Cyclical Ratcheting in Government Spending: Evidence from the OECD

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Abstract

This paper studies the role of business cycles in the phenomenon of increasing government spending/GDP ratios in the OECD countries. An empirical framework that includes both long-run and cyclical considerations in the determination of government spending is applied to panel data covering the 1975-1998 period. The main finding is that the prolonged rise in the government spending/GDP ratio is partially explained by cyclical upward ratcheting due to asymmetric fiscal behavior: the spending/GDP ratio increases during recessions and is only partially reduced in expansions. The long-run ratcheting effect is estimated as approximately 2 percent of GDP. Also analyzed are the cyclical changes in the composition of government spending (government consumption, transfers and subsidies, and capital expenditure), as well as a possible link between cyclical ratcheting and government weakness.

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1 Introduction

Government spending in the OECD countries has risen from an average of 27.4 percent of GDP in 1974 to 35.9 percent in 1998, i.e., by 8.5 percentage points. The share of government spending in output has been rising since the beginning of the twentieth century.[1] However, from the middle 1970s the spending drift has been accompanied by deficits and a growing public debt. This feature was linked in the literature to political and institutional mechanisms. For example, von Hagen and Harden (1996) and Alesina and Perotti (1999) studied the influence of budgetary institutions, and Roubini and Sachs (1989) and Kontopoulos and Perotti (1999) addressed electoral rules and the structure of parties and governments.

The hypothesis tested in this paper is that asymmetric government spending over the business cycle leads to upward *cyclical ratcheting* in government spending. The mechanism underlying this hypothesis—as described in Buchanan and Wagner (1978)—is that while countercyclical policy is conducted in recessions, high tax revenues in expansions make it difficult for governments to resist pressure from interest groups to reduce spending symmetrically. The results indicate that cyclical ratcheting of government spending in the OECD countries can explain a long-run increase of about 2 percent of GDP.

The cyclical pattern of government expenditure in industrial economies has been studied by Backus, Kehoe and Kydland (1995), Gavin and Perotti (1997), Talvi and Vegh (2000), and others. In particular, Gavin and Perotti present evidence of asymmetrical fiscal behavior over the cycle: government consumption is moderately procyclical in expansions, while in contractions government consumption and transfers are strongly countercyclical. The contribution of this paper to this literature is to test the link between this asymmetry and the spending/output drift.

The paper is organized as follows. Section 2 presents an empirical framework for the dynamic determination of government spending. Section 3 reports the results regarding total government spending, and in particular the estimate of a cyclical ratcheting coefficient. Section 4 decomposes government spending into its main components—government consumption, trans-

[1] Documentation of these long-term developments is presented in Tanzi and Schuknecht (2000).

fers and subsidies, and capital expenditure—in order to analyze the differential impact of cyclical ratcheting. Section 5 reports two additional tests. The first is whether cyclical ratcheting is related to government weakness, and the second is whether there was a regime change in the determination of government spending during the early 1990s. Section 6 contains concluding remarks.

2 Dynamic determination of the government spending/output ratio

In the following framework the dynamics of government spending are determined by (1) basic considerations (long-run equalization of marginal benefit to marginal cost) and (2) cyclical considerations. The specification is empirically oriented, aimed at the estimation of the degree to which cyclical spending behavior affects the long-run level of the government spending/output ratio, denoted as $\mathbf{g}_t = g_t/y_t$.

2.1 Basic considerations

The basic criterion affecting the dynamics of $\mathbf{g}$ is the long-run equalization of marginal benefit to marginal cost from the policymaker's point of view—which may or may not coincide with those of society. Long-run marginal benefit is specified as $\beta(\gamma - \mathbf{g}_t)$, $\gamma, \beta > 0$. Marginal benefit decreases with $\mathbf{g}_t$, and γ is the bliss level beyond which government expenditures have negative marginal benefit. Marginal cost is formulated as $c + \omega\mathbf{g}_t$, $c, \omega > 0$. Increasing marginal cost may follow from the marginal deadweight loss of taxation, or from a relative price response to government demand.

The basic dynamics are formulated as

$$\Delta(\mathbf{g}_t)^* = \pi[\beta(\gamma - \mathbf{g}_{t-1}) - (c + \omega\mathbf{g}_{t-1})], \tag{1}$$

where Δ indicates the *growth rate* and $0 < \pi < \infty$. The spending/output ratio increases when the marginal benefit exceeded the marginal cost in the previous period (decreases in the opposite case). The positive but finite nature of π captures adjustment costs in changing $\mathbf{g}$. Equating marginal benefit to marginal cost yields the basic long-run ratio: $\mathbf{g}^* = \frac{\gamma\beta - c}{\beta + \omega}$.

In the context of the basic considerations, an increasing spending/output ratio—as in the OECD since 1974—could be rationalized by an upward shift in β or γ or by a downward shift in c at that time, triggering a process of convergence to a higher $\mathbf{g}^*$.

2.2 Cyclical considerations

Defining

$$\begin{aligned}(\Delta y_t)^p &\equiv (\Delta y_t - \overline{\Delta y})d_t, \\ (\Delta y_t)^n &\equiv (\Delta y_t - \overline{\Delta y})(1-d_t),\end{aligned}$$

where $\overline{\Delta y}$ is the average growth rate and

$$\begin{aligned}d_t &= 1 \text{ if } \Delta y_t > \overline{\Delta y}, \\ d_t &= 0 \text{ if } \Delta y_t < \overline{\Delta y},\end{aligned}$$

the cyclical spending behavior is specified as

$$(\Delta \mathbf{g}_t)^c = \alpha_1 (\Delta y_t)^p + \alpha_2 (\Delta y_t)^n . \tag{2}$$

The coefficients α_1 and α_2 capture the spending pattern in "expansions" and "contractions," respectively.

The cyclical pattern of government spending may have two alternative forms: (a) symmetric behavior in expansions and contractions, (b) asymmetric behavior.

(a) Symmetric behavior

In this case, $\mathbf{g}$ reacts in the same way to $(\Delta y_t)^p$ and to $(\Delta y_t)^n$, i.e., $\alpha_1 = \alpha_2 = \alpha$. When $\alpha = 0$, the evolution of $\mathbf{g}$ is unrelated to the cycle. If $\alpha > 0$, $\mathbf{g}$ increases in expansions and decreases in contractions (procyclical), and the vice versa (countercyclical) when $\alpha < 0$.[2] A special case is $\alpha = -1$,

[2]Under this definition, expansions and contractions are relative to average growth, while in the standard definition they are relative to zero (i.e., an expansion is a movement from trough to peak, $\Delta y_t > 0$, and a contraction is a movement from peak to trough, $\Delta y_t < 0$). The definition adopted here has the characteristic that expansions and contractions average over time to zero. An analysis based on the standard definition of expansions/contractions is reported in Appendix C.

where cyclical spending collapses to constant growth at the average growth rate of output.[3]

In the terminology of Buchanan and Wagner (1978), symmetric cyclical spending can result from the implementation of Keynesian economic policies in an idealized environment—i.e., policies that would be implemented by a benevolent Keynesian planner who is free of short-sighted considerations. This planner would generate deficits in recessions by increasing spending, and symmetric surpluses in expansions by reducing spending. In principle, this type of behavior could reflect, for example, an optimal cyclical pattern of public investment, or unemployment benefits that produce a more efficient job search.

(b) Asymmetric behavior

Buchanan and Wagner stress the asymmetry that emerges from attempting to implement Keynesian economic policies in a *realistic* environment, in which policy is also affected by short-sighted considerations. Increasing spending during recessions is likely to be politically attractive. In expansions, however, a symmetric reduction of spending is hard to implement since tax revenues abound: powerful interest groups, which may represent acute needs from their own point of view, are unlikely to be convinced that available tax revenues should be put aside because that is the right time to be thrifty.

The asymmetric behavior described above implies that $\alpha_1 > \alpha_2$. In this case, fluctuations in output growth are accompanied by an *increasing* spending/output ratio over time. The quantitative importance of this mechanism can be measured by the ratcheting coefficient $\phi \equiv \alpha_1 - \alpha_2$.[4]

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[3] To see this, note that when $\alpha_1 = \alpha_2 = -1$,

$$(\Delta g_t)^c - \Delta y_t \equiv (\Delta \mathbf{g}_t)^c = -((\Delta y_t)^p + (\Delta y_t)^n) = \overline{\Delta y} - \Delta y_t.$$

Hence, $(\Delta g_t)^c = \overline{\Delta y}$. When $\alpha < -1$, $(\Delta g_t)^c > \overline{\Delta y}$ in recessions and$(\Delta g_t)^c < \overline{\Delta y}$ in expansions.

[4] The spending behavior in expansions is related to the "flypaper effect," which refers to the finding that grants to state and local governments in the U.S. encourage their spending much more than it could be predicted from income effects. See Hines and Thaler (1995) for a survey and interpretation of this phenomenon. Cyclical ratcheting can be seen as a combination of countercyclical policy, coupled with "flypaper" behavior in booms, which renders spending behavior asymmetric over the cycle.

2.3 Empirical formulation

The basic and the cyclical considerations are included together in the regression equation

$$\Delta \mathbf{g}_t = (\Delta \mathbf{g}_t)^* + (\Delta \mathbf{g}_t)^c + \varepsilon_t = \alpha_o + \alpha_1 (\Delta y_t)^p + \alpha_2 (\Delta y_t)^n + \lambda g_{t-1} + \varepsilon_t, \quad (3)$$

where $\alpha_o = \pi(\beta\gamma - c)$, $\lambda = -\pi(\beta + \omega)$ and ε_t is a white noise error.[5]

To illustrate the ratcheting mechanism, let us consider the following example, which can be considered as a benchmark case. Assume that the elasticity of tax revenues with respect to output is one. In expansions all additional tax revenue is spend, and hence, given unitary elasticity of tax revenue, $\mathbf{g}$ remains constant. This implies that $\alpha_1 = 0$. In recessions, spending grows at the normal rate, and correspondingly $\alpha_2 = -1$. In this case, the ratcheting coefficient ϕ is $\alpha_1 - \alpha_2 = 1$. In terms of the drift of $\mathbf{g}$ over time, after two years with $(\Delta y_t)^p = 0.01$ in one and $\Delta y_t^n = -0.01$ in the other, the spending/output ratio is higher than previously by one percent.

The regression coefficients can be used to compute the basic level of $\mathbf{g}$ in the long-run:

$$\mathbf{g}^* = \frac{(\beta\gamma - c)}{(\beta + \omega)} = -\alpha_o/\lambda. \quad (4)$$

The actual long-run ratio can be obtained from (3) by equating $\Delta \mathbf{g}_t$ and ε_t to zero, the cyclical variables to their average levels, and solving for $\mathbf{g}_{t-1}$ in the long run. The resulting ratio is

$$\widetilde{\mathbf{g}} = -\left[\alpha_o + \alpha_1 \overline{(\Delta y)^p} + \alpha_2 \overline{(\Delta y)^n}\right]/\lambda.$$

Given that $\overline{(\Delta y)^p} = -\overline{(\Delta y)^n} \equiv \sigma$, $\widetilde{\mathbf{g}}$ can be written as

$$\widetilde{\mathbf{g}} = \mathbf{g}^* + \phi\sigma/(-\lambda). \quad (5)$$

[5] Stationarity of $\mathbf{g}$ requires that λ is negative, as the current framework predicts. A problem with panel data regressions of this type is that the estimate of λ is biased towards stationarity. This bias is large when the length of the sample is small relative to the number of cross-section units. See Nickell (1981) for a computation of this bias when the length of the sample is small and the number of units goes to infinity. The sample to be used here, however, is moderately long.

Hence, the long-run spending/output ratio is higher than $\mathbf{g}^*$ if there is cyclical ratcheting. Besides ϕ, the magnitude of the additional term depends positively on the amplitude of the cycle, σ, and negatively on $|\lambda| = \pi(\beta+\omega)$, which determines the speed of convergence to the long-run. The higher π, β or ω, the sooner upward ratcheting is balanced by the downward effect of the higher level of spending.

The likelihood of a lag between the timing of economic activities being taxed and actual tax collection makes desirable to include also lagged cyclical variables. Hence, equation (3) is generalized as follows:

$$\Delta \mathbf{g}_t = \alpha_o + \alpha_{11} (\Delta y_t)^p + \alpha_{12} (\Delta y_{t-1})^p + \alpha_{21} (\Delta y_t)^n + \alpha_{22} (\Delta y_{t-1})^n + \lambda \mathbf{g}_{t-1} + \varepsilon_t. \tag{6}$$

The ratcheting coefficient is now defined as $\phi \equiv (\alpha_{11} + \alpha_{12}) - (\alpha_{21} + \alpha_{22})$.

Two remarks regarding the interpretation of the estimates from this model are in order. First, an alternative rationalization of the ratcheting effect could be based on a welfare function where unemployment increases the marginal benefit from related spending at a growing rate. In this case, the amplitude of the cycle would raise the average level of optimal spending—in a similar way as in equation (5).[6] However, if there are tax smoothing considerations, the permanent nature of ratcheting implies that it should not be accompanied by deficits. This interpretation seems inconsistent with the observed deficits and growing public debt during the period studied.[7]

Second, the discussion above is based on the assumption that the cyclical variables are exogenous. Blanchard and Perotti (1999) have estimated, using U.S. data, small but persistent effects of government spending shocks on output. With this type of reverse causality, there should be a positive correlation between the cyclical variables and ε_t, and hence the individual estimates should be biased. The important question in the present context, however, is whether the estimate of the coefficient ϕ should also be biased. Appendix A addresses this question, and the discussion can be summarized

[6] When unemployment exceeds the normal rate (assuming that this corresponds to $(\Delta y_t)^n < 0$), the marginal benefit from g would increase more than the absolute decline in the opposite case. Hence, cyclical fluctuations would lead to a higher average $\mathbf{g}$.

[7] According to Barro's (1979) tax smoothing hypothesis, because ratcheting is known in advance, a welfare-maximizing government should raise the tax rate at the beginning of the planning period, generating an initial surplus.

here as follows: although individual coefficients should be biased when reverse causality is present, this is not necessarily the case for the difference $\phi = \alpha_{11} + \alpha_{12} - (\alpha_{21} + \alpha_{22})$. If (a) output growth is symmetric around average, and, in a parallel fashion, (b) government spending affects output symmetrically, there should be no bias in the estimate of ϕ. When (a) and (b) do not hold, two opposite forces exist. Hence, if these effects do not fully offset each other, a bias may exist in an unknown direction.

3 Estimation results

3.1 The data

The panel data set used to estimate equation (6) includes the 22 OECD countries that appear in Table 1. The data, from Government and Financial Statistics (GFS), are annual figures over the period 1975-1998.[8] The variable g is matched to consolidated central government spending (including interest payments) and y is represented by GDP in constant prices. The ratio g/y, however, is computed using nominal variables, as a better measure of the share of government spending in output.[9] The average growth rate, $\overline{\Delta y}$, is country specific, i.e., $(\Delta y_t)^p$ and $(\Delta y_t)^n$ are the deviations of output growth in a given country from the average in the same country over the 1975-1998 period.

Given that the hypothesis refers to the cyclical pattern of government spending, it is important to have large cyclical variation in the sample. The use of panel data for 22 countries contributes in this respect, since in each individual country the degree of cyclical variation during the 23-year sample is small. Output growth across countries is not strongly correlated, the average correlation across the 22 countries is 0.21.

[8] There are some changes in the GFS definitions during the sample period, two of the major changes being for Japan, 1991, and Greece, 1991. All the regressions reported in the paper exclude 1991 for these two countries. All other changes (in 8 out of more than 400 data points) are minor. Excluding these observations does not affect the results.

[9] Alternatively, **g** could be computed as the ratio of spending in constant prices to output in constant prices. However, using data in constant prices implies that changes in public-sector wages—which are treated as price changes—are not captured. We prefer to match **g** to the total burden of government spending relative to output.

Spending by the consolidated central government includes central government and social security funds, but excludes regional governments.[10] In terms of composition, it includes four categories: (i) government consumption, (ii) transfers and subsidies, (iii) capital expenditure, and (iv) interest payments.

Table 1: Government expenditure (percentage of GDP)

Country	1975	End of sample	Increment
United States	21.0	19.8 (1998)	-1.2
United Kingdom	38.9	36.7 (1998)	-2.2
Austria	34.8	40.5 (1997)	0.7
Belgium	44.4	46.4 (1997)	2.0
Denmark	34.6	41.6 (1995)	7.0
France	36.6	46.1 (1997)	9.5
Germany	29.6	32.6 (1998)	3.0
Italy	35.0	44.1 (1998)	9.1
Netherlands	48.4	48.0 (1997)	-0.4
Norway	35.0	35.7 (1997)	0.7
Sweden	29.4	40.7 (1998)	11.3
Switzerland	18.5	27.9 (1997)	9.4
Canada	21.0	24.1 (1995)	3.1
Japan	14.7	23.7 (1993)	9.0
Finland	28.0	34.5 (1997)	6.5
Greece	30.5	33.7 (1997)	3.2
Ireland	40.6	35.3 (1996)	-5.3
Portugal	32.7	40.6 (1997)	7.9
Spain	20.7	36.1 (1996)	15.4
Australia	22.2	27.1 (1998)	4.9
New Zealand	33.2	33.4 (1998)	0.2
Turkey	16.4	29.9 (1997)	13.5

Table 1 shows some basic statistics from the data set. In most countries (all except the United States, the United Kingdom, Ireland, and the

[10]Transfers from central governments to regional governments are included in central government data. The data on spending of general government—i.e., including the net additional spending of regional governments—are used in separate regressions which are also reported. The sample in this case, however, is considerably smaller.

Netherlands), the spending/GDP ratio increased during the sample period. Additionally, there is a wide heterogeneity of government spending levels: the approximate ranges are 15-48 percent of GDP in 1975 and 20-48 percent at the end of the sample.

3.2 Total government expenditure

The panel estimation of equation (6) includes idiosyncratic constants (α_0), which allows for computing $\mathbf{g}^*$ for each country.[11] A GLS procedure is adopted to deal with cross-section heteroskedasticity, with weights computed from the residual variances for each country in a preliminary OLS regression. The OLS estimation is also reported. The estimates of the cyclical parameters are presented in Table 2. The country-specific constants, along with the long-run implications of the model, are reported in Table 3.

Table 2: Total government expenditure			
Dependent variable: $\Delta\mathbf{g}_t$			
Sample: 1976-1998 (standard errors in parentheses)			
Variable - Coefficient*		Weighted - using cross-section variances	OLS**
$(\Delta y_t)^p$	α_{11}	-0.670 (0.150)	-0.580 (0.224)
$(\Delta y_{t-1})^p$	α_{12}	-0.038 (0.158)	0.219 (0.237)
$(\Delta y_t)^n$	α_{21}	-1.425 (0.129)	-1.232 (0.255)
$(\Delta y_{t-1})^n$	α_{22}	-0.348 (0.118)	-0.315 (0.195)
$\mathbf{g}_{t-1}$	λ	-0.417 (0.042)	-0.435 (0.073)
R^2		0.236	0.245
Ratcheting coefficient ϕ		1.066 (0.318)	1.185 (0.515)
Observations: 23; Number of countries: 22			
Total panel observations: 468			
* Country-specific constants included			
** White heteroskedasticity-consistent standard errors			

[11]Table B1 in Appendix B reports the results when the cyclical parameters are also allowed to be country specific.

The results indicate the presence of cyclical ratcheting, and they can be elaborated as follows:[12]

- The estimates of ϕ in the two regression forms are 1.07 and 1.19, and significantly different from zero. In what follows we refer only to the weighted-regression estimate 1.07.[13] Similarly as in the benchmark example in Section 2, where $\phi = 1$, this estimate implies that following an artificial two-year cycle of 1 percent amplitude (1 percent above $\overline{\Delta y}$ in the first year and 1 percent below $\overline{\Delta y}$ in the second), the spending/output ratio is 1.07 percent higher than prior to the cycle.[14]

- Although the estimated ϕ is close to the benchmark example, the cyclical pattern is quite different. While in the example the coefficient for contractions was -1 (meaning that when output growth is lower than average, spending growth remains at the average rate), the corresponding estimate of $\alpha_{21} + \alpha_{22}$ is -1.77. Hence, spending growth in contractions is actually *higher* than normal (by 0.77 percent for each percentage point of output growth below $\overline{\Delta y}$. Spending in contractions, therefore, can be described as an active Keynesian-type countercyclical policy. For expansions, the coefficient in the benchmark example was 0—implying that spending grows at the same, higher-than-normal, rate as output—while the corresponding estimate of $\alpha_{11}+\alpha_{12}$ is -0.71.

[12] When the cyclical variables lagged two years are included, their coefficients turn out statistically insignificant.

[13] An additional GLS estimation carried out is based on the possibility that omitted factors within each group of countries—Europe, Asia/Pacific and North America—are similar. The corresponding, extreme, assumption is that the residual correlations within each group are the same. A new covariance matrix was obtained by replacing the covariances (from the OLS regression) within each group by the average for that group. (The variances and the covariances across groups were left the same). The resulting estimate of ϕ is 1.49 and statistically different from zero. The estimates from this regression are reported in Appendix D, Table D1.

[14] Equation (6) is also estimated with country-specific cyclical coefficients. These coefficients are reported in Appendix B, Table B1, along with the corresponding country-specific ratcheting coefficients. The estimates of ϕ are positive in 16 countries out of 22, but statistically significant only in 3. The low significance seems related to the small time series variation within each country. The estimation with common cyclical coefficients, and fixed effects, materially increases the degree of time series variation in the sample.

Except for Norway, all countries exhibit contemporaneous countercyclical policy in recessions (negative coefficients on $(\Delta y_t)^n$). These coefficients are significant in 12 countries.

This means that spending is actually expanded by only 0.29 percent for each percentage point of output growth above normal. This estimate reflects sizeable surpluses in expansions, rather than a balanced budget as in the benchmark example. However, the surpluses are not large enough to offset the deficits incurred in contractions.

- Finally, a remark is in order about the starting year of the sample for the regressions—1976. In 1974 and 1975, following the oil shock, there were sharp increases in government spending. Given that these were recession years, including them in the regressions would have increased the magnitude of the coefficient on contractions and the estimate of ϕ.

When data on general government—i.e., including spending of local governments net of transfers from the central government, obtained from the GFS—are used, the results are similar. The results are reported in Appendix D, Table D2. The estimated ratcheting coefficients are 0.736 and 0.859 for the weighted and OLS regressions, respectively, smaller than those reported in Table 2, but with similar levels of statistical significance. The sample, however is considerably smaller.

The estimates in Table 2 can be used to derive the optimal long-run spending ratio, $\mathbf{g}^*$ and accumulated ratcheting, $\widetilde{\mathbf{g}} - \mathbf{g}^* = \phi\sigma/(-\lambda)$, for each country in the sample. These magnitudes, computed using equations (4) and (5), are reported in Table 3.

Table 3: Optimal long-run **g** and accumulated ratcheting				
Country	α_0	$\mathbf{g}^*$	σ	$\phi\sigma/(-\lambda)$
United States	0.09	0.21	0.007	0.018
United Kingdom	0.15	0.37	0.009	0.019
Austria	0.16	0.39	0.009	0.017
Belgium	0.21	0.49	0.011	0.018
Denmark	0.17	0.40	0.012	0.022
France	0.18	0.44	0.008	0.014
Germany	0.12	0.28	0.008	0.032
Italy	0.19	0.46	0.011	0.019
Netherlands	0.22	0.52	0.008	0.014
Norway	0.16	0.37	0.009	0.019
Sweden	0.18	0.43	0.008	0.017
Switzerland	0.11	0.26	0.010	0.021
Canada	0.10	0.23	0.011	0.022
Japan	0.08	0.20	0.009	0.020
Finland	0.13	0.32	0.013	0.028
Greece	0.19	0.45	0.013	0.022
Ireland	0.16	0.38	0.021	0.032
Portugal	0.17	0.40	0.013	0.025
Spain	0.15	0.35	0.009	0.016
Australia	0.11	0.26	0.010	0.021
New Zealand	0.15	0.36	0.015	0.026
Turkey	0.09	0.22	0.017	0.037
Average		0.36		0.021

According to the estimates, the average optimal spending is 35.5 percent of GDP, and the average accumulated ratcheting is 2.1 percent of GDP.

To check the robustness of the results, we proceed as follows. First, interest payments, which depend on past events and thus cannot be considered as fiscal policy, are excluded from **g**. The results, not reported, are very similar to those in Table 2. Second, the upward trends in unemployment and the dependency ratio during the sample, which affect spending via their impact on unemployment benefits and pension payments, are controlled for.

3.3 Upward trends in unemployment and the dependency ratio

Unemployment has an upward trend during the sample period. Therefore, part of the upward drift in the spending/output ratio can be expected to be related to increasing unemployment benefit payments, and hence we control here for these developments. Given the strong correlation between actual unemployment and output growth, the Hodrick-Prescott trend of unemployment—computed for each country separately—is used in the regression. The dependency ratio, defined as the population over 65 years old divided by the working age population, also increased during the sample period. The data on this ratio is available only through 1995. Table 4 reports the regressions that include these two additional variables.

Table 4: Trends in unemployment and dependency ratio		
Dependent variable: $\Delta \mathbf{g}_t$		
Weighted - using cross-section variances (standard errors in parentheses)		
Variable*	Sample: 1976-1995	Sample: 1976-1998
$(\Delta y_t)^p$	-0.656 (0.153)	-0.642 (0.148)
$(\Delta y_{t-1})^p$	-0.055 (0.158)	0.006 (0.155)
$(\Delta y_t)^n$	-1.340 (0.131)	-1.356 (0.129)
$(\Delta y_{t-1})^n$	-0.230 (0.120)	-0.276 (0.118)
$\mathbf{g}_{t-1}$	-0.388 (0.045)	-0.385 (0.043)
d(dependency ratio)**	-0.087 (0.607)	—
d(unemployment trend)**	0.018 (0.006)	0.019 (0.005)
R^2	0.26	0.25
Ratcheting coefficient ϕ	0.858 (0.324)	0.996 (0.314)
Observations: 23; Number of countries: 22		
Total panel observations: 425 and 466		
* Country-specific constants included		
** First difference		

The first regression includes the first differences of both the unemployment trend and the dependency ratio. In the second regression only the unemployment trend is included. The unemployment trend is statistically significant, but the dependency ratio is not. The coefficients of the cyclical variables are similar to those in Table 2. The estimates of ϕ are somewhat lower than in Table 2, but remain significant.

4 Expenditure decomposition

We turn here to the disaggregated analysis of government expenditures. The three components considered are: (1) government consumption, (2) transfers and subsidies, and (3) capital expenditure. The considerations for total spending in Section 2 are adapted here as follows. The ratio of spending in component i to output denoted by $\mathbf{g}_t^i$, $i = 1, 2, 3$. The marginal benefit of spending in component i is $\beta^i(\gamma^i - \mathbf{g}_t^i)$, $\gamma^i, \beta^i > 0$, and the marginal cost is $c^i + \omega_i^i \mathbf{g}_t^i + \omega_j^i \mathbf{g}_t^j + \omega_k^i \mathbf{g}_t^k$, $c^i, \omega_i^i, \omega_j^i, \omega_k^i > 0$, $j, k \neq i$. This formulation of the cost allows for a crowding-out effect of spending in component i by spending in others. Similarly as for total spending—equation (1)—the evolution of disaggregated spending from basic considerations is described by

$$(\Delta \mathbf{g}_t^i)^* = \pi^i[\beta^i(\gamma^i - \mathbf{g}_{t-1}^i) - (c^i + \omega_i^i \mathbf{g}_{t-1}^i + \omega_j^i \mathbf{g}_{t-1}^j + \omega_k^i \mathbf{g}_{t-1}^k)],$$

or

$$\begin{aligned} (\Delta \mathbf{g}_t^i)^* &= \pi^i(\beta^i\gamma^i - c^i) - \pi^i(\beta^i + \omega_i^i)\mathbf{g}_{t-1}^i - \pi^i\omega_j^i \mathbf{g}_{t-1}^j - \pi^i \omega_k^i \mathbf{g}_{t-1}^k, \\ i &= 1, 2, 3, \ \ j, k \neq i. \end{aligned}$$

Including the cyclical considerations, the empirical equations (counterparts of equation (3)) are

$$\begin{aligned} \Delta \mathbf{g}_t^i &= \alpha_o^i + \alpha_{11}^i (\Delta y_t)^p + \alpha_{12}^i (\Delta y_{t-1})^p + \alpha_{21}^i (\Delta y_t)^n + \alpha_{22}^i (\Delta y_{t-1})^n \\ &\quad + \lambda^i \mathbf{g}_{t-1}^i + \theta_j^i \mathbf{g}_{t-1}^j + \theta_k^i \mathbf{g}_{t-1}^k + \varepsilon_t^i, \\ i &= 1, 2, 3, \ \ j, k \neq i, \end{aligned} \tag{7}$$

where $\alpha_o^i = \pi^i(\beta^i\gamma^i - c^i)$, $\lambda^i = -\pi^i(\beta^i + \omega_i^i)$, $\theta_j^i = -\pi^i\omega_j^i$, $\theta_k^i = -\pi^i\omega_k^i$.

The results are reported in Table 5. Cyclical ratcheting is found in the three components of spending, although for capital expenditure it is insignificant.[15] For government consumption, the ratcheting coefficient is

[15]The smaller cyclical ratcheting in capital expenditure seems related to its weaker cyclical behavior. It can be noted that, in general, the cyclical coefficients on capital expenditure are much smaller in magnitude than those on the other two categories.

1.30 and for transfers and subsidies it is 1.63. The result in the basic regression that total spending is strongly countercyclical in contractions, is also evident in the separated regressions. The sums of the coefficients for contractions, $\alpha_{21}^i + \alpha_{22}^i$, are -1.56, -2.08, and -1.16, for government consumption, transfers/subsidies and capital expenditure, respectively. The latter is barely significantly different from zero, and insignificantly different from -1. For government consumption and transfers/subsidies, however, the sums of the coefficients are significantly lower than -1, indicating active countercyclical spending in these two components during contractions.

Most of the cross effects are negative, as expected, but insignificantly different from zero. The cross effects on transfers/subsidies, however, are positive, and that of capital expenditure is even significantly different from zero. We did not find a satisfactory explanation for this positive cross effect. One may speculate that capital spending in productive infrastructure has a positive effect on economic activity, and thus on tax collection, beyond that captured by the cyclical variables. This consideration, however, should be consistent with positive effects on both government consumption and subsidies/transfers, while a positive effect was found only on the latter.

Table 5: Components of government expenditure

Dependent variable: $\Delta \mathbf{g}_t^i$, $i = 1, 2, 3$

Sample: 1976-1998 (standard errors in parentheses)

Variable*	Government consumption (1)	Transfers and subsidies (2)	Capital expenditure (3)
$(\Delta y_t)^p$	-0.467 (0.189)	-0.743 (0.196)	-0.098 (0.576)
$(\Delta y_{t-1})^p$	0.205 (0.191)	0.292 (0.205)	-0.287 (0.571)
$(\Delta y_t)^n$	-1.245 (0.177)	-1.510 (0.177)	-1.059 (0.558)
$(\Delta y_{t-1})^n$	-0.314 (0.152)	-0.571 (0.165)	-0.105 (0.465)
$\mathbf{g}_{t-1}^1$	-0.735 (0.208)	0.220 (0.236)	-0.256 (0.432)
$\mathbf{g}_{t-1}^2$	-0.121 (0.074)	-0.970 (0.100)	-0.091 (0.211)
$\mathbf{g}_{t-1}^3$	-0.246 (0.317)	0.746 (0.312)	-4.708 (1.052)
R^2	0.06	0.08	0.01
Ratcheting coefficients	1.296 (0.401)	1.630 (0.432)	0.779 (1.225)

Observations: 23; Number of countries: 22

Total panel observations: 451

* Country-specific constants included

5 Additional tests

5.1 Government weakness

Roubini and Sachs (1989) find a tendency to larger deficits in industrial democracies with weaker governments after 1973. Studies assessing the importance of the strength of budgetary institutions for fiscal policy outcomes include those of Hallerberg and von Hagen (1999) and Kontopoulos and Perotti (1999), who identify government weakness using cabinet size.

The related hypothesis considered here is that cyclical ratcheting is higher in countries with weaker governments. For this purpose, we use a measure of government weakness of the type constructed by Roubini and Sachs (1989), who define an index between 0 and 3 for government weakness: 0 represents a one-party majority parliamentary government, 1 represents a majority coalition government with two or three coalition partners, 2 represents a majority coalition government with four or more coalition partners and 3 represents a minority parliamentary government. The government weakness variable used is taken from de Haan, Sturm and Beekhuis (1999), who apply the same method as Roubini and Sachs for all the countries in our sample (except Turkey) for the period 1979-1995. We then build a dummy variable ($WEAK$) which takes the value 1 when the political weakness index is higher than average (across countries and time) and 0 when it is lower than average.[16] The interaction terms between $WEAK$ and the cyclical variables should detect additional ratcheting associated with weak governments. The dummy variable itself captures the differential $\mathbf{g}^*$ associated with weak governments.

[16]Similar results are obtained when the government weakness index itself is used.

Table 6: Government weakness	
Dependent variable: $\Delta \mathbf{g}_t$	
Sample: 1979-1995 (standard errors in parentheses)	
Variable*	Coefficient
$(\Delta y_t)^p$	-0.508 (0.152)
$(\Delta y_{t-1})^p$	-0.188 (0.168)
$(\Delta y_t)^n$	-1.306 (0.097)
$(\Delta y_{t-1})^n$	-0.288 (0.100)
$\mathbf{g}_{t-1}$	-0.463 (0.042)
$WEAK$	-0.003 (0.004)
$WEAK \times (\Delta y_t)^p$	-0.184 (0.213)
$WEAK \times (\Delta y_{t-1})^p$	-0.124 (0.240)
$WEAK \times (\Delta y_t)^n$	-0.357 (0.246)
$WEAK \times (\Delta y_{t-1})^n$	-0.169 (0.206)
R^2	0.32
Change in ϕ	0.218 (0.699)
Observations: 17; Number of countries: 21	
Total panel observations: 347	
* Country-specific constants included	

The results shown in Table 6 do not support the existence of a relationship between cyclical ratcheting and government weakness. According to the Wald test applied to the coefficients of the interaction variables with $WEAK$, the hypothesis that there is an additional bias related to government weakness cannot be accepted at standard significance levels. The coefficient of $WEAK$ itself is also insignificant at standard levels. It seems, therefore, that the cyclical ratcheting phenomenon is shared by countries with different degrees of government strength.[17]

5.2 Regime change in the 1990s

The Maastricht Treaty, which is relevant for a large group of countries in our sample, was signed in 1991 and approved through referendums during

[17] The current procedure ranks all governments along one dimension. Another possibility is to address separately different types of government institutions. Persson (2001) found a ratcheting effect in parliamentary systems.

the period 1992-1994.[18] This and other institutional arrangements that were put in place in the 1990s deal with the increasing share of government in the economy. From the point of view of the present framework, one may interpret these developments as a manifestation of the correction mechanism embedded in the dynamic equation, which leads to a stable long-run $\mathbf{g}$. Alternatively, establishing such institutions can be considered a regime change, which either constrains short-sighted policies—thereby diminishing cyclical ratcheting—or changes optimal spending.

The hypothesis of a change in fiscal regime is tested by introducing interaction terms between the cyclical variables and a dummy for the period 1992-1998, $D92$, (or for 1994-1998, $D94$), and the dummy variable itself. The choice of 1992 (or 1994) is due to the Maastricht Treaty approval. The interaction with the cyclical variables tests an effective constraint to politically-induced spending, and the dummy variable itself captures a change in the benefits or costs of government spending.

[18] The countries joining the treaty are (in parenthesis we quote the date of referendum approval): 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), Portugal (10.12.92), Spain (25.11.92), Denmark (18.5.93), United Kingdom (23.7.93), Germany (12.10.93), Austria (12.6.94), Finland (16.10.94) and Sweden (13.11.94). Source: Kessing's Records of World Events.

Table 7: Regime change in the 1990s		
Dependent variable: $\Delta \mathbf{g}_t$		
Sample: 1976-1998 (standard errors in parentheses)		
Variable*	$D92$	$D94$
$(\Delta y_t)^p$	-0.766 (0.166)	-0.767 (0.163)
$(\Delta y_{t-1})^p$	-0.030 (0.174)	0.009 (0.168)
$(\Delta y_t)^n$	-1.269 (0.154)	-1.331 (0.141)
$(\Delta y_{t-1})^n$	-0.299 (0.150)	-0.406 (0.135)
$\mathbf{g}_{t-1}$	-0.391 (0.044)	-0.372 (0.043)
$DYEAR$	-0.011 (0.005)	-0.012 (0.006)
$DYEAR \times (\Delta y_t)^p$	0.015 (0.420)	0.104 (0.470)
$DYEAR \times (\Delta y_{t-1})^p$	-0.418 (0.447)	-0.399 (0.501)
$DYEAR \times (\Delta y_t)^n$	-0.489 (0.288)	0.216 (0.326)
$DYEAR \times (\Delta y_{t-1})^n$	-0.151 (0.251)	0.239 (0.246)
R^2	0.22	0.24
Change in ϕ	0.247 (0.778)	-0.576 (1.147)
Observations: 23; Number of countries: 22		
Total panel observations: 468		
* Country-specific constants included		

The results are reported in Table 7. The coefficients of the dummy variables $D92$ and $D94$ are negative and significantly different from zero at the 5 percent level. This result can be interpreted as a reduction in the optimal size of government spending, induced by a lower marginal benefit or a higher marginal cost. The fact that the coefficient of $D94$ is larger than that of $D92$ may indicate a gradual change as the Maastricht Treaty was approved in the different countries. The change in ratcheting behavior (change in ϕ) is insignificant in both regressions. This suggests that the short-sighted considerations remain unchanged.

Table 8 shows the implications of the coefficients of $D92$ and $D94$ for the average long-run spending/output ratios ($\widetilde{\mathbf{g}}$) across the countries in the sample. Because these coefficients are negative, the computed $\widetilde{\mathbf{g}}$ values decline. For comparison, the actual average level of $\mathbf{g}$ at the end of the sample period is also included.

Table 8 - Average long-run government spending/output ratio ($\widetilde{\mathbf{g}}$)			
No dummy	Dummy for 1992-98	Dummy for 1994-98	Actual-1998
0.381	0.364	0.349	0.359

The no-dummy estimate follows from Table 3. The computation using $D92$ yields a lower level of spending, but it is still higher than the actual figure for 1998. When $D94$ is used, the computed $\widetilde{\mathbf{g}}$ is lower than the actual ratio in 1998.

An alternative role of the timing of the Maastricht dummy variables (1992 or 1994) is to test whether the delay in cutting expenditures after 1992 was due to a delay in implementing the guidelines, or to the recession that most countries in the sample experienced in 1992-1993. Given that the cyclical variables are included in the regression, the fact that the computed $\widetilde{g}$ using $D94$ is lower than the one using $D92$ supports the former interpretation.

6 Concluding remarks

This paper reports evidence that the prolonged increase in government spending/output ratios in OECD countries after 1974 is partially explained by cyclical ratcheting, whose accumulated effect is estimated as 2 percent of GDP. The spending/output ratio tends to increase in contractions, and its reduction in expansions is only partial. A separate analysis of the components of government expenditure indicates that while cyclical ratcheting is present in the three main components—government consumption, transfers and subsidies, and capital expenditure—it is particularly high in transfers and subsidies.

The mechanism generating asymmetric behavior was discussed by Buchanan and Wagner, who stress the consequences of implementing Keynesian economic policies in a realistic environment. In such an environment, increasing spending during recessions is likely to be politically attractive. In expansions, however, a symmetric reduction of spending is hard to implement since tax revenues abound, and it may be hard to withstand interest groups lobbying to spend them.

The possibility that cyclical ratcheting reflects cost-benefit considerations for increasing **g** seems inconsistent with the observed accompanying deficits if there are tax smoothing considerations. Since ratcheting generates permanent increases in spending, tax smoothing implies that it should be accompanied by parallel tax increases. The findings about the 1990s, shown in Table 7, are also relevant in this context: A tendency to reduce the long-run size of government becomes apparent following the Maastricht Treaty, but the cyclical asymmetry is found to remain the same as in the previous period. Hence, asymmetric behavior over the cycle does not seem to be a channel for achieving a planned change in the spending/output ratio.

References

[1] Alesina A. and R. Perotti (1999), "Budget Deficits and Budget Institutions', in J. M.. Poterba and J. von Hagen eds., *Fiscal Institutions and Fiscal Performance*, The University of Chicago Press.

[2] Backus D. K., P. J. Kehoe and F. E. Kydland (1995), "International Business Cycles: Theory and Evidence," in T. Cooley ed., *Frontiers of Business Cycle Research,* Princeton University Press.

[3] Barro R. J. (1979), "On the Determination of Public Debt," *Journal of Political Economy*, 87, 940-971.

[4] Blanchard O. and R. Perotti (1999), "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output", NBER Working Paper no W7269.

[5] Buchanan J. and R. Wagner (1978), "Fiscal Responsibility in Constitutional Democracy," *Studies in Public Choice,* 1, 79-97.

[6] de Haan, J. , J-E. Sturm and G. Beekhuis (1999), "The Weak Government Thesis: Some New Evidence," *Public Choice,* 101 (3-4), 163-176.

[7] Gavin M. and R. Perotti (1997), "Fiscal policy in Latin America," *NBER Macroeconomics Annual,* 12, 11-61.

[8] Hallerberg M. and J. von Hagen (1999), "Electoral Institutions, Cabinet Negotiations, and Budget Deficits within the European Union," in *Fiscal Institutions and Fiscal Performance*, ed. J. Poterba and J. von Hagen. University of Chicago Press.

[9] Hines, J. R. and R. H. Thaler (1995), "Anomalies: The Flypaper Effect," *Journal of Economic Perspectives*," 9, 217-226.

[10] Kontopoulos, J. and R. Perotti (1999), "Government Fragmentation and Fiscal Policy Outcomes: Evidence from OECD Countries," in J. M. Poterba and J. von Hagen, eds, *Fiscal Institutions and Fiscal Performance,* edited by , University of Chicago Press.

[11] Nickell, S. (1981), "Biases in Dynamic Models with Fixed Effects," *Econometrica*, 46, 1417-1426.

[12] Persson T. (2001), "Do Political Institutions Shape Economic Policy?" NBER Working Paper no 8214.

[13] Roubini N. and J. Sachs (1989), "Political and Economic Determinants of Budget Deficits in the Industrial Democracies," *European Economic Review*, 33, 903-938.

[14] Talvi E. and C. Vegh (2000), "Tax Base Variability and Procyclical Fiscal Policy," NBER Working Paper no 7499.

[15] Tanzi, V. and L. Schuknecht (2000) "*Public Spending in the Twentieth Century: A Global Perspective*," Cambridge University Press.

[16] von Hagen J. and J. Harden (1996), "Budget Processes and Commitment to Fiscal Discipline," International Monetary Fund Working Paper 96/78.

Appendix A
Econometric considerations

Reverse causality from government spending to output implies that the individual estimates are biased. The important question here is whether the estimate of the difference $\phi = \alpha_{11} + \alpha_{12} - (\alpha_{21} + \alpha_{22})$, should also be biased.

The present discussion is based on the OLS estimation-bias vector:

$$\widehat{\alpha} - \alpha = (X'X)^{-1}X'\varepsilon, \tag{8}$$

where $\alpha \equiv [\alpha_o, \alpha_{11}, \alpha_{12}, \alpha_{21}, \alpha_{22}, \lambda]'$, X is the $N \times 6$ observations matrix—with vectors: ones, $(\Delta y)^p, (\Delta y)^p_{-1}, (\Delta y)^n, (\Delta y)^n_{-1}$ and $\mathbf{g}_{-1}$—and ε is the vector of white-noise residuals. Under the assumption that ε is white noise it should be uncorrelated with the lagged variables, or $E((\Delta y_{t-1})^p \varepsilon_t) = E((\Delta y_{t-1})^n \varepsilon_t) = E(\mathbf{g}_{t-1}\varepsilon_t) = 0$.

The elements in $\widehat{\alpha} - \alpha$ are likely to be nonzero if there is reverse causality from government spending to output. However, they depend not only on $((\Delta y)^p)' \varepsilon$ and $((\Delta y)^n)'\varepsilon$, which are presumed to be positive, but also on $X'X$, or the entire correlation structure.

A special case for assessing $\widehat{\phi} - \phi$ is when $(\Delta y_t)^p$ and $(\Delta y_t)^n$ are uncorrelated with the lagged variables, and hence the dependence on the overall correlation structure is eliminated. In this case, the elements of the vector $(X'X)^{-1}X'\varepsilon$ corresponding to $(\Delta y_t)^p$ and $(\Delta y_t)^n$ can be written as if these two were the only explanatory variables. Correspondingly,

$$\widehat{\phi} - \phi = \widehat{\alpha}_{11} - \widehat{\alpha}_{21} - (\alpha_{11} - \alpha_{21}) = \frac{((\Delta y)^p)'\varepsilon}{((\Delta y)^p)'(\Delta y)^p} - \frac{((\Delta y)^n)'\varepsilon}{((\Delta y)^n)'(\Delta y)^n}$$

If reverse causality is symmetric, the numerators in this expression are equal, and if the distribution of Δy is symmetric, then the denominators are also equal. Hence, in this case this expression is asymptotically zero. However, as is true in general, in the current sample the distribution of Δy is slightly skewed to the left, or $((\Delta y)^p)'(\Delta y)^p < ((\Delta y)^n)'(\Delta y)^n$. This inequality generates a positive bias in the estimated ratcheting coefficient. However, this asymmetry suggests that positive shocks affect output less than negative shocks. If there is a corresponding asymmetric response to government spending, reverse causality from Δg to Δy is stronger in recessions than in expansions, and then $((\Delta y)^p)'\varepsilon < ((\Delta y)^n)'\varepsilon$ should also hold. This generates an offsetting negative bias in $\widehat{\phi}$.

One may summarize these arguments as follows: in the symmetric case $\widehat{\phi}$ should be unbiased; in the asymmetric case a bias may exist, in an unknown direction, if the two opposite considerations above do not fully offset each other.

The previous discussion was based on $(\Delta y_t)^p$ and $(\Delta y_t)^n$ being uncorrelated with the lagged variables. In fact, the sample correlations between $(\Delta y_t)^p$, $(\Delta y_t)^n$ and the lagged variables $(\Delta y_{t-1})^p, (\Delta y_{t-1})^n, \mathbf{g}_{t-1}$ are weak but nonzero. They range between -0.12 and 0.22. To gauge the quantitative implications of these nonzero correlations for the estimate of the ratcheting coefficient—relative to a situation of zero correlations—the following exercise was carried out.

Using the OLS formula $\widehat{\alpha} = (X'X)^{-1}X'\Delta\mathbf{g}$, the six elements in the matrix $X'X$ corresponding to $\sum_{t=1}^{N} x_{it}x_{jt}$, where $x_{it} = (\Delta y_t)^p, (\Delta y_t)^n$, $x_{jt} = (\Delta y_{t-1})^p, (\Delta y_{t-1})^n, \mathbf{g}_{t-1}$, were replaced by $\overline{x}_i\overline{x}_j$. This implies that the correlations between the x_is and the x_js are forced to be zero. The vector $\widehat{\alpha}$ was computed twice: before and after this substitution. Before the substitution—i.e., with the actual sample values—the computed coefficients of the cyclical variables are -0.56 and 0.32 for expansions, and -1.14 and -0.18 for recessions. These estimates differ somewhat from the OLS estimates in Table 2 because the present simplistic computation abstracts from fixed effects. The corresponding ratcheting coefficient is 0.72. After the substitution, the coefficients change to -0.39 and 0.39 for expansions, and -1.24 and -0.46 for recessions. The resulting ratcheting coefficient is now 0.79. Hence, the correlation with the lagged variables does not seem to affect $\widehat{\phi}$ much.

Appendix B

Table B1: Country-specific cyclical coefficients**					
	$(\Delta y_t)^p$	$(\Delta y_{t-1})^p$	$(\Delta y_t)^n$	$(\Delta y_{t-1})^n$	ϕ
US	-0.67	0.54	*-1.85	*-1.23	*3.0
UK	-1.00	-1.39	*-1.66	-0.25	-0.5
Austria	-0.62	0.02	*-1.84	-0.10	1.3
Belgium	-0.49	0.49	*-1.57	-0.53	2.1
Denmark	-0.72	-0.83	-1.47	0.05	-0.1
France	*-1.24	-0.33	*-1.36	-0.11	-0.1
Germany	0.89	*-2.93	*-0.87	0.05	-1.2
Italy	-0.85	-0.45	-0.71	1.35	-1.9
Netherlands	*-1.53	-0.08	*-1.18	-0.56	0.1
Norway	-0.65	-0.78	0.67	-0.39	-1.7
Sweden	-0.43	-0.01	*-2.53	-0.21	2.3
Switzerland	0.31	*-1.25	*-2.43	-0.47	2.0
Canada	0.81	0.97	*-2.01	-0.43	*4.2
Japan	-1.27	1.82	-0.89	-3.95	*5.4
Finland	-1.00	-0.35	*-1.90	-0.34	0.9
Greece	-0.94	0.59	-2.44	0.33	1.8
Ireland	-0.74	0.07	-1.64	-0.09	1.1
Portugal	-1.27	0.97	-0.01	-1.41	1.1
Spain	-0.90	0.81	-1.52	-0.09	1.5
Australia	-0.50	0.13	*-0.93	-0.65	1.2
New Zealand	0.10	0.61	-1.72	-0.53	3.0
Turkey	0.90	2.21	-0.15	0.61	2.7
* Significant at the 5 percent level					
** Country-specific constants included					

Appendix C

Here we consider the relationship between the definition of expansions and contractions used in the paper with the alternative, 'standard' one, where expansions and contractions are defined by $\Delta y_t > 0$ and $\Delta y_t < 0$, respectively. The latter requirement for a contraction is more stringent: growth has to be lower than zero, rather than lower than $\overline{\Delta y}$, which is positive. Hence, the range $0 < \Delta y_t < \overline{\Delta y}$, which corresponds to a contraction in the paper, is included in the expansion range under the alternative definition.

To facilitate the comparison of the results with those in the paper, the main regression (Table 2) is rerun with three, rather than two, ranges for output growth. The variable $(\Delta y_t)^p$ is an expansion under the two definitions. The variable $(\Delta y_t)^n$ is used along with the dummy variable D_t, which equals 1 when $0 < \Delta y_t < \overline{\Delta y}$, i.e., low but still positive growth, and 0 when $\Delta y_t < 0$. Hence, $(\Delta y_t)^n \times D_t$ and $(\Delta y_t)^n \times (1 - D_t)$ subdivide the $(\Delta y_t)^n$ variable. The difference between the two definitions has to do with $(\Delta y_t)^n \times D_t$. In the paper it is considered a contraction (i.e., it should affect $\mathbf{g}$ similarly as $(\Delta y_t)^n \times (1 - D_t)$), and under the alternative definition it is an expansion (i.e., it should affect similarly as $(\Delta y_t)^p$). The results, with the three ranges for output growth are presented in Table C1.

Table C1: Three ranges for output growth

Dependent variable: $\Delta \mathbf{g}_t$

Sample: 1976-1998 (standard errors in parentheses)

Variable*	
$(\Delta y_t)^p$	-0.516 (0.225)
$(\Delta y_t)^n \times D_t$	-1.483 (0.373)
$(\Delta y_t)^n \times (1 - D_t)$	-1.187 (0.183)
$(\Delta y_{t-1})^p$	0.291 (0.229)
$(\Delta y_{t-1})^n \times D_{t-1}$	-0.645 (0.379)
$(\Delta y_{t-1})^n \times (1 - D_{t-1})$	-0.296(0.167)
$\mathbf{g}_{t-1}$	-0.426 (0.057)
R^2	0.24

Observations: 23; Number of countries: 22

Total panel observations: 468; *Country-specific constants included

The coefficients of $(\Delta y_t)^n \times D_t$, (low but positive growth) are more similar to the coefficients of the negative growth variable, $(\Delta y_t)^n \times (1 - D_t)$, than to $(\Delta y_t)^p$. Using the Wald test, the hypothesis that the sum of the current and lagged $(\Delta y)^n \times D$ coefficients equals the sum of the corresponding $(\Delta y)^n \times (1 - D)$ coefficients cannot be rejected at any reasonable significance level. In contrast, the hypothesis that the current and lagged $(\Delta y)^n \times D$ coefficients equal those corresponding to $(\Delta y)^p$ can be rejected at any reasonable significance level. One may conclude that low but positive output growth is treated by fiscal policy as a contraction, similar to periods of negative growth. In other words, the definition of expansions and contractions used here seems more appropriate for the purposes of analyzing fiscal policy than the alternative one.

Appendix D

Table D1: Total government expenditure Weighted - based on three groups of countries*	
Dependent variable: $\Delta \mathbf{g}_t$	
Sample: 1976-1998 (standard errors in parentheses)	
Variable**	
$(\Delta y_t)^p$	-0.855 (0.193)
$(\Delta y_{t-1})^p$	0.387 (0.192)
$(\Delta y_t)^n$	-1.096 (0.184)
$(\Delta y_{t-1})^n$	-0.864 (0.156)
$\mathbf{g}_{t-1}$	-0.587 (0.069)
R^2	0.250
Ratcheting coefficient ϕ	1.493 (0.444)
Observations: 23; Number of countries: 22	
Total panel observations: 468	
* See footnote 13	
** Country-specific constants included	

Table D2: General government expenditure			
Dependent variable: $\Delta \mathbf{g}_t$			
Sample: 1976-1998 (standard errors in parentheses)			
Variable - Coefficient*		Weighted - using cross-section variances	OLS**
$(\Delta y_t)^p$	α_{11}	-0.706 (0.160)	-0.692 (0.155)
$(\Delta y_{t-1})^p$	α_{12}	-0.168 (0.166)	-0.002 (0.173)
$(\Delta y_t)^n$	α_{21}	-1.380 (0.128)	-1.318 (0.149)
$(\Delta y_{t-1})^n$	α_{22}	-0.231 (0.132)	-0.235 (0.138)
$\mathbf{g}_{t-1}$	λ	-0.364 (0.044)	-0.306 (0.051)
R^2		0.432	0.437
Ratcheting coefficient ϕ		0.736 (0.268)	0.859 (0.363)
Observations: 23; Number of countries: 19			
Total panel observations: 324			
* Country-specific constants included			
** White heteroskedasticity-consistent standard errors			