OECD Public Spending Adjustment since the 1990s

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Preliminary, Comments Welcome

Abstract

During the nineties there was a drastic reduction in public spending in OECD countries, which brought about a reduction of deficits and debt. This paper investigates whether this reduction was a global process or specific to groups of countries, like those participating in the Maastricht Treaty or in the Stability and Growth Pact. We found that the public spending adjustment took place since 1994 and that it was a global development. The paper also examines the relationship between government spending adjustment and the economic cycle. While overall countercyclicality in government spending remained relatively unchanged after 1994, we found that in expansions spending is less procyclical, while in recessions it is less countercyclical. On both accounts, the asymmetry of government spending toward the cycle declined, implying a reduction in government spending cyclical bias. The similar magnitude of expenditure adjustment in expansions and recessions calls for a reform in budget rules.

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Figure 1:

Introduction

During the nineties there was a drastic reduction in public spending in OECD countries. After a decade of increasing spending, from 37.5 to 41.9 percent of GDP in average, there was a clear change in trend in the early nineties which brought about a reduction of expenditure by 4 percent of gdp during the period 1994 to 2000. However, in recent years this trend was reversed once again, which raises the question of the persistence of government spending adjustment. While cyclically adjusted public spending including interest payments continued to decline in the last three years – due to the reduction of public deficit and debt - the reduction of public spending excluding interest payments, even after cyclical adjustment, was reversed (Figure 1).

In this paper we analyze the anatomy of the government spending correction process stressing the developments during the nineties, by analyzing the dynamics of expenditure to three main forces: a. the reaction of expenditure to exogenous forces – mainly population increase and composition; b. we explore whether there is a specific role to institutional processes like the Maastricht Treaty or the Globalization process taking place in industrialized countries; and c. the sensitivity of the correction of spending to the cycle.

The exercise is conducted by using a structural model for government spending, which allows us to calculate government spending dynamics and its long-run level – for both the total level of spending and its components: transfers, government consumption and investment.

In recent years some attempts were made to explore the reduction of government spending and deficit during the nineties. Buti and Giudice (2002) stress the importance of Maastricht rules as a possible engine for the government spending and deficit reduction. Butti, Eijffinger and Franco (2003) analyze the implementation pros and cons of these arrangements. Ballabriga and Martinez-Mongay (2002) ask whether the pre-EMU monetary and fiscal rules remained unchanged after the implementation of the EMU, and they arrived to the conclusion that the monetary dominance rule prevailing before the EMU continued to be the policy rule after EMU implementation. Fatas, Von Hagen, Hallet, Strauch and Sibert (2003) analyze the impact of the Stability and Growth Pact, and they found that sustainable growth is a key element of the spending/Gdp ratio reduction.

Gali and Perotti (2003) concentrate on the implications of Maastricht and the Stability and Growth Pact on the ability of governments to continue to apply countercyclical policies, and conclude that this ability was not harmed by the new pacts during the nineties. These authors also note that the government spending and deficit reduction was a global process for all OECD countries, and not a mere change in countries that signed the Maastricht Treaty. The main question addressed in their paper is whether fiscal policy had become more or less pro-cyclical, i.e., they focus on the coefficient of the output gap in regressions of the cyclical variables. Their main result is that the post-Maastricht reaction is more countercyclical than the pre-Maastricht reaction.

We, in contast, look at the asymmetry in reactions between expansions and recessions. In other words, this is a different issue, given that countercyclicality can increase while asymmetry goes down. In fact, when we discuss our main results, we can say that overall "countercyclicality" in OECD countries is unchanged, and in spite of this, looking at the asymmetry issue, we do find a change: in expansions spending is less procyclical, while in recessions it is less countercyclical. On both accounts, the asymmetry declines, while total countercyclicality seems to remain unchanged.

2 Aggregate expenditure

2.1 Econometric framework

The dynamics of the adjustment in government spending during the 1990s is analyzed using the a panel data econometric framework with 18 OECD countries, indexed by i, and 24 years, indexed by $1980 \leq t \leq 2003$.The ratio of government expenditures, excluding interest payments, to GDP is denoted by $g_{it} \equiv G_{it}/Y_{it}$, and the ratio of the public debt to GDP by $b_{it} \equiv B_{it}/Y_{it}$. The interest payments, relative to output, are denoted accordingly by $r_{it-1}b_{it-1}$. Note that interest payments have an important role in the long run, since the reduction of spending and deficit allows for a reduction of debt, which is recorded in the budget as a reduction of interest payments. In fact, the permanent reduction of interest payments is a driving force of the adjustment process that took place in the early nineties, after the OECD countries reached very high levels of budget deficit and government debt at the late eighties. This high level of debt caused European countries to sign the Maastricht Treaty at the end of 1991, which was the institutional basis for the reduction of the budget deficit. Later, in 1997, those countries that entered the European Monetary Union (EMU) signed the Stability and Growth Pact (SGP), which stipulates that government balance should approach zero along the cycle. Note, however, that the expenditure adjustment occurred well beyond European countries, an issue that will be investigated in our paper.

In year $t_{a_i} \geq 1980$ country i adjusts g_i. If no adjustment is made, $t_{a_i} > 2003$. The adjustment dummy variable A_{it} is then formulated as follows:

$$A_{it} = \begin{cases} 1 & \text{if } t \geq t_{a_i} \\ 0 & \text{if } t < t_{a_i}. \end{cases}$$

Defining $\Delta \ln \widetilde{y}_{it} \equiv \Delta \ln Y_{it} - avg(\Delta \ln Y_{it})$, where $avg(\Delta \ln Y_{it})$ is the average growth rate in country i,[1] the possibility of differential adjustment in

[1] An alternative way of defining this variable is by looking at the difference between the actual figure and a trend variable, f.e., using an HP filtered GDP serie. This is done in

g_i during periods of high and low growth is studied using the dummy variable

$$d_{it} = \begin{cases} 1 & \text{if } \Delta \ln \widetilde{y}_{it} > 0 \\ \\ 0 & \text{if } \Delta \ln \widetilde{y}_{it} < 0. \end{cases}$$

The basic equation for aggregate government expenditures is then specified as[2]

$$\begin{aligned} \Delta g_{it} &= \alpha_{0i} + \alpha_1 d_{it} A_{it} + \alpha_2 (1 - d_{it}) A_{it} + \varphi_1 \Delta \ln(\widetilde{y}_{it}) d_{it} + \varphi_2 \Delta \ln(\widetilde{y}_{it})(1 - d_{it}) \\ &\quad + \gamma \left(r_{it-1} b_{it-1} \right) + \beta x_{it} + \lambda g_{it-1} + \varepsilon_{it}, \qquad (1) \\ i &= 1, .., 18, \end{aligned}$$

where x_{it} is a vector of control variables. Stationarity of the government spending/output ratio requires that $\lambda < 0$. The coefficients φ_1 and φ_2 are expected to be negative, representing the adjustment of government spending started at t_{a_i}. If adjustment occurs specially in expansions, then $|\alpha_1| > |\alpha_2|$. The cyclical variables involving $\Delta \ln(\widetilde{y}_{it})$ are introduced themselves, as in Hercowitz and Strawczynski (2004), to capture cyclical assymetry in government spending, represented by $\varphi_1 \neq \varphi_2$. If $\varphi_1 - \varphi_2 > 0$, there is an upwards ratcheting process, as found in that paper.[3] Whether the ratcheting behavior changes at t_{a_i} is also tested by adding an interaction between the cyclical variables with A_{it}. The coefficient γ will be negative if interest

Appendix A.1.

[2]This equation can be seen as following from an "error-correction" model, where the long-run relationship is

$$g_{it} = \delta_{0i} + \delta_1 z_{it} + \xi_{it}$$

and the short-run adjustment is given by

$$dg_{it} = \omega_{0i} + \omega_1 dv_{it} - \gamma \xi_{it-1} + \varepsilon_{it},$$

where z_{it} (demografic factors, $rb_{it-1}, d94...$) and v_{it} (cyclical variables, $d\ln(pop_t)$) are the long and short-run variables, respectively, and δ_1 and ω_1 are the corresponding vectors of coefficients. Substituting ξ_{it-1} from the long-run relationship into the short-run equation, and rearranging terms, yields equation (1)

[3]Note that when checking procyclicality of spending, one needs to take into account the simultaneity of spending and output. In contrast, when checking asymmetry this problem is solved if simultaneity is the same over the cycle. For a further ellaboration of this point see Hercowitz and Strawczynski (2003), appendix A, p. 360.

payments, $r_{it-1}b_{it-1}$, crowd out other expenditure. See below for the long-run treatment of this variable.

2.2 Long-run

The long-run value of g_i can be obtained from equation (1) as follows:

$$\begin{aligned} 0 &= \alpha_{0i} + \alpha_1 d_i A_{t_{a_i}} + \alpha_2(1-d_i)A_{t_{a_i}} \\ &\quad +\varphi_1 avg\left(\Delta \ln(\widetilde{y}_{it})d_{it}\right) + \varphi_2 avg\left(\Delta \ln(\widetilde{y}_{it})(1-d_{it})\right) \\ &\quad +\gamma r_i b_i + \beta x_i + \lambda g_i, \\ i &= 1,..,18, \end{aligned} \tag{2}$$

where the variables without the index t represent the long-run values of the corresponding variables. The problem with using (2) to compute g_i is that the equation involves b_i, which is related to g_i through the long-run budget constraint $b_i = \frac{\tau_i - g_i}{r_i - avg(\Delta \ln y_{it})}$. Given that also the tax rate τ_i is involved, this equation is not enough for closing the system. This indeterminacy is resolved by assuming a required $b_i = \bar{b}$, as in the Maastricht Treaty where $\bar{b} = 0.6$. Then, assuming $r_i = r$, the long-run levels of government spending are

$$\begin{aligned} g_i &= -\frac{1}{\lambda}\left[\begin{array}{c} \alpha_{0i} + \alpha_1 d_i A_{t_{a_i}} + \alpha_2(1-d_i)A_{t_{a_i}} + \varphi_1 avg\left(\Delta \ln(\widetilde{y}_{it})d_{it}\right) \\ +\varphi_2 avg\left(\Delta \ln(\widetilde{y}_{it})(1-d_{it})\right) + \gamma r \bar{b} + \beta x_i \end{array}\right] \\ i &= 1,..,18. \end{aligned}$$

If adjustment does take place during the sample, $(\alpha_1 d_i + \alpha_2(1-d_i))/(-\lambda)$ is the corresponding change in the long-run ratio of government spending to output. If the α's are negative, as expected, this expression is also negative. If, for example, exactly half of the time output growth is above average, the long-run adjustment is $(\alpha_1 + \alpha_2)/(-2\lambda)$. Similarly as in Hercowitz and Strawczynski (2004), $\left[\varphi_1 avg\left(\Delta \ln(\widetilde{y}_{it})d_{it}\right) + \varphi_2 avg\left(\Delta \ln(\widetilde{y}_{it})(1-d_{it})\right)\right]/(-\lambda)$ is the long-run effect of cyclical ratcheting.

Note that γ/λ represents the degree to which a long-run reduction in interest payments increases other goverment expenditure.

2.3 Data

The panel data set used in the estimation is composed of 18 countries, 11 of them in the EMU—Austria, Belgium, Germany, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal and Spain—and 7 other OECD countries—Canada, Denmark, Japan, Norway, Sweden, United Kingdom and U.S.A. The data is annual over the sample 1980-2003. The variable G is matched to total general government spending (including transfers but excluding interest payments) and Y is represented by GDP.The data is based on the OECD Economic data. Government spending data is for the general government, which includes central government and regional authorities.

Concerning the cyclical variable, there is a need to answer an important question: should cycles be defined as a function of the *GDP level* using deviations from trend (as in Gali and Perotti, 2003) or as a function of *GDP growth* using the difference between actual and average growth (as in Hercowitz and Strawczynski, 2004)? Using the first definition implies that previous growth cycles affect actual position: f.e., if there is a period of low growth, the transition to a boom does not occur when growth picks up, but only when the GDP gets high enough so as to be above the trend. The second definition is more sensitive to growth: a change in the growth rate immediately affects the definition of cycles. Given that budget processes in all countries are influenced mainly by growth forecasts (all budget expenditure items are affected by the growth prospects) and the difficulty to choose the right measure for the GDP trend, we adopt the second definition as the benchmark. In fact, we found that the econometric fit using this definition is better[4] than using the "deviations from trend approach". However, in order to allow for a comparison with previous work, we present in the appendix results using the first definition as well.

2.4 Preliminary estimation results

Here we report the estimation of equation (1) in a preliminary form, concentrating on the adjustment variable A. For this purpose, the cyclical variables are constrained to enter in a symmetric form, i.e., $\varphi_1 = \varphi_2$, and the interest payments and control variables are not included.

The variable A is captured in three alternative forms. One is based on the timing of referendum approval of the Maastricht Treaty during the 1992-1994 period and on the distinction between the 14 countries in the treaty,

[4]In the appendix we show that both the adjusted R squared and the Durbin Watson Satistic is lower when using Deviations from trend as estimated using the Hp Filter approach.

and the 4 others which are not—Canada, Japan, Norway and U.S.A. The dummy variable $MAAST$ is constructed with ones in the years following the treaty approval in these 14 countries, and zero prior to the approval in these countries and in the other 5 countries for the entire sample.[5] The second form is using a dummy variable applying to all countries in the sample for the period starting at some point in the 1990s. Table 1 reports the results with the dummy variable for 1994, $d94$, which turned out to yield the best fit—relative to the alternative dummy variables for 1991 through 1996. The third form is by using a dummy variable (SGP) which takes the value of 1 for EMU countries after 1997 and 0 otherwise.

These preliminary results are presented in Table 1.

Table 1: Total Government Expenditure

Dependent Variable: Δg

Sample: 1981-2003 (standard errors in parentheses)

Variable				
g_{-1}	-0.170 (0.019)	-0.176 (0.018)	-0.171 (0.019)	-0.176 (0.018)
$\Delta \ln \widetilde{y}$	-0.412 (0.025)	-0.399 (0.025)	-0.402 (0.026)	-0.405 (0.028)
$d94$		-0.340 (0.089)	-0.396 (0.131)	
$d94 \cdot d$				-0.321 (0.118)
$d94 \cdot (1-d)$				-0.365 (0.115)
$MAAST$	-0.376 (0.134)		-0.062 (0.165)	
$DSGP$	0.152 (0.167)		0.250 (0.165)	
R^2	0.51	0.52	0.52	0.52
$D.W.$	1.55	1.53	1.54	1.54
Observations: 23; Number of countries: 18				
Total panel observations: 389				

(*) order of the variables according to the basic equation

The results show the following:

[5] The countries in the sample which joined the Maastricht treaty are (in parenthesis we quote the date of referendum approval): Austria (12.6.94), Belgium (5.11.92), France (23.9.92), Italy (29.10.92), Luxembourg (2.7.92), Holland (15.12.92), Ireland (18.6.92), Greece (31.7.92), Spain (25.11.92), Denmark (18.5.93), United Kingdom (23.7.93), Germany (12.10.93), Finland (16.10.94) and Sweden (13.11.94). Source: Kessing's Records of World Events.

- The variable MAAS is negative and significant, implying that in principle this treaty is candidate for a regime change. However, note that also D94 - which relates to all OECD countries -is negative and statistically significant, raising the question on whether the globaliztion process is the driving force of the adjustment.

- In fact, when running all three dummy variables together (column 3) we found that the single significant variable is D94, while MAAS and SGP have no further explanatory power. This result implies that a common force to all OECD countries (globalization) is the main candidate for explaining the regime change.

- The adjustment was performed both in periods of booms, following high growth, and in periods of recession. In fact, when controling for the bussiness cycle (fourth column), the coefficients of the adjustment for booms and recessions are of a similar magnitude. This result implies that actual policy was problematic since one would expect the adjustment to be performed in booms.[6] This result is suggesting that the consolidation process in OECD countries has not been performed optimally, and that there is room for improving the policy rules by incentivating countries to cut expenses in expansions. We will further investigate this point later.

2.5 Basic estimation results

In Table 2 we report the estimation of the basic equation (1). The cyclical behavior is allowed to be asymmetric, and interest payments and control variables are included. The control variables are[7]: the growth rate of the

[6] In Hercowitz and Strawczynski (2004) we present a model of government spending adjustment to cope with a public debt\output guideline (like the 60 percent guideline of Maastricht). In that model, if one allows the spending adjustment cost parameter to vary between booms and recessions, clearly the cost of adjustment in recessions is higher than in booms. This is so since in the former periods unemployment and poverty increase, and consequently more individuals are adversely affected by the spending reduction.

[7] According to Tanzi and Schnucknecht (2000), the most relevant exogenous variables in explaining the increase of long-term government expenditure are war effort, depression and demographic development. Since war effort is a minor element for our sample countries, we focus on the other two.

population, $\Delta \ln pop$, and the fractions of the young (0-14 years of age), *young*, and the old (65 and older), *old*, in the population. An additional candidate is *theil*, an inequality index, which is discussed in an appendix. These variables are expected to have positive effects on Δg.

Table 2: Total Government Expenditure				
Dependent Variable: Δg				
Sample: 1981-2003 (standard errors in parentheses)				
Variable/coefficient		(1)	(2)	(3)
g_{-1}	λ	-0.121 (0.019)	-0.120 (0.019)	-0.124 (0.019)
$\Delta \ln \widetilde{y} \cdot d$	φ_1	-0.183 (0.051)	-0.195 (0.054)	-0.077 (0.061)
$\Delta \ln \widetilde{y} \cdot (1-d)$	φ_2	-0.563 (0.044)	-0.567 (0.045)	-0.626 (0.049)
$d94 \cdot \Delta \ln \widetilde{y} \cdot d$				-0.228 (0.102)
$d94 \cdot \Delta \ln \widetilde{y} \cdot (1-d)$				0.243 (0.105)
$d94$	α	-0.535 (0.131)		-0.270 (0.162)
$d94 \cdot d$	α_1	-	-0.502 (0.146)	
$d94 \cdot (1-d)$	α_2	-	-0.581 (0.159)	
$\Delta \ln pop$		0.509 (0.192)	0.505 (0.192)	0.477 (0.195)
$(rb)_{-1}$	γ	-0.209 (0.041)	-0.211 (0.042)	-0.222 (0.042)
$(young)_{-1}$	β_1	-0.057 (0.058)	-0.062 (0.058)	-0.061 (0.058)
$(old)_{-1}$	β_2	0.041 (0.085)	0.037 (0.085)	0.051 (0.083)
R^2		0.58	0.58	0.58
$D.W.$		1.84	1.84	1.87
Observations: 23; Number of countries: 18				
Total panel observations: 389				

(*) order of the variables

The results show the following:

- The estimate of α in column 1 is negative and significant, indicating an important downward adjustment in government spending after 1994. Column 2 reports on the possiblity of differential adjustment in expansions and recessions (similarly to the regression in Table 1 but including now the control variables): the corresponding estimates of α_1 and α_2

are similar, while the adjustment during recessions was mildly higher.[8] This result confirms that adjustment was not done in expansions, as one would expect in an optimal model. We also tested for differential behavior for extreme cyclical situations, i.e., when output growth deviates from the mean by 75 percent of the standard deviation. In this case, not reported, the difference between the coefficients in expansions and recessions was not statistically significant.

- The estimate of the ratcheting coefficient—the estimate of $\varphi_1 - \varphi_2$— in column 1 is 0.393 percentage point of GDP, significantly different from zero at the 1 percent level. Column 3 addresses the hypothesis that ratcheting behavior changed after 1994. Interestingly, we find that ratcheting behavior is weakened both in expansions and recessions: the spending/output ratio in expansions *declines more* than prior to 1994 (by 0.241 percentage point of GDP), and in recessions it *increases less* (by 0.257 percentage point of GDP). Hence, according to this regression the ratcheting coefficient declines from 0.556 prior to 1994 to 0.058.afterwards. Note that in terms of overall cyclicality of government spending, studied by Gali and Perotti (2003), these results tend to indicate a lack of change—as the coefficients representing the change have similar magnitude and opposite signs.

- Another interesting result is the negative and significant coefficient of interest payments (γ). A reduction of interest payments is followed by a crowding in effect: other expenditures increase by 20 percent of the saved amount.

- Population growth has a positive and significant effect on spending, while the share of old and young in the population are not significant.

- Another candidate for explaining the change in transfers is the development of gross inequality in wages. Appendix A.2 shows results using the Theil index of wages inequality. In general, inequality does not succeed in explaining total expenditure.

[8] Using a Wald test we can say that the difference in the coefficients is 0.08 with a 1 percent statistical significance. The result is robust also for shorter samples (shortened year by year backwards until 2000).

- The estimates of λ in the table are about 0.125, indicating that the convergence to the long-run value of g takes place quite gradually.

  Table 3 shows the impact of the adjustment on long-run expenditure in the different countries. Clearly the regime change of 1994 has a remarkable impact on long-run expenditure.

Table 3: Long-Run Government Expenditure

	Whole Sample	Regime Change in 1994	Last year
Austria	0.512	0.503	0.487
Belgium	0.530	0.506	0.453
Canada	0.443	0.418	0.314
Denmark	0.576	0.556	0.522
Finland	0.552	0.507	0.474
France	0.512	0.502	0.519
Germany	0.460	0.441	0.458
Greece	0.543	0.517	0.417
Ireland	0.454	0.401	0.344
Italy	0.492	0.471	0.429
Japan	0.357	0.340	0.326
Luxembourg	0.406	0.379	0.478
Netherlands	0.514	0.497	0.454
Portugal	0.504	0.474	0.451
Spain	0.414	0.396	0.366
Sweden	0.617	0.600	0.563
United Kingdom	0.421	0.401	0.403
United States	0.343	0.319	0.297

Table 4 further investigates the symmetry of spending for countries signing the Maastricht Treaty:

Table 4: Maastricht treaty countries				
Dependent Variable: Δg				
Sample: 1981-2003 (standard errors in parentheses)				
Variable/coefficient	(1)	(2)	(3)	(4)
g_{-1}	-0.120 (0.019)	-0.122 (0.020)	-0.121 (0.019)	-0.118 (0.020)
$\Delta \ln \widetilde{y}.d$	-0.168 (0.055)		-0.078 (0.060)	
$\Delta \ln \widetilde{y}.(1-d)$	-0.598 (0.045)		-0.636 (0.051)	
$mas.\Delta \ln \widetilde{y}.d$			-0.239 (0.111)	
$mas.\Delta \ln \widetilde{y}.(1-d)$			0.086 (0.107)	
mas			-0.113 (0.179)	-0.123 (0.160)
$mas.d$	-0.398 (0.166)			
$mas.(1-d)$	-0.263 (0.164)			
$\Delta \ln \widetilde{y}.d2$		-0.127 (0.054)		-0.095 (0.057)
$\Delta \ln \widetilde{y}.(1-d2)$		-0.607 (0.046)		-0.590 (0.047)
$mas.\Delta \ln \widetilde{y}.d2$				-0.287 (0.107)
$mas.\Delta \ln \widetilde{y}(1-d2)$				0.077 (0.102)
$mas.d2$		-0.557 (0.222)		
$mas.(1-d2)$		-0.349 (0.210)		
$\Delta \ln pop$	0.540 (0.195)	0.522 (0.200)	0.559 (0.197)	0.540 (0.200)
$(rb)_{-1}$	-0.179 (0.041)	-0.180 (0.042)	-0.190 (0.041)	-0.190 (0.042)
$(young)_{-1}$	-0.084 (0.061)	-0.035 (0.062)	-0.085 (0.061)	-0.048 (0.063)
$(old)_{-1}$	-0.086 (0.079)	-0.039 (0.080)	-0.083 (0.079)	-0.041 (0.080)
R^2	0.56	0.53	0.56	0.53
$D.W.$	1.85	1.82	1.86	1.82
Observations: 23; Number of countries: 18				
Total panel observations: 389				
$d2$ - 0.75				

The findings are:

- In contrast to overall OECD picture, countries signing the Maastricht Treaty seem to adjust expenditure in times of expansion. According to column 1 the difference between expansions adjustment and recession adjustments is 0.15, significant in a 5 percent level according to a Wald test. This finding is corroborated when testing a change in behavior using the interaction term (column 3). However, given the low magnitude of the difference and the high coefficient of adjustment in recessions, we interpret this result as providing only weak evidence on a better adjustment policy management among Maastricht countries.[9]

- When testing cycles of big magnitude (more than 75 percent of one standard deviation), we found that this behavior is related to extreme cycles, since in big expansions the coefficients are significant and much higher than the ones obtained in previous columns.

  These findings provide only a weak evidence on a better policy management of Maastricht Treaty countries compared to other OECD countries. One possible explanation is that these countries decided explicitely about a fiscal consolidation as part of their fiscal long-term obligations toward a reduction of debt as required by the Treaty.

3 Expenditure decomposition

3.1 Econometric framework

Here we focus on government at the disaggregated level, considering three components: 1. goods and services, 2. transfers and subsidies, and 3. capital expenditure. Given the results with aggregate expenditure, the adjustment in the 1990s is assumed here to be symmetric. For expenditure in category $j = 1, 2, 3$, the basic equation (1) is extended to

$$\begin{aligned} \Delta g_{it}^{j} &= \alpha_{0i}^{j} + \alpha_{1}^{j} A_{it} + \varphi_{1}^{j} \Delta \ln(\widetilde{y}_{it}) d_{it} + \varphi_{2}^{j} \Delta \ln(\widetilde{y}_{it})(1 - d_{it}) \\ &\quad + \gamma^{j} \left(r_{t-1} b_{it-1} \right) + \beta^{j} x_{it} + \lambda_{1}^{j} g_{it-1}^{1} + \lambda_{2}^{j} g_{it-1}^{2} + \lambda_{3}^{j} g_{it-1}^{3} + \varepsilon_{it}^{j}, \\ i &= 1, .., 18. \end{aligned}$$

This formulation allows for a crowding-out effect of spending in component i by spending in others. Otherwise, the equation is similar to (1). The parameters $\lambda_1^j, \lambda_2^j, \lambda_3^j$ are expected to be negative, similarly as γ^j. In matrix notation,

$$\Delta \mathbf{g}_{it} = \boldsymbol{\alpha}_{0i} + \boldsymbol{\alpha}_{1} A_{it} + \boldsymbol{\varphi}_{1} \Delta \ln(\widetilde{y}_{it}) d_{it} + \boldsymbol{\varphi}_{2} \Delta \ln(\widetilde{y}_{it})(1 - d_{it})$$

[9] In addition, when cycles are defined as deviations from an HP-filtered trend, this result was not significant (see appendix).

$$
\begin{aligned}
& +\boldsymbol{\gamma}\left(r_{t-1} b_{it-1}\right)+\boldsymbol{\beta} x_{it}+\boldsymbol{\lambda} \mathbf{g}_{it-1}+\boldsymbol{\varepsilon}_{it}, \\
i \quad = \quad & 1, .., n,
\end{aligned}
$$

where $\mathbf{g}_{it}$, $\boldsymbol{\alpha}_{0i}$, $\boldsymbol{\alpha}_1$, $\boldsymbol{\varphi}_1$, $\boldsymbol{\varphi}_2$, $\boldsymbol{\gamma}$ and $\boldsymbol{\varepsilon}_{it}$ are 3×1 (the column size corresponding to the number of categories), $\boldsymbol{\beta}$ is $3 \times k$ while x_{it} is $k \times 1$, and $\boldsymbol{\lambda}$ is 3×3.

3.2 Long-run

The long-run values for the ratios of the different spending components to output are obtained following a similar procedure as for the aggregate spending case, but applied now to the vector of spending/output ratios. In the long run we have,

$$
\begin{aligned}
\mathbf{0} \quad = \quad & \boldsymbol{\alpha}_{0i}+\boldsymbol{\alpha}_1+\boldsymbol{\varphi}_1 avg\left(\Delta \ln(\widetilde{y}_{it}) d_{it}\right)+\boldsymbol{\varphi}_2 avg\left(\Delta \ln(\widetilde{y}_{it})(1-d_{it})\right) \\
& +\boldsymbol{\gamma}\left(r \bar{b}\right)+\boldsymbol{\beta} x_i+\boldsymbol{\lambda} \mathbf{g},
\end{aligned}
$$

where $\mathbf{0}$ is a 3×1 vector of zeroes.

Inverting the matrix $\boldsymbol{\lambda}$, this equation can be expressed as

$$
\mathbf{g}_i=-\boldsymbol{\lambda}^{-1}\left(\begin{array}{c}
\boldsymbol{\alpha}_{0i}+\boldsymbol{\alpha}_1+\boldsymbol{\varphi}_1 avg\left(\Delta \ln(\widetilde{y}_{it}) d_{it}\right)+\boldsymbol{\varphi}_2 avg\left(\Delta \ln(\widetilde{y}_{it})(1-d_{it})\right) \\
+\boldsymbol{\gamma} r \bar{b}+\boldsymbol{\beta} x_i
\end{array}\right) .
$$

Similarly as for the aggregate spending case, the main result to be obtained here the quantitative adjustment during the 1990s of the three components. The results will not only reflect the direct effect measured by the coefficient of the dummy variable for the 1990s on the estimation, but also the indirect effects from two different channels: the interaction between the components in each country (the crowding out or in of the individual categories by spending on the others).

Results are shown in Table 5.

Table 5 : Components of government expenditure			
Sample: 1981-2002 (standard errors in parentheses)			
	Consumption Expenditure	Current Transfers	Investment
Dependent Variable	Δg^1	Δg^2	Δg^3
Variable			
$(g^1)_{-1}$	-0.138 (0.023)	0.041 (0.027)	-0.029 (0.011)
$(g^2)_{-1}$	-0.045 (0.021)	-0.111 (0.026)	-0.013 (0.010)
$(g^3)_{-1}$	0.063 (0.044)	0.108 (0.049)	-0.150 (0.024)
$\Delta \ln \widetilde{y} \cdot d$	-0.086 (0.026)	-0.087 (0.027)	0.015 (0.011)
$\Delta \ln \widetilde{y} \cdot (1-d)$	-0.204 (0.023)	-0.314 (0.025)	0.007 (0.011)
$d94$	-0.223 (0.080)	-0.167 (0.092)	-0.045 (0.037)
$\Delta \ln pop$	-0.121 (0.100)	0.249 (0.104)	0.154 (0.047)
$(rb)_{-1}$	-0.093 (0.023)	-0.071 (0.027)	-0.021 (0.010)
$(young)_{-1}$	-0.050 (0.029)	-0.001 (0.031)	-0.016 (0.014)
$(old)_{-1}$	0.102 (0.048)	0.066 (0.054)	-0.026 (0.024)
R^2	0.51	0.57	0.35
$D.W.$	1.78	1.76	2.09
Observations: 22; Number of countries: 18			
Total panel observations: 369			

The results show the following:

- The adjustment after 1994 took place mainly through consumption expenditure and current transfers, while for investment the coefficient was not significant.
- During the sample, transfers crowded out government consumption, but not the opposite.
- While for consumption and investment government policy is asymmetric and countercyclical, for invetsment the policy is mildly procyclical (note that the coefficients are positive but not significant).
- Population is a driving force for transfers and investment.
- The share of old population increased government consumption, but during the sample it did not have a significant impact on transfers.
- The reduction of interest payments that took place in the late nineties crowds in mainly government consumption and transfers, but also investment - although in a lower extent. Table 6 shows the long-run direct effect of reducing interest payments.

Table 6: Long-run effect of interest payments

Government Consumption	Transfers	Investment	Aggregate Expenditure
0.67	0.64	0.14	1.69

4 External effects

4.1 Aggregate spending

$$
\begin{aligned}
dg_{it} &= \alpha_i + \beta x_{it} + \lambda g_{it-1} + \delta g_{t-1} + \gamma \left(rb_{it-1} \right) + \varepsilon_{it}, \\
i &= 1, .., n,
\end{aligned}
$$

where g is the weighted average government spending/output ratio across countries.[10]

In the long run:

$$\begin{aligned} 0 &= \alpha_i + \beta x_i + \lambda g_i + \delta g + \gamma\left(r b_i\right), \\ i &= 1, .., n. \end{aligned}$$

¿From the long-run budget constraint, it follows that

$$\tau_i = (r-\mu) b_i + g_i.$$

Hence, the long-run equation can be written as

$$0 = \alpha_i + \beta x_i + \lambda g_i + \delta g + \frac{\gamma r}{r-\mu}\left(\tau_i - g_i\right).$$

$b_i = \bar{b} = 0.6.$

$$\begin{aligned} 0 &= \alpha_i + \beta x_i + \lambda g_i + \delta g + \gamma r \bar{b}, \\ i &= 1, .., n. \end{aligned}$$

or,

$$\begin{aligned} g_i &= -\frac{\alpha_i}{\lambda} - \beta\frac{1}{\lambda} x_i - \frac{\delta}{\lambda} g - \frac{\gamma r}{\lambda}\bar{b}, \\ i &= 1, .., n \end{aligned}$$

To solve for the long-run values of g, we need to calculate the average spending/output ratio across countries:

$$\begin{aligned} g &= -\frac{\alpha}{\lambda} - \beta\frac{1}{\lambda} x - \frac{\delta}{\lambda} g - \frac{\gamma r}{\lambda}\bar{b} \\ \left(1 + \frac{\delta}{\lambda}\right) g &= \left(\frac{\lambda+\delta}{\lambda}\right) g = -\frac{\alpha}{\lambda} - \beta\frac{1}{\lambda} x - \frac{\gamma r}{\lambda}\bar{b} \\ g &= -\frac{\alpha}{\lambda+\delta} - \beta\frac{1}{\lambda+\delta} x - \frac{\gamma r}{\lambda+\delta}\bar{b} \end{aligned}$$

[10] In an integrated world the impact of other countries' policy is likely to affect individual country's policy. See f.e. Ardagna, Caselli and Lane (2004) who study such an effect in the case of fiscal policy.

The average spending/output ratio across countries depends on the average of the idiosyncratic effects, the average of the common effects, and the long-run debt/output ratio. The convergence coefficient λ and the external effects coefficient δ will also affect the average level. Substituting this expression for g in to the equation for g_i yields the long-run g_i for country i.

Also, the average tax rate can be obtained as

$$\tau = (r - \mu)\bar{b} + g.$$

The main result to be obtained from this framework is the quantitative adjustment during the 1990s: the values of g with the dummy variable set to 0 (before the adjustment) and to 1 (after the adjustment).

4.2 Expenditure decomposition

$$\begin{aligned} d\ln g_{it}^{j} &= \alpha_i^j + \beta^j x_{it} + \lambda_1^j g_{it-1}^1 + \lambda_2^j g_{it-1}^2 + \lambda_3^j g_{it-1}^3 + \delta^j g_{t-1}^j + \gamma^j \left(rb_{it-1} \right) + \varepsilon_{it}^j, \\ i &= 1,..,n,\ j = 1,2,3. \end{aligned}$$

The externality is assumed to pertain to the same spending category only.

In matrix notation,

$$\begin{aligned} d\ln \mathbf{g}_{it} &= \boldsymbol{\alpha}_i + \boldsymbol{\beta} x_{it} + \boldsymbol{\lambda} \mathbf{g}_{it-1} + \boldsymbol{\delta} \mathbf{g}_{t-1} + \boldsymbol{\gamma} \left(rb_{it-1} \right) + \boldsymbol{\varepsilon}_{it}, \\ i &= 1,..,n, \end{aligned}$$

$\mathbf{g}_{it}$, $\boldsymbol{\alpha}_i$ and $\boldsymbol{\varepsilon}_{it}$ are 3×1 (the column size corresponding to the number of categories),

$\boldsymbol{\beta}$ is $3 \times k$ and x_{it} is, as previously, $k \times 1$,

$\boldsymbol{\lambda}$ is 3×3 and $\mathbf{g}_{it-1}$ is 3×1,

$\boldsymbol{\delta}$ is 3×3, with $\delta^1, \delta^2, \delta^3$ on the diagonal and zeros elsewhere, and $\mathbf{g}_{t-1}$ is 3×1, and

$\boldsymbol{\gamma}$ is 3×1.

The long-run values for the ratios of the different spending components to output are obtained following a similar procedure as for the aggregate spending case, but applied now to the vector of spending/output ratios. In the long run we have,

$$\begin{aligned} \mathbf{0} &= \boldsymbol{\alpha}_i + \boldsymbol{\beta} x_i + \boldsymbol{\lambda} \mathbf{g}_i + \boldsymbol{\delta} \mathbf{g} + \boldsymbol{\gamma} r b_i, \\ i &= 1,..,n, \end{aligned}$$

where $\mathbf{0}$ is a 3×1 vector of zeroes. Using the constraint on the long-run debt/output ratio, this equation can be expressed as

$$\mathbf{0} = \boldsymbol{\alpha}_i + \boldsymbol{\beta} x_i + \boldsymbol{\lambda} \mathbf{g}_i + \boldsymbol{\delta} \mathbf{g} + \boldsymbol{\gamma} r \bar{b},$$

or

$$\boldsymbol{\lambda} \mathbf{g}_i = -\boldsymbol{\alpha}_i - \boldsymbol{\beta} x_i - \boldsymbol{\delta} \mathbf{g} - \boldsymbol{\gamma} r \bar{b}.$$

The next step is to invert the matrix $\boldsymbol{\lambda}$ to obtain

$$\mathbf{g}_i = -\boldsymbol{\lambda}^{-1} \boldsymbol{\alpha}_i - \boldsymbol{\lambda}^{-1} \boldsymbol{\beta} x_i - \boldsymbol{\lambda}^{-1} \boldsymbol{\delta} \mathbf{g} - \boldsymbol{\lambda}^{\mathbf{-1}} \boldsymbol{\gamma} r \bar{b}.$$

Then, the average vector $\mathbf{g}$ can be computed by averaging this expression (using the weights for each country).

$$\mathbf{g} = -\boldsymbol{\lambda}^{-1} \boldsymbol{\alpha} - \boldsymbol{\lambda}^{-1} \boldsymbol{\beta} x - \boldsymbol{\lambda}^{-1} \boldsymbol{\delta} \mathbf{g} - \boldsymbol{\lambda}^{\mathbf{-1}} \boldsymbol{\gamma} r \bar{b}.$$

$$\mathbf{g}(\mathbf{I}_3 + \boldsymbol{\lambda}^{-1} \boldsymbol{\delta}) = -\boldsymbol{\lambda}^{-1} \boldsymbol{\alpha} - \boldsymbol{\lambda}^{-1} \boldsymbol{\beta} x - \boldsymbol{\lambda}^{\mathbf{-1}} \boldsymbol{\gamma} r \bar{b},$$

where $\mathbf{I}_3$ is the 3×3 identity matrix. The resulting average vector of components is

$$\mathbf{g} = -\left(\boldsymbol{\lambda}^{-1} \boldsymbol{\alpha} + \boldsymbol{\lambda}^{-1} \boldsymbol{\beta} x + \boldsymbol{\lambda}^{\mathbf{-1}} \boldsymbol{\gamma} r \bar{b} \right) (\mathbf{I}_3 + \boldsymbol{\lambda}^{-1} \boldsymbol{\delta})^{-1}.$$

Substituting this vector into the expression for $\mathbf{g}_i$ yields the ratios for the three components for each country.

Similarly as for the aggregate spending case, the main result to be obtained here the quantitative adjustment during the 1990s of the three components. The results will not only reflect the direct effect measured by the coefficient of the dummy variable for the 1990s on the estimation, but also the indirect effects from two different channels: the interaction between the components in each country (the crowding out or in of the individual categories by spending on the others) and the spill-overs across countries, working via the average spending across countries in the different components.

5 Summary and Conclusions

This paper studied the government spending adjustment during the nineties. It was shown that the adjustment started in 1994 and that it was a global process rather than a local process by countries that signed agreements, like the Maastricht agreement or the SGP among European countries.

Similarly to Gali and Perotti (2003), we found that overall countercyclicallity of government spending behavior remained similar after 1994. However, this was due to a remarkable change in government spending behavior: while in expansions spending was less procyclical, in recessions it was less countercyclical. These two changes reduce the government cyclical spending *bias*, implying that after 1994 there is a regime change toward reducing government spending.

Our findings have important implications for policy. In the presence of cycles, it is preferable to perform expenditure adjustments during expansions. This is so since in recessions the adjustment costs of reducing expenditure are much higher, due to adverse effects of the spending cuts in a situation of increasing unemployment and poverty. Consequently, our finding that there is only weak evidence that adjustment was performed in expansions, implies that the expenditure adjustment process must be improved. In light of the adherence of East European Countries to the European Union and the fact that these countries are required to start a fiscal consolidation, it is important to build explicit new budget rules that will encourage these countries to reduce government expenditure mainly during expansions.

Table A.1: Deviations from HP filter				
Dependent Variable: Δg				
Sample: 1981-2003 (standard errors in parentheses)				
Variable/coefficient		(1)	(2)	(3)
g_{-1}	λ	-0.159 (0.024)	-0.159 (0.024)	-0.156 (0.026)
$yd \cdot d'^{*}$	φ_1	-0.061 (0.063)	-0.040 (0.065)	0.033 (0.066)
$yd \cdot (1-d')$	φ_2	-0.258 (0.066)	-0.237 (0.068)	-0.294 (0.072)
$d94$	$\alpha_1 = \alpha_2$	-0.965 (0.159)		
$d94 \cdot d'$	α_1	-	-1.116 (0.197)	
$d94 \cdot (1-d')$	α_2	-	-0.866 (0.173)	
$maas \cdot d'$				-0.288 (0.211)
$maas \cdot (1-d')$				-0.201 (0.196)
$\Delta \ln pop$		0.692 (0.240)	0.677 (0.240)	0.716 (0.243)
$(rb)_{-1}$	γ	-0.230 (0.045)	-0.241 (0.046)	-0.176 (0.047)
$(young)_{-1}$	β_1	0.134 (0.068)	0.134 (0.068)	0.150 (0.073)
$(old)_{-1}$	β_2	0.407 (0.099)	0.411 (0.099)	0.211 (0.095)
R^2		0.34	0.34	0.27
$D.W.$		1.40	1.41	1.43
Observations: 23; Number of countries: 18				
Total panel observations: 389				
$*$ d' - equals 1 if the actual value is higher than the logaritmic trend (HP filtered)				

In general, the statistical power of the regression is lower, as reflected by the adjusted R-squared and the DW Statistic. Concerning the issue of assymetric adjustment, we note that for the OECD countries the adjustment in expansions was higher than in recessions. However, this result is not robust.[11] Moreover, the recession coefficient is high, which implies a pro-cyclical adjustment in recessions. This reaction is strenghted when shortening the sample.

For the Maastricht countries the cyclical adjustment coefficients are not significant.

[11] In some of the shorter regressions the difference dissapeared.

Table A.2: Controling for income inequality				
Dependent Variable: Δg				
Sample: 1981-1999 (standard errors in parentheses)				
Variable/coefficient		(1)	(2)	(3)
g_{-1}	λ	-0.116 (0.022)	-0.114 (0.022)	-0.113 (0.022)
$yd \cdot d'$	φ_1	-0.166 (0.062)	-0.190 (0.064)	-0.012 (0.068)
$yd \cdot (1-d')$	φ_2	-0.543 (0.052)	-0.546 (0.052)	-0.585 (0.053)
$d94 \cdot yd \cdot d'$				-0.123 (0.136)
$d94 \cdot yd \cdot (1-d')$				0.463 (0.188)
$d94$	$\alpha_1 = \alpha_2$	-0.891 (0.184)		-0.768 (0.222)
$d94 \cdot d'$	α_1	-	-0.806 (0.193)	
$d94 \cdot (1-d')$	α_2	-	-1.146 (0.259)	
$\Delta \ln pop$		0.801 (0.243)	0.777 (0.243)	0.773 (0.242)
$(rb)_{-1}$	γ	-0.273 (0.064)	-0.277 (0.064)	-0.285 (0.065)
$(young)_{-1}$	β_1	-0.020 (0.077)	-0.027 (0.077)	-0.004 (0.078)
$(old)_{-1}$	β_2	0.223 (0.134)	0.227 (0.134)	0.285 (0.135)
$theil$	β_3	8.470 (7.585)	8.483 (7.562)	13.012 (7.782)
R^2		0.63	0.63	0.64
$D.W.$		1.96	1.96	1.99
Observations: 19; Number of countries: 18				
Total panel observations: 282				

The results show that the inequality index is not significant for explaining total expenditure. In a non-reported regression we obtained that inequality succeeds in explaining transfers.

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