CO-MOVEMENT OF PUBLIC SPENDING IN THE G7

GIUSEPPE ALBANESE, SALVATORE MODICA ⋆

Abstract. The size of government in the G7 countries in the last fifty years follows a common pattern: it grows in the first three decades, then turns flat at the beginning of the nineties, for all countries alike. We highlight this common pattern in a dynamic factor model, and argue that a satisfactory explanation for it would be desirable.

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1. Introduction

There is a large literature, both theoretical and empirical, on the size of Government; references [7, 14, 21] are surveys, and [2, 10, 12, 15, 17] confront models with empirical evidence. An apparently unnoticed striking fact is that in the last fifty years the dynamics of government size in the developed countries follows a common trend, as Figure 1 shows for the G7 countries: size grows for the three decades starting from 60's and then, for all countries, stops growing in the 90's. What drives the common turn? We do not have a definite answer to this question, but as a first step we gauge the weight of this common underlying factor for the G7 countries.

We estimate a common component in the series of public spending after partialling out the effect of global business cycle by introducing explicitly this variable as a regressor in the model. We find that this common component has a significant impact on public spending in all countries but Japan.

The latent factor is a 'common feature' in the language of Engle and Kozicki [6]. Our starting point for an interpretation of the evidence just discussed is the following. We believe that government size is, in the long run, determined by voters' preference, in the spirit of the Meltzer-Richard median-voter model; the common trend must be

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⋆ Respectively Banca d'Italia and Facoltà di Economia, Università di Palermo, Italy. Email giuseppe.albanese@bancaditalia.it, modica@unipa.it. The views expressed in the present work are those of the authors and do not involve the responsibility of the institutions to which they belong. Modica gratefully acknowledges support from MIUR, Italy.

due to existence of global 'signals' to which somehow similar electorates react at the same time in the same way. Identification of such processes, which appear to influence preferences across borders, seems an interesting topic for further inquiry. We include a couple of comments in section 4.

2. Descriptive statistics

In this section, we summarize the evidence about the growth of Governments size in the G7 countries. From now on, our measure will be the total government expenditure (relative to GDP). Figure 1 plots the seven series against time; the data cover the period 1960-2006 and are collected from OECD sources. Firstly, we note the remarkable increase in Government size in particular in 60s and 70s. The (unweighted) average ratio of public spending to GDP grew from 29 per cent in 1960 to 41 per cent in 1980. As Tanzi and Schuknecht [21] point out, this expansion could reflect mostly a change in attitude toward the role of the state since it occurred when most countries were not engaged in war effort or voting reform. Analogously, public spending continued to grow (but less rapidly) in 80s, while in the first half of 90s there was an inversion in most of the countries.

There is a large literature on the size and growth of public spending. Previous works have analyzed the cross-sectional and the time-series variation. But it is

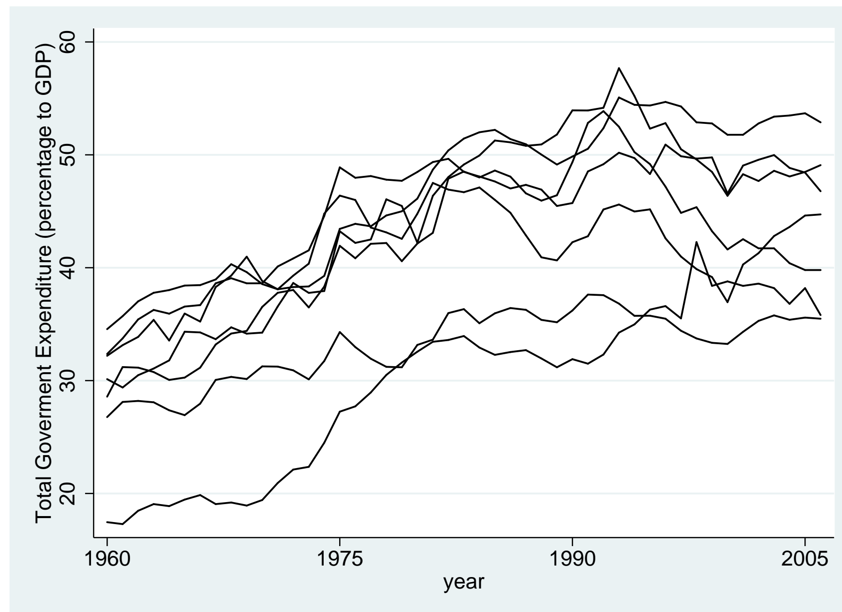

Figure 1. Government Size in the G7 countries

Table 1. Correlation among changes in Government size

	Canada	France	Germany	Italy	Japan	UK	USA
Canada	1						
France	0.396*	1					
Germany	0.474*	0.565*	1				
Italy	0.393*	0.570*	0.425*	1			
Japan	0.202	0.177	0.236	0.185	1		
UK	0.352*	0.488*	0.475*	0.236	0.063	1	
USA	0.763*	0.425*	0.518*	0.166	0.051	0.429*	1

Note. * $p < 0.05$

evident that Figure 1 is suggestive of the existence of another question, that is the presence of cross sectional dependence, referable to some common component.

In fact, and despite the relative size of Government, the variations observed in the government spending series seem to be similar in the G7. Table 1 reports the pairwise correlation between the first difference of total government expenditure (relative to GDP) for the seven countries. The coefficients are almost all significant, with the exclusion of the case of Japan and of the correlations between Italy from one hand and USA and UK from the other hand.

Once we notice this pattern, the question then arises as to how to explain it. A first possibility is linked to a reaction to the world business cycle. If all the countries react in the same way to common booms and slumps, we will observe a similar behavior of the public spending for all them. This interpretation is supported by previous findings. A lot of works (we cite, e.g., Norrbin and Schlagenhauf [16], Gregory and Head [9], Canova et al [3] and Kose et al [11]) show that it is possible to identify a common component in the business cycle of G7 countries. Beside this, there is some literature on the cyclical fiscal policy observing that government spending tends to be mildly countercyclical in the G7 countries (for example Lane [13] and Talvi and Veigh [20]).

Apart from this cyclical component, other factors could be at work. Ideological, political, demographic and economic factors were cited to explain the growth in Government size after the World War II in the industrialized countries. But the correlations presented in Table 1 suggest that, regardless of cross-country differences, the force behind this process seems to be largely contemporaneous for all the countries

In this work we do not supply a definite answer on what is that force, but as a first step we try to determine the weight of this common underlying factor for the

G7 countries. Since we choose to treat it as unobservable, we are going to use a factor model in which the dynamics of Government size is partially driven by the movements of the latent variable. The advantage of using this approach is two-fold. Ex-ante, it is not necessary to agree on the regressors able to proxy for the real factor. Ex-post, it is possible obtain an estimate for the latent variable useful to shine a light on its identity.

3. The Model

Dynamic factor models have been developed and applied in macro-econometrics; see Geweke [8], Watson and Engle [22] and Stock and Watson [18, 19]. Whereas a static factor model is used to explain the variance-covariance matrix among observed cross-sectional variables, a dynamic factor model looks at the spectral density matrix of a set of time series.

Let G_{it} denote a measure of growth of public spending for country i at time t. The dynamic factor model we consider is:

$$\begin{aligned} G_{it} &= \alpha_i F_t + \beta_i Y_t + \mu_i + E_{it} \\ F_t &= \rho F_{t-1} + \epsilon_t \\ E_{it} &= \phi_i E_{it-1} + \xi_{it} \end{aligned} \tag{1}$$

The growth of public spending in country i is decomposed into four components, two common and two country-specific effects. The first is the product of F_t and a time-invariant impact coefficient, α_i. The factor F_t is equal across countries and we interpret it as a measure of common influence on spending for the G7 countries. The alpha parameters are called factor loadings and capture the sensitivity to the latent factor. The second is the product of Y_t and a time-invariant impact coefficient, β. Y_t is a measure of global business cycle; in particular, according with the literature cited above, we choose to introduce a single measure of business cycle to partial out this factor. The third component is a time-fixed effect specific to country. Lastly, the fourth component, E_{it}, is a time-varying term specific to country i.

Our specification assumes the common factor F_t and the country-specific component E_{it} to be $AR(1)$ processes. We also assume that the innovations in the two processes are uncorrelated across countries and over time. The autoregressive parameters, the factor loadings and the business cycle coefficients are fixed; allowing for time variation would improve the explicative power of the model but greatly increase the number of parameters. Note that while Y_t is measured, F_t and E_{it} are two unobservables.

Basic versions of such models are often estimated by maximum likelihood. However, the presence of correlated errors and lagged variables makes maximum likelihood estimation more complex. Thus, following the usual approach, we transform

the model in state space form and apply Kalman filtering. In particular, the state space form consists of a state vector, a transition equation (giving the dynamics of the state vector) and a measurement equation that relates the state vector to observed variables. The advantage is that introducing state variables allows to reduce all dynamics to simple one-period dynamics. In the case of the one-factor dynamic model we consider, the state vector is composed by a single latent variable (factor). The transition equation governs how the latent variables evolve as functions of its past values. Lastly, the measurement equation ties a series of multiple indicators to the latent variable (and possibly also to other exogenous variables), such as happens in a static factor model. After transforming the model in state space form, Kalman filtering is used to separate out measurement errors from the real dynamics of the process.

4. Empirical findings

The dynamic factor model (1) is estimated using data on total government expenditures, as percentage of GDP, for the G7 countries.[1] The variable G_{it} which measures change in government size is taken to be the first difference of total government expenditure (relative to GDP). In Albanese-Modica [1] it coincides with the relevant fiscal policy decision variable in a balanced-budget setting. To estimate the model we also need a measure for the global business cycle. Following Crucini [4], we use a weighted average of yearly output growth rates of the seven countries, where the weights are proportional to GDP (in PPP terms). Figure 2 plots this measure against time.

Parameter estimates for the dynamic factor model are contained in Table 2. The impact of the common component F_t goes in the same direction for all countries. Moreover, the coefficients on the growth of government size are statistically significant (at 5 per cent) for all but Japan. This evidence confirms indication of a common feature in the variation of public spending on time. We note that fluctuations in this factor are very persistent. Its first-order autocorrelation is estimated to be 0,945. As we set apart a term for common cyclical effect, this latent factor seems to be linked to a structural phenomena and not to a cyclical dimension of the data.

With regard to the global business cycle, we note that its impact is negative for all the countries and significant (at 5 per cent) for six out of seven (except Japan again). This evidence is therefore linked to a counter-cyclical reaction to (global) business cycle. Summarizing, not only public spending grew after 1960, but in at least six of the G7 countries it also moved in the same time according to the presence of two elements: the reaction to the global economic cycle and the effect of a structural but unobservable common feature.

[1] Estimation was performed using the command `dfactor` in Stata 11.

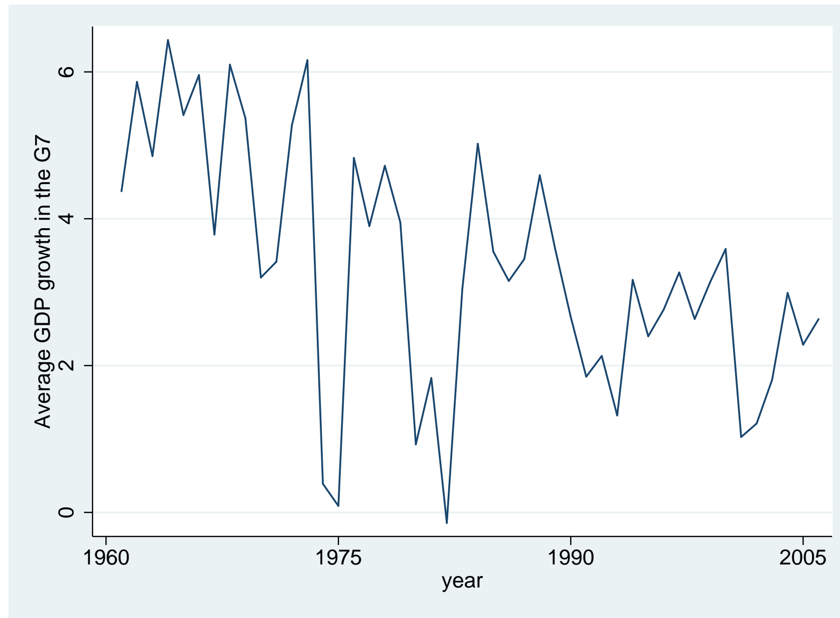

FIGURE 2. Average GDP growth in the G7 countries

It is possible to obtain an estimation for the latent variable. Figure 3 plots this latent factor against time. Because the factor is unobservable and we have only extracted an estimate of it, it is difficult to agree on what it represents. Nevertheless, if we interpret the latent variable as a measure of common willingness to modify spending, then this picture suggests that the consensus on spending policy was high in 60's and declining over time as government size and taxation grew larger. In particular, we note that at the end of 70's the factor switches from positive to negative values, suggesting a common 'message' to decrease spending. It is noteworthy that after the two oil crises the government size reached peaks and exceeded the 40 per cent in five of the G7 countries (Canada, France, Germany, Italy and the UK). After a short ascent in 1990 and 1991, a steep decline occurs in 1992 at the time of the Maastricht Treaty.

We can disentangle the contribution of common and specific components to the variation of public spending. In particular, we can rewrite G_{it} as:

$$G_{it} = G_{it}^C + G_{it}^S$$

where $G_{it}^C = \alpha_i F_t + \beta_i Y_t$ and $G_{it}^S = \mu_i + E_{it}$. Since we do not restrict the fixed country effects to be orthogonal to the common factors (and accordingly it is not true that $cov(G_{it}^C, G_{it}^S) = 0$), it is not possible to obtain an exact variance decomposition between the two term. But their observed correlation is negligible for all the countries,

Table 2. Results

	Impact coefficients		AR coefficient	% var. of G_{it} explained by common factors
	α	β	ρ	
Canada	0.542***	-0.807***		0.71
	(0.177)	(0.113)		
France	0.224***	-0.374***		0.46
	(0.089)	(0.108)		
Germany	0.362***	-0.540***		0.55
	(0.113)	(0.112)		
Italy	0.291**	-0.360**		0.18
	(0.124)	(0.159)		
Japan	0.121	-0.244*		0.07
	(0.085)	(0.135)		
UK	0.349***	-0.547***		0.34
	(0.140)	(0.155)		
USA	0.287***	-0.572***		0.74
	(0.094)	(0.061)		
Latent Factor			0.945***	
			(0.060)	

Note. Standard deviations are in parenthesis.

so that we can approximate the relative contribution of the common factors with the ratio $cov(\alpha_i F_t + \beta_i Y_t, G_{it})/var(G_{it})$. In the last column of Table 2 we report it for the seven countries.

5. Conclusions

Our empirical analysis finds that there are significant common movements in the growth of government size for the G7 countries. They are due in part to a response at the global business cycle, but we detect the presence of a latent factor that is also responsible for this behavior. Because the factor is unobservable and we have only extracted an estimate of it, it is difficult to agree on what it represents; so we argue that a satisfactory explanation for it would be desirable.

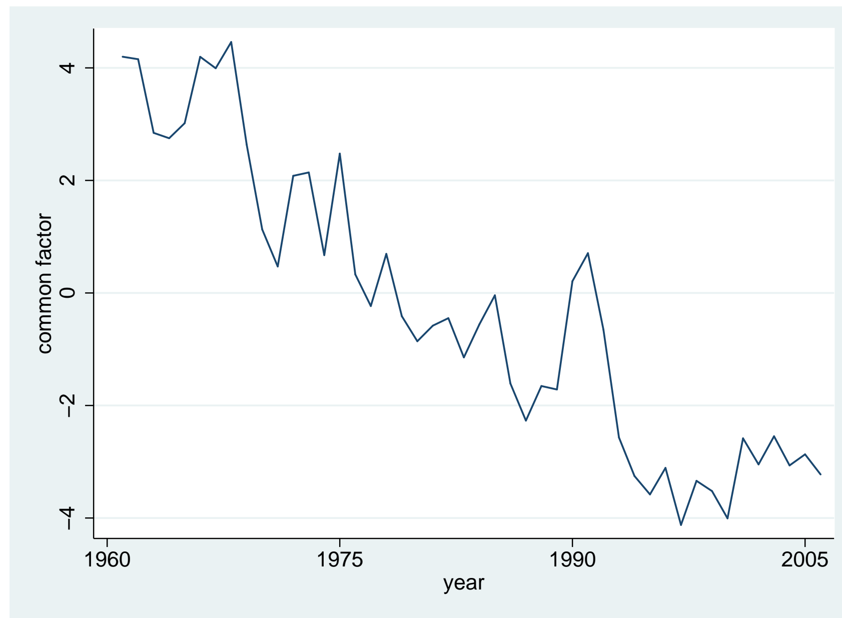

FIGURE 3. The latent factor behind common government dynamics

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