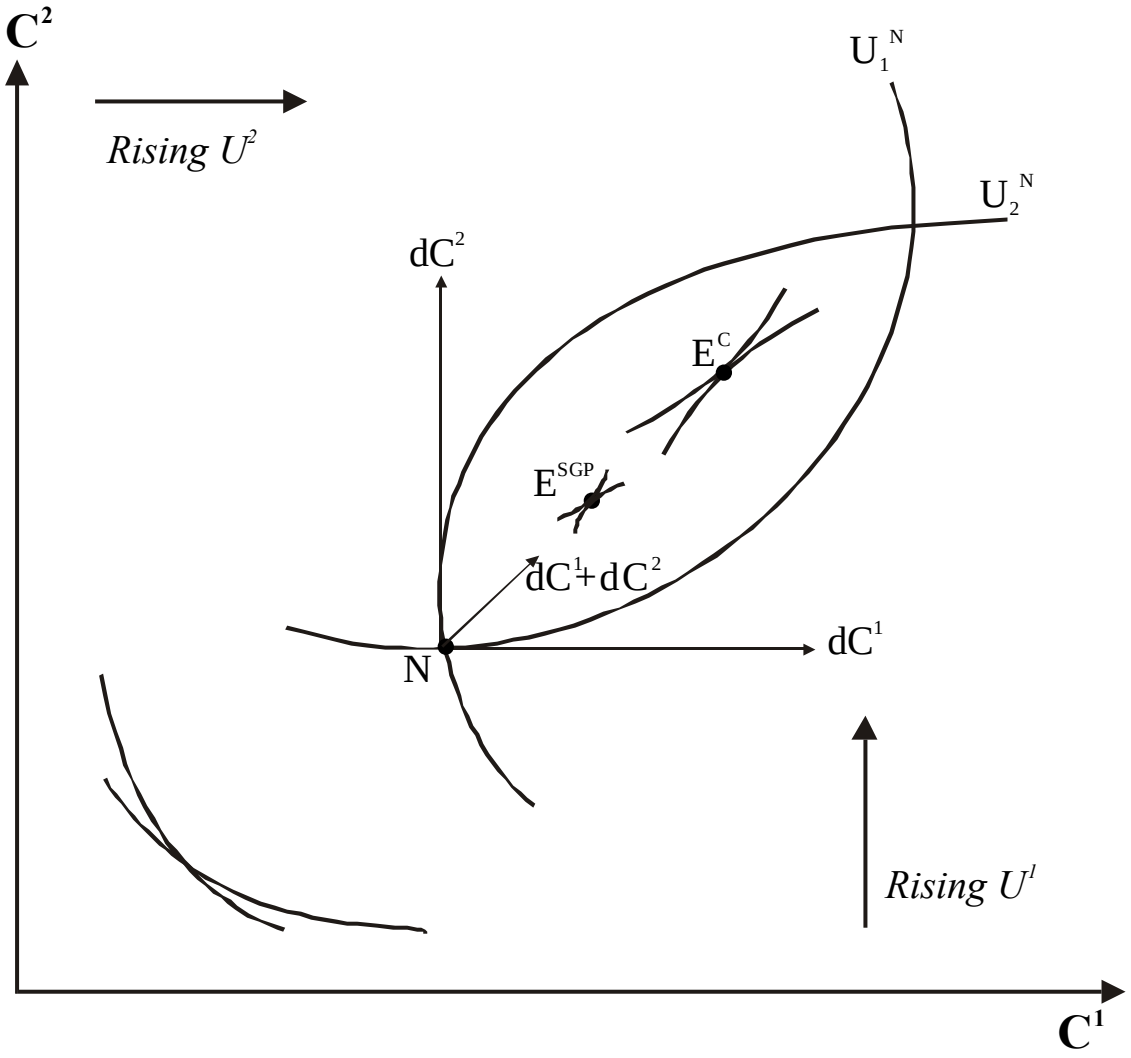
$$T^C = C^C \Gamma + T^B \tag{21}$$

And the *welfare gain from cooperation* (or coordination) is defined by

$$U^C - U^N = -\frac{1}{2} T^C R_C T^{CT} + \frac{1}{2} T^B R_C T^{BT} . \tag{22}$$

The argument for coordination can be demonstrated by a two-country example in a simple diagram (see *Oudiz-Sachs*, 1984, p. 27). In *Figure 1* the indifference curves for countries 1 and 2 are drawn in (C^1, C^2) space. It is assumed that $\partial U^1 / \partial C^2$ and $\partial U^2 / \partial C^1$ are both positive. That means that the influence of the other country's policy action exerts a positive impact on the home country. At the Nash equilibrium, N, C^1 is chosen to maximize U^1 given C^{2N}, so that the indifference curve for 1 is horizontal at N (that is, $\partial U^1 / \partial C^1 = 0$); similarly the indifference curve for 2 is vertical at N. Now, when C^1 is changed in the direction $\nu(\partial U^2 / \partial C^1)$, the domestic control is moved by the vector dC^1 (ν is a positive small positive number). For small changes, $dU^1 \approx 0$ and $dU^2 > 0$ (actually, U^1 falls by a second-order term, while U^2 rises by a first-order term). The vertical vector in the figure

Figure 1: The Geometry of Policy Coordination in EMU



Two-country case: C^1 = (fiscal) policy of country 1; C^2 = (fiscal) policy of country 2. U_1^N and U_2^N are the indifference (utility) curves of country 1 and country 2 respectively. E^C = equilibrium with unrestraint cooperation. E^{SGP} = equilibrium with cooperation under the constraint of the stability and growth pact (SGP).

Source: *Oudiz-Sachs* (1984, p.27) with own adjustments.

represents dC^2. By the same argument, a small rise in C^2 leads to $dU^1 > 0$ and $dU^2 \approx 0$. A cooperative equilibrium would be given by a sum of vectors dC^1 and dC^2, shown as the upward-sloping vector at point N. It clearly moves into a region of joint welfare improvement.

Figure 1: The Geometry of Policy Coordination in EMU

The region between the two indifference curves U_1^N and U_2^N describes the entire set of policy moves that are Pareto improving vis-a-vis N. In a non-EMU world, where each country has control over all policy instruments, at point E^C, the indifference curves of countries 1 and 2 are tangent. When no movement of C^1 and C^2 from E^C can be Pareto improving, E^C is an efficient policy equilibrium. The equilibrium E^C would be the optimal solution in a normal two-country world, where each country has full control over all policy instruments. However, in EMU – as described in chapter 2 – the framework is different. Even if point E^C might be the Pareto efficient coordination equilibrium, the Stability and Growth Pact (SGP) with its limitations of the government budget deficit to 3 percent of GDP as an upper limit and the medium term target of close to balance acts as a constraint for an unrestricted coordination equilibrium. Under the restrictive regime of the SGP the policy coordination outcome might result in an second-best equilibrium at point E^{SGP} (see *Figure 1*). As our results show, this is exactly the case. The SGP is binding for an optimal policy coordination outcome. These arguments can easily be generalized to a $n-$country world.

4.4 Gains from Cooperation

Based on the optimization procedure for cooperation described in the equations (19) and (20) we can calculate optimization gains for two scenarios, for (1) a „full cooperation“ (all EMU countries coordinate their fiscal policy with the monetary policy of the ECB) and, (2) for a „partial cooperation“ (where only the EMU countries coordinate their fiscal policy and the ECB stays aside). In both scenarios, firstly the unconstrained results are reported. Then restrictions to guarantee Pareto improvement are introduced and constraints by the SGP have to be taken into account. The numerical optimization are carried out with GAMS (General Algebraic Modeling System).

Table 6: Optimal Fiscal and Monetary Policy with Cooperation and Welfare Gains from Cooperation in the EMU

	Optimal Policy C^C	Utility at Nash Equilibrium U^N	Utility at Cooperative Equilibrium U^C	Welfare gain[a] $(U^C - U^N)$
I. Fiscal Policy[b]				
Belgium (B)	6.223	-0.707	-1.098	-0.391
Germany (D)	3.799	-3.045	-1.419	1.626
Spain (E)	5.913	-8.183	-5.964	2.219
France (F)	4.165	-3.661	-2.133	1.528
Ireland (IRL)	7.217	-5.475	-7.154	-1.679
Italy (I)	2.302	-6.288	-4.934	1.354
Netherlands (NL)	2.220	-1.724	-5.037	-3.313
Austria (A)	6.258	-2.962	-1.295	1.667
Portugal (P)	4.437	-2.206	-5.777	-3.571
Finland (FIN)	5.360	-2.995	-3.814	-0.819
II. Monetary policy[c]				
European Central Bank (ECB)[d]	-3.549	-3.402	-2.156	1.246
Total[e]	-	-3.985	-3.425	0.560

[a] The unit of welfare gain is equivalent to a percentage change in GDP, averaged over three years (1999-2001).

[b] The unit of fiscal policy is a sustained increase of government spending equal x percent of GDP.

[c] The unit of monetary policy is a sustained decrease of EMU's short-term interest rate of x percent.

[d] Welfare of the ECB is calculated from a welfare function with GDP weighted target variables: output and inflation.

[e] Weighted average of the national utility levels (weights according to council votes: ECB is a large country).
Weighted total utility of EMU is maximized.

Table 7: Outcome of Fiscal and Monetary Policy Optimization with Cooperation: Output and Inflation in the EMU, 1999-2001

	1999		2000		2001	
	T^C	T^B	T^C	T^B	T^C	T^B
	Deviations from target values[a]					
I. Output						
B	-0.72	-1.08	-0.20	-0.97	**-1.83**	-0.48
D	-2.63	-4.64	-1.60	-2.51	**-1.26**	-0.52
E	-11.22	-15.01	-8.64	-8.93	-5.62	-5.95
F	-4.29	-6.84	-4.06	-5.16	**-3.80**	-3.60
IRL	1.48	-0.90	-2.15	-2.43	**-5.02**	-2.92
I	-11.77	-12.89	-8.62	-9.92	-6.67	-6.82
NL	1.51	-0.66	**-1.46**	-0.65	**-4.74**	-1.87
A	-1.63	-3.49	-1.21	-2.55	**-2.34**	-1.60
P	1.47	-0.09	**-4.05**	-2.69	**-6.97**	-3.78
FIN	-0.12	-2.28	-2.66	-2.66	**-5.02**	-2.65
ECB[b]	-4.82	-6.88	-3.88	-4.71	**-3.45**	-2.88
II. Inflation						
B	**3.76**	1.31	0.12	1.89	-0.09	2.08
D	0.57	0.85	2.05	2.28	1.55	2.42
E	1.50	1.88	2.15	2.16	2.08	2.13
F	0.87	0.98	**1.64**	1.58	1.06	1.87
IRL	2.78	2.96	**4.06**	3.73	**3.93**	3.64
I	1.65	1.98	1.35	1.96	1.42	2.05
NL	1.87	1.89	**2.32**	2.01	1.54	2.27
A	0.84	1.26	1.21	1.73	1.43	2.18
P	**3.90**	3.50	**5.04**	3.92	3.44	3.85
FIN	**1.95**	1.83	**2.34**	2.29	**2.02**	2.01
ECB[b]	1.24	1.37	1.81	2.04	1.46	2.19

[a] Target values are as follows: output gap, zero (full employment); inflation, zero.
T^C = target values at cooperative equilibrium; T^B = target values at baseline (Nash equilibrium).

[b] The outcome for the ECB is equivalent to the GDP weighted average of those of the EMU member countries.

Table 8: Outcome of Fiscal and Monetary Policy Optimization with Cooperation: Government Budget and Gross Public Debt in the EMU, 1999-2001

	1999		2000		2001	
	T^C	T^B	T^C	T^B	T^C	T^B
	Deviations from target values[a]					
I. Government Budget						
B	**-5.81**	1.29	**-5.56**	1.70	**-6.55**	1.70
D	**-2.80**	0.84	**-2.73**	1.14	**-3.49**	1.30
E	**-4.51**	1.08	**-5.28**	1.36	**-5.60**	1.41
F	**-2.74**	0.35	**-2.98**	1.07	**-3.47**	1.33
IRL	**-4.16**	5.36	**-4.76**	5.24	**-5.61**	5.21
I	**-3.81**	0.58	**-4.07**	0.84	**-4.65**	1.00
NL	**1.17**	1.85	**-0.40**	1.85	**-2.37**	1.99
A	**-6.04**	0.82	**-6.60**	1.19	**-7.07**	1.73
P	**-5.77**	0.40	**-8.28**	0.18	**-10.87**	0.00
FIN	**-2.33**	2.99	**-3.21**	3.09	**-4.16**	3.18
ECB[b]	**-3.18**	0.87	**-3.49**	1.23	**-4.21**	1.41
II. Gross Public Debt						
B	**58.58**	55.72	**61.99**	52.24	**68.67**	48.27
D	**6.21**	5.31	**9.75**	4.96	**14.83**	4.56
E	**11.20**	10.43	**16.78**	8.42	**20.85**	6.44
F	**5.52**	5.15	**8.92**	4.34	**12.35**	3.04
IRL	**-4.76**	-9.24	**-1.89**	-15.69	**2.78**	-21.44
I	**55.80**	54.92	**56.02**	51.27	**58.08**	47.54
NL	4.29	5.40	**5.88**	4.12	**9.91**	2.86
A	**5.93**	3.13	**12.45**	2.25	**19.81**	0.96
P	**1.08**	-1.52	**8.66**	-2.03	**19.81**	-2.37
FIN	**-7.75**	-9.80	**-3.92**	-12.34	**0.71**	-14.90
ECB[b]	**17.68**	16.81	**20.76**	15.24	**24.89**	13.50

[a] Target values are as follows: government budget balance to GDP ratio, -3 percent of GDP (Stability and Growth Pact upper limit); gross public debt to GDP ratio, 60 percent of GDP. A negative (positive) sign indicates that the budget deficit and/or the public debt target is violated (is below target) by x percent of GDP.
T^C = target values at cooperative equilibrium; T^B = target values at baseline (Nash equilibrium).

[b] The outcome for the ECB is equivalent to the GDP weighted average of those of the EMU member countries.

4.4.1 Gains from Full Fiscal and Monetary Policy Cooperation

Unconstrained cooperative equilibrium:

In a first step the *cooperative equilibrium* is calculated according to the optimization problem of the equations (18) and (19). This gives the unconstrained results for the optimal policy vector C^C of equation (20) (see *Table 6*) and hence the policy targets at cooperation T^C according to equation (21) (see the *Tables 7 and 8*).

Table 6: Optimal Fiscal and Monetary Policy with Cooperation and Welfare Gains from Cooperation in EMU

Table 7: Outcome of Fiscal and Monetary Policy Optimization with Cooperation: Output and Inflation

Table 8: Outcome of Fiscal and Monetary Policy Optimization with Cooperation: Government Budget and GrossPublic Debt

Using the weighting according to the votes in the Council, total utility in the EMU at cooperative equilibrium is higher by 0.56% of GDP[6] than in the case of the Nash equilibrium (or in the baseline; see *Table 6*). This implies an optimal fiscal policy[7] impulse (increase of real public expenditures) in the EMU member states by 2 1/4 percent of GDP in the Netherlands and Italy to 7.2 percent of GDP in Ireland. As an optimal monetary policy the ECB would have to decrease the short-term interest rate y 3.5 percentage points. Although in this unconstraint optimization solution total EMU utility would increase, in some EMU member states cooperation would lead to a welfare loss compared to the baseline situation (or non-cooperation). This is not an Pareto optimal solution for all EMU members.

Full economic policy cooperation would lead to an improvement in the targets (output and inflation) in most countries compared to the baseline solution in the three years (1999-2001) under examination (see *Table 7*).

The most unpleasant result concerns the fiscal targets of the Stability and Growth Pact (SGP), namely the budget deficits (upper bound of 3% of GDP) and the public debt to GDP ratio (60%). In practically all EMU member countries the full policy coordination scenario would

[6] As *Oudiz-Sachs* (1984, p. 64) have shown, small utility gains are equivalent to percent changes in GDP.

[7] If one would choose equal weights w^i in equation (19) instead of our choice of voting power in the Council the respective values for optimal policy would be lower. For fiscal policy between 0.9% of GDP in Italy to 3.6% in Ireland, and the monetary policy impuls would only be –1.8%.

Table 9: Optimal Fiscal and Monetary Policy with Cooperation and Welfare Gains from Cooperation in the EMU
(Utility and SGP constrained)

	Optimal Policy C^C	Utility at Nash Equilibrium U^N	Utility at Cooperative Equilibrium U^C	Welfare gain[a] $(U^C - U^N)$
I. Fiscal Policy[b]				
Belgium (B)	0.297	-0.707	-0.707	0.000
Germany (D)	-0.419	-3.045	-3.045	0.000
Spain (E)	1.235	-8.184	-8.184	0.000
France (F)	-0.279	-3.661	-3.610	0.051
Ireland (IRL)	2.272	-5.475	-5.475	0.000
Italy (I)	-0.180	-6.287	-6.287	0.000
Netherlands (NL)	0.272	-1.725	-1.725	0.000
Austria (A)	0.754	-2.962	-2.852	0.110
Portugal (P)	-0.124	-2.206	-2.206	0.000
Finland (FIN)	0.926	-2.995	-2.995	0.000
II. Monetary policy[c]				
European Central Bank (ECB)[d]	-0.308	-3.402	-3.402	0.000
Total[e]	-	-3.985	-3.972	0.013

[a] The unit of welfare gain is equivalent to a percentage change in GDP, averaged over three years (1999-2001).

[b] The unit of fiscal policy is a sustained increase of government spending equal x percent of GDP.

[c] The unit of monetary policy is a sustained decrease of EMU's short-term interest rate of x percent.

[d] Welfare of the ECB is calculated from a welfare function with GDP weighted target variables: output and inflation.

[e] Weighted average of the national utility levels (weights according to council votes: ECB is a large country).
Weighted total utility of EMU is maximized.

lead to a violation of the SGP targets (see *Table 8*). Whereas in the baseline[8] all EMU member states exhibit already a fiscal balance below the 3% of GDP deficit target of the SGP, after the massive fiscal impulse, as the optimization solution for cooperation would imply this target would be violated by all countries (except the Netherlands) not only at the end of the three year period but already in 1999.

Confronted with this violation of the vital EMU fiscal policy targets one has to question the room for manoeuvre for fiscal and monetary policy coordination in EMU. In the next step we look therefore for the degree of welfare gains from cooperation, given the constraints of a Pareto optimal solution concerning utilities for all EMU countries (they should all be positive) and the objective that the fiscal targets (budget deficits and public debt) are not violated.

Constrained cooperative equilibrium:

Now, we take into consideration the two additional constraints for cooperation:

1. *Pareto optimality constraint:* All countries must improve their welfare or should at least not be worse off than in the non-cooperative situation ($U^{Ci} \geq U^{Ni}$). Such a condition is necessary when bargaining for policy cooperation.
2. *Stability and Growth Pact constraint:* The SGP aims at a budgetary position of the EMU member states of close to balance or in surplus in the medium-run. An excess over this reference value is only allowed when it results from a severe economic downturn which is exceptional (i.e. when real GDP declines by at least 2% per annum). In our empirical analysis we only concentrate at the upper bound of the SGP budget deficit target of 3% of GDP which we use as an additional condition for the optimization procedure. The constraint on fiscal deficit is included in the form of a multiplier equation $\tilde{T} \leq C\tilde{\Gamma} + \tilde{T}^{B}$, where $\tilde{T}^{B}$ is the government budget balance to GDP ratio deviation from its target value (-3 percent of GDP) and $\tilde{\Gamma}$ are the multipliers on government budget balance to GDP ratio. Baseline and multipliers are taken from the the OEF model in an analogous way to the values of T^{B} and Γ in equation (1).

Table 9: Optimal Fiscal and Monetary Policy with Cooperation and Welfare Gains from Cooperation in EMU (Utility and SGP constrained)

[8] A comparison of the baseline forecast of the OEF world model with the stability programmes submitted by the EMU member states under the SGP rules early in 1999 shows no big differences in the budgetary position and

Table 10: Optimal Fiscal Policy with Cooperation and Welfare Gains from Cooperation in the EMU

	Optimal Policy C^C	Utility at Nash Equilibrium U^N	Utility at Cooperative Equilibrium U^C	Welfare gain[a] $(U^C - U^N)$
I. Fiscal Policy[b]				
Belgium (B)	-0.494	-0.707	-0.707	0.000
Germany (D)	0.398	-3.045	-3.035	0.010
Spain (E)	0.690	-8.183	-8.179	0.004
France (F)	0.384	-3.661	-3.636	0.025
Ireland (IRL)	0.199	-5.475	-5.556	-0.081
Italy (I)	0.125	-6.288	-6.246	0.042
Netherlands (NL)	0.196	-1.724	-1.785	-0.061
Austria (A)	0.393	-2.962	-2.905	0.057
Portugal (P)	0.094	-2.206	-2.267	-0.061
Finland (FIN)	0.256	-2.995	-3.034	-0.039
II. Monetary policy[c]				
European Central Bank (ECB)[d]	0.000	-3.402	-3.268	0.134
Total[e]	-	-3.985	-3.965	0.020

[a] The unit of welfare gain is equivalent to a percentage change in GDP, averaged over three years (1999-2001).

[b] The unit of fiscal policy is a sustained increase of government spending equal x percent of GDP.

[c] The unit of monetary policy is a sustained decrease of EMU's short-term interest rate of x percent.

[d] Welfare of the ECB is calculated from a welfare function with GDP weighted target variables: output and inflation.

[e] Weighted average of the national utility levels (weights according to council votes: ECB is a large country).
Weighted total utility of EMU is maximized.

also in the debt to GDP ratios.

These two constraints for calculating a cooperative equilibrium reduces the room for manoeuvre for an optimal fiscal and monetary policy dramatically (see *Table 9*). Total utility improves only slightly by 0.013% GDP. Only France and Austria can expect a small improve in their welfare from cooperation. The pattern of optimal fiscal policy varies from –0.4% in Germany to 2.3% in Ireland. The ECB would reduce short-term interest rates only by 0.3%. This implies that an optimal solution under the two constraints results in a fiscal policy pattern which allocates to some countries a fiscal expansion whereas others should restrict their fiscal policy!

4.4.2 Gains from Partial, only Fiscal Policy Cooperation

In case of a fiscal cooperation only among the EMU member countries with an ECB not participating, the welfare gains would be only 0.02% of GDP. The fiscal impulses would be below 1% of GDP (in Belgium the fiscal policy should even be restrictionist). Four out of 10 EMU countries would be worse off with cooperation compared to non-cooperation (see *Table 10*).

Table 10: Optimal Fiscal Policy with Cooperation and Welfare Gains from Cooperation in EMU

The advantage of this partial cooperation would be that the SGP targets would practically not be violated. Due to the small fiscal impulse the direct targets of optimization (output-gap and inflation) would only slightly be improved. If one introduces the additional constraints (Pareto optimality concerning welfare in each country; SGP targets) the cooperative welfare gains would be practically nil.

In both cases, a constrained cooperative solution (results in *Table 9*) and a partial cooperation scenario (results in *Table 10*) lead to a situation which leads the EMU countries back to the baseline or Nash equilibrium (as demonstrated in *Figure 1*). Only full cooperation leads to massive welfare gains, however, it violates some basic targets (each country gains and the SGP objectives are binding).

5. Conclusions

With a large-scale econometric world model we calculate the multipliers for fiscal and monetary policy for 10 EMU countries and the ECB. Fiscal policy is in the responsibility of the EMU member countries, monetary policy is conducted centrally by the ECB for Euroland. Then in a Tinbergen-like approach we link targets to policy instruments. In order to evaluate the gains from cooperation we compare a cooperative equilibrium with the non-cooperative one (by definition the baseline scenario is called the Nash equilibrium). The cooperative equilibrium is the result of the maximization of a weighted utility function with derived parameters for the targets output gap and inflation. In the case of a „full“ cooperation, where the 10 EMU countries coordinate their fiscal policy with the monetary policy of the ECB the welfare gains obtained are very large for Euroland as a whole. However the strong fiscal and monetary policy impulses as a result of this optimization procedure lead, firstly to a violation of the fiscal targets (budget deficit, public debt) of the Stability and Growth Pact (SGP) which limits the room for manoeuvre of fiscal policy of the EMU member states in stage III of EMU. Secondly, we find that not in all countries cooperation leads to welfare gains, a result which is not Pareto efficient. Therefore, by considering these two constraints (Pareto optimality and SGP objectives) the constrained optimization leads to a solution in case of „full“ cooperation which drives most countries back to the Nash position at the baseline. In addition, a „partial“ cooperation in which the ECB stays aside and only the fiscal policies of the EMU member countries are active, leads to a very small welfare improvement and violates again (only to minor degree the Pareto optimality condition). The optimal fiscal policy impulses are very modest.

The policy implications are twofold: First, our results indicate that – taking realistic data over the next three years – the SGP might have a very strong limiting impact on the efforts for a positive or active cooperation in EMU which would lead to more output and employment. Second, the EMU consists of still not fully harmonized economies with different reactions to policy shocks. That means the present EMU still does not present an optimum currency area. It may well be, however, that in the medium-run the single currency leads to a stronger real convergence (convergence of the business cycle and to a comparable impact of similar policy shocks).

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