Government Spending Adjustment: The OECD Since the 1990s[1]

by

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Abstract

This paper investigates the drastic reduction in public spending in OECD countries during the 1990s. Using a panel data set of 18 countries, we find this adjustment to be a general OECD development, beginning in 1994, and that participation in the Maastricht Treaty or in the Stability and Growth Pact does not introduce additional effects. In the long run, this adjustment is estimated to reduce the ratio of primary government spending to output by about 4 percentage points. There is no evidence of differential adjustment in expansions or recessions. We also find that declines in interest payments on public debt are followed by increases in primary expenditures by about the same amount. The econometric framework makes it possible to compute the long-run ratios of government expenditures to GDP in the 18 OECD countries in the sample.

1. Introduction

There was a drastic reduction in public spending in the OECD during the 1990s. Primary government expenditures declined from a cyclically adjusted, weighted average of 36.4 percent of GDP in 1992 to 34.1 percent in 1998. Since 1999, however, primary expenditures increased once more. Figure 1 illustrates the behavior of the average ratio of government spending to output in the OECD, using PPP adjusted GDP as weights. The solid line represents the ratio of cyclically adjusted primary spending to GDP whereas the dashed line represents that ratio including interest payments. Both reflect the spending cuts of the early 1990s. Towards the end of the sample, the primary spending-output ratio bounces back while the ratio including interest payment remains constant.

Government Expenditures

(Weighted Average - Cyclically Adjusted)

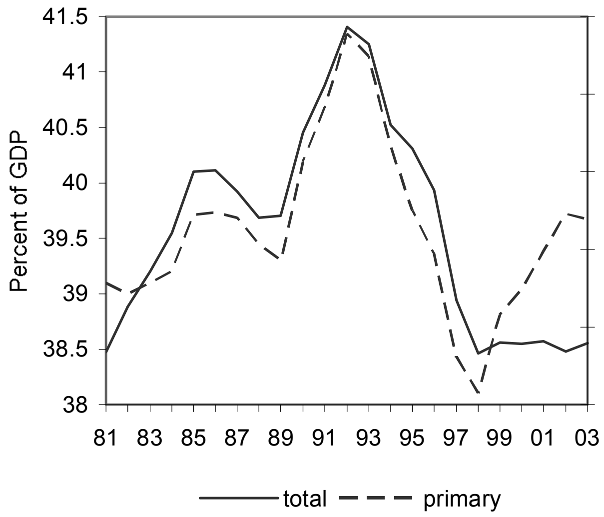


Figure 1

Using panel data for 18 OECD countries over the 1980-2003 sample, we analyze the public spending changes since the 1990s, controlling for demographic and cyclical factors. More specifically, we address the following questions:

1) Is the adjustment a general OECD phenomenon, or are there separate effects of the Maastricht Treaty and the Stability and Growth Pact?
2) Is the adjustment symmetric in expansions and recessions?

3) What are the long-run quantitative implications of the adjustment in the different countries?
4) How is the composition of government spending affected by the adjustment?
5) What are the quantitative implications of reduced interest payments for primary government spending and its composition? In particular, can the reversal of primary expenditures, shown in Figure 1 at the end of the sample, be explained by the reduced burden of interest payments?

We use an econometric model that makes it possible to compute the dynamics of government spending and long-run levels in the different countries for total primary spending and its components: government consumption, transfers and subsidies, and public investment.

The analysis is fact-finding in nature. The purpose is to characterize the adjustment empirically, rather than to evaluate it normatively, as conducted for example by Buti, Eijffinger and Franco (2003), or to propose changes to the current rules, as in Fatas, Von Hagen, Hallett, Strauch and Sibert (2003). Gali and Perotti (2003) analyze the fiscal implications of the Maastricht Treaty and the Stability and Growth Pact, and find that they did not reduce the ability of governments to conduct countercyclical fiscal policy.

The paper proceeds as follows. Section 2 presents the econometric framework for the analysis of aggregate primary government expenditures as well as the computation of the effects of the fiscal adjustments in the 1990s on the long-run ratios of government expenditures to output. Section 3 reports the empirical results. In Section 4 we extend the analysis by disaggregating primary expenditures into three components: government consumption, transfers and subsidies, and public investment. Section 5 concludes.

2. Econometric Framework for Aggregate Primary Expenditure

Consider a panel data set with 18 countries, indexed by i, and a sample of 24 years, indexed by $1980 \le t \le 2003$. The ratio of primary government expenditures to GDP is denoted by $g_{it} \equiv G_{it} / Y_{it}$, and the ratio of public debt to GDP by $b_{it} \equiv B_{it} / Y_{it}$.

In year $1980 \le t_{a_i} \le 2003$, country i starts to adjust g_i. The timing of the adjustment process is captured by the dummy variable A_{it}, which is formulated as:

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

Defining $\Delta \ln \tilde{y}_{it} \equiv \Delta \ln Y_{it} - avg(\Delta \ln Y_i)$ where $avg(\Delta \ln Y_i)$ is the average growth rate in country i, the possibility of differential adjustment in g_i during periods of high and low growth is allowed by using the dummy variable

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

The main three factors affecting government spending at the focus of our analysis are:

1) The adjustment itself, captured by A_{it}, interacting with d_{it} and $1 - d_{it}$. This interaction allows for differential adjustments during recessions and booms.
2) The business cycle, represented by $\Delta \ln \tilde{y}_{it}$, also interacting with d_{it} and $1 - d_{it}$ to capture asymmetric countercyclical policy.
3) Interest payments as a fraction of output, denoted by $r_{it-1} b_{it-1}$. Introducing this variable makes it possible to explore crowding out effects of debt servicing on primary government expenditures.

The basic equation for aggregate government expenditures is then specified as

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

where x_{it} is a vector of control variables affecting the level of g. Stationarity of the government spending-output ratio requires that $\lambda < 0$. The coefficients α_1 and α_2 are expected to be negative, representing the adjustment of government spending starting at t_{a_i}. If adjustments take place mainly in expansions, then $|\alpha_1| > |\alpha_2|$. The cyclical variables involving $\Delta \ln \widetilde{y}_{it}$ are introduced, as in Hercowitz and Strawczynski (2004), to capture cyclical asymmetry in government spending, represented by $\varphi_1 \neq \varphi_2$. If $\varphi_1 - \varphi_2 > 0$, there is an upwards ratcheting process, as reported in that paper.[1] Whether the ratcheting behavior changes at t_{a_i} is also tested by adding an interaction between the cyclical variables and A_{it}. The coefficient γ is negative if interest payments, $r_{it-1}b_{it-1}$, crowd out other expenditure.

Note that in this specification, the adjustment *starts* at time t_{a_i} and continues thereafter. The total adjustment is captured by the accumulated effects, which will be reflected in the long-run ratio.

2.1 The Long Run

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

$$\begin{aligned} 0 &= \alpha_{0i} + \alpha_1 avg(d_i) + \alpha_2 avg(1-d_i) + \varphi_1 avg(d_i \Delta \ln \widetilde{y}_i) \\ &+ \varphi_2 avg((1-d_i)\Delta \ln \widetilde{y}_i) + \gamma r_i b_i + \beta x_i + \lambda g_i, \\ i &= 1,..,18, \end{aligned} \tag{2}$$

where the variables without the index t represent long-run values. 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 the tax rate τ_i is also involved, this equation is insufficient for closing the system. Indeterminacy is resolved by assuming a required $b_i = \overline{b}$, as in the Maastricht Treaty where $\overline{b} = 0.6$. Then, assuming $r_i = r$, the long-run levels of government spending are

[1] Note that when checking for cyclical asymmetry, the simultaneity problem is alleviated if simultaneity is similar in expansions and recessions. For a further elaboration of this point see Hercowitz and Strawczynski (2004), Appendix A.

$$g_i = -\frac{1}{\lambda}\begin{bmatrix} \alpha_{0i} + \alpha_1 avg(d_i) + \alpha_2 avg(1-d_i) + \\ \varphi_1 avg(d_i \Delta \ln \tilde{y}_i) + \varphi_2 avg((1-d_i)\Delta \ln \tilde{y}_i) + \gamma r\bar{b} + \beta x_i \end{bmatrix} \quad (3)$$

$i = 1,..,18.$

Note that $1/\lambda$ represents the degree to which a permanent change in one of right-hand variables affects the long-run level of government spending.

When the adjustment does take place during the sample, its contribution to the long-run ratio of government spending to output is $(\alpha_1 avg(d_i) + \alpha_2 avg(1-d_i))/(-\lambda)$. If, for example, output growth is above average exactly half the time, the long-run adjustment is given by $(\alpha_1 + \alpha_2)/(-2\lambda)$. The long-run contribution of cyclical ratcheting is $[\varphi_1 avg(d_i \Delta \ln \tilde{y}_i) + \varphi_2 avg((1-d_i)\Delta \ln \tilde{y}_i)]/(-\lambda)$. If the cyclical spending pattern is symmetric in expansions and recessions, i.e., $\varphi_1 = \varphi_2$, and the average deviations of output growth above and below average are the same, the business cycle does not affect the long-run g_i. Alternatively, for example, if $\varphi_1 > \varphi_2$ and the average deviations of output growth from average are the same, output fluctuations lead to higher government spending. The next factor is interest payments: If $\gamma < 0$, as expected, a permanent reduction in interest payments increases g_i times the factor $-\gamma/\lambda$. Finally, x_i are long-run values of other variables, such as demographic factors, which affect the level of the government spending-output ratio.

3. Results for Aggregate Government Spending

3.1 The Data

The panel data set is composed of 18 countries, 12 of them in the EMU—Austria, Belgium, Germany, Finland, France, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal and Spain—and 6 other OECD countries—Canada, Denmark, Japan, Sweden, United Kingdom and the U.S. Most of these countries performed the primary expenditure adjustment shown in Figure 1, but some did not, such as Japan and Greece. The data are annual over the 1980-2003 period. The variable G is matched to primary general government expenditures, i.e., it includes regional authorities, and Y is represented by GDP. The source is the OECD economic data.

3.2 Estimation Results

We report first a preliminary estimation of equation (1), concentrating on the adjustment variable A. For this purpose, the fiscal adjustment and cyclical variables are constrained to enter in a symmetric form, i.e., $\alpha = \alpha_1 = \alpha_2$, $\varphi = \varphi_1 = \varphi_2$; interest payments and control variables are not included.

The variable A is introduced in three alternative formulations. One is based on the Maastricht Treaty. The dummy variable *Maast* takes the value 1 in the years following referendum approval in each one of the 15 countries joining the treaty, and 0 elsewhere.[2] We also used an alternative specification, excluding the three countries with a derogation status—the U.K., Sweden and Denmark—from the *Maast* variable. The second form is a dummy variable for all countries in the sample, taking the value 1 starting in a specific year during the 1990s, and 0 previously. Table 1 reports the results with the dummy variable for 1994, $d94$, which turned out to yield the best fit among the alternatives for 1991 through 1996. The third form is based on the Stability and Growth Pact: The variable *SGP* takes the value 1 in the EMU countries during and after 1997, and 0 elsewhere.

The results from this preliminary specification are presented in Table 1.

[2] The countries in the sample that joined the Maastricht Treaty are (the date of referendum approval is indicated in the parenthesis): 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), Sweden (13.11.94) and Portugal (10.12.92). Source: Kessing's Records of World Events.

Table 1: Aggregate Government Expenditure				
Dependent Variable: Δg				
Sample: 1981-2003 (srandard errors in parentheses)				
Variable-coefficient$^{(i)}$		(1)	(2)	(3)
*d*94	α		-0.342 (0.089)	-0.502 (0.135)
Maast	α	-0.334 (0.126)		0.048 (0.159)
SGP	α	0.191 (0.156)		0.318 (0.155)
$\Delta \ln(\tilde{y})$	φ	-0.449 (0.026)	-0.432 (0.026)	-0.432 (0.026)
g_{-1}	λ	-0.181 (0.018)	-0.187 (0.018)	-0.182 (0.018)
R^2		0.53	0.55	0.56
D.W.		1.53	1.51	1.53
Observations: 23; Number of countries: 18				
Total panel observations: 386				
(*i*) Country fixed-effects included				

The main results in Table 1 are the following. In column (1), the variable *Maast* has a negative and significant coefficient, but *SGP* does not have additional explanatory power. However, when $d94$ is also included (column (3)), only $d94$ has a negative and significant coefficient, *Maast* becomes insignificant and *SGP* appears with a positive and even border-line significant coefficient. Hence, it appears that the adjustment is a general OECD phenomenon, and not specific to EU countries. The positive coefficient of *SGP* resembles a partial reversal. The results are practically the same when we use the *Maast* specification that excludes the U.K., Sweden and Denmark.

In Table 2 we report the estimation of the complete specification of equation (1). The adjustment and cyclical behavior is allowed to be asymmetric; and the interest payments and control variables are included. The control variables are: The population growth rate, $\Delta \ln pop$, and the fractions of the young (0-14 years of age), *young*, and the old (65 and older), *old*, in the population. In Table A.2 in the appendix, we report the inclusion of an inequality index. This variable is expected to have positive effects.

Table 2: Aggregate Government Expenditure				
Dependent Variable: Δg				
Sample: 1981-2003 (standard errors in parentheses)				
Variable-coefficient $^{(i)}$		(1)	(2)	(3)
d94	α	-0.604 (0.130)		-0.482 (0.162)
*d94 * d*	α_1		-0.578 (0.147)	
*d94 * (1-d)*	α_2		-0.645 (0.155)	
$\Delta \ln(\tilde{y})$* *d*	φ_1	-0.290 (0.053)	-0.296 (0.056)	-0.270 (0.069)
$\Delta \ln(\tilde{y})$* *(1-d)*	φ_2	-0.515 (0.045)	-0.524 (0.045)	-0.561 (0.049)
d94 * $\Delta \ln(\tilde{y})$* *d*	$\tilde{\varphi}_1$			-0.075 (0.106)
d94 * $\Delta \ln(\tilde{y})$* *(1-d)*	$\tilde{\varphi}_2$			0.199 (0.108)
$(rb)_{-1}$	γ	-0.194 (0.040)	-0.197 (0.040)	-0.211 (0.041)
$\Delta \ln pop$	β_1	0.484 (0.208)	0.472 (0.209)	0.460 (0.211)
$(young)_{-1}$	β_2	-0.044 (0.056)	-0.051 (0.057)	-0.054 (0.056)
$(old)_{-1}$	β_3	0.100 (0.087)	0.094 (0.088)	0.111 (0.087)
g_{-1}	λ	-0.140 (0.018)	-0.140 (0.018)	-0.140 (0.018)
R^2		0.60	0.60	0.61
D.W.		1.72	1.73	1.74
Observations: 23; Number of countries: 18				
Total panel observations: 386				
(*i*) Country fixed-effects included				

The main results are the following:

- The estimate of α in column 1, -0.6, is large and significant, indicating a strong downward adjustment in government spending beginning in 1994. Column 2 reports the test of differential adjustment in expansions and recessions. One may expect that a downward adjustment in the spending-output ratio is socially and politically easier during expansions. The Wald test indicates, however, that the estimates of α_1 and α_2 are insignificantly different from one another. We also tested for differential behavior in more extreme cyclical situations, i.e., when output growth deviates from the mean by more than one standard deviation. In this case as well (not shown), the difference between the coefficients in expansions and recessions is statistically insignificant.
- The estimate of the ratcheting coefficient $(\varphi_1 - \varphi_2)$ in column 1 is 0.23

percentage points of GDP, significantly different from zero at the 1 percent level. Column 3 addresses the hypothesis that the asymmetric cyclical behavior leading to ratcheting changed after 1994. According to the point estimates in column 3, the ratcheting behavior practically disappears from 1994 onwards: It declines from $\varphi_1 - \varphi_2 = 0.29$ to $\varphi_1 - \varphi_2 - (\tilde{\varphi}_1 - \tilde{\varphi}_2) = 0.025$. However, among the coefficients $\tilde{\varphi}_1$ and $\tilde{\varphi}_2$, only $\tilde{\varphi}_2$ is close to being significant at the 5 percent level. Hence, the evidence of a change towards less asymmetric cyclical behavior is weak.

- Another important result is the negative and significant coefficient of interest payments (γ). A reduction of interest payments is followed by an increase in primary expenditures of 20 percent of the amount saved in the following year. If the decline in interest payments is permanent, the effect on other expenditures accumulates over time. Below, we compute the long-run effect.
- The shares of old and young in the population are insignificant, but population *growth* has a positive and significant effect.
- The estimate of $\lambda = 0.14$ indicates that the convergence to the long-run value of g takes place quite gradually.

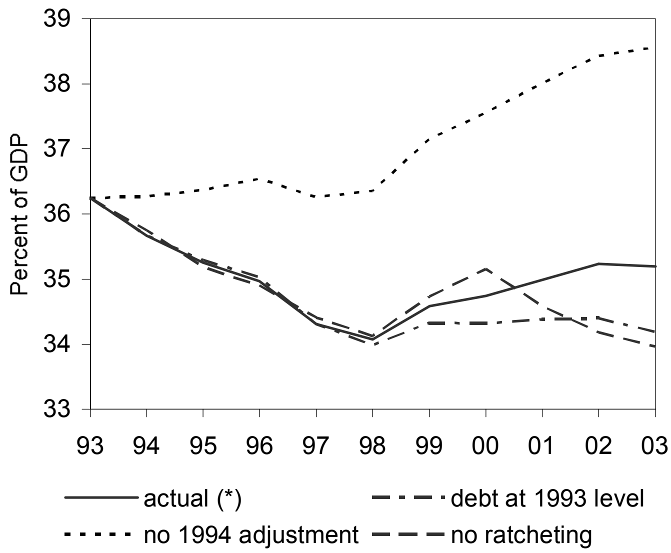
We also ran these regressions including only the 15 countries that joined the Maastricht Treaty in order to explore different behavior. The results, are similar to those presented in Table 2. This supports the notion that fiscal behavior is similar in all countries in the sample.

We tested the possibility of an upwards adjustment of total government expenditure after 1998. This is done by adding a dummy variable that takes the value of 1 after 1998 and 0 elsewhere. It turned out that the corresponding coefficient was not significant. This result suggests that the upward trend after 1998 is explained by the other explanatory variables.

3. Implications of the Results

Here we address the dynamic effects of the results in Table 2. The coefficients express the effects of the explanatory variables on the *immediate change* in the government's spending-output ratio. If the movements in the explanatory variables are persistent, the changes accumulate over time although this accumulation generates an opposite stabilizing effect via the term λg_{t-1}.

Partial Effects on Government Expenditures



(*) Weighted average of cyclically adjusted ratio to GDP.

Figure 2

Figure 2 illustrates the in-sample net accumulated effects of each of the main variables of interest since 1993. The solid line represents the cyclically-adjusted weighted average ratio of primary government spending to GDP. The cyclical adjustment is symmetric in expansions and recessions.[3] Using the coefficients in Table 2, column 1, we then computed the hypothetical behavior of g in three cases: (a) No adjustment in 1994, i.e., setting $\alpha d94 = 0,$ (b) No change in interest payments, i.e., assuming that the burden of servicing the debt did not decline since 1993, (c) No asymmetric cyclical spending, and hence no ratcheting behavior - i.e., setting $\Delta \ln \tilde{y} = 0$ from 1994 onwards.

Figure 2 shows that without the adjustment introduced in 1994, government

[3] The weights are based on PPP-adjusted GDP. This is the same variable presented in Figure 1.

spending would have been more than 3 percentage points of GDP higher - the vertical distance between the no 1994 adjustment and the actual line. This is the source of the largest contribution to the change in government spending. A constant debt burden since 1993 would have implied that no funds would have been released to increase primary expenditure. The line for debt at 1993 level illustrates that primary spending would have been 1 percentage point of GDP lower. The line for no ratcheting represents the hypothetical spending-GDP ratio without asymmetric spending over the business cycle. Without asymmetry, the spending-GDP ratio would have been lower by 1.2 percentage point of GDP.

From the graph it follows that one of these two factors - (1) reduced interest payments or (2) ratcheting behavior - can be considered responsible for the spending rebound since 1998. The three lines - actual, debt at 1993 level, and no ratcheting - are at about the same level in 1998. The vertical distance between the actual ratio and the other two ratios in 2003 is about 1 percentage point, which is precisely the increase in actual spending from 1998 to 2003.

4. Expenditure decomposition

Here we focus on government expenditures disaggregated into three components: (1) consumption expenditure, (2) transfers and subsidies, and (3) public investment. The sum of the three components is somewhat lower than the total primary expenditure figures used in the aggregate analysis due to items such as capital expenditure, which are not included in the separate components.

4.1 Econometric Framework

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

$$\begin{aligned} \Delta g_{it}^{j} &= \alpha_{0i}^{j} + \alpha_{1}^{j} A_{it} + \varphi_{1}^{j} \Delta \ln(\tilde{y}_{it}) d_{it} + \varphi_{2}^{j} \Delta \ln(\tilde{y}_{it})(1 - d_{it}) \\ &+ \gamma^{j} (r_{t-1} b_{it-1}) + \beta^{j} x_{it} + \lambda_{1}^{j} g_{it-1}^{1} + \lambda_{2}^{j} g_{it-1}^{2} + \lambda_{3}^{j} g_{it-1}^{3} + \varepsilon_{it}^{j}, \qquad (4) \\ i &= 1,..18. \end{aligned}$$

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

$$\begin{aligned} \Delta \mathbf{g}_{it} &= \boldsymbol{\alpha}_{0i} + \boldsymbol{\alpha}_1 A_{it} + \boldsymbol{\varphi}_1 \Delta \ln(\tilde{y}_{it}) d_{it} + \boldsymbol{\varphi}_2 \Delta \ln(\tilde{y}_{it})(1 - d_{it}) \\ &+ \boldsymbol{\gamma}(r_{t-1} b_{it-1}) + \boldsymbol{\beta} x_{it} + \boldsymbol{\lambda} \mathbf{g}_{it-1} + \boldsymbol{\varepsilon}_{it}, \\ i &= 1,..,18, \end{aligned} \tag{5}$$

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, $\boldsymbol{\beta}$ is $3 \times k$, x_{it} is $k \times 1$, and $\boldsymbol{\lambda}$ is 3×3.

4.2 The Long Run

The long-run ratios of the different spending components to output can be obtained following a procedure similar to that used for the aggregate spending case but now applied to the vector of spending-output ratios. In the long run we have

$$\mathbf{0} = \boldsymbol{\alpha}_{0i} + \boldsymbol{\alpha}_1 + \boldsymbol{\varphi}_1 avg(\Delta \ln(\tilde{y}_i) d_i) + \boldsymbol{\varphi}_2 avg(\Delta \ln(\tilde{y}_i)(1 - d_i)) + \boldsymbol{\gamma}(r\bar{b}) + \boldsymbol{\beta} x_i + \boldsymbol{\lambda} \mathbf{g},$$

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

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

$$\mathbf{g}_i = -\boldsymbol{\lambda}^{-1}(\boldsymbol{\alpha}_{0i} + \boldsymbol{\alpha}_1 + \boldsymbol{\varphi}_1 avg(\Delta \ln(\tilde{y}_i) d_i) + \boldsymbol{\varphi}_2 avg(\Delta \ln(\tilde{y}_i)(1 - d_i)) + \boldsymbol{\gamma} r\bar{b} + \boldsymbol{\beta} x_i). \tag{6}$$

Similarly to aggregate spending, the focus of the analysis is the quantitative adjustment since the 1990s. The results will reflect not only the direct effects measured by the coefficients of the dummy variable for the 1990s on the estimation, but also the indirect effects from the interaction between the components (the crowding out of the individual category by spending on the others). The results are shown in Table 3.

Table 3: Components of Government Expenditure			
Sample: 1981-2003 (standard errors in parentheses)			
	Consumption Expenditure	Current Transfers	Investment
Dependent Variable$^{(i)}$	Δg^1	Δg^2	Δg^3
Variable			
d94	-0.149 (0.072)	-0.174 (0.080)	-0.041 (0.033)
$\Delta \ln(\tilde{y})$* *d*	-0.138 (0.025)	-0.179 (0.029)	-0.001 (0.012)
$\Delta \ln(\tilde{y})$* *(1-d)*	-0.170 (0.022)	-0.267 (0.026)	0.020 (0.010)
$(rb)_{-1}$	-0.070 (0.020)	-0.021 (0.022)	-0.021 (0.010)
$\Delta \ln pop$	-0.106 (0.094)	0.438 (0.109)	0.172 (0.044)
$(young)_{-1}$	-0.031 (0.024)	-0.005 (0.030)	-0.011 (0.012)
$(old)_{-1}$	0.096 (0.041)	0.079 (0.047)	-0.008 (0.021)
$(g^1)_{-1}$	-0.115 (0.021)	0.072 (0.025)	-0.017 (0.011)
$(g^2)_{-1}$	-0.097 (0.019)	-0.137 (0.022)	-0.026 (0.010)
$(g^3)_{-1}$	0.046 (0.037)	0.007 (0.045)	-0.166 (0.023)
R^2	0.54	0.59	0.38
D.W.	1.68	1.69	2.05
Observations: 23; Number of countries: 18			
Total panel observations: 386			
(*i*) Country fixed-effects included			

The results show the following:

- The direct effects of the adjustment from 1994 apply mainly to consumption expenditure and transfers, while the coefficient on investment is not significant.
- Transfers crowd out government consumption, but not the opposite.
- Consumption and transfers are countercyclical and asymmetric—and the corresponding coefficients are statistically significant. The results from aggregate spending, presented previously, reflect this behavior. For investment, the results are quite different. In high-growth years, investment is acyclical whereas in low-growth years, investment appears *procyclical*, with a coefficient that is almost significant at the 5 percent level.
- Population growth has a strong effect on transfers and investment.
- The share of the old in the population increases government consumption, but its impact on transfers is not significant at 5 percent significance level.

- Interest payments have crowding out effects on consumption and investment. The coefficient on transfers is statistically insignificant.

The dynamic adjustment parameters are:

$$\boldsymbol{\lambda} = \begin{bmatrix} -0.115 & -0.097 & 0.046 \\ 0.072 & -0.137 & 0.007 \\ -0.017 & -0.026 & -0.166 \end{bmatrix}$$

Each row represents the cross-effects on one spending component, and each column the impact of one spending component on the others. Investment is crowded out by consumption and transfers, and consumption is crowded out by transfers. This is the type of cross effects expected. In contrast, consumption crowds transfers in.

The long-run interaction is given by

$$-\boldsymbol{\lambda}^{-1} = \begin{bmatrix} 5.779 & -4.347 & 1.413 \\ 2.992 & 4.991 & 1.059 \\ -1.066 & -0.348 & 5.727 \end{bmatrix}.$$

The long-run effects follow from the direct effects in λ. The first column represents the long-run effects of an initial change in consumption spending (due to a change in any of the exogenous variables). The largest effect is on consumption spending itself, which spills over to transfers. Investment, on the other hand, is crowded out. The second column indicates the effects of an initial change in transfers: it crowds out the other two types of spending, mainly government consumption. An initial investment change, in contrast, crowds in both consumption and transfers.

How did the adjustment in the 1990s affect the long-run composition of government spending? The coefficients of $d94$ indicate the immediate changes in the spending-output ratios. These coefficients are $\boldsymbol{\alpha}_1' = [-0.149,\ -0.174,\ -0.041]$, on consumption expenditure, transfers and investment, respectively. The largest direct effect is on transfers. To compute the long-run implications of the adjustment, one needs to take into account the cross effects among the spending components. This computation is given by:

$$\Delta \mathbf{g}_i \big|_{d94} = -\boldsymbol{\lambda}^{-1}\boldsymbol{\alpha}_1 = \begin{bmatrix} -0.167 \\ -1.357 \\ -0.014 \end{bmatrix}.$$

The largest long-run decline is of transfers, about 1.4 percentage points of GDP. According to this computation, government consumption and public investment are only marginally affected by the adjustment.

A similar computation for interest payments yields

$$\Delta \mathbf{g}_i \big|_{rb} = -\boldsymbol{\lambda}^{-1}\boldsymbol{\gamma} = \begin{bmatrix} -0.342 \\ -0.339 \\ -0.039 \end{bmatrix}.$$

These figures indicate that a decline in interest payments generates increases in government consumption and transfers equal to about a third of the decline. The total increase in the three items is about 0.72.

We can use the same procedure to compute the implications of population aging. Given the coefficient of the variable *old* in Table 3, we get

$$\Delta \mathbf{g}_i \big|_{old} = -\boldsymbol{\lambda}^{-1}\boldsymbol{\beta}_{old} = \begin{bmatrix} 0.200 \\ 0.670 \\ -0.173 \end{bmatrix}.$$

Hence, for each percentage point increase in the share of individuals 65+ in the population, transfers increase by 0.67 percent of GDP, and public consumption by 0.2 percent of GDP. Investment spending decreases by 0.17 percent.[4]

[4] For an analysis of the implications of population aging on the public finances of industrial countries, see Heller and Hauner (2005).

Finally in this section, we report in Table 4 the long-run ratios of government spending to output in the 18 countries in the sample and, in parenthesis, the ratios in the last year in the sample. The computation uses the equation shown above together with: (a) the coefficients in Table 3, (b) the average values of the cyclical variables in each country, (c) $d94 = 1$ and $rb = 0.05 \times 0.6$, and (d) the demographic variables set at their 2003 values. The computed long-run values of g are, in most countries, higher than the actual ratios at the end of the sample. This can be rationalized by the forces pushing for higher spending, such as lower interest payments and cyclical ratcheting, not reaching their long-run effects by 2003. However, none of the long-run values are statistically different from the last values in the sample.

Table 4: Long-Run Ratios of Government Expenditure Components to GDP

	Consumption	Current Transfers	Investment	Total
Austria	0.184 (0.180)	0.240 (0.254)	0.020 (0.012)	0.444 (0.446)
Belgium	0.242 (0.228)	0.225 (0.201)	0.017 (0.016)	0.484 (0.445)
Canada	0.230 (0.192)	0.135 (0.102)	0.027 (0.027)	0.392 (0.321)
Denmark	0.259 (0.266)	0.232 (0.227)	0.015 (0.017)	0.506 (0.510)
Finland	0.216 (0.223)	0.252 (0.212)	0.021 (0.029)	0.489 (0.464)
France	0.236 (0.243)	0.221 (0.217)	0.028 (0.033)	0.485 (0.493)
Germany	0.191 (0.192)	0.223 (0.229)	0.013 (0.015)	0.427 (0.436)
Greece	0.166 (0.160)	0.251 (0.189)	0.026 (0.039)	0.443 (0.388)
Ireland	0.180 (0.159)	0.156 (0.119)	0.032 (0.039)	0.367 (0.317)
Italy	0.216 (0.195)	0.239 (0.199)	0.022 (0.026)	0.477 (0.420)
Japan	0.167 (0.177)	0.127 (0.102)	0.056 (0.054)	0.350 (0.333)
Luxembourg	0.173 (0.182)	0.175 (0.209)	0.040 (0.048)	0.388 (0.439)
Netherlands	0.255 (0.254)	0.190 (0.155)	0.029 (0.036)	0.474 (0.445)
Portugal	0.192 (0.214)	0.192 (0.184)	0.030 (0.034)	0.414 (0.432)
Spain	0.184 (0.179)	0.179 (0.148)	0.034 (0.035)	0.397 (0.362)
Sweden	0.286 (0.283)	0.241 (0.222)	0.031 (0.031)	0.558 (0.536)
United Kingdom	0.199 (0.209)	0.178 (0.168)	0.014 (0.017)	0.391 (0.394)
United States	0.159 (0.152)	0.116 (0.113)	0.021 (0.026)	0.296 (0.291)

(i) In parenthesis: Last year of the sample (2002 for Canada, Japan and United States, 2003 for other countries).

In half of the countries in the sample, long-run government consumption is higher than in the last year of the sample. For transfers, this feature characterizes almost all countries. Finally, for total expenditure in some countries (Austria, Denmark, Germany, United Kingdom and the U.S.), long-run values are similar to those in the last year of the sample, but for most they are higher.

5. Concluding comments

We found that the government spending adjustment began in 1994, and that it can be characterized as an OECD phenomenon rather than as a phenomenon specific to countries participating in the Maastricht Treaty or the Stability and Growth Pact.

The spending adjustment was estimated to reduce the long-run ratio of primary spending to GDP by about 4 percentage points. As shown in Figure 2, the contribution of this adjustment to average spending by 2003 was about 3.3 percentage points of GDP. We did not find evidence that the adjustment is carried out differently in expansions and recessions.

The results from aggregate spending indicate that a decline in interest payments generates a long-run increase in other expenditure that is larger by 1.4 percentage points. However, we cannot reject the hypothesis that this effect is statistically different from 1. In any event, this result implies that in the long run, declining debt servicing does not reduce the total amount of government spending.

We found that the bouncing back of the average ratio of primary spending to GDP since 1998 can be quantitatively explained by either the reverse crowding out of the decline in interest payments, or the accumulated ratcheting generated by asymmetric cyclical spending behavior.

The analysis of the spending components indicates that the long-run effect of the spending adjustment was concentrated on transfers. The long-run effect on government consumption was estimated to be much smaller, and the corresponding effect on public investment was very small.

Appendix A

We also considered HP-filtered output as the cyclical variable (as in Gali and Perotti, 2003) instead of the deviations of the growth rate of output from their average value. In the following table, we define yd as HP-filtered ln(GDP), d' is a dummy variable with a value of 1 when $yd > 0$, and 0 otherwise.

Table A1: HP-filtered GDP as the Cyclical Variable				
Dependent Variable: Δg				
Sample: 1981-2003 (standard errors in parentheses)				
Variable-coefficient$^{(i)}$		All countries (18)	All countries (18)	Maastricht (15)
*yd * d'*	φ_1	-0.193 (0.063)	-0.187 (0.065)	-0.147 (0.073)
*yd * (1-d')*	φ_2	-0.092 (0.066)	-0.085 (0.067)	-0.013 (0.081)
d94	α	-0.012 (0.002)		
*d94 * d'*	α_1		-0.012 (0.002)	-0.013 (0.002)
*d94 * (1-d')*	α_2		-0.011 (0.002)	-0.011 (0.002)
$\Delta \ln pop$		0.840 (0.268)	0.826 (0.269)	0.686 (0.298)
$(rb)_{-1}$	γ	-0.257 (0.045)	-0.260 (0.046)	-0.271 (0.049)
$(young)_{-1}$	β_1	0.114 (0.067)	0.114 (0.067)	0.158 (0.074)
$(old)_{-1}$	β_2	0.445 (0.099)	0.446 (0.099)	0.534 (0.118)
g_{-1}	λ	-0.157 (0.025)	-0.156 (0.025)	-0.130 (0.026)
R^2		0.34	0.34	0.33
D.W.		1.38	1.38	1.42
Observations: 23				
Total panel observations. Columns (1) and (2): 386, column (3): 330				
(*i*) Country fixed-effects included				

In general, the fit of the regressions is poorer than in Table 2, as reflected by the lower R^2 and $D.W.$ statistics. Other differences are that the coefficient of countercyclical policy in recessions is no significant here, and that the variable *old* is positive and significant.

Table A.2 includes a Theil index of inequality in gross wages in the OECD countries (Source: University of Texas Inequality Project). This index is available only through 1999. According to the results presented in column 1 inequality does not affect total government expenditure at a 5 percent significance level.

Table A.2: Controlling for Income Inequality				
Dependent Variable: Δg				
Sample: 1981-1999 (standard errors in parentheses)				
Variable-coefficient		(1)	(2)	(3)
$\Delta \ln(\tilde{y})* d$	φ_1	-0.249 (0.067)	-0.290 (0.068)	-0.263 (0.077)
$\Delta \ln(\tilde{y})* (1-d)$	φ_2	-0.518 (0.053)	-0.534 (0.051)	-0.547 (0.053)
$d94 * \Delta \ln(\tilde{y})* d$				0.028 (0.144)
$d94 * \Delta \ln(\tilde{y})* (1-d)$				0.417 (0.195)
$d94$	α	-0.982 (0.187)		-0.997 (0.226)
$d94 * d$	α_1		-0.009 (0.002)	
$d94 * (1-d)$	α_2		-0.015 (0.003)	
$\Delta \ln pop$		0.593 (0.254)	0.524 (0.251)	0.551 (0.252)
$(rb)_{-1}$	γ	-0.222 (0.065)	-0.219 (0.064)	-0.224 (0.066)
$(young)_{-1}$	β_1	-0.019 (0.079)	-0.026 (0.078)	-0.0003 (0.079)
$(old)_{-1}$	β_2	0.183 (0.139)	0.180 (0.137)	0.239 (0.140)
Theil	β_3	0.141 (0.076)	0.162 (0.076)	0.184 (0.078)
g_{-1}	λ	-0.134 (0.023)	-0.129 (0.022)	-0.131 (0.022)
R^2		0.63	0.65	0.65
D.W.		1.87	1.88	1.89
Observations: 19; Number of countries: 18				
Total panel observations: 282				

References

Buti, M., S. Eijffinger and D. Franco (2003), Revisiting the Stability and Growth Pact: Grand design or internal adjustment?, *European Economy Economic Papers*, 180.

Fatas A., Von Hagen, J. , Hallett, A. H., Strauch, R.R., and A. Sibert (2003), Stability and growth in Europe: Towards a better pact, CEPR and ZEI, *Monitoring European Integration*, 13.

Gali, J. and R. Perotti (2003), Fiscal policy and monetary integration in Europe, *Economic Policy,* 18 (37), 533-572.

Heller, P. S., and D. Hauner (2005), Characterizing the expenditure uncertainty of the industrial countries in the 21st Century, paper presented at the 7th Banca d'Italia Workshop on Public Finance, held in Perugia.

Hercowitz Z. and M. Strawczynski (2004), Cyclical ratcheting in government spending: Evidence from the OECD, *Review of Economics and Statistics*, 86 (1), 353-361.