

Government Size, the Role of Commitments*

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Abstract.

We explore the hypothesis that long-term commitments affect the dynamics of government expenditure. With the aid of a simple median-voter model we interpret the pattern of increasing-then-constant tax rates observed in OECD countries in the second half of the last century: persistence of public expenditure and a lower bound on new interventions will push government size upward, and preferences of the electorate put a halt to this growth at some point. In this view, the fiscal policy variable is seen to consist of only a part of the total expenditure, the rest being predetermined by its past level.

Jel Numbers: H1, H5, N4

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I. Introduction

For most countries for which data exist the share of government in GDP has grown since the nineteenth century until around the 1980s, and remained constant or slightly decreased thereafter. Extensive recollections and analysis of the relevant facts are contained in the books by Tanzi and Schuknecht (2000) and Lindert (2004). To make a long story short, the first noticeable rise occurs from 1880 to the 1930s; then came the years around World War II, with the obvious impact of military outlays; and finally a widespread sharp acceleration in government interventions starting around 1960 took, in three decades, the share of the public sector to the levels we observe today.

Given the wealth increase occurred throughout the nineteenth century there is little doubt that expansion of the voting franchise has played a major role in the increase in social spending and public good provision in the 1880-1930 phase.¹ Skipping the war years, more complex becomes the task of explaining the post-war boom, on which the present paper concentrates. A critical analysis of theories and data is offered by Dennis Mueller (2003).

To shorten another long story, and referring the reader to the cited book for a comprehensive lists of references, the two main alternative approaches to the study of government size are based on the demand-driven median-voter model of Meltzer and Richard (1981) and on the supply-driven model of revenue-maximizing government initiated by Niskanen (1971).² Referring to the post-war decades under present focus, Mueller's concludes thus: "How much of the growth of government [...] can be explained by a slackening of the reins of government in citizens' hands, how much is a reflection of the preference of citizens transmitted through the political process, and how much reflects merely the preferences of those within the government remains a somewhat open question".

Indeed, casual observation of real governments' behavior makes it difficult to think that, with imperfect information on the part of voters and the possibility to resort to targeted transfers for politicians, supply-side factors like self-interested bureaucracy have no weight in the observed increase in the share of government. But to make sense of increases like the ones observed for example in the OECD area, where from 1970 to 1990 public expenditure grew on average from 35 to over 50% of GDP (see Figure 1), one must surely go beyond the idea of pork-barrel spending by non-benevolent governments, and think of the working of explicit electoral programs which have voters' support and call for public interventions. Moreover, without recurring to demand-side considerations it would be difficult to locate an upper limit to this growth. Indeed it seems reasonable

¹ Qualifications concerning tax collection effectiveness apply, see Aidt and Jensen (2009) and Aidt, Dutta and Loukoianova (2006).

² For surveys, data appraisals and general views one may also consult Holcombe (1989), Hosley and Borcharding (1997), Borcharding (1985) and Holcombe (2005). Not directly relevant for the dynamics of government size, but a relevant component of the general picture is, somehow in between, the literature building on the observation that the structure of the democratic processes also matters, dating back to the book by Buchanan and Tullock (1962) and extended to new insights by Persson and Tabellini (2000). Improvements in tax collection technology are also relevant, see e.g. Aidt and Jensen (2009)

to think that in mature democracies, in the long run observed equilibrium cannot be totally detached from voters' preference, and to this view we adhere.

The starting point of this paper is the seemingly neglected observation that governments' actions cannot be easily undone, because they most often involve long-term commitments. As is well known (in the economics literature at least since Baumol, 1967), a substantial part of public funds is spent on labor-intensive activities carried out by public servants and, certainly in the period under discussion, typically with long-term contracts; also, entitlements to services provided by the State are usually for good. Thus a fraction of a period's public expenditure is inevitably carried over to the future. Note, incidentally, that this fraction may well be larger than 1, because implied commitments and outlays are often underestimated, and it often happens that plans which are initially targeted to a restricted category are subsequently, by legislative intervention usually motivated by equity considerations, extended to much broader groups of beneficiaries. But if part of current expenditure is predetermined, *the decision variable relevant for policy concerns not the whole of G as usually thought, but only new interventions*. And these typically consists of new programs, except when the incumbent government embarks in costly termination of existing ones. As we shall see this way of looking at fiscal policy has interesting implications for the *dynamics* of the size of government and the tax rate. For even in absence of a deliberate policy intervention, the latter is driven up when income does not grow fast enough to generate sufficient revenue to meet past commitments; and of course it increases more in consequence of expansionary plans supported by the electorate. If incumbent governments do not dismiss existing programs if not pressed by the electorate, then we shall see that the tax rate tends to increase, given that new debt must be sooner or later matched by new taxes. In line with the median-voter view we shall assume that the upper limit on the relative size of government is determined by the median voter when she starts paying too much for the services it provides.

To sum up, accounting for the role of commitments in the process of government intervention in a median-voter model leads to the implication that *new plans do not just raise G , but directly its share on income G/Y* ; in the long run new plans will be viable only if not opposed by the majority of voters. In essence we buy the old simple story that new programs are added period after period as long as the public supports them. But we add that what swells in the process is not just the amount of public expenditure, but directly its share in the national income. Put otherwise, given long run size of government as determined by citizens' preferences, we isolate the forces behind the process driving the economy to that equilibrium.

Our interpretation of the post-war evidence on the tax rate and the size of government in the OECD countries derives from the view just expressed, and the belief that eventually 'democracy works'. The data are consistent with two alternative scenarios. In the first, median voters' evaluation of costs and benefits of government interventions have been changing over the post-war decades, weighing relatively more the benefits until the 80s, then the costs. Under this hypothesis the growth of governments has closely matched with the development of new programs a continuing, marked change in the electorates' preference for public goods. In the second scenario median voters' tastes

have been roughly constant over the period, in which case a sizable gap between the current size of government and the level acceptable by voters was to be closed in the course of the years. We favor the second hypothesis, because in the period in discussion there are no changes in the political process comparable to the extension of the voting franchise, and the skewness of income distribution has not varied much, as is reflected in the ratio between median and average income (cfr. Tullock, 1983 on this). In this view the main force that drew the tax rate upwards until the 1980s is the presence of a gap between the current size of government and the level acceptable by the majority of citizens. When the gap started to close voters' pressure put a halt to the process, with a likely correction for inevitable overshooting. Closing the gap took several decades because the spending potential of governments is, increasingly in time, limited by imperfect knowledge of what the economy may need and by what it may absorb at a given stage of development (more on this in section IV).

Focusing on new interventions as the relevant policy variable we also address two classical empirical problems: the relation of expenditure to business cycles, and its dependence on taxes and debt. Our fiscal policy variable appears to be anti-cyclical in an asymmetric way, in the sense that it is used to contrast downturns but it does not revert to lower levels during periods of expansion. Secondly, expenditure is negatively influenced by tax and debt levels as expected, but interestingly, when the interaction term between tax and debt is included tax and debt are not significant separately, while their joint effect is negative and highly significant. Thus it seems that budget considerations become binding when both tax and debt are high; otherwise government could make use of one of the two alternative financing sources to vary their spending.

The sequel of the paper is organized as follows. In the next section we sketch a simple model which motivates our analysis; section III confronts theory and data to estimate the extent to which current expenditure is predetermined; in section IV we apply the conclusions reached in the previous two to interpret post-war evidence on the dynamics of the tax rate; in section V the newly defined policy variable is regressed on a vector of usual policy determinants; section VI concludes.

II. Mechanics of Expenditure and Taxes

There are two goods, one produced by private individuals, the other by Gov. There is no capital, and leisure is not valued. The privately produced consumption good is obtained by labor, and productivity is stochastic over time. Each unit of the Gov-good is produced from the private good and labor, p units of private good and one of labor yielding one unit of Gov-good. So if quantities at time t are respectively C_t and G_t , total income Y_t in units of the private good is

$$Y_t = C_t + pG_t. \quad (1)$$

The point we make here is that owing to multi-period commitments the quantity G_t of Gov good produced at t depends on G_{t-1} . Our linear specification is

$$G_t = \xi_t G_{t-1} + g_t, \quad (2)$$

with g_t newly added intervention at t . We do not restrict g_t to be positive; if negative, it represents explicit cuts on expenditure which otherwise Gov has to sustain. The main consequence of this specification is that the real, discretionary policy decision at t is g_t rather than G_t . For notational convenience we let $z_t = g_t/G_{t-1}$, so that $g_t = z_t G_{t-1}$; then, letting $\zeta_t = \xi_t + z_t$, assumption (2) reads

$$G_t = \zeta_t G_{t-1}. \quad (3)$$

We assume that Gov must balance budget, so the tax rate τ must satisfy $\tau Y = pG$.³ Using this, equation (3) (multiplied by p) gives Gov budget constraint as

$$\frac{\tau_t}{\tau_{t-1}} = \frac{\zeta_t Y_{t-1}}{Y_t}. \quad (4)$$

Consumers have Cobb-Douglas utility $u(C, G) = C^{1-\alpha} G^\alpha$, with α varying across consumers and parameterizing relative preference on goods.⁴ In particular we let $\alpha = \alpha^m$ for the median consumer; so her MRS between C and G is

$$p^m(C, G) \equiv \frac{u_G}{u_C} = \frac{\alpha^m}{1 - \alpha^m} \frac{C}{G}.$$

If $\text{MRS} < \text{MRT} \equiv p$, utility would increase with a fall in G . But from $\tau Y = pG$ it follows that

$$p > p^m \iff \tau > \alpha^m. \quad (5)$$

So we assume that if $\tau > \alpha^m$ voters urge politicians to lower τ . From now on we denote by $\tau^m \equiv \alpha^m$ the median voter's utility parameter.

Since commitments make it difficult to cut spending we also assume that there is a lower bound z_t^{lb} for z_t (i.e. on g_t); this induces a lower bound $\zeta_t^{lb} = \xi_t + z_t^{lb}$ on ζ_t , and in turn on τ_t/τ_{t-1} from (4).

To complete the model we specify government information on τ^m and consequent action. Gov does not observe τ^m directly, but at each t does hear citizens' voice v_t , encoded into the realization of a random variable $v(\tau^m - \tau_{t-1})$ with mean $\tau^m - \tau_{t-1}$. Positive (resp. negative) voice corresponds to positive (resp. negative) pressure on government intervention, on average generated by $\tau^m > \tau_{t-1}$ (resp. $\tau^m < \tau_{t-1}$). Thus Gov observes $\tau_{t-1} + v_t$, the realizations of a random variable centered on the unknown mean τ^m . Letting $e_t(\tau^m)$ denote Gov's estimate of τ^m at t , we assume that $e_t(\tau^m) > \tau_{t-1}$ whenever $\tau_{t-1} \leq \tau^m$. This induces Gov to realize new projects, i.e. set $g_t > 0$, which are likely to entail an increase in τ . Indeed, to anticipate in the OECD data we observe

³ Of course, taken literally this is not realistic, and in the empirical analysis we take also public debt into account. On the other hand our attention is focused on long run trends, and debt must eventually be honored. This is confirmed in Figure (1) as expenditure falls relative to revenue.

⁴ The idea behind this reduced form utility is that the good provided by Gov is distributed uniformly to the citizens; so the poor like G more than the rich because in absence of public provision they could afford less of it hence enjoy a lower utility. An equivalent utility function is used by Barro (1990) for a representative consumer (and for different purposes).

⁵ Multiply inequality $p > p^m$ by G/C and note that $pG/C = (pG/Y)/(C/Y) = \tau/(1 - \tau)$.

$g_t > 0$ always implies a tax raise (technically we estimate $\xi_t = 1 + r_t$, where r_t is the growth rate of Y_t , whence $\tau_t > \tau_{t-1}$ iff $g_t > 0$).

If on the other hand $\tau^m < \tau_{t-1}$ we assume $e_t(\tau^m) < \tau_{t-1}$ so that, under voters' pressure, Gov will lower τ as much as it can towards $e_t(\tau^m)$ while meeting eq. (4). Given the lower bound ζ_t^{lb} , if $\tau_{t-1} > \tau^m$ Gov will then set

$$\tau_t = \max \left\{ e_t(\tau^m), \tau_{t-1} \frac{\zeta_t^{lb} Y_{t-1}}{Y_t} \right\}.^6$$

This government behavior will thus imply that in a situation where $\tau < \tau^m$ commitments tend to drive up τ towards τ^m : they make it difficult to lower the tax rate, and the involved costs are not offset any by benefits for politicians. Imperfect information makes convergence uneven and intermittent, for the government knows neither how much it can raise public spending nor what is the best way to do it, so that it occasionally experiments with new programs when it is relatively more confident to have voters' support, in particular during slumps or crises, and in general when the electorate's voice is clear about specific needs and directions of intervention. When on the other hand τ is close to τ^m , new programs pushing τ above τ^m will make it necessary to cut existing plans to bring tax rate back down to the level tolerable by the electorate. This gives a possible interpretation of the OECD data shown in Figure (1), assuming that median voter type has remained unchanged in the period under consideration.

III. Empirics of Commitment

In this section we turn to the empirical content of our model, in particular of the central assumption embedded in equation (2), by assessing the influence of past commitments on current expenditure. The model predicts some degree of persistence in public spending, and we now confront the hypothesis with the empirical data; we then test for the presence of unit root non-stationarity that the data suggest. It is worth emphasizing that the role of equation (2), and of its empirical counterpart (5) to follow, is to pin down the newly defined policy variable g/Y representing new interventions. Determinants of policy will be introduced in Section V once the dependent variable is well defined.

Data.

The model of section II emphasizes the role of the tax rate in the dynamics of government spending in the long run. On the empirical side, the tax rate is roughly approximated by the total government revenue, as a percentage of GDP. In order to make comparable the dimension on the revenue and spending side, we need a measure for the overall size of

⁶ The behavior we assume on the part of government is in the spirit of the (Markov perfect) equilibrium policy in Battaglini and Coate (2008), which is such that in times of abundance gov uses funds to finance pork-barrel projects, while if pressed by financial constraints it scales down intervention and eliminates transfers. The difference here is that we posit that government action does not have full flexibility, that there is a biting constraint to reversibility of choices.

government. Accordingly, we use the OECD data which report the total disbursements for general government including investment and transfers for all the components of central, state, and local governments. We examine a balanced panel of 20 countries covering the period 1960-2008.⁷ The data are collected from various issues of OECD Historical Statistics and OECD Economic Outlook, and summarized in Figure 1.

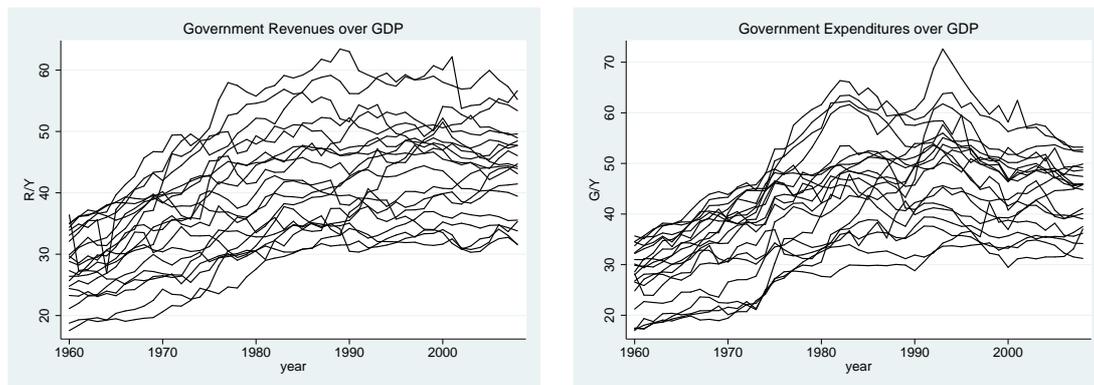


Figure 1. Government Revenue (left panel) and Government Expenditure (right panel), Percentage of GDP.

The paths observed in the data are obviously not monotone, owing to individual or common shocks which affect spending in the short run. This is reminiscent of Peacock and Wiseman (1961), but these shocks appear to be spread along time and not linked to single specific episodes.

In the rest of the section we abstract from the factors producing short run displacements to focus on the tendency of public spending to persist in the long run. Section V below then deals with the determinants of change in G/Y .⁸

Re-writing equation (2).

To assess the weight of long term commitments in the dynamics of government size we test how much its level tends to persist unless new shocks (represented by g_t in our model) occur. More precisely, we evaluate the coefficient λ in the panel regression

$$\frac{G_{it}}{Y_{it}} = \lambda \frac{G_{i,t-1}}{Y_{i,t-1}} + \gamma_t + \eta_i + \epsilon_{it}, \quad (5)$$

where i is country and variables are expressed in nominal terms.

We consider λ as a measure of the inertia of past expenditures. Turning back to government expenditure expressed by (2), one obtains (5) by assuming that ξ_t can be written as a constant multiple of Y 's rate of growth, $\xi_t = \lambda(1 + r_t)$.

⁷ The countries are Australia, Austria, Belgium, Canada, Denmark, Finland France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Sweden, Switzerland, United Kingdom and United States.

⁸ Albanese and Modica (2010) assess relevance of common shocks.

The value of λ is unrestricted in the model (in particular in equation (2)), but as the sequel of this section will show the data point to a hypothesis of $\lambda = 1$, which is never rejected by the tests we have run. The implication is that the long run trend for G/Y is to persist, so that the variation observed in the ratio of public spending to GDP in the decades under scrutiny should be explained by the process of new interventions.

Estimating λ .

We first estimate eq. (5). Table 1 contains estimates of λ obtained by different methods. Column 1 reports the value obtained by using a Fixed Effect estimator. This is a usual choice for analysis regarding countries, since it allows for correlation between the individual effect (in this case all the fixed factors in each country like political system rule and other) and the error terms. But the lag of the dependent variable produces a downward bias in the estimate of λ of order $1/T$ (Nickell, 1981). In addition, this bias could be more pronounced if the coefficients of λ is large, as it is in our case. For this reasons a better choice is a GMM estimator. This solution was initially proposed by Arellano and Bond (1991) and is based on exploiting the lagged values of the dependent variable to obtain a full set of instruments for the endogenous regressor in the first-differencing version of the dynamic (panel) equation. The Arellano-Bond estimator is refined by Arellano and Bover (1995) and Blundell and Bond (1998), who devise an estimator which performs better than the former if the autoregressive parameter is large; the estimate is in column 2. Consistency of this estimator in our case is confirmed by the test proposed in Arellano and Bond (1991) for the hypothesis of no second-order serial correlation for the disturbances and the Hansen test of over-identifying restrictions. An additional problem in our case is the small sample in the N dimension. There is an outstanding literature debating the efficiency of GMM methods to estimate dynamic equation in small panel. In particular, Judson and Owen (1999) and Bun and Kiviet (2001) show that the bias-corrected Least Squares Dummy Variable (LSDVC) estimator proposed by Kiviet (1995) outperforms the GMM estimator, and recommend this method if the cross-sectional dimension is not large. The LSDVC estimate is in column 3 of Table 1. For completeness we report pooled FGLS and OLS estimates in columns 4 and 5.

As shown in the table the preferred LSDVC estimator is close to 1, and none of the others is far from that value.

Testing $\lambda = 1$.

Given the estimates of λ just discussed, it is natural to test the hypothesis $\lambda = 1$. Again we do this by applying different methods. We first run the Levin-Lin-Chu (2002) test. This test assumes a specification similar to ours (it postulates each individual unit in the panel sharing the same AR(1) coefficient and allows for individual and time effects). We next consider the possibility of misspecification in the process postulated above, in particular the presence of heterogeneity in the AR parameter and cross-sectional dependence. In the first case the pooled estimators in dynamic heterogeneous panel models are inconsistent, and to address this problem Im, Pesaran and Shin (2003) have

TABLE 1
Panel Regressions of G/Y

	(1)	(2)	(3)	(4)	(5)
λ	0.941	0.967	0.991	0.983	0.987
p -value	0.000	0.000	0.000	0.000	0.000
Methods	FE	GMM	LSDVC	FGLS	OLS
Country effects	yes	yes	yes	no	no
Time effects	yes	yes	yes	yes	yes
Observations	960	960	960	960	960
R^2	0.97				0.97

Note. FE is fixed effect; GMM is the Blundell-Bond estimator; LSDVC is the Kiviet LSDV corrected estimator; the last two are pooled FGLS and OLS.

developed a unit-root test for this case. The IPS test is a way of combining the evidence on the unit root hypothesis from the N individual unit root tests performed on the N country series, thus avoiding the inconsistency problems in the estimation of a pooled λ parameter. An alternative is the Fisher test developed by Maddala and Wu (1999). This test has some advantage in our case because asymptotic results depend on T going to infinity (while in the IPS test the asymptotic results depend on N going to infinity).

The other issue is that the individual time series in the panel may not cross-sectionally independent. Philipps and Sul (2003) and Pesaran (2006) show that conventional panel estimators can result in misleading inference and even inconsistent estimators in this case. In our context the problem is mitigated by the presence of the common time effect which reduces the bias due to cross sectional dependence (Sarafidis and Robertson, 2009), but it is still interesting to consider time effect entering in a possibly different way for each country. We run the unit-root test introduced by Pesaran (2007) for this type of model.

Table 2 contains the results of the four tests just discussed. They all support the null $\lambda = 1$ in the AR regression (5) of the ratio G/Y .

IV. Budget Constraint and Post-war Evidence

The Budget Constraint

On the basis of the results of the previous section we now take $\lambda = 1$. Then $\xi_t \equiv \lambda(1 + r_t) = 1 + r_t$ and $\zeta_t \equiv \xi_t + z_t = 1 + r_t + z_t$. Then the government budget constraint

TABLE 2
Panel unit root Tests

	(1)	(2)	(3)	(4)
Statistic	-6.243	-1.492	44.83	-1.901
<i>p</i> -value	0.259	0.499	0.148	0.267
Method	LLC	IPS	MW	P

Note. H_0 is $\lambda = 1$. LLC is the Levin-Lin-Chu test; IPS is the Im-Pesaran-Shin test; MW is the Maddala-Wu test; P is the Pesaran test.

equation (4) becomes

$$\frac{\tau_t}{\tau_{t-1}} = 1 + \frac{z_t}{1 + r_t}, \quad (6)$$

where recall that z_t is defined by $g_t = z_t G_{t-1}$. This specification implies that owing to commitments inherited from the past new programs will always raise taxes, the more so the lower output growth; and that dually, to reduce the tax rate the government needs to intervene and breach existing obligations. This is politically costly, and it seems reasonable to assume that will be done only under pressure from the electorate, which is exerted if $\tau > \tau^m$ as explained in section II. Otherwise new programs will usually start with consequent increment of the tax rate.

Thus the assumption embedded in equation (2) applied to OECD post-war data confirm that as long as τ is lower than τ^m the tax rate will always increase, the more the higher g_t is pushed by political consensus. As argued before, it is reasonable to assume that when τ reaches its upper bound it will remain around that value as long as τ^m does not change.

Interpreting Evidence

We add a few comments on the interpretation of post-war evidence on government growth based on the approach presented in this paper. Given that new plans directly raise government relative size, part of the rise must be a response to society's demand for new, or renewed, public goods and services; and part of it is surely due to the Baumol (1967) effect.

Concerning the evolution of the electorate's preferences, as we mentioned in the introduction the data are consistent with different hypotheses; but there are also other forces at play, and a look at the period 1880-1930 may be useful to assess their relative strength. In those years one has to consider institutional change, in particular the widespread extension of the voting franchise; sustained income growth; and the drop in

the cost of broad-based tax collection (on the last aspect see Aidt and Jensen (2009)). Of these three factors, income growth has remained strong after war, but the political scene and tax collection technology have not undergone changes of comparable order. The citizen’s preferences do vary with income, but other than that the electorate’s structure has not seen dramatic variations, as confirmed by the constancy of the median-to-average income (cfr. Tullock, 1983). For this reason we think that the electorate’s preferences have changed but not very much and have determined the existence, until the 1980s, of a gap between current government size and the upper limit acceptable by the median voter.

If a gap is indeed present, new plans –and the government’s share in income with them– also expand as ‘experiments’, made possible by a loose check on government’s actions exerted by the electorate. The idea of experimentation is that even a benevolent government (that is, aside from bureaucrats’ self-serving objectives) operates in a context of imperfect information, hence is inclined to carry out a certain amount of experimentation on new interventions deemed useful for the society’s needs and/or for economic growth. The looser the check by the electorate, the larger the amount of new programs the government will implement. In the light of the findings presented in this paper we know that these plans accumulate unless explicitly canceled, contributing to the growth of government size.⁹

V. Policy, Taxes and Debt

Our approach highlights the distinction between two components in public spending: inherited expenditure and new interventions. Given the estimate $\xi_t = 1 + r_t$, the discretionary policy variable g_t/Y_t in equation (2) is $\Delta(G/Y)$. Note that it would reduce to the traditional G/Y if it were $\lambda = 0$ (no persistence). With $\lambda = 1$ the relevant variables are increments, of expenditure and taxes (given budget balance $\tau Y = pG$); and these, not absolute values, are after all the variables on which policy debates always center.¹⁰

In this section we focus on how the term $\Delta(G/Y)$ relates to the state of the economy, described by the GDP growth rate, and to budget constraints imposed by past taxes and debt. In particular, we analyze the following regression:

$$\Delta \frac{G_{it}}{Y_{it}} = \mu + X_{i,t-1}\phi + Z_{it}\beta + \gamma_t + \eta_i + \epsilon_{it},$$

where $X_{i,t-1}$ includes taxes and debt, and Z_{it} contains GDP growth and other control variables.

⁹ It may look puzzling that a gap reflecting a disequilibrium state may have lasted thirty years. But the yearly rates of increase in public spending, for instance in Europe, have been steadily already well above 5%, which as we know imply doubling in less than 15 years.

¹⁰ In the recent debate on effects of fiscal consolidation, see Alesina-Ardagna (2010) and IMF World Economic Outlook 2010 ch.3, the measurement of the fiscal variable is controversial. The issue is whether it is appropriate to measure *outcomes* of policy, in the form of cyclically adjusted net revenues, or *actions* taken by the fiscal authority, namely expenditure or tax changes. We are clearly in line with the second approach, which is the one the IMF supports.

We consider three different specifications. In all cases lagged variables account for the budget considerations motivated by past tax and debt evolution. The controls included in our regressions measure different covariates besides GDP growth (YGROWTH): the Consumer Price Index, as percent change from prior year (CPI); the long term interest rate (INTEREST); an index of openness to trade (OPEN), measured as the sum of import and export as a share of GDP; a measure of country size, the log of population (LNPOP); and a measure of welfare, the log of GDP per capita (LNYP).¹¹

Co-movements in the growth of G/Y due to some unobserved common dynamic effect may be relevant for validity of estimates. To address this problem we first use a Fixed Effect estimator (including also time dummies) and base the inference reported in columns 1, 2 and 3 of Table 3 on panel corrected standard errors (in parenthesis) as suggested by Beck and Katz (1995). This method seems more appropriate respect to the Driscoll and Kraay (1998) methodology when the time series dimension is larger than the cross-sectional dimension of the panel¹². When the unobservable common factors are correlated with the explanatory variables the Beck and Katz correction is inadequate, and to take this possibility into account we adopt the (pooled) correlated cross equation errors (CCEP) estimator developed in Pesaran (2006), who proposes to augment the individual-specific regression by means of weighted cross-section aggregates both of the dependent variable and the included regressors and shows that doing so permits to obtain more correct parameter estimates, reducing the cross-sectional correlation bias. Therefore we also estimate our three specifications using a LSDV estimator augmented with the cross-sectional means of the regressors plus the cross-sectional mean of the dependent variable. The CCEP estimates are in columns 4, 5 and 6 of Table 3.

In the first specification we look at the relationship between tax rate and new interventions. It would be an inverse relation if at low tax rates one has $e(\tau^m) > \tau$. Accordingly, column (1) and (4) in Table 3 include only a budget constraint, that is the lagged government Revenue over GDP (LTAX) as a measure of the tax rate. The coefficient is negative and significant, but this specification neglects the role of debt. Its presence removes the synchronism between increasing in spending and variation of the tax rate, weakening the tax constraint. To verify this we add in the second specification (columns 2 and 5) the Debt-to-GDP ratio (LDEBT) to account for the debt burden, while in the third (columns 3 and 6) the interaction of the two variables is also present. The interesting result is that when the interaction term is included tax and debt are not significant separately, while their joint effect is negative and highly significant. It thus seems that budget considerations become binding when both tax and debt are high; otherwise the government seems to manage spending increases by making use of one of the two alternative financing sources.

The estimates in Table 3 contain another result, in that public spending is found to be anti-cyclical. The debate on this issue is extensive and recent literature is surveyed

¹¹ Data for this section are available for the period 1960-2004. They are collected from different sources: data on public spending, taxes and debt from OECD; GDP growth, GDP per capita and population from GGDC dataset; CPI and interest rate from IMF; openness to trade from Penn World Tables.

¹²We thank the referee on this point

TABLE 3
Panel Regressions of $\Delta(G/Y)$

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
LTAX	-0.0832*** (0.0207)	-0.0356** (0.0159)	0.0290 (0.0359)	-0.0824*** (0.0167)	-0.0334 (0.0253)	0.0298 (0.0368)
LDEBT		-0.0156*** (0.0050)	0.0161 (0.0203)		-0.0157*** (0.0038)	0.0151 (0.0136)
LTAX×LDEBT			-0.0008** (0.0003)			-0.0008** (0.0003)
YGROWTH	-0.282*** (0.030)	-0.366*** (0.038)	-0.354*** (0.038)	-0.280*** (0.027)	-0.350*** (0.034)	-0.339*** (0.034)
INTEREST	0.098** (0.040)	0.132** (0.060)	0.133** (0.060)	0.097*** (0.035)	0.126*** (0.045)	0.126*** (0.045)
CPI	-0.049* (0.028)	-0.060 (0.042)	-0.059* (0.042)	-0.046* (0.024)	-0.053* (0.031)	-0.050 (0.031)
OPEN	-0.014** (0.007)	-0.015 (0.009)	-0.006 (0.009)	-0.014** (0.006)	-0.016** (0.007)	-0.008 (0.008)
LNYP	1.076* (0.560)	2.201* (0.978)	1.375 (1.152)	1.055* (0.552)	2.192** (0.907)	1.361 (0.971)
LNPOP	0.011 (1.090)	1.200 (1.283)	0.023 (1.153)	0.004 (1.053)	1.232 (1.591)	0.218 (1.672)
Methods	FE	FE	FE	CCEP	CCEP	CCEP
Country effects	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	no	no	no
Observations	774	586	586	774	586	586
R^2	.	.	.	0.458	0.515	0.520

Note. FE is fixed effect with standard errors obtained by Beck-Katz (1995) methodology; CCEP is Pesaran (2006) pooled estimator. Standard errors are in parenthesis. * p -value < 0.10 ** p -value < 0.05 *** p -value < 0.01

in Golinelli and Momigliano (2009). That paper explains why the results of the various studies differ so greatly and concludes that the assertion that fiscal policies in the OECD countries are pro-cyclical is not supported by the data. A more refined hypothesis concerning the cyclical behavior of g_t which our model suggests is that during recessions the voice for new intervention is likely to be present, while in expansions a symmetric reduction of spending is harder to implement since cutting entitlements determined by past programs is costly. To verify this, a different measure for the variation in GDP is needed. We then consider the output gap (YGAP), which is defined as the gap between actual and potential GDP as a percentage of potential, the latter being the level consistent with

TABLE 4
 $\Delta(G/Y)$ and the economic cycle

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
LTAX×LDEBT	-0.0005*** (0.0001)	-0.0004*** (0.0001)	-0.0004*** (0.0001)	-0.0005*** (0.0001)	-0.0004*** (0.0001)	-0.0004*** (0.0001)
YGROWTH	-0.361*** (0.039)			-0.346*** (0.032)		
YGAP		-0.244*** (0.069)			-0.223*** (0.060)	
YNEGGAP			-0.332*** (0.117)			-0.307*** (0.106)
YPOSGAP			-0.154 (0.146)			-0.135 (0.111)
INTEREST	0.126** (0.056)	0.152** (0.061)	0.146*** (0.058)	0.121*** (0.043)	0.148*** (0.047)	0.142*** (0.048)
CPI	-0.058* (0.039)	-0.002 (0.043)	-0.001 (0.043)	-0.049* (0.029)	-0.002 (0.032)	-0.004 (0.032)
Methods	FE	FE	FE	CCEP	CCEP	CCEP
Country effects	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	no	no	no
Observations	586	586	586	586	586	586
R^2	.	.	.	0.514	0.424	0.425

Note. FE is fixed effect with standard errors obtained by Beck-Katz (1995) methodology; CCEP is Pesaran (2006) pooled estimator. Standard errors are in parentheses. * p -value < 0.10 ** p -value < 0.05 *** p -value < 0.01

full utilization of all factors of production. Potential output cannot be observed directly from available data, so as usual we measure it as the country-specific trend of the log of real GDP obtained by using the Hodrick-Prescott filter; so YGAP is computed as the difference between the log of real GDP in the given country and its trend. This approach allows one to distinguish among positive and negative cyclical conditions. In particular, we can consider two additional variables (YPOSGAP and YNEGGAP) defined as the products of the output gap with dummy variables identifying respectively positive and negative gap values. In Table 4 we report our estimates, which confirm the asymmetric anti-cyclical character of public spending. As previously observed by Hercowitz and Strawczynski (2004) and Balassone et al. (2008), expenditure seems to grow relative to GDP in downturns and to remain stable when output is above its trend. In our paper the possibility of asymmetry arises naturally from the assumptions of persistence of expenditure and lower bound for new interventions

VI. Concluding Remarks

Assuming that long-term commitments affect the dynamics of government expenditure results in a novel view of the fiscal policy variable, which is seen to consist of only a part of the total expenditure, the rest being predetermined by its past level. This, together with a median-voter model of government size, helps explaining the long term pattern of increasing, then constant tax rate observed in OECD countries in the second half of the last century.

In our empirical analysis we find that the long-term trend in public expenditure is to grow at the same rate as the GDP. Its relevant implication is that under budget balance the tax rate does not decrease unless government dismisses existing programs under way. We also find that the discretionary fiscal policy variable is anti-cyclical, asymmetric and negatively affected by the joint impact of taxes and debt.

Finally, it is striking that a distinct common pattern clearly emerges from the data on taxes and expenditure in all the OECD countries on which data are available (see Figure 1), and an open question remains as to why this trend is so similar across countries. We begin to address the issue in Albanese and Modica (2010).

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