Cyclical Asymmetry in Fiscal Policy, Debt Accumulation and the Treaty of Maastricht

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Abstract

In this paper we present a stylised framework of fiscal policy determination which considers both structural targets and cyclical factors. Applying this framework to a sample of 16 OECD countries we find evidence of significant asymmetry in the reaction of fiscal policy to positive and negative cyclical conditions, with budgetary balances deteriorating in contractions and not improving in expansions. This asymmetry appears to have contributed significantly to debt accumulation. We find no evidence that EU fiscal rules have reduced the ability of governments to conduct stabilisation policy.

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1 Introduction

The aim of this paper is twofold. On the one hand we are interested in assessing whether fiscal policy reacts asymmetrically to positive and negative cyclical conditions. An asymmetric reaction is not consistent with a strategy aiming at stabilising the economy and might contribute to debt accumulation. On the other hand we intend to analyse the effects of fiscal rules introduced in view of the Monetary Union on the conduct of fiscal policy in EU countries.

According to European Commission (2001) between 1970 and 2000 "… [in the EU] deficits did not fall during periods of high economic growth, implying that countries offset the working of the automatic stabilisers via discretionary tax cuts or, more frequently, expenditure increases; such fiscal relaxation in good times in turn necessitated a tightening during economic downturns" [p. 63].[1]

If discretionary tightening in bad times exactly matches discretionary loosening in good times (i.e. if fiscal policy, though pro-cyclical, reacts symmetrically to the cycle) then this tendency, though negative for the stability of the economic environment, would not imply that fiscal activism per se contributes to debt accumulation.

Some evidence of asymmetric behaviour is provided by Buti, Franco and Ongena (1998) for high debt EU countries where, between 1970 and 1990, deficit to GDP ratios are at around 6 per cent of GDP when output is close to or above its trend value while the imbalance increases up to 8 per cent when output falls below its trend level.

Buti and Sapir (1998) also find that in the same period, for the average of EU countries, "when there is a moderately negative output gap […] the

[1] See also Buti, Franco and Ongena (1997). Von Hagen (2002) finds similar evidence for the 1998-2001 period. He argues that in this period "the tendency to behave in a procyclical way may indeed be a result of fiscal policy that relaxes in times of strong economic growth and tightens in times of recession for fear of hitting the limits set by […] the Stability and Growth Pact" [p. 7]. The persistence of the tendency to run pro-cyclical policies is also seen as evidence that fiscal rules devised for monetary union are inadequate to enforce virtuous fiscal discipline (see, e.g., Buti and Martinot, 2000; Korkman, 2001).

actual deficit gradually increases" (even though the reaction to larger negative output gaps is not stronger) while "when there is a moderately positive output gap […] the actual deficit remains stable" and it is only "when there is a strongly positive output gap [that] the actual deficit improves" [p. 87-88].

However, these results are not uncontroversial. Melitz (2002), finds that "…[in EU countries] fiscal policy responded in a stabilising manner in all phases of the cycle but only mildly so" and points out that "…under expansion, the divergence [with Buti and Sapir, 1998] is important".

Melitz (2002) also concludes that "…the explosion of debt/output ratios in the EU, and the OECD as a whole, must be explained independently of the cycle" [p. 235].

In this paper we present a stylised framework of fiscal policy determination which considers both structural targets and cyclical factors.[2] We use this framework to test the presence of asymmetry in the conduct of fiscal policy over the cycle in a sample of 16 OECD countries and to assess whether and to what extent asymmetric fiscal policy has contributed to the growth of public debt as a share of GDP.

To our knowledge, while a number of papers have tried to estimate the cyclical sensitivity of fiscal policy in OECD countries,[3] none has tried to account separately for reactions to positive and negative phases of the cycle. Also no estimate is available of the impact of fiscal policy asymmetries on debt.

Within this framework we also test for the presence of structural breaks in fiscal policy in EU countries in connection with the Treaty of Maastricht. A popular view in the recent policy debate is that EU fiscal rules have reduced the ability of governments to conduct stabilisation policy. Galì and Perotti (2003) test the same hypothesis in a different context and find no evidence of such a break.

Our results suggest that fiscal policy reacts asymmetrically to cyclical conditions as a downturn is usually accompanied by a deterioration of the budget balance (the estimated elasticity is about 0.4) while an upturn does

[2] This builds upon Hercowitz and Strawczynski (2002) who investigate public expenditure behaviour over the cycle.

[3] See, for example, Melitz (1997), Arreaza *et al*. (1999), Wyplosz (1999) and Galì and Perotti (2003).

not entail an improvement of the balance.

This asymmetry has significantly contributed to debt accumulation. The average the debt to GDP ratio in our sample grew from about 34.5 per cent in 1977[4] to about 68.1 in 2000. We estimate that almost a third of the increase is due to asymmetric budgetary behaviour.

As to European fiscal rules we find that while they seem to have increased the relevance of the debt level in the definition of budgetary targets, they have had no impact on the reaction to cyclical conditions.

The paper is structured as follows. Section 2 describes the stylised framework underlying the empirical tests. Section 3 reports the results of tests for the presence of cyclical asymmetry in the conduct of fiscal policy and for structural breaks in connection with the Treaty of Maastricht. Section 4 is devoted to the analysis of the implications for government debt dynamics. Section 5 concludes.

2 The stylised framework

We split the ratio of the budget balance to GDP (b_t, with $b_t>0$ indicating a deficit) into a long-run component (b^l_t) and a cyclical component (b^c_t)

(1) $$b_t = b^l_t + b^c_t$$

We assume that the long-run component is determined by a linear adjustment process towards government's preferred balance (b*) and debt (d*) ratios to GDP:[5]

[4] 1977 is the first year in which data on government debt are available for all countries included in our sample.

[5] These can be thought of as the result of the optimisation of an objective function linking electoral support (or consistency with one's "ideology" or both) to a number of macroeconomic variables subject to the constraint posed by one's preferred model of the economy (along the lines of the literature on the political business cycle; see, e.g. Nordhaus, 1972, and Alesina, 1987). Alternatively, b* and d* may be seen as the government's preferred solution to satisfying the present value budget constraint (Blanchard *et al.*, 1990). Artis and Marcellino (1998) provide a review of studies testing the hypothesis that governments actually behave so as to satisfy the present value budget constraint. A debt stabilisation motive in modelling budgetary decisions has been adopted in empirical analyses by several authors. See, e.g., Bohn (1998), Ballabriga and Martinez-Mongay (2002) and Galì and Perotti (2003).

(2) $$b^l_t = b_{t-1} + \alpha\,(b^* - b_{t-1}) + \beta\,(d^* - d_{t-1}) \qquad \alpha,\beta>0$$

Note that in the long run $d^*=b^*/k$, where k is nominal GDP growth.

The cyclical component, instead, is proportional to the expected difference between actual and trend GDP (i.e. the output gap, ω):

(3) $$b^c_t = \eta E[\omega_t]$$

Note that the η coefficient in (3) includes both the automatic reaction of the budget to the cyclical conditions (i.e. to what is usually called the budget elasticity to the cycle) and the discretionary action undertaken by fiscal authorities in response to such conditions. In other words, we model policy decision as the outcome of a process that takes into account the automatic response of the budget to the cycle.[6]

We assume that the cyclical component can be asymmetric, i.e. that η can be different depending on whether ω_t is positive or negative, and consequently rewrite (3) as

(4) $$b^c_t = \eta_p\, E[\omega_t^P] + \eta_n\, E[\omega_t^N]$$

where $\eta_p \neq \eta_n$ (the suffixes p and n indicate whether the coefficient applies to positive or negative output gaps) and $E[\omega_t^P]= m_t E[\omega_t]$, $E[\omega_t^N]=(1-m_t)E[\omega_t]$, with $m_t=1$ if $E[\omega_t]>0$, $m_t=0$ if $E[\omega_t]<0$.

Substituting (2) and (4) in (1) we get:

(5) $$b_t= \alpha_0+\alpha_1 d_{t-1}+ \alpha_2 b_{t-1}+\eta_p\, E[\omega_t^P] + \eta_n\, E[\omega_t^N]$$

where $\alpha_0=[\alpha+\beta/k]b^*$, $\alpha_1=-\beta$ and $\alpha_2=(1-\alpha)$.

A consistent stabilisation policy would require $\eta_n,\eta_p<0$, i.e. that an expected slowdown in economic activity, implying $E[\omega_t]<0$, determines a worsening of the budget and that an expected expansion, implying $E[\omega_t]>0$, determines an improvement of the budget.

[6] And expected interest outlays given that we consider the overall balance as a target variable.

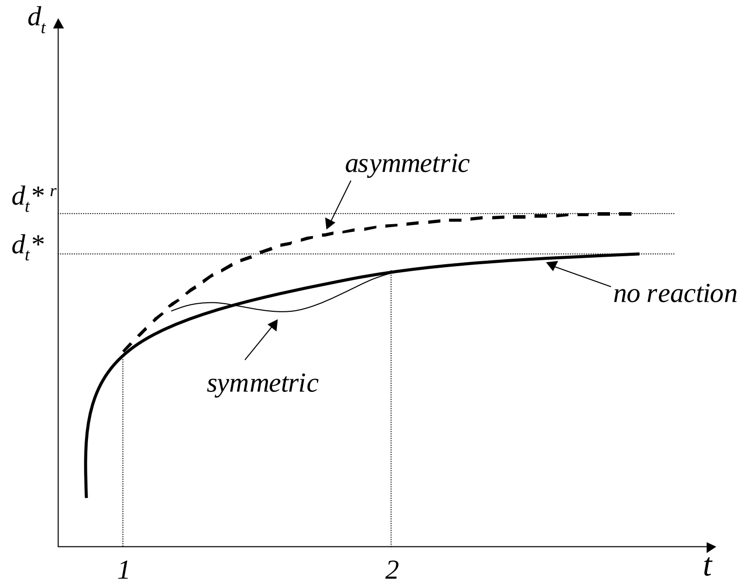
We define an index of asymmetry in the conduct of fiscal policy as:

(6) $$\phi = \eta_n - \eta_p$$

$\phi<0$ indicates that the impact of a downturn implies a deterioration of budget balances stronger than the improvement, if any, caused by an upturn. An upward impulse to debt accumulation follows. If $\phi=0$ then fiscal behaviour is symmetric with respect to the cycle.

Figure 1 provides a graphical illustration under the simplifying assumptions that $E[\omega_t]=\omega_t$ and that $b^l_t=b_{t-1}>0\ \forall t$ (so that, assuming constant GDP growth, d_t converges to a finite value[7]). The bold line indicates the growth path of the debt to GDP ratio in the absence of reactions to cyclical fluctuations. Following a negative shock at time 1, the deficit increases and so does the rate of growth of d. As cyclical conditions improve and the economy actually reaches a positive output gap the deficit may simply return to its initial level (asymmetric fiscal response) and d remains above the path it would have followed in the absence of shocks (dotted line) or it may decrease below the initial level (symmetric response, continuous thin line) so that once the cycle is over (time 2) d is back onto its original path.

Fig. 1 – Debt to GDP dynamics under different responses to the cycle



[7] We are assuming that there is no stock-flow adjustment, i.e. that nominal deficit coincides with the change in debt. See also section 4 below.

3 The estimation

For our estimation we used European Commission data for EU member states (excluding Luxembourg) plus Japan and the USA. Data coverage for debt and deficit ranges between 1969-2002 and 1977-2002.

The budget balance (b_t) is defined as general government net borrowing/lending, the debt (d_t) is measured by general government gross financial liabilities at nominal value.[8]

As a proxy of output gaps expected values we used ex-post evaluations of the gap obtained by means of the Hodrick-Prescott filter applied to GDP series covering the 1960-2004 period (we used Commission forecasts for 2003 and 2004). To avoid the end-point bias affecting the output gap estimates, in the deficit regressions we dropped the observations following the year 2000.[9]

Our estimating equation is therefore:

$$b_t = \alpha_0 + \alpha_1 d_{t-1} + \alpha_2 b_{t-1} + \eta_p \omega_t^P + \eta_n \omega_t^N \qquad (7)$$

Given the presence of the lagged dependent variable among regressors we applied the Arellano-Bond procedure for the estimation of fixed-effects panel models.[10]

For the whole sample the estimated coefficient of lagged deficit is 0.88, significantly different from zero and lower than 1 as expected and consistent

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[8] Net borrowing/net lending does not include net acquisitions of financial assets which is instead included among determinants of changes in gross debt. To the extent that these transactions respond to the cycle too, a comprehensive analysis of fiscal policy sensitivity to the cycle and of its contribution to debt accumulation should take them into account. However transactions in financial assets are likely to be undertaken following other considerations than the cyclical conditions of the economy.

[9] We tried different values for the smoothing parameter λ and found that results from the estimation of (5) are robust to different choices. For the regressions we used output gap estimates obtained by setting $\lambda=30$. See Bouthevillain *et al.* (2001) for a discussion of the issues involved in the use of the HP filter.

[10] The test for second order autocorrelation does not reject the validity of the procedure. The Sargan test for over-identifying restrictions ($\chi^2_{734}=505.99$) signals an over-fitting bias which we cannot address given that we use no other instruments than the lagged explanatory variables. As expected in these circumstances we find that Arellano-Bond estimates are extremely close to OLS ones.

with long run convergence of the equation.[11]

The estimated coefficient of lagged debt is –0.02, significantly different from zero and negative as expected.

We found a significant asymmetry in the conduct of fiscal policy. While η_n=-0.41 (significant at the 1% level), η_p=-0.05 (not significantly different from zero). The difference between the two coefficients is statistically different form zero, implying an asymmetry coefficient of about ϕ=0.36 (Table 1).

As the Arellano-Bond procedure is based on first differencing of the estimating equation, in order to get an estimate of the constant term and obtain an evaluation of b* from the restrictions induced by our model on the parameters in (7), we used standard OLS fixed effect panel estimation (which turned out to be extremely close to Arellano-Bond ones). We found that, assuming k=0.05, the estimated government preferred deficit (b*) is about 2.40 per cent of GDP.

Similar results are obtained if the analysis is restricted to the 14 EU countries of our sample (Table 2). The estimated coefficient of lagged deficit is 0.89, the estimated coefficient of lagged debt is –0.02. The conduct of fiscal policy is significantly asymmetric: η_n=-0.41, η_p=-0.04 (not significantly different from zero), ϕ=0.37. The estimated government preferred deficit, using OLS fixed effect estimates, is 2.37 per cent of GDP.

It should be noted that, since estimates by international organisations of automatic budgetary elasticity to the cycle average to about 0.5 for EU countries,[12] our results can be taken to suggest that, on average, while during downturns automatic stabilisers are left free to operate, during expansions their effect is compensated by discretionary loosening.

In order to test for the presence of structural breaks in connection with the Treaty of Maastricht we introduced dummy variables both for the constant term and the slope coefficients.

The estimates do not suggest any change in the ηs between the pre-1992 and the post-1992 years (Table 2).

The only significant dummy is the one interacted with lagged debt. Dropping

[11] The estimate is significantly different from 1 which we take to allow us to consider that there is no unit-root problem, especially considering the panel nature of the estimates.

[12] See Bouthevillain *et al.* (2001).

the other dummies, the pre-1992 lagged debt coefficient is estimated at –0.01 while the post 1992 one is –0.03; the estimates are both significantly different from zero and so is their difference.

The estimated government preferred deficit (b*), using OLS estimation, drops from 3.21 per cent of GDP in the pre-1992 period to 1.78 per cent in the post-1992 period. [13]

4 Debt dynamics

Based on OLS estimates in the previous section we computed predicted values of the debt to GDP ratios for the year 2000 for each country of the sample by substituting the predicted values of the deficit in the following dynamic debt equation:

$$d_t = d_{t-1}/(1+k_t) + b_t + s_t \qquad (8)$$

where k_t is nominal GDP growth and s_t is the actual value of stock-flow adjustments in each year.[14] In most cases the predicted values of debt come reasonably close to the actual ones (Table 3).

We computed the debt ratios that would have occurred if fiscal policy had been conducted symmetrically. Symmetry may be simulated in different ways, as a benchmark we restrict all ηs to zero.

The difference between the two computations provides an estimate of the effect exerted by asymmetric fiscal policy on debt accumulation.

The effect amounts on average to 9.8 percentage points of GDP, about a third of the increase observed in the average debt to GDP ratio. It is always sizeable for all countries and usually close to average, the main exception being Finland (19.8).

[13]Table 3 provides country estimates of b*.

[14]Nominal deficits do not coincide with changes in nominal debt. The difference, usually referred to as "stock-flow adjustment", reflects differences in the definitions of the two indicators both with respect to the relevant transactions (the debt measure is gross of financial assets, whereas the deficit corresponds to a net flow of liabilities) and with respect to the valuation criteria adopted (e.g. nominal values versus accrual). See

5 Conclusions

In this paper we have presented a stylised framework of fiscal policy determination which considers both structural targets and cyclical factors.

Applying this framework to a sample of 16 OECD countries we have found evidence of significant asymmetry in the conduct of fiscal policy over the cycle. Our computations suggest that this feature has provided a sizeable contribution to debt accumulation.

Possible extensions of our work include the separate analysis of revenues and expenditure and the expansion of our stylised framework for policy determination to allow distinct consideration of the automatic and discretionary reactions to the cycle.

A full research agenda should also consider the inclusion of control variables, accounting for, e.g., different governments and institutional settings both among countries and within each of them, and different measures of expected output gaps.

Balassone, Franco and Zotteri (2002) for a discussion of these differences in the context of EMU fiscal rules.

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Table 1 - Estimation Results

Sample: EU countries (excluding Luxembourg), USA and Japan; period 1970-2000

Variable	Coeff.	Fixed effect model - OLS	Arellano-Bond estimation
Constant	α_0	**1,310**	-0,006
		(0,246)	(0,013)
Lagged Debt (d_{t-1})	α_1	**-0,022**	**-0,020**
		(0,004)	(0,006)
Lagged Balance (b_{t-1})	α_2	**0,884**	**0,883**
		(0,027)	(0,026)
Current Positive Cycle $\omega_t\, m_t$	η_p	-0,052	-0,054
		(0,078)	(0,074)
Current Negative Cycle $\omega_t\,(1-m_t)$	η_n	**-0,416**	**-0,414**
		(0,080)	(0,075)
Observations		466	450
Ratcheting $\phi=\eta_n-\eta_p$		**-0,364**	**-0,360**
test: ϕ =0 (p-value in brackets)		-2,69 (0,007)	8,01 (0,005)
Model parameters:			
$\alpha=1-\alpha_2$		0,116	0,117
$\beta=-\alpha_1$		0,022	0,020
$b^*=\alpha_0/[(1-\alpha_2)-(\alpha_1/k))$ with k=0,05		2,396	
Sargan			505,99 (1,000)
Autocorrelation (2nd order)			-0,78 (0,434)
$\alpha_2=1$			21,04 (0,000)

Note: Bold figures indicate significance at 5% confidence level (standard errors in brackets).

Table 2 - Estimation Results
Sample: EU countries (excluding Luxembourg)

Variable	Coeff.	Arellano-Bond estimation - restricted= $\eta_n=\eta_p$	Fixed effect model - OLS - restricted= $\eta_n=\eta_p$	Arellano-Bond estimation - unrestricted - no dummies	Fixed effect model - OLS - unrestricted - no dummies	Arellano-Bond estimation - unrestricted - dummies on all variables	Arellano-Bond estimation - unrestricted - dummies only on debt	Fixed effect model - OLS - unrestricted - dummies only on debt
Constant	α_0	**-0,013**	**1,744**	0,011	**1,399**	0,051	0,026	**1,045**
		(0,014)	(0,226)	(0,014)	(0,262)	(0,019)	(0,016)	(0,271)
Dummy after Maastricht	α_{0a92}					-0,197		
						(0,672)		
Lagged Debt (d_{t-1})	α_1	**-0,021**	**-0,026**	**-0,021**	**-0,024**			
		(0,006)	(0,004)	(0,006)	(0,004)			
Lagged Debt (d_{t-1}) before Maastricht	α_{1b92}					**-0,015**	**-0,013**	-0,008
						(0,007)	(0,006)	(0,006)
Lagged Debt (d_{t-1}) after Maastricht	α_{1a92}					**-0,039**	**-0,029**	**-0,022**
						(0,008)	(0,006)	(0,004)
Lagged Balance (b_{t-1})	α_2	**0,891**	**0,895**	**0,891**	**0,894**	**0,789**	**0,841**	**0,844**
		(0,027)	(0,029)	(0,027)	(0,028)	(0,034)	(0,028)	(0,030)
Lagged Balance (b_{t-1}) after Maastricht	α_{2a92}					0,126		
						(0,066)		
Current Cycle ω_t m_t	η	**-0,216**	**-0,216**					
		(0,041)	(0,450)					
Current Positive Cycle ω_t m_t	η_p			-0,036	-0,032		-0,129	-0,118
				(0,079)	(0,084)		(0,791)	(0,085)
Current Positive Cycle ω_t m_t before Maastricht	η_{pb92}					-0,152		
						(0,082)		
Current Positive Cycle ω_t m_t after Maastricht	η_{pa92}					-0,645		
						(0,325)		
Current Negative Cycle ω_t $(1-m_t)$	η_n			**-0,405**	**-0,409**		**-0,416**	**-0,408**
				(0,081)	(0,087)		(0,079)	(0,085)
Current Neg. Cycle ω_t $(1-m_t)$ before Maastricht	η_{nb92}					**-0,333**		
						(0,092)		
Current Neg. Cycle ω_t $(1-m_t)$ after Maastricht	η_{na92}					**-0,485**		
						(0,152)		

Table 2 - Estimation Results
Sample: EU countries (excluding Luxembourg)
(continue)

	Arellano-Bond estimation - restricted= $\eta_n=\eta_p$	Fixed effec model - OLS - restricted= $\eta_n=\eta_p$	Arellano-Bond estimation - unrestricted - no dummies	Fixed effect model - OLS - unrestricted - no dummies	Arellano-Bond estimation - unrestricted - dummies on all variables	Arellano-Bond estimation - unrestricted - dummies only on debt	Fixed effect model - OLS - unrestricted - dummies only on debt
Observations	391	405	391	405	391	391	405
Ratcheting $\phi=\eta_n-\eta_p$			**-0,370**	**-0,376**		**-0,287**	**-0,290**
test: ϕ =0 (p-value in brackets)			7,35 (0,007)	2,58 (0,010)		4,58 (0,032)	-2,00 (0,046)
Model parameters:							
$\alpha=1-\alpha_2$	0,109	0,105	0,109	0,106		0,159	0,156
$\beta=-\alpha_1$	0,021	0,026	0,021	0,024			
$\beta_{b92}=-\alpha_{1b92}$						0,013	0,008
$\beta_{a92}=-\alpha_{1a92}$						0,029	0,022
$b^*=\alpha_0/[(1-\alpha_2)-(\alpha_1/k)]$ with k=0,05		2,832		2,372			
$b^*=\alpha_0/[(1-\alpha_2)-(\alpha_1/k)]$ with k=0,05 - before Maastricht							3,212
$b^*=\alpha_0/[(1-\alpha_2)-(\alpha_1/k)]$ with k=0,05 - after Maastricht							1,776
test: α_{1a92}-α_{1b92} =0 (p-value in brackets)					8,24 (0,004)	21,54 (0,000)	4,10 (0,000)
test: η_{pb92} -η_{pb92}=0 (p-value in brackets)					2,22 (0,137)		
test: η_{nb92}-η_{nb92} =0 (p-value in brackets)					0,74 (0,390)		
Sargan	457,43 (1,000)		443,71 (1,000)		441,46 (1,000)	445,52 (1,000)	
Autocorrelation (2nd order)	-1,16 (0,247)		-1,2 (0,231)		-1,00 (0,320)	-1,11 (0,2687)	
α_2=1	16,61 (0,000)		16,45 (0,000)		38,74 (0,000)	31,51 (0,000)	

Note: Bold figures indicate significance at 5% confidence level (standard errors in brackets).

Table 3 - Actual and simulated debt accumulation
Sample: EU countries (excluding Luxembourg), USA and Japan

		BE	DK	DE	EL	ES	FR	IE	IT	NL	AT	PT	FI	SE	UK	Average EU countries	USA	JP	Average 16 countries
Initial government debt	a	67,93	12,08	18,57	19,84	14,97	20,14	53,58	37,92	40,79	18,88	15,32	11,70	27,42	78,69	33,73	49,30	11,22	34,51
(in brackets initial year)		*(1969)*	*(1971)*	*(1970)*	*(1970)*	*(1970)*	*(1977)*	*(1970)*	*(1970)*	*(1975)*	*(1970)*	*(1973)*	*(1970)*	*(1970)*	*(1970)*	*(1977)*	*(1969)*	*(1970)*	*(1977)*
Actual Government debt in 2000	b	109,60	47,38	60,19	106,21	60,55	57,32	39,32	110,62	55,77	66,84	53,27	44,53	52,80	42,11	64,75	59,88	123,56	68,12
Observed variation	c=b-a	41,67	35,31	41,62	86,37	45,58	37,18	-14,26	72,69	14,99	47,97	37,95	32,83	25,38	-36,58	31,02	10,58	112,35	33,61
With break in 1992 for EU countries																			
Simulated debt in 2000 with asymmetric fiscal policy	d	106,18	42,27	51,16	92,48	50,50	52,32	55,35	105,59	47,97	56,24	55,71	26,44	40,16	44,93	59,09	59,78	98,41	61,59
Simulated debt in 2000 with symmetric fiscal policy	e	97,89	34,29	41,88	84,25	39,57	43,27	45,58	98,90	40,20	49,16	41,85	6,66	29,30	35,48	49,16	51,93	87,79	51,75
Debt accumulation due to asymmetric fiscal policy	f=d-e	8,29	7,98	9,28	8,22	10,93	9,05	9,77	6,69	7,77	7,08	13,86	19,79	10,86	9,46	9,93	7,85	10,62	9,84
observed variation-accumulation due to asymmetric fiscal policy	g=f-c	*33,38*	*27,33*	*32,33*	*78,14*	*34,65*	*28,13*	*-24,03*	*66,01*	*7,21*	*40,89*	*24,09*	*13,04*	*14,52*	*-46,03*	*21,09*	*2,73*	*101,72*	*23,77*
$b^*=\alpha_0/[(1-\alpha_2)-(\alpha_1/k)]$ with k=0,05																	2,47	2,76	2,40
$b^*=\alpha_0/[(1-\alpha_2)-(\alpha_{1b92}/k)]$ with k=0,05		6,47	1,87	1,93	5,22	2,53	2,60	4,13	6,70	2,87	2,89	3,86	-1,10	1,97	2,48	3,21			
$b^*=\alpha_0/[(1-\alpha_2)-(\alpha_{1a92}/k)]$ with k=0,05		3,58	1,03	1,07	2,89	1,40	1,44	2,28	3,70	1,59	1,60	2,13	-0,61	1,09	1,37	1,78			