

---

BANK OF FINLAND  
ECONOMICS DEPARTMENT  
WORKING PAPERS

---

29.9.1998

6/98

**Hanna Pesonen**

The Effects of GDP Changes on  
Fiscal Balances in EMU

---



# The Effects of GDP Changes on Fiscal Balances in EMU\*

Economics Department Working Papers 6/98

Hanna Pesonen

## Abstract

This paper uses the National Institute Global Econometric Model (NIGEM) to investigate the effects of a decline in GDP on general government deficits and debts in EMU. The results suggest that the sensitivity of fiscal balances varies across countries. Furthermore, the consequences of a negative shock to private consumption causing a decline in GDP depend on the monetary policy rule used in the simulation.

## Tiivistelmä

Tässä työpaperissa käytetään National Institute Global Econometric Model (NIGEM) -mallia tutkittaessa bruttokansantuotteen alenemisen vaikutuksia julkisten talouksien alijäämiin ja velkoihin EMU-maissa. Tulokset osoittavat, että julkisen talouden rahoitustasapainon herkkyys vaihtelee maittain. Lisäksi negatiivisesta kulutussokista aiheutuvan bruttokansantuotteen alenemisen vaikutukset riippuvat simuloinnissa käytetystä rahapolitiikkasäännöstä.

---

\* I wish to thank Ray Barrell at NIESR, Hanna-Leena Männistö, Ilmo Pyyhtiä, Antti Suvanto and Anne Brunila for helpful comments and Reijo Siiskonen for research assistance. I am responsible for all the remaining errors.



# Contents

Abstract .....	3
Tiivistelmä.....	3
1. Introduction.....	7
2. Simulation results.....	8
2.1 Elasticities under different monetary policy rules .....	8
2.2 Variation in the responses of different countries.....	10
3. Concluding remarks .....	11



# 1. Introduction

We used the National Institute Global Econometric Model (NIGEM) to study the short-term effects of a Europe-wide decline in GDP on general government deficits and debts. The decline in the level of GDP was assumed to result from a fall in private consumption in Europe, possibly reflecting increasingly cautious behaviour on the part of consumers due to the financial turmoil in Asia and recently in Russia.

In the simulations, a permanent negative shock is introduced to private consumption in all EU-11 countries. This reduces GDP to about 1 per cent below baseline level in the following few years. In the long run, the level of GDP is determined by the supply side and hence returns to its baseline level.

The shock is introduced at the start of 1999 to the National Institute's July 1998 baseline. Fiscal policy is assumed to be fixed in the sense that governments do not respond to increasing budget deficits by raising taxes. The sensitivity of general government deficit and debt ratios to changes in economic activity is then assessed by calculating corresponding elasticities.

We assume the existence of the European Central Bank and thus a uniform interest rate level from the start of 1999. Monetary policy is based on weighted economic conditions in all EU-11 countries.

The effects of the shock are examined under five different monetary policy rules: money base targeting, nominal GDP targeting, Taylor rule, fixed nominal short-term interest rates and fixed real rates. Under money base targeting, the interest rate decreases if the actual nominal money stock is lower than the target level. Nominal GDP targeting makes the model react more rapidly since an inflation target is added to the rule so that a below-target inflation rate leads to a further decrease in the interest rate. The Taylor rule adjusts nominal short-term interest rates in response to any divergence of inflation and output from their respective targets.

According to the National Institute, some of these rules are still in the formulation stage and hence the results presented here are only preliminary. It should also be pointed out that we used the National Institute's default values for the coefficients of the monetary feedback rules.

The model is solved with backward-looking expectations, which allows for solution in the absence of fiscal solvency rules. The exchange rates are fixed. Because of the backward-looking wages and long-term interest rates, the possibility of solving the model with forward-looking exchange rates is ruled out.<sup>1</sup>

---

<sup>1</sup> We also experimented with forward-looking expectations. We could not however obtain a solution for the model under the Taylor rule and fixed real rates. Furthermore, the results under money base targeting and nominal GDP targeting turned out very different from what was expected. To deal with this issue, further research is needed.

## 2. Simulation results

In this section, we present the results of the five simulations. We first compare the monetary policy rules and show the reaction of the (short-term) interest rate in order to illustrate the associated monetary policy, after which we consider differences between the reactions of different EU-11 countries.

The results are presented in the form of elasticities of the deficit and debt ratios with respect to GDP. The elasticities give the percentage point increases in general government deficit ratio<sup>2</sup> and debt ratio (both vs GDP) as a response to a 1 per cent decrease in the level of GDP, which in turn is brought about by an exogenous negative shock to private consumption.

### 2.1 Elasticities under different monetary policy rules

Charts 1 and 2 present the aggregate response of EU-11 countries to a negative shock to the level of GDP. The EU-11 aggregate response is obtained by allocating weights to the responses of individual countries. We used the 1997 GDP shares as weights.

The response of the fiscal balance to a cyclical downturn in GDP depends clearly on the monetary policy rule.

As expected, the strongest response is associated with a fixed nominal interest rate rule. In that case, a 1 per cent decrease in GDP implies a 1 percentage point increase in the aggregate EU-11 deficit ratio in three years and a 0.7 percentage point increase in five years. Correspondingly, the elasticity of the general government debt ratio is 4 in three years and 5 in five years. Notice that, with a fixed nominal interest rate, the elasticity of the deficit ratio reaches its peak in three years, while the elasticity of the debt ratio increases continuously for 5 years.

The fixed nominal interest rate case represents a benchmark scenario in the sense that both fiscal and monetary policy are fixed. Under the other four monetary feedback rules the interest rate is allowed to adjust downward.

In general, if the nominal interest rate is allowed to decline, the elasticities are smaller (in magnitude). In order from weakest to strongest reaction in terms of fiscal balance, the five monetary policy rules are nominal GDP targeting, fixed real rates, money base targeting, the Taylor rule and fixed nominal short-term interest rates.

According to the simulation results, the elasticities are roughly the same in the first year regardless of monetary policy rule. However, after the first year, the choice of the rule does affect the results in that the elasticities start to diverge. In five years, the elasticity of the deficit ratio ranges from 0.1 to 0.7, ie the choice of monetary policy rule can make a difference of as much as 0.6 percentage point in the EU-11 aggregate deficit ratio. Correspondingly, in five years the elasticity of the debt ratio varies from 2.7 to 5, ie over a range of 2.3 percentage points.

---

<sup>2</sup> A minus sign indicates that the budget deficit ratio becomes more negative, ie the deficit increases.



Chart 1.

**Elasticity of the General Government Deficit Ratio with respect to GDP, EU-11**

Year	Money Base Targeting	Fixed Nominal Short Rates	Nominal GDP Targeting	Taylor Rule	Fixed Real Rates
1998	0	0	0	0	0
1999	-0,409	-0,421	-0,406	-0,413	-0,417
2000	-0,810	-0,897	-0,776	-0,862	-0,808
2001	-0,797	-1,029	-0,694	-0,970	-0,719
2002	-0,551	-0,929	-0,388	-0,862	-0,399
2003	-0,277	-0,745	-0,120	-0,687	-0,187

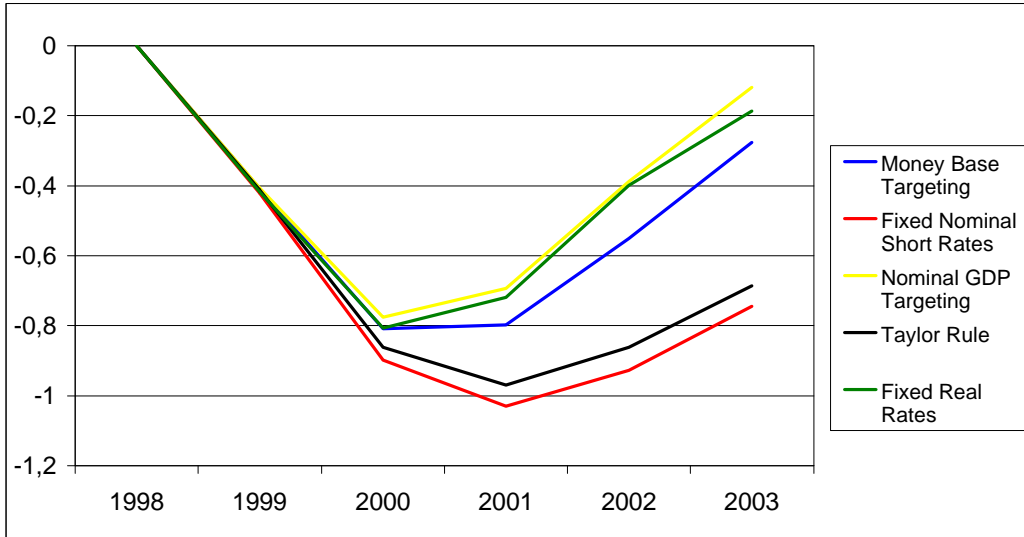


Chart 2.

**Elasticity of the General Government Debt Ratio with respect to GDP, EU-11**

Year	Money Base Targeting	Fixed Nominal Short Rates	Nominal GDP Targeting	Taylor Rule	Fixed Real Rates
1998	0	0	0	0	0
1999	1,280	1,280	1,280	1,282	1,284
2000	2,739	2,925	2,657	2,850	2,728
2001	3,481	4,071	3,192	3,937	3,236
2002	3,622	4,757	3,086	4,581	3,071
2003	3,378	5,049	2,712	4,869	2,830

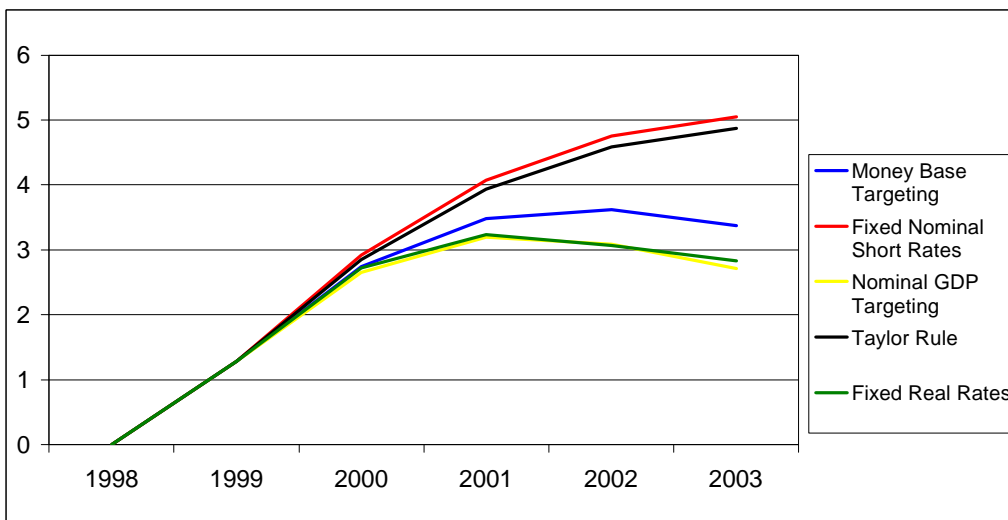
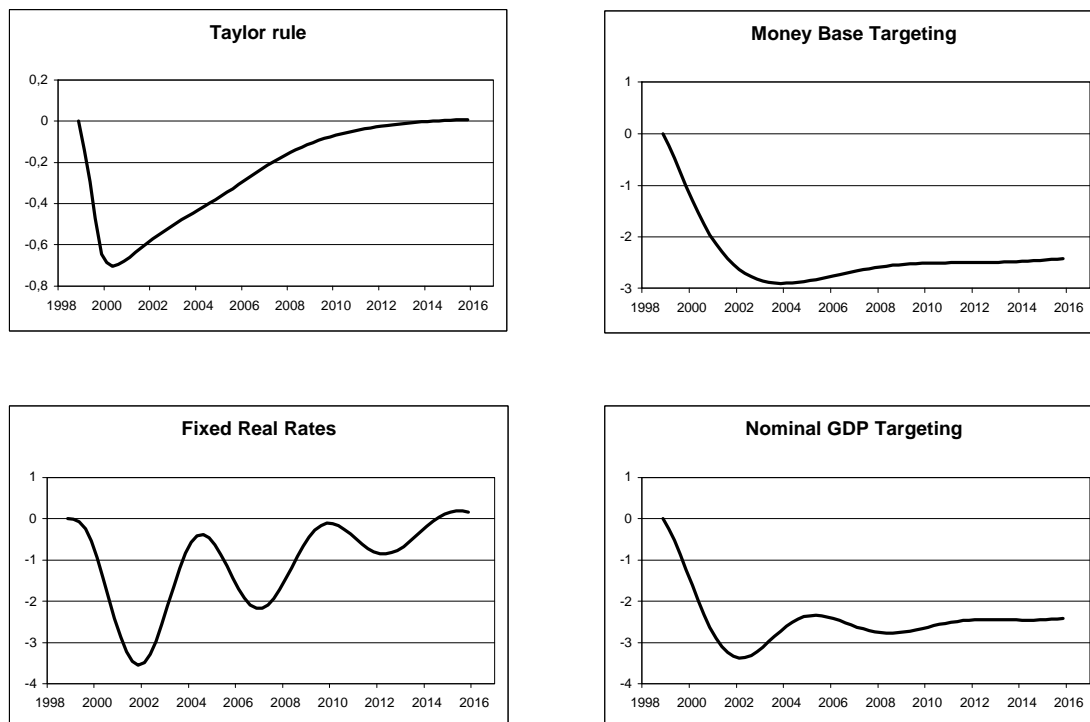


Chart 3 shows the implications of a looser monetary policy in terms of the level of the short-term interest rate. For example, we can see that under nominal GDP targeting the interest rate is more than 3 percentage points below the baseline after two years. The shock does not however lead to any changes in exchange rates since they are fixed.

Chart 3. **Nominal short-term interest rate in EMU under different monetary policy rules, differences from baseline, percentage points**



## 2.2 Variation in the responses of different countries

Charts 4-8 present country-specific elasticities of the general government deficit ratio, illustrating the differences in reactions. The charts run from the monetary policy rule that generates the strongest response (fixed nominal interest rate) to that giving the weakest response (nominal GDP targeting). Charts 9-13 give the corresponding elasticities of the debt ratio.

Comparing the response paths of the different countries reveals that their reactions clearly differ. In the case of the deficit ratio elasticity, the difference between the strongest and the weakest country-specific reaction is roughly 0.7 percentage point in three years under all five policy rules. The difference in the case of the government debt elasticity is more than 3 percentage points in 3 years. Given the differences in the response paths, one can argue that, under a common monetary policy rule, a decline in GDP puts strong pressure on fiscal balances in some countries, while in others the effect is less severe.

To summarize, the consequences of the shock tend to be relatively strong in Italy, and in some cases also in Belgium. The reaction of Belgium depends on the monetary policy rule in effect and is thus less consistent than Italy's reaction.

The impact of the shock is also rather strong in Germany and France. The responses of these countries are naturally close to the weighted EU-11 average due to their large shares in aggregate GDP. However, Germany tends to be below the aggregate line while France is slightly above it.

In contrast, the weakest response paths seem to be associated with Portugal, Ireland and the Netherlands, while Spain and Austria tend to be around the middle or slightly higher.

It should be pointed out that the above analysis excludes Finland due to some peculiarities in the obtained response paths. Finland's responses clearly differ from those of the other countries under money base targeting, fixed real rates and nominal GDP targeting. As the model for Finland in NIGEM is comparatively new and has not as yet been tested extensively, it is possible and even likely that the peculiar results for Finland are due to modelling deficiencies.

### 3. Concluding remarks

This paper investigates the consequences of a decline in GDP for the government deficit and debt ratios in EMU. We find that the response to the shock depends on the monetary policy rule in effect.

The results obtained under the strictest monetary policy rule<sup>3</sup>, ie, fixed short-term interest rates, show that a 1 per cent decrease in GDP (below baseline) is associated with a 1 percentage point increase in the general government deficit ratio in three years and a five percentage point increase in five years.

If interest rates are allowed to adjust downward from pre-shock levels, the shock loses some of its strength and the response paths of the EU-11 aggregate elasticities start to diverge. The range of elasticities from the weakest to the strongest response for EU-11 deficit ratios with respect to GDP, calculated from simulations of the NIGEM, is 0.3 percentage point in three years and 0.6 percentage point in five years. Correspondingly, the range for the debt ratio elasticity is 2.3 percentage points in five years.

Furthermore, under all five monetary policy rules tested, the responses diverge across the different countries. Regardless of policy rule, the range is roughly 0.7 percentage point for the deficit ratio elasticity and over 3 percentage points for the debt ratio elasticity in three years. The consequences of a symmetric shock that lowers the level of GDP in all EMU countries would thus be different in each country.

To illustrate, even allowing the interest rate to adjust downward by more than 2 percentage points under money base targeting, which is the 'medium response' policy rule, a 1 per cent GDP shock leads in the aggregate to a 0.8 percentage point increase in the deficit ratio and a 3.5 percentage point increase in the debt ratio in three years. In that case, the elasticities of different countries range roughly from 0.5 to 1.1 for the deficit ratio and from 2 to 5 for the debt ratio.

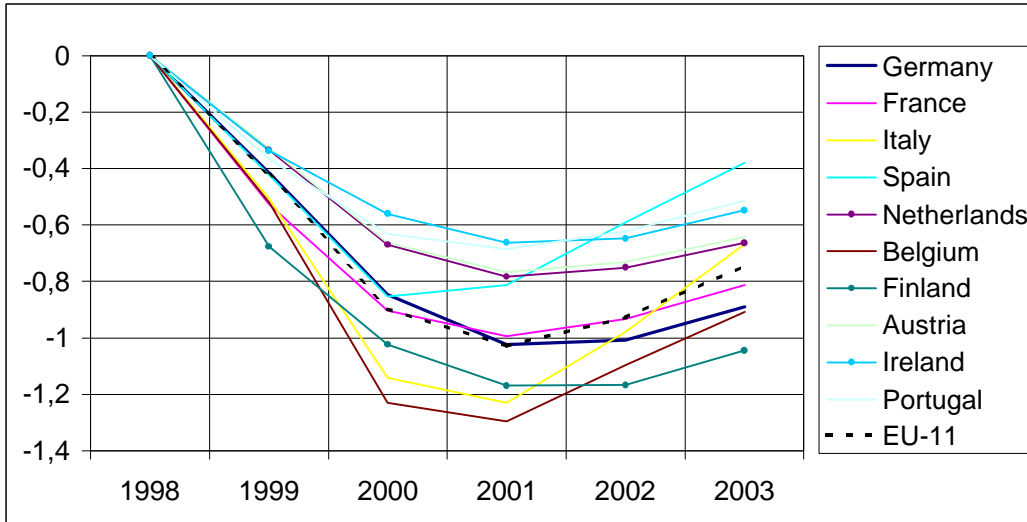
---

<sup>3</sup> In all simulations, the adjustment to the shock is achieved without changes in the exchange rates.

**Chart 4. Elasticity of the General Government Deficit Ratio with respect to GDP**

JUL2: Fixed Nominal Short Rates

Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	-0,417	-0,528	-0,506	-0,423	-0,336	-0,520	-0,678	-0,328	-0,337	-0,367	-0,421
2000	-0,846	-0,905	-1,142	-0,854	-0,670	-1,231	-1,024	-0,663	-0,560	-0,632	-0,897
2001	-1,024	-0,993	-1,230	-0,812	-0,784	-1,297	-1,170	-0,769	-0,663	-0,686	-1,029
2002	-1,007	-0,934	-0,978	-0,592	-0,751	-1,097	-1,168	-0,730	-0,649	-0,623	-0,929
2003	-0,889	-0,812	-0,669	-0,380	-0,664	-0,909	-1,045	-0,643	-0,549	-0,513	-0,745



**Chart 5. Elasticity of the General Government Deficit Ratio with respect to GDP**

JUL4: Taylor Rule

Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	-0,419	-0,510	-0,475	-0,416	-0,333	-0,390	-0,645	-0,326	-0,330	-0,361	-0,413
2000	-0,826	-0,841	-1,066	-0,809	-0,595	-1,025	-0,720	-0,627	-0,500	-0,545	-0,862
2001	-0,981	-0,891	-1,127	-0,735	-0,667	-1,076	-0,781	-0,697	-0,570	-0,546	-0,970
2002	-0,959	-0,826	-0,879	-0,509	-0,631	-0,901	-0,836	-0,650	-0,541	-0,486	-0,862
2003	-0,852	-0,712	-0,588	-0,306	-0,564	-0,749	-0,837	-0,573	-0,451	-0,406	-0,687

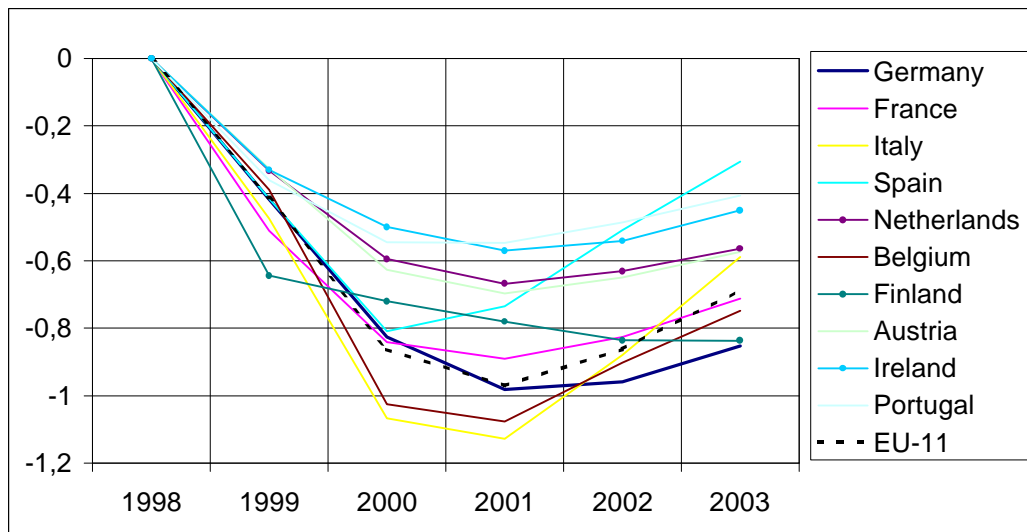


Chart 6.

### Elasticity of the General Government Deficit Ratio with respect to GDP

JUL1: Money Base Targeting

Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	-0,421	-0,509	-0,457	-0,416	-0,326	-0,308	-0,603	-0,326	-0,324	-0,357	-0,409
2000	-0,796	-0,780	-0,982	-0,774	-0,510	-0,744	-0,307	-0,590	-0,434	-0,456	-0,810
2001	-0,847	-0,713	-0,940	-0,610	-0,395	-0,572	0,342	-0,553	-0,385	-0,239	-0,797
2002	-0,696	-0,511	-0,596	-0,277	-0,147	-0,235	1,086	-0,366	-0,221	0,084	-0,551
2003	-0,491	-0,283	-0,252	0,002	0,075	-0,006	1,736	-0,172	-0,013	0,369	-0,277

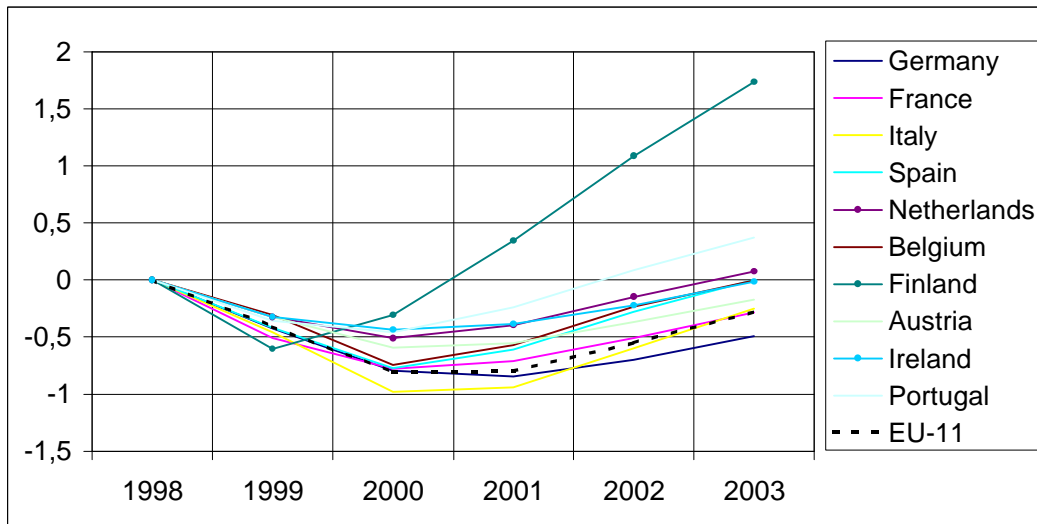
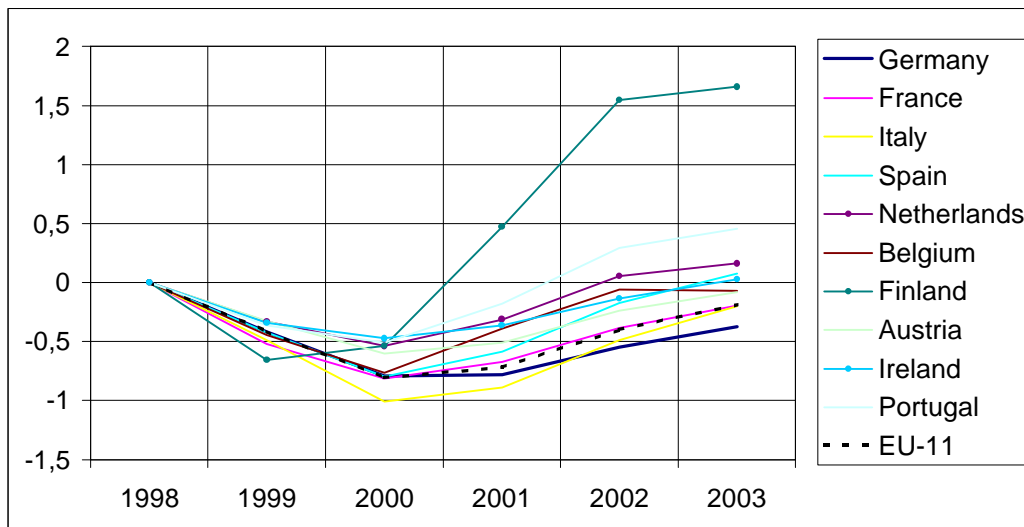


Chart 7.

### Elasticity of the General Government Deficit Ratio with respect to GDP

JUL5: Fixed Real Rates

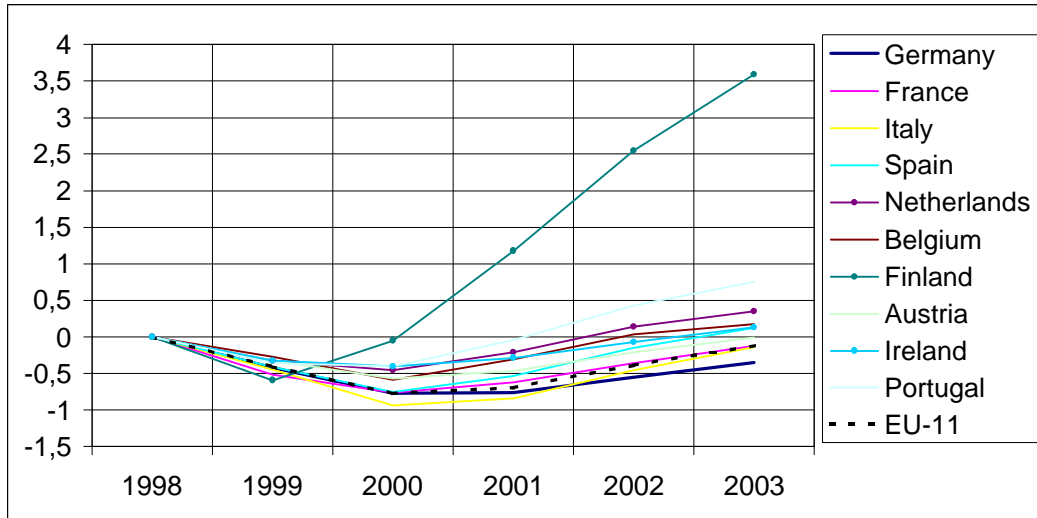
Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	-0,418	-0,520	-0,490	-0,422	-0,334	-0,443	-0,658	-0,327	-0,341	-0,364	-0,417
2000	-0,791	-0,814	-1,006	-0,797	-0,539	-0,766	-0,538	-0,602	-0,474	-0,507	-0,808
2001	-0,781	-0,671	-0,889	-0,586	-0,312	-0,392	0,473	-0,510	-0,362	-0,181	-0,719
2002	-0,547	-0,385	-0,489	-0,173	0,056	-0,061	1,549	-0,236	-0,135	0,293	-0,399
2003	-0,374	-0,197	-0,200	0,078	0,161	-0,070	1,658	-0,084	0,027	0,456	-0,187



**Chart 8. Elasticity of the General Government Deficit Ratio with respect to GDP**

JUL3: Nominal GDP Targeting

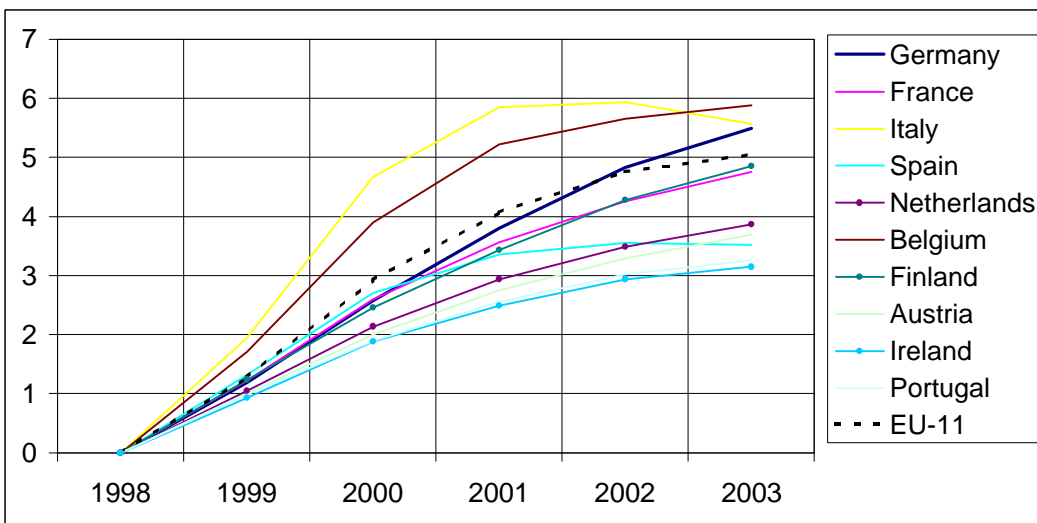
Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	-0,421	-0,513	-0,447	-0,414	-0,322	-0,268	-0,592	-0,328	-0,325	-0,355	-0,406
2000	-0,774	-0,763	-0,934	-0,751	-0,452	-0,588	-0,050	-0,568	-0,401	-0,404	-0,776
2001	-0,765	-0,624	-0,837	-0,531	-0,210	-0,309	1,177	-0,466	-0,286	-0,043	-0,694
2002	-0,556	-0,356	-0,462	-0,148	0,141	0,035	2,551	-0,211	-0,073	0,434	-0,388
2003	-0,349	-0,122	-0,139	0,124	0,349	0,175	3,590	-0,010	0,132	0,754	-0,120



**Chart 9. Elasticity of the General Government Debt Ratio with respect to GDP**

JUL2: Fixed Nominal Short Rates

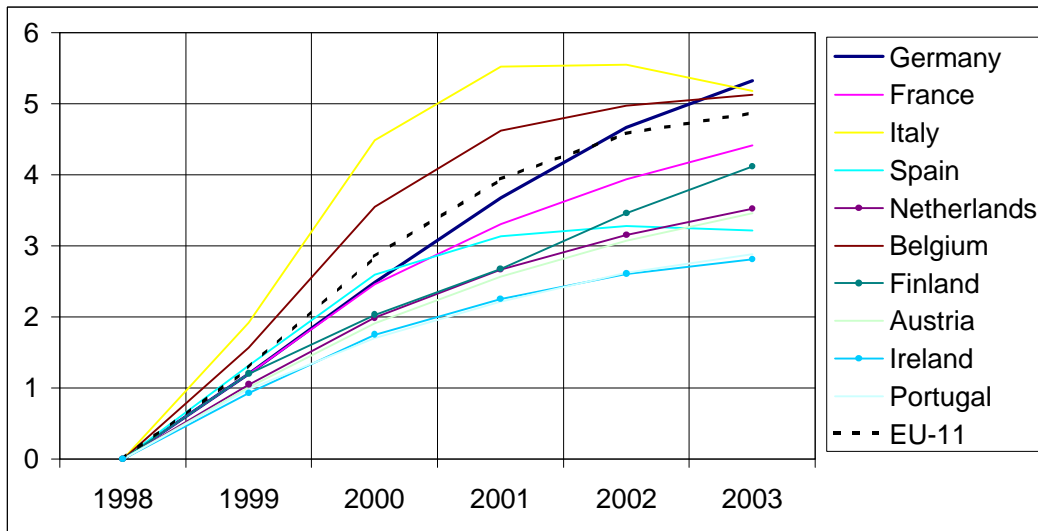
Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	1,190	1,218	1,946	1,325	1,045	1,710	1,237	1,007	0,928	0,985	1,280
2000	2,573	2,597	4,669	2,707	2,135	3,904	2,460	1,995	1,885	1,897	2,925
2001	3,801	3,561	5,849	3,350	2,939	5,223	3,433	2,750	2,486	2,557	4,071
2002	4,830	4,253	5,931	3,550	3,484	5,651	4,275	3,298	2,937	3,025	4,757
2003	5,487	4,756	5,566	3,519	3,869	5,879	4,851	3,688	3,146	3,263	5,049



**Chart 10. Elasticity of the General Government Debt Ratio with respect to GDP**

JUL4: Taylor Rule

Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	1,196	1,200	1,916	1,316	1,046	1,561	1,199	1,002	0,928	0,980	1,282
2000	2,485	2,456	4,481	2,591	1,983	3,551	2,028	1,902	1,749	1,701	2,850
2001	3,673	3,300	5,518	3,133	2,666	4,625	2,671	2,563	2,252	2,216	3,937
2002	4,664	3,936	5,544	3,276	3,152	4,972	3,459	3,068	2,606	2,618	4,581
2003	5,323	4,414	5,178	3,211	3,521	5,123	4,113	3,457	2,809	2,879	4,869



**Chart 11. Elasticity of the General Government Debt Ratio with respect to GDP**

JUL1: Money Base Targeting

Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	1,197	1,201	1,885	1,316	1,039	1,482	1,145	1,008	0,919	0,967	1,280
2000	2,368	2,338	4,308	2,507	1,783	3,127	1,406	1,806	1,618	1,480	2,739
2001	3,239	2,867	4,990	2,785	2,008	3,524	0,692	2,176	1,792	1,427	3,481
2002	3,747	3,065	4,547	2,536	1,826	3,097	-0,663	2,237	1,713	0,994	3,622
2003	3,855	3,019	3,753	2,054	1,484	2,541	-2,480	2,145	1,398	0,292	3,378

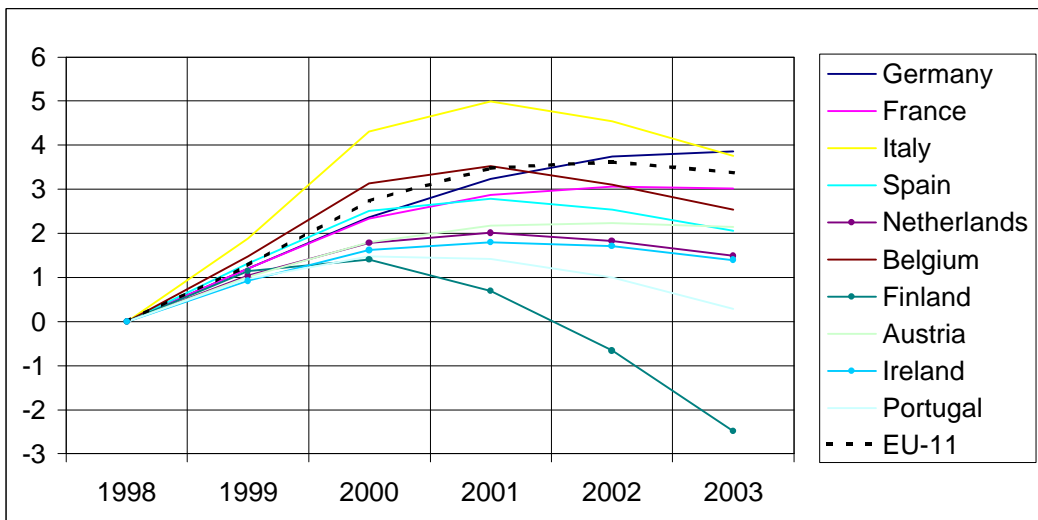


Chart 12.

**Elasticity of the General Government Debt Ratio with respect to GDP**

JUL5: Fixed Real Rates

Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	1,199	1,209	1,931	1,326	1,047	1,634	1,214	1,011	0,928	0,991	1,284
2000	2,375	2,411	4,404	2,566	1,833	3,239	1,722	1,824	1,722	1,585	2,728
2001	3,002	2,779	4,902	2,716	1,744	3,318	0,615	2,035	1,750	1,268	3,236
2002	3,211	2,717	4,134	2,208	1,220	2,559	-1,470	1,843	1,431	0,382	3,071
2003	3,303	2,616	3,308	1,699	0,981	2,116	-3,035	1,789	1,117	-0,196	2,830

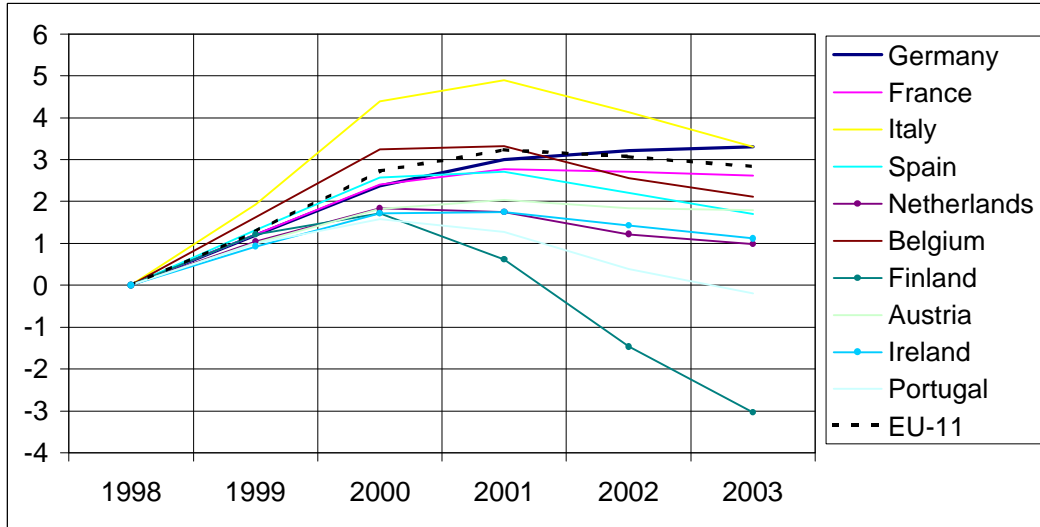
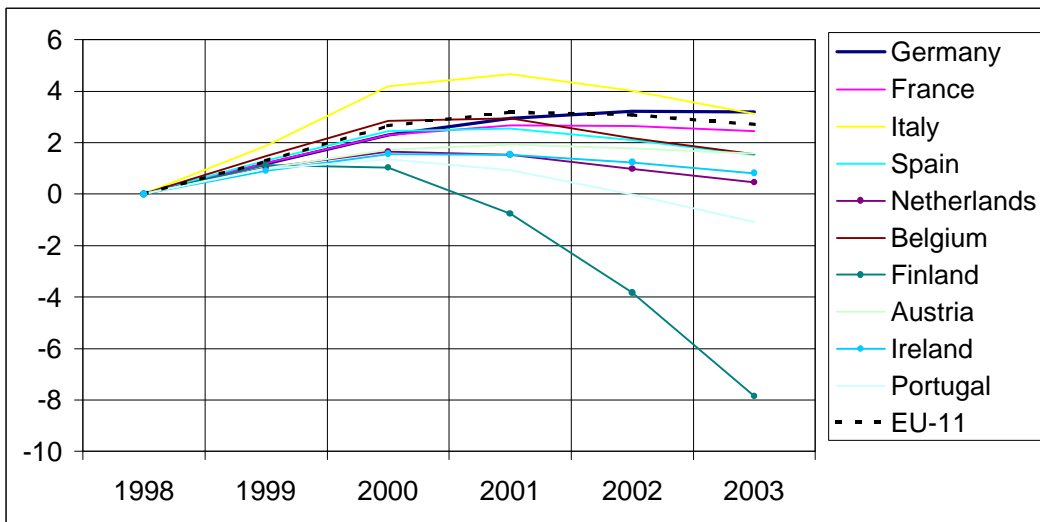


Chart 13.

**Elasticity of the General Government Debt Ratio with respect to GDP**

JUL3: Nominal GDP Targeting

Year	Germany	France	Italy	Spain	Netherlands	Belgium	Finland	Austria	Ireland	Portugal	EU-11
1998	0	0	0	0	0	0	0	0	0	0	0
1999	1,189	1,203	1,885	1,312	1,034	1,482	1,139	1,013	0,909	0,971	1,280
2000	2,296	2,302	4,193	2,449	1,659	2,850	1,036	1,742	1,561	1,365	2,657
2001	2,955	2,678	4,678	2,555	1,529	2,951	-0,766	1,931	1,541	0,938	3,192
2002	3,233	2,648	4,012	2,098	0,984	2,176	-3,836	1,783	1,245	-0,023	3,086
2003	3,206	2,455	3,134	1,523	0,469	1,556	-7,862	1,576	0,820	-1,083	2,712





- 1/98 Helvi Kinnunen  
Tuotannon kasvuhäiriöiden lähteet Suomessa ja EU-maissa, 21 p., 29.1.1998
- 2/98 Chris-Marie Rasi – Jan-Markus Viikari  
Ajassa muuttuva NAIRU ja potentiaalinen tuotanto Suomessa, 27 p., 23.2.1998
- 3/98 Pasi Kuoppamäki  
Pörssikupla. Tasapainoanalyysi HEX yleisindeksistä vuosina 1966–1997, 24 p., 30.3.1998
- 4/98 Anne Brunila  
Julkisen talouden konsolidointi EU-maissa 1990-luvulla, 16 p., 4.6.1998
- 5/98 Pasi Kuoppamäki  
Aggregoitu varallisuushintaindeksi. Laskelmia Suomen aineistolla vuosina 1970–1997, 38 p., 18.6.1998
- 6/98 Hanna Pesonen  
The effects of GDP changes on fiscal balances in EMU, 16 p., 29.9.1998