DECENTRALIZATION AS A CONSTRAINT TO LEVIATHAN: A PANEL COINTEGRATION ANALYSIS

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DECENTRALIZATION AS A CONSTRAINT TO LEVIATHAN:

A PANEL COINTEGRATION ANALYSIS*

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Abstract

This paper reconsiders the effects of fiscal federalism on the size of government: the Leviathan hypothesis, suggesting a negative relationship between fiscal decentralization and government growth, has been recently enriched by theoretical and empirical research that points out at the importance of distinguishing between grants and own resources to gauge the effects of fiscal decentralization on public sector size; moreover, several additional economic, demographic and political control variables have been proved to be empirically relevant. This paper improves on this literature by distinguishing long from short run relationships by means of appropriate panel cointegration techniques.

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1. Introduction

During the last two decades, a renewed interest has emerged for the design of fiscal relations across levels of government both in the practice and in the literature of public finance. Several industrial countries, especially in the European Union, have decentralized competencies and tax-raising powers to regional and local levels of government (OECD, 2002, 2003). Fiscal decentralization is also taking place in developing countries and in former Communist countries, with the aim of promoting economic and social development, protection from the risks of excessive concentration of political power, efficiency and transparency in the public sector (Panizza, 1999; Garrett and Rodden, 2002; Rodden, 2003). On the other hand, theoretical developments in economic and public finance theory, such as yardstick competition, tragedy of the commons, soft budget constraints, endogenous size of nations, incentives constraints in government structures and electoral accountability, brought to surface a large and complex set of channels linking fiscal decentralization with government size, economic efficiency, and political transparency.

To find our way through this variety of effects of fiscal decentralization, it is important to characterize their temporal dimension. Although implicitly and indirectly, the theoretical literature has already begun to discuss this issue. In the long run, fiscal decentralization and horizontal competition among governments may well be considered as means to reduce government size and waste (Brennan and Buchanan, 1980), increase political transparency (Salmon, 1987; Besley and Case, 1995), stimulate efficiency-enhancing policy choices (Inman and Rubinfeld, 1997; Feld and Dede, 2005), provide a better match between population's preferences and public services (Oates, 1972) and preserve markets and individual initiatives (Weingast, 1995). Yet, in the short run, the movement towards greater decentralization may

create an institutional hybrid (Scharpf, 1988) that enhances, rather than reduce, problems of fiscal imbalances (Rodden, 2003), electoral control of the government (Franzese, 2001), corruption (Rodden and Rose-Ackermann, 1997; Bardhan and Mokherjie, 2000) and income inequality (Wilson, 1986; Keen and Marchand, 1996). The distinction between long and short run effects of fiscal decentralization is especially important in designing reforms of the vertical organization of government. Separating the effects of the transitional dynamics towards decentralization from those associated with stable long run decentralization equilibria shed light on the relative costs of a slow, progressive movement towards fiscal decentralization, vs. a faster, more radical types of reform.

This paper takes on the task of sorting the long run from short run effects of fiscal decentralization on the government size. Several reasons lead us to focus on this nexus. First, the size of the public sector is the dimension on which fiscal decentralization exerts its most direct and immediate impact. This should allow for greater precision in the estimates, a necessary condition to discriminate the long run from the short run nature of the relationship. Secondly, many of the countries that have recently engaged in a process of fiscal decentralization are going through either a transitional dynamics from non market to market based structures of the economy (e.g. the former Communist countries) or a succession of reforms of the vertical organization of government (e.g. some industrialized countries like Italy). The short run effects of fiscal decentralization related to these cases may blur the long run effects associated with the other countries on their long run equilibrium. Finally, since the times of the "searching for Leviathan" empirical literature (Oates, 1985; Fiva, 2005), government growth has been traditionally associated with the analysis of fiscal

federalism. As Rodden (2003) and Fiva (2005) point out, this is by and large a still unresolved issue.

For this type of inquiry the panel cointegration analysis, along the lines suggested by Kao (1995) and Im at al. (2003), is the appropriate empirical model. Yet, this approach has never been used so far in the empirical literature on fiscal decentralization and government growth. Rodden (2003) makes a move in this direction by estimating an ECM model, but by skipping the analysis of the stochastic nature of the series opens his empirical analysis to the risk of incorrect model specification.

The rest of the paper is organized as follows. Section 2 reviews the literature, pointing out the contributions that emphasize long run and short run effects of fiscal decentralization. In section 3 we describe the empirical model. Section 4 presents the results of the empirical analysis with reference to the long run effects (section 4.1) and the short run ones (section 4.2). Section 5 concludes the analysis.

2. *Literature review*

The literature on the link between fiscal decentralization and government size is grounded on two alternative theoretical approaches, reflecting two contrasting visions of public sector decision-making. An earlier strand of literature, which assumes benevolent policymakers who seek to maximize the "well-being of society", emphasized that fiscal competition can create a welfare reducing "race-to-the-bottom" in public good provision (Stigler, 1957; Musgrave, 1959; Wilson, 1986, and Zodrow and Mieszkowski, 1986, formalize these earlier contributions). Brennan and Buchanan (1980) have criticized this approach, challenging the notion that tax competition is welfare reducing. Starting from the opposite assumption that

governments are revenue-maximizing "Leviathans", they argue that competition between horizontally related governments for mobile tax bases imposes a serious restriction on the ability of government to raise revenues. It follows that decentralization of the public sector, being characterized by higher mobility at the sub-central than at the central level, contributes to contain agency problems and thereby tames the Leviathan. The famous Leviathan hypothesis can be thus summarized: "Total government intrusion into the economy should be smaller, *ceteris paribus*, the greater the extent to which taxes and expenditures are decentralized" (Brennan and Buchanan, 1980, p.185).

Brennan and Buchanan emphasized that the Leviathan hypothesis holds more the lower the degree of "collusion" among governmental units. Agreements between sub-central and central government about revenue sharing programs are an obvious and frequent form of collusion. Grossman (1989), Ehdaie (1994) and Persson and Tabellini (1994) point out a variety of ways in which sub-central governments use revenue-sharing schemes to trade between lowers power to tax and reduced political costs of spending decisions. Revenue-sharing programs *de facto* blur the responsibility for spending decisions by a) dispersing among a potentially large number of levels of governments; b) increasing situations of common pool, which make it more likely for sub-central governments to impose the political and economic costs of their spending decisions on residents outside their jurisdiction.

In a recent paper, Rodden (2003) emphasizes that for decentralization to have a constraining effect on the growth of government, it must occur on both the expenditure and revenue sides. In the vast majority of countries, however, increased state and local expenditures are funded primarily by grants, shared revenues, or other sources that are controlled and regulated by the national government. Expenditure

decentralization without corresponding local tax powers will neither engender the tax competition that drives the Leviathan model, nor will it strengthen the agency relationship between local citizens and their representatives. On the contrary, decentralization funded by "common pool" resources, as grants and revenue-sharing schemes, might have the opposite effect. By breaking the link between taxes and benefits, mere expenditure decentralization might turn the public sector's resources into a common pool that competing local governments will attempt to overspend. Depending on whether funded by local or common pool resources, decentralization might either retard or intensify the growth of government. Thus meaningful cross-national analysis requires data on transfers, revenue-sharing and local taxation, separately.

Furthermore, tests of the Leviathan hypothesis require controlling for the "quality" of the principal-agent relation between voters of their representatives, as well as for the characteristics of the institutional framework. First, other links between decentralization and government size may also exist: 1) As the Oates theorem underlines (Oates, 1972), decentralization provides a better match between the population preferences and the public services or, alternatively, political agents at the sub-central level are better able to tailor public goods to the needs of their constituency. This may imply lower waste and smaller government, but also a more efficient public sector, with lower marginal costs of public services that lead residents to increase their demand for these expenditures (Oates, 1985; Joulfaian and Marlow, 1990); 2) Decentralization affects agency problems through various channels: by raising the accountability and visibility of public officials which may give more competent and less corrupt government (Strumpf, 2002); by increasing voters' information costs provided that these are related to the number of government levels (Franzese, 2001), an issue particularly emphasized in the "second generation theory of federalism" (Oates, 2005); finally, by making each

government unit more likely to be captured by local interest groups (Barhan and Mokerjee, 2000; Treisman, 2000). As it may be easily gathered, on theoretical grounds, it is not easy to derive clear-cut predictions about decentralization and government size by considering about the quality of monitoring.

Theory has pointed out a variety of ways in which the decentralization-government size nexus is sensitive to the institutional framework that surrounds it. Inman and Rubinfeld (1997) explore the role of logrolling in universalistic legislatures including those where lower levels of government are directly represented. Persson and Tabellini (2000,) and Milesi-Ferretti, Perotti and Rostagno (2001) argue that majoritarian - as opposed to proportional - elections increase competition between parties by focusing it in some key marginal districts, which leads to policies favoring targeted local redistribution at the expense of broad public goods and social insurance programs. Persson and Tabellini (2000, 2002) also argue that presidential regimes encourage more intense competition than parliamentary regimes, which leads to fewer rents, less redistribution, and smaller government in the former.

Given the complexity that characterized the decentralization-government size relationship, it is no surprise that the empirical literature provide very mixed results. Beginning from the 1990s, the "searching for Leviathan" literature found fiscal decentralization negatively correlated with government spending in some U.S., Canadian, and Swiss case studies; yet, in cross-national samples (Oates, 1985) the relationship emerged either statistically insignificant, or, as in the case of Latin American countries, positive and significant (Stein, 1999). This led Oates (1985) to conclude that Leviathan is indeed a mythical beast. More recently, however, Rodden (2003) argued that existing cross-national studies are insufficient to disconfirm the Leviathan's hypothesis, for two reasons. First, these studies employ cross-section

averages or single-year units that neglect the dynamic nature of decentralization and growth of government. As we have seen, this is especially troublesome as governance and economic structures are undergoing major transformations in many countries around the world. Second, insufficient attention has been devoted to the financial means - own resources or revenue sharing - used in the processes of decentralization.

In his empirical test Rodden (2003) addresses each of these problems. First, rather than concentrating exclusively on cross-country variation, he uses panel data from a large group of countries for the 1978-1997 sample period and an error-correction setup to distinguish between short and long-term effects. Second, he employs both GFS and OECD data set that aims to pinpoint different aspects of subnational tax autonomy. Rodden's analysis demonstrates quite clearly that the effect of decentralization on government size is conditioned by the nature of fiscal federalism. The GFS sample shows that, other things equal, decentralization funded by common pool resources is associated with faster growth in overall government spending. In contrast, the smaller OECD sample lends empirical support to the prediction that decentralization that is funded by autonomous local taxation is associated with slower government growth.

Although a step in the right direction, this analysis is possibly flawed, as it fails to analyze the stochastic properties of the series in order to distinguish in a rigorous way between short and long-term effects. Theory is of little help in this respect, as no model exists where the dynamic structure of the various effects of decentralization on government size is clearly specified. A panel cointegration analysis is necessary.

3. Empirical model

Taking Rodden's model as the basis for the analysis, we assume that there is a relationship to explain variations in expenditure, which is a mixture of economic and political variables:

$$EXP/GDP = f(GRANTS, OWNSUB, POP, GDPPOP, DEPRAT, OPEN, TRADE,$$
$$SURPLUS, SYSTEM, PARTISAN, DEMOCRACY, VETO)$$

where *EXP/GDP* = size of government

GRANTS = transfers to sub-national governments

OWNSUB = revenue raised at sub-national level

POP = population

GDPPOP = GDP per capita

DEPRAT = dependency ratio (proportion of the population outside working age)

OPEN = dummy for (no) exchange restrictions

TRADE = ration of trade to GDP

SURPLUS = central government surplus (or deficit)

SYSTEM = 0 presidential; 1 assembly-elected presidents; 2 parliamentary

PARTISAN = government ideology (0 center-right, 1 center-left)

ELECTION = a dummy which takes the value 1 in election years

DEMOCRACY = 20-point scale of democracy

VETO = institutional veto players

In order to estimate the relationship, we start with the basic model of Rodden and explore the consequences of examining the relationship in more depth using a

balanced panel of 24 countries[1] for the time period 1978-1998. The countries are a range generally form amongst developed countries and so are not directly comparable with Rodden but the data requirements of the estimation technique and the underlying methodology require not only a balanced panel but also a considerable time-series element and 21 years is deemed to be close to the minimum pre-requisite for this.

As noted by Rodden, is likely that total government expenditure as a proportion of GDP will be affected by previous activity and that variables affecting this expenditure will have long-term and short-term effects. That is, there may well be a long-run position of a desired expenditure relative to the prosperity of the country, while short-run (political) decisions cause temporary deviations from this long-run target. If this is the case, a dynamic model is needed. This can be done either following Rodden through an error-correction model (ECM) or possibly, if there was to be no real long-run desired position, through a simple dynamic model with lags. Whether this distinction between long-term and short-term effects is necessary is essentially an empirical question. Therefore, as a first step we consider the variables' degree of integration. If all the variables are stationary, i.e. I(0), the distinction between long-term and short-term would be superfluous. However, if some or all of the relevant variables are non-stationary, the distinction takes on real meaning.

The (non-)stationarity of the variables in our model is analysed using the test for panel stationarity of Im *et al*. (2003)[2]. The results of these tests are provided in

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[1] The countries are Argentina, Australia, Austria. Belgium, Bolivia, Brazil, Canada, Denmark, Finland, France, Germany, India, Iran, Ireland, Luxemburg, Mexico, Netherlands, Norway. South Africa, Spain, Sweden, Thailand, United Kingdom and United States.

[2] There is a deal of debate as to the precision of these tests (see Harris and Sollis, 2003), in particular about how cross-section independence is treated. To accommodate this, we checked the results using tests proposed by Breitung (2000) and Hadri (2000). No change in inference with respect to the levels of integration of the variables was observed. The Hadri test is a sensible check as it assumes a null

table 1. It can be seen that the vast majority of the variables are all I(1); the exceptions being POP (population) and grants, though this latter variables. For the political variables in the model, it is not very clear what the tests would indicate as these variables change only infrequently (and often in a series of breaks). The general inference, when test was however, that these variables are I(0) as the test statistics fall dramatically when breaks are considered. Given this, and the work of Perron (1988) on individual time series, the political variables were considered as I(0)[3].

Table 1 here

Given the non-stationarity of the majority of our economic variables observed in table 2, we follow Rodden and specify the structure of expenditure evolution as an error-correction model, also treating population and grants as I(1) in the initial estimation. In its most general form, this has the following structure:

$$\Delta \ln(EXP/GDP)_{it} = b_0 + b_1 \Delta \ln(GRANTS)_{it} + b_1 \Delta \ln(OWNSUB)_{it} +$$
$$b_3 \Delta \ln(POP)_{it} + b_4 \Delta(GDP/POP)_{it} + b_5 \Delta(OPEN)_{it} + b_5 \Delta(SURPLUS)_{it} \qquad (1)$$
$$+ b_7 \Delta(TRADE)_{it} + b_8 \Delta(DEPRAT)_{it} + b_9 \Delta(\textbf{POLITICAL})_{it} + b_{10} ECM)_{it-1} + e$$

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hypothesis of stationarity (whereas the others assume a null hypothesis of non-stationarity).

[3] Nonetheless, as will be seen, consideration was made of what effect these variables have on the long-run pattern of expenditure. It is an empirical matter therefore whether they affect long or short-run expenditure. IPS tests all indicated I (0) as the level of integration for these variables. It is of note that Rodden implies different levels of integration for his variables, but given the differences in the data sets, this may not be entirely surprising. The OPEN dummy must be I(0); it should be noted that the omission of OPEN in the cointegrating relationship does not destroy its presence so it is assumed that the breaks are not crucial to the estimation.

where **POLITICAL** is a vector of various I(0) variables, *SYSTEM*, *PARTISAN*, *ELECTIONS*, *DEMOCRACY* and *VETO PLAYERS*[4]. *ECM* refers to the error-correction mechanism and represents deviations from any long-run relationship between the I(1) economic variables (EXP/GDP, GRANTS, OWNSUB, POP, GDP/POP, SURPLUS, TRADE, DEPRAT) and, possibly, additional I(0) (political) variables. This is explored in more detail below.

The above equation could be estimated directly. This approach has in a related context been followed by Rodden and is also well established in other areas of political economy, e.g. Rattsø and Tovmo (2002). Whilst the long-run relationship can then be inferred from the error-correction term, this is not ideal because the long-run relationship is not empirically tested. Recent developments, from Pedroni (1995, 1999), Kao (1999) and McCoskey and Kao (1999), enable a long-run relationship to be established first, after which the short-run can be investigated. This is the route followed here.

4. Empirical results

4.1 Long-run effects. We proceed by first assessing whether our variables together form a long-run cointegrating relationship. If this is the case, the residuals from this cointegrating equation constitute a stationary variable, i.e. these residuals are I(0), and so can be incorporated into the estimating equation above. We consider this by employing the tests of Kao (1999)[5].

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[4] Rodden examines various cross product terms. For the initial analysis, it is not obvious that these should be introduced but they are clearly important once a basic relationship has been derived and are the subject of further examination.

[5] These are Dickey-Fuller (DF) type tests in a two-step procedure akin to the traditional Engle-Granger tests for single time-series. Specifically, we employ four DF tests. These tests differ from one another in how they deal with exogeneity: two of them assume strong exogeneity in the regressors and the errors and two make non-

The results of the cointegration tests are given in table 2. A number of results are presented. Firstly, there is a test using all the variables of the model and, secondly, a more restricted version which has only the significant variables within it in order for there to be more clarity of effects[6]. In addition, both the fully modified OLS (FMOLS) and dynamic OLS (DOLS) results are reported[7].

Table 2 here

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parametric corrections for any endogenous relationships. All four tests also make non-parametric adjustments for any serial correlation. Additionally, we perform a fifth test that includes lagged changes in the residuals – much like the standard Augmented Dickey-Fuller (ADF) tests. Note that all five tests impose homogeneity such that the slope coefficients are not allowed to vary across the municipalities. Pedroni (1995, 1999) relaxes the assumption of homogeneity and the results were checked using a number of his tests. The same holds for the reverse test of McCoskey and Kao (1999) with cointegration as the null hypothesis (indicating the robustness of our results).

[6] It is of note that there is a cointegrating relationship if only the economic variables are used, as would be expected if the political variables are indeed I(0). There is also a case for considering the electoral cycle as opposed to just the election year as in most cases (the UK being a notable exception) this is well known and unchanging. Thus, it is possible that a pattern, a form of seasonality, should be taken into account. Preliminary examination of this suggests an insignificant effect (actually, not yet examined for the short-run). It should also be noted that the results of a direct estimation via an ECM using Arellano and Bond techniques provides broadly similar, but not identical, results to those presented in the paper. This is not the case if the estimation is done using a standard panel data approach. In those circumstances, there is a reverse of the results with respect to grant and sub-national revenue raising with grants appearing to push up expenditure and sub-national raising of revenue placing a dampener, underlining the approach (but possibly also underlining the difference between different groups of countries with the group examined here being more homogenous than those considered by Rodden).

[7] The difference between these estimation techniques is in their approach to dealing with serial correlation: the former taking a non-parametric approach and the latter a parametric approach where lagged first differences are estimated. The preference for one or other estimation rests on judgements with respect to the data (see Harris and Sollis, 2003, for more). In this case, given the differential sizes of the municipalities, the FMOLS is probably to be preferred. As can be seen, the results from both estimation techniques are, however, very much in line which suggests a degree of robustness; given the annual data, the lags on the DOLS were taken to be first-order.

Firstly, what is immediately clear is that there is a clear difference by using this approach from the results found by other researchers. Further, when compared with Rodden, it is clear that there appear to be many more significant factors. Of initial interest, let us consider what is insignificant in the long run. Grants have no effect in the long run, which is in contrast to the Rodden implication; there is no significant evidence from grants of the common pool hypothesis in the long-run, supporting the original results of Oates. Initially of most note is the positive significance of own sub-national revenue. An increase in the relative funding from, for example, user-fees and local taxes leads to an increase in the expenditure, that is, decentralisation does lead to an increase in government; a 10% increase in sub-national revenue raising leads to somewhere between 0.6% and 0.7% increase in total expenditure. Fiscal decentralisation raises the size of the public sector.

Examining the other variables, it can be seen that there is a positive and significant sign on income, in line with Wagner's Law implications. Whilst the sign on population indicates scale economies, this is highly insignificant. Otherwise all the other economic and demographic variables are significant. As would be anticipated, an increase in the dependency ratio raises the size of government. With respect to TRADE (which is on the borderline of significance) and OPENNESS, it can be seen that both of these lead to a growth in expenditure, presumably because of some form of insurance risk-sharing argument. Finally, a central government surplus leads to a fall in expenditure. This is slightly difficult to rationalise for the long-run, as there is no necessity to run a surplus in a real long run; yet, given that the cointegration is an indication of what constitutes a determination of the long-run position, it is not unrealistic.

This leads to a consideration of the political variables. Again, let us consider the insignificant variables first. The presence of an election appears to indicate a fall in expenditure in that year; this may seem odd, but it should be remembered that this is annual data and it is not clear where the elections fall in the year; furthermore, the variable is insignificant[8]. PARTISAN is insignificant thus in the long-run: the partisanship of the executive has no effect on the size of government. This leads to the three variables that are significant, if only at a 10% level. As can be seen the sign on democracy is positive, which is in line with the Leviathan hypothesis in that if you trust the government (pre-supposing that democratic governments are more trustworthy than dictatorship) then the populace allows it to expand more. This might happen by for example, making people increasing the elasticity of their labour supply function and pushing the revenue maximizing point of the Laffer curve further[9]. With veto players, this being positive reflects the war of attrition and is in line with expectations. Finally, as SYSTEM refers to presidential as against parliamentary democracies, the anticipate sign is positive and this proves to be the case.

Thus overall the initial consideration of the long-run model provides a sensible and reasonable interpretation of activities.

4.2 Short-run effects. Having established a long-run relationship, it is now possible to estimate how the short-run varies from this relationship[10]. The results of

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[8] Postponing the election dummy to the following year does produce a positive sign but is still insignificant.

[9] An alternative but similar view would be that simply the effective median voter has a lower income in democracies or a larger number of lobbies capture the government in democracies

[10] The estimation of short-run effects via an ECM is well established in individual time-series but less prevalent in panels where the papers dealing with cointegration have tended to consider only the long-run. The authors can see no reason why the I(0) variable of the residuals from the cointegrating relationship cannot be added to a standard short-run regression.

the estimation of the ECM are given in table 3. It is noteworthy that there was little difference in the results, no matter whether the residuals came from the long-run relationship estimated using the FMOLS or the DOL methods of finding the long-run relationship.

Table 3 here

What is clear from these results is that there are very few effects on the growth of the sector in the short run other than a very significant and quite quick error-correction of around 0.50. In order to clarify matters, only a direct discussion will be made of the significant effects. Firstly, a change in grants in the short-run creates an increase in the growth of government, even though this common pool effect does not work itself way (directly) through to the long-run and will be counterbalanced over time by the error-correction. Secondly, an increase in the dependency ratio in the short term decreases growth of government, presumably because of a loss of revenue (and thus expenditure) before the full impact is taken on board. It can be seen that TRADE has a positive effect but it is possible that this variable is insignificant, though its addition helps with the diagnostic tests being satisfactory, hinting at some multicollinearity. A change in government surplus has an immediate effect in slowing the growth of government and so does not ignore such surpluses in the short. Finally, there is a reverse of the democracy effect in the short-run. Whilst in the long-term democracies lead to larger government, a more autocratic government (or a move towards a dictatorship, say) leads to a short-term rise or, in the converse, moves towards democracy in the short-term liberate the private sector and slacken the growth in the public sector.

5. Conclusion

This paper has re-considered the effects of fiscal federalism on the growth of government, in particular by examining the role of fiscal federalism on the growth of government in both the short and long run using recent panel data estimation techniques. It has shown that there is indeed a long-run relationship between the size of government and a number of economic and political factors; notably, the amount of revenue raised by sub-national governments leads to a long-term rise in the size of government but grants between the different levels of government do no lead to a growth of government. In addition, the more democratic the government, the greater will be the size of government. However, when the short-term is considered, these influence do not work immediately. Whilst the speed of adjustment towards the desired size of government is fairly quick, here there is a clear effect from the role of grants, which stimulate the growth of government, and the effect of democratisation in the short-run works against a growth of government. Clearly, these results are tentative and need to be considered outside the sample of countries chosen and the actual nature of the relationship between levels of government; particularly the role of tax autonomy must be examined more closely.

Table 1: Im et al Tests of Panel Stationarity for the Main (Economic) Variables

Variable	IPS Test Statistic
Ln (TOTEXP/GDP)	**-1.431**
Ln (GRANTS/TOTAL REVENUE)	**-1.712**
Ln (OWN SOURCE SUBNATIONAL REVENUE/ TOTAL REVENUE)	**-1.248**
Ln POPULATION	**-2.975**
Ln GDP PER CAPITA	**-0.499**
CENTRAL GOVERNMENT SURPLUS	**-0.902**
TRADE / GDP	**-1.266**
DEPENDENCY RATIO	**-1.109**

Note: the IPS test statistic, in the limit, follows a standard normal distribution. Values smaller than – 1.645 imply rejection of null hypothesis of a unit root at the 5% level.

Table 2

Test for Panel Cointegration and Panel Estimates of the Cointegration Vectors

Variables				
Dependent Variable	Ln (TOTEXP/GDP)	Ln (TOTEXP/GDP)	Ln (TOTEXP/GDP)	Ln (TOTEXP/GDP)
Estimation Method	FMOLS	DOLS	FMOLS	DOLS
Ln (GRANTS/TOTAL REVENUE)	0.018 (0.940)	0.015 (0.540)		
Ln (OWN SOURCE SUBNATIONAL REVENUE/ TOTAL REVENUE)	**0.066 (2.871)**	**0.066 (1.987)**	**0.076 (3.283)**	**0.049 (2.132)**
Ln GDP PER CAPITA	**0.168 (1.914)**	**0.227 (6.437)**	**0.168 (1.930)**	**0.201 (7.234)**
Ln POPULATION	-0.084 (-0.375)	0.041 (0.127)		
DEPENDENCY RATIO	**1.399 (5.179)**	**1.255 (3.251)**	**1.413 (5.317)**	**0.950 (2.079)**
TRADE / GDP	0.003 (1.581)	*0.003 (1.661)*	0.003 (1.427)	0.003 (1.600)
OPENNESS	**0.068 (2.230)**	0.063 (1.502)	**0.061 (2.091)**	0.050 (1.527)
DEMOCRACY	*0.005 (1.766)*	0.012 (2.722)	*0.009 (1.719)*	0.018 (2.262)
CENTRAL GOVERNEMNT SURPLUS	**-3.502 (-12.743)**	**-2.517 (-6.388)**	**-3.528 (-12.861)**	**-2.350 (-7.282)**
VETO PLAYERS	*0.024 (1.873)*	**0.028 (3.035)**	*0.022 (1.732)*	**0.027 (2.99)**
ELECTION YEAR	-0.070 (-1.480)	-0.054 (-1.214)		
SYSTEM	*0.097 (1.807)*	**0.125 (2.463)**	*0.095 (1.793)*	**0.166 (2.658)**
PARTISAN	-0.031 (-0.024)	-0.021 (-1.176)		
Adjusted R2	0.248	0.546	0.223	0.542
Kao				
DF	-24.271	-19.1617	-19.3577	-18.9962
DFt	-20.391	-17.1202	-17.2696	16.9913
DF *	-29.231	-24.4486	-22.4668	-24.4384
DFt*	-15.486	-11.9820	-8.9246	-11.8582
ADF(1)	-5.785	-8.6284	-4.6039	-8.4976
Pedroni				
Panel	0.004	0.0087	0.0079	0.1576
Panel	-14.807	-12.9971	-13.2741	-9.0023
Panel t (non-parametric)	-10.355	-9.4454	-6.997	-6.3386
Panel t (parametric)	-10.775	-12.4413	-8.4473	-7.3752
McCoskey and Kao	-1.427	-1.2536	-1.5391	-1.6001

Notes: t-statistics are in parentheses. The panel cointegration tests are explained in detail in footnote 10. For the Pedroni tests a deterministic intercept is included; including a deterministic trend or omitting both the intercept and the trend give the same inference. All results were computed using NPT 3.1 with necessary corrections and the Pedroni tests were checked using the RATS procedure where there were only minor differences and not with respect to inference. The inference of cointegration is implied whichever residuals are used. It should be noted that if included in the restricted version, grants never has a t-statistic above 0.234. Omitting trade from the restricted version does not change the inference of the other variables unduly.

Table 3: Short-Run Results (Estimation of Error-Correction Equation)

Dependent Variable	ΔLn(TOTEXP/GDP)	ΔLn(TOTEXP/GDP)
Independent Variables		
ΔLn (GRANTS/TOTAL REVENUE)	0.023 (1.532)	*0.027* (*1.832*)
ΔLn (OWN SOURCE SUBNATIONAL REVENUE/ TOTAL REVENUE)	-0.022 (-0.693)	
ΔLn GDP PER CAPITA	0.006 (0.185)	
ΔLn POPULATION	0.366 (0.431)	
ΔDEPENDENCY RATIO	**-0.644** **(2.142)**	**-0.700** **(2.214)**
ΔTRADE / GDP	*-0.004* (*-1.634*)	*-0.004* (*-1.689*)
ΔOPENNESS	0.041 (0.958)	
ΔDEMOCRACY	*-0.018* (*-1.656*)	*-0.018* (*-1.717*)
ΔCENTRAL GOVERNMENT SURPLUS	**-1.931** **(-2.012)**	**-1.594** **(-4.422)**
ΔVETO PLAYERS	-0.602 (-0.065)	
ΔVETO PLAYERS* CENTRAL GOVERNEMNT SURPLUS	0.066 (0.273)	
ELECTION YEAR	0.003 (0.069)	
ΔSYSTEM	0.032 (0.331)	
ΔPARTISAN	0.014 (0.721)	
ECM-1	**-0.503** **(-11.517)**	**-0.592** **(-13.009)**
Intercept		
R2	0.339	0.327
INSIG		0.903
Fixed Effects	**74.767**	**75.840**
Hausman Test	*23.420*	**41.023**
RESET	2.117	3.221
Normality	5.887	4.887
Period Effects	0.613	0.881

Notes: Estimated t-statistics are in parentheses. The fixed effects and Hausman tests are the standard panel tests for a different fixed effect for each country and whether this can be modelled as a random effect. All of the I(0) variables when added to the equation instead of the change are insignificant, that is, whether or not a variable is significant in the "long-run", it proves to not to be such in the short run, hence changes are reported where relevant. The random effects results are available on request, but the overall inference is for fixed effects. RESET is the Ramsey test of (in)appropriate functional form and "normality" is the Jarque-Bera test.

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DATA APPENDIX

TOTEXP/GDP	Total expenditure/GDP	IMF-Government Finance Statistics 1980-2004
GRANTS/TOTREV	Grants/Total Revenue	IMF-Government Finance Statistics 1980-2004
OWNS/TOTREV	Own-source subnational revenue/Total Revenue	IMF-Government Finance Statistics 1980-2004
POPULATION	Population	Penn World Tables (on-line)
GDPPOP	GDP per capita (PPP in US$)	Penn World Tables (on-line)
DEMOCRACY	Democracy	Polity IV Database (on-line)
TRADE	Imports+Exports/GDP%	Penn World Tables (on-line)
DEPRATIO	% of population less than 15 and more than 65 of age	World Bank World Development Indicators 2000 (on-line)
SYSTEM	Presidential, Assembly-elected President, Parliamentary	World Bank Database on Political Institution (on-line)
PARTISANSHIP	Partisanship of executive	World Bank Database on Political Institution (on-line)
SUPLUS	Central government surplus/GDP	IMF-Government Finance Statistics 1980-2004
VETOPLAYER	Veto players	Worl Bank Database on Political Institution (on-line)
ELECTION	Executive Election year	Worl Bank Database on Political Institution (on-line)
OPENNESS	Openness dummy	IMF-Annual Report on Exchange Arrangements and Exchange Restrictions 1970-2003
GDP	Gross Domestic Product	*IMF-International Finance Statistics 1998 - Hystorical Yearbook*