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Subnational fiscal autonomy and impact of decentralization
The case of European transition countries

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Abstract

Following the work of Ebel and Yilmaz (2002), this paper examines the fiscal decentralization measurement problem. Using new data published by the OECD (2001, 2002), it reproduces several indicators and proposes new measures of decentralization that take into consideration subnational governments' autonomy over their revenues. It underlines the importance of fiscal autonomy as an indicator of decentralization. Three models are reproduced to estimate decentralization effects on: 1) macroeconomic stability (linked to government budget balance; DeMello, 2000); 2) economic growth (Davoodi and Zou, 1998); and 3) the public sector size (Oates, 1985). Even if estimation results concerning macroeconomic stability are mixed, fiscal autonomy seems to have a positive relation with government balance. Some stronger evidence suggests that fiscal autonomy positively affects economic growth. Also, it seems to affect the public sector size, but evidence on this relation is limited. In sum, despite some statistical weaknesses, there are sufficient indications to argue that subnational governments' fiscal autonomy should be a major concern when measuring decentralization.

Contents

Introduction

Decentralization is an ongoing process and seems to expand itself to every part of the world. A number of studies have tried to evaluate its impacts on economic outcomes (DeMello, 2000; Davoodi and Zou, 1998; Akai and Sakata, 2002; Oates, 1985; Ehdaie, 1994; and Jin and Zou, 2002). Most of them used the *Government Finance Statistics* (GFS) of the International Monetary Fund to measure decentralization (the only available cross-country data at this time). Unfortunately, GFS indicators do not identify the level of subnational governments' autonomy over their revenues or expenditures.

The OECD has published surveys on the fiscal design of six European transition countries in 2001. Ebel and Yilmaz (2002) used this new information to illustrate how previous estimation results could be sensitive to the choice of a fiscal decentralization indicator. They computed indicators for different degrees of subnational governments' fiscal autonomy and found that these had markedly different effects on economic performance.

The OECD published new surveys in 2002, increasing to ten the number of countries for which the data on fiscal design are now available. The purpose of this paper is to redo the study of Ebel and Yilmaz, using the augmented sample of OECD data. More observations are expected to yield stronger statistical results. It should also allow the addition of some control variables to the models replicated in the Ebel and Yilmaz study. New measures of decentralization will also be computed, modeling the interaction between revenue share and fiscal autonomy of subnational governments.

Availability of data restricts the scale of the analysis contained in this paper to a regional analysis of European transition economies (countries that hope to accede the European Union). Even if not representative of the world economy, this sample shows some good characteristics. Historical, cultural, political and economical similarities that exist among countries help to control for unobserved influences in regressions.

This paper is divided as follows. Part I examines the definition of fiscal decentralization, how it should be measured, and reviews existing empirical work dealing with its effects on economic outcomes. Part II introduces data of the OECD surveys, as well as all the decentralization indicators, and explains models used for regression. Finally, part III presents the analysis of estimation results.

I – Decentralization, measurement and existing empirical works

The "what" *and* "why" *of decentralization*

There is no right or unique definition of fiscal decentralization. It encompasses the three related processes of "devolution", "delegation" and "deconcentration" (Bird, 2001; Bird and Vaillancourt, 1998; Litvak and al., 1998; and Martinez-Vazquez and McNab, 1997). Devolution is a process by which central government transfers some authority to subnational governments. In this case subnational governments gain the right to govern their own affairs, including ability to raise taxes and formulate expenditure budgets, without intervention of the central authority. Delegation is a process by which central government transfers some responsibility to subnational governments or public organizations that are ultimately accountable to it. Subnational governments could acquire the power to raise some revenues in accordance with their new responsibilities, knowing however that this can be changed or revoked on the discretion of the central authority. At the end of the spectrum, there is deconcentration, (which is not even considered as decentralization by Martinez-Vazquez and McNab, 1997). In this process, central government disperses responsibilities for certain services to regional branch offices of the central government. It does not involve any participation of subnational governments.

The conceptual framework of fiscal decentralization is well established, drawing largely on contributions by Tiebout (1956), Musgrave (1959) and Oates (1972). In a decentralized State, mobility of citizens, voting power and competition among local governments ensure the matching of local public services production with preferences of citizens and enhance efficiency (Tiebout, 1956). Also, Oates (1972) argues that in a world with little externalities and heterogeneous tastes, local governments are best suited to provide local public services because they can better adapt to differences in tastes and because they have an information advantage on tastes over central government. This can be referred to as *Oates' decentralization theorem*. An efficient allocation of local public services means that subnational governments provide services up to the point at which

the value placed on the last unit of services for which citizens are willing to pay is just equal to its benefits. This implies that subnational governments must be free to levy "own-source" revenues to match citizens' preferences on expenditures.

Bahl (1999) has identified some characteristics for successful decentralization. These range from the requirement for open local elections to the fundamental question of whether subnational governments have some authority to set revenues. A key requirement in this regard is accountability. Providers of local public services must be accountable both to those who pay for them and those who benefit from them. The critical point in this respect is "accountability at the margin", which implies that marginally, subnational governments actions to raise or lower local revenues or expenditures will be directly affecting outcomes (Bird and Vaillancourt, 1998).

It must be noticed however that no convincing empirical evidence exists on the efficiency gain from decentralization. Most of the discussion about fiscal decentralization is theoretical and refers to anecdotal evidence from few studies (Bardhan, 2002; and Litvack, 1998). These studies suggest generally positive effects of decentralization, but it is hard to draw any conclusive lessons.

The measurement problem

Since fiscal decentralization has been defined as a multidimensional process, its measurement is expected to be as well multidimensional (Martinez-Vazquez and McNab, 1997). There is no single or best measure of decentralization, but a multitude of measures that should be compared one to another. Most of previous studies on fiscal decentralization used GFS data to compute indicators (DeMello, 2000; Davoodi and Zou, 1998; Oates, 1985; Ehdaie, 1994; and Jin and Zou, 2002). The need to standardize the fiscal variables using these data inevitably leads to a loss of details about the design of the fiscal system. Most decentralization measures computed with GFS are defined on the basis of a single aspect of decentralization that is subnational share of aggregate

government revenue or expenditure. This gives an inappropriate representation of fiscal decentralization because it does not take into account the subnational governments' control over tax bases or rates. They have a weak capacity to treat multiple dimensions of decentralization and usually overestimate the level of real decentralization.

In 2001, the OECD published surveys on the fiscal design of six European transition countries (Czech Republic, Hungary, Poland, Estonia, Latvia and Lithuania). Ebel and Yilmaz (2002) used this new information to show how effects of decentralization were responsive to subnational governments' fiscal autonomy. They estimated models with four variables (five if considering two different measures of fiscal dependency), representing different degrees of subnational governments' revenue autonomy. These, from the most decentralized to the most centralized element of fiscal revenue, were tax autonomy, non-tax autonomy, fiscal dependency and tax sharing (see Table 6, in part II, for details). Not surprisingly, they found that different indicators had markedly different effects on economic performance.

A criticism of the Ebel and Yilmaz study is that no variable of total decentralization has been computed. Ratios of different subnational revenue sources over total revenue were the only independent variables. Also, no attention has been given to the size of subnational governments. The subnational share of government revenue or expenditure is not part of any measure, leaving aside this important aspect of fiscal decentralization.

Effects of decentralization

Fiscal design across levels of government is not just a matter of taste. It has serious consequences on economic outcomes such as macroeconomic stability, economic growth and public sector size. A number of studies have tried to estimate the economic impacts of fiscal decentralization (DeMello, 2000; Davoodi and Zou, 1998; Akai and Sakata, 2002; Oates, 1985; Ehdaie, 1994; and Jin and Zou, 2002). Their results are summarized in Table 1.

Macroeconomic stability. DeMello (2000) argues that one key element to the success of decentralization is to design a system of multilevel public finances that provides local services efficiently while maintaining stability. He warns that coordination failures arising from an improperly designed revenue system may induce subnational governments to spend inefficiently and endanger macroeconomic stability by aggravating fiscal imbalance. According to him, the pitfalls of fiscal decentralization are related more closely to macroeconomic stability, while its benefits involve gains in allocation efficiency. Conducting an empirical analysis relating decentralization to budget balance, measured as the ratio of the fiscal deficit to GDP, he found that decentralization promoted fiscal imbalance. According to his definitions, budget imbalance is linked to the worsening of fiscal positions and leads to macroeconomic instability. The proxy variables used for decentralization by DeMello were tax revenue ratio, grant revenue ratio and spending ratio. The tax revenue ratio was found to worsen fiscal positions. The grant revenue ratio was found to worsen fiscal positions at the central government level for non-OECD countries, and had no significant impact at the subnational level. The spending ratio was also found to worsen fiscal positions.

Ebel and Yilmaz (2002) obtained different results. They replicated the DeMello model, but used their own indicators for fiscal decentralization. They found that tax autonomy improves fiscal positions of subnational governments, while fiscal dependency worsens it. Following the argument of DeMello, this suggests that countries in which subnational governments have a greater control over their tax revenue and receive less transfers from central government usually have more stability (at least in the sample used).

Table 1 : ***Summary table of existing empirical work***
(grouped by dependent variables)

Panel A : Macroeconomic Stability

Technical Information	Dependent Variable	Measure of decentralization	Control variables	Main Results
Study : De Mello (2000) Data used : GFS Sample : 150 obs. Cross sect. : 30 countries (17 OCDE and 13 non OCDE) Period : 1970-1995 (five-year average data)	-Government balance : ratio of fiscal deficit to GDP (for each level of government)	-Tax revenue ratio -Grant ratio -Spending share (see Table 6, Panel A, in part II, for more details)	-Money creation : M2 annual growth rate -GDP growth -Terms of trade -Age dependency ratio (see Table 6, Panel A, in part II, for more details)	-Tax revenue worsens fiscal positions -Grant revenue has mixed results
Study : Ebel and Yilmaz (2002) Data used : OECD Sample : 19 obs. Cross sect. : 6 European transition countries Period : 1996-1999	-Government balance : ratio of fiscal deficit to GDP (for s.n. govs. only)	-Tax autonomy -Non tax revenue -Grant ratio -Fiscal dependency -Tax Sharing (see Table 6, in part II, for more details)	-None	-Tax autonomy improves fiscal positions -Fiscal dependency worsens fiscal positions

Panel B : Economic Growth

Technical Information	Dependent Variable	Measure of decentralization	Control variables	Main Results
Study : Davoodi and Zou (1998) Data used : GFS Sample : 158 and 86 obs. Cross sect. : 46 countries (19 industrial and 27 developing) Period : 1970-1989 (5-year and 10-year average data)	-GDP per capita growth	-Spending share net of transfers (see Table 6, Panel B, in part II, for more details)	-Tax rate -Population growth -Secondary school enrolment -GDP per capita -Investment as share of GDP (see Table 6, Panel B, in part II, more details)	-Decentralization has a negative impact on growth for developing economies
Study : Akai and Sakata (2002) Data used : USA Sample : 50 obs. Cross sect. : 50 States Period : 1992	-GDP per capita growth from 1992 to 1996	-Subnational share of aggregate government revenues -Subnational share of aggregate government spending -Ratio of tax revenue over total revenues of s.n. governments	-Population growth -Anterior GDP growth -School graduates -Gini coefficient -Openness : ratio of international trade to GDP	-Decentralization contributes to State economic growth

Panel B (continued)

Technical Information	Dependent Variable	Measure of decentralization	Control variables	Results
Study : Ebel and Yilmaz (2002) Data used : OECD Sample : 19 obs. Cross sect. : 6 European transition countries Period : 1996-1999	-GDP per capita annual growth	-Tax autonomy -Non tax revenue -Grant ratio -Fiscal dependency -Tax Sharing (see Table 6, in part II, for more details)	-None	-Tax autonomy and non-tax autonomy have a positive impact on growth -Fiscal dependency has no significant effect -Tax sharing has a negative effect on growth

Panel C : Public sector size

Technical Information	Dependent Variable	Measure of decentralization	Control variables	Results
Study : Oates (1985) Data used : GFS Sample : 43 obs. Cross sect. : 43 countries (18 industria and 13 developing) Period : 1982	-Aggregate tax receipt as ratio of total personal income	-Revenue share -Spending Share -Absolute number of subnational units (see Table 6, Panel C, in part II, for more details)	-Revenue per capita -Urbanisation ratio -Population (see Table 6, Panel C, in part II, for more details)	-There is no significant relation between decentralization and the public sector size
Study : Ehdaie (1994) Data used : GFS Sample : 30 obs. Cross sect. : 30 countries (17 industrial and 13 developing) Period : 1987	-Total general government expenditure as share of GDP	-Fiscal decentralization : Ratio of tax and non-tax revenue to total expenditure of s.n. governments -Fiscal collusion : ratio of grant revenue to total spending of s.n. governments	-Revenue per capita -Urbanisation ratio -Population	-Fiscal decentralization has negative impact on the public sector size -Fiscal collusion has no significant impact
Jin and Zou (2002) Data used : GFS Sample : 345 obs. Cross sect. : 32 countries (17 industrial and 15 developing) Period : 1980-1994	-Central, subnational and aggregate total expenditure as share of GDP	-Ratio of s.n. governments tax and non-tax revenue to aggregate government revenue -Spending Share -Vertical imbalance : Ratio of grant revenues to s.n. governments spending	-GDP per capita -GDP growth -Urban population ratio -Openness -Inflation -Political dummies	-Expenditure decentralization leads to larger State -Revenue decentralization leads to smaller State -Vertical imbalance leads to larger State
Study : Ebel and Yilmaz (2002) Data used : OECD Sample : 19 obs. Cross sect. : 6 European transition countries Period : 1996-1999	-Aggregate total government expenditures as share of GDP	-Tax autonomy -Non tax revenue -Grant ratio -Fiscal dependency -Tax Sharing (see Table 6, in part II, for more details)	-None	-Tax autonomy leads to smaller State -Non-tax autonomy leads to a larger State -Fiscal dependency and tax sharing have no significant impact.

Economic growth. It is expected that if decentralization brings more efficiency in the allocation of public services, it should also bring economic growth. It is also well documented that most measures of fiscal decentralization using subnational governments' share of revenue or expenditure are positively correlated with the level of economic development measured by per capita income (Martinez-Vazquez and McNab, 1997). This means that fiscal decentralization is either a superior good or otherwise helps economic development. In the second case, a positive relation between decentralization and economic growth should then be obvious. This is not however what Davoodi and Zou (1998) have found. Using spending share net of intergovernmental transfers as the measure for decentralization, they found a negative relationship with economic growth for developing countries, but no relationship at all for developed countries. This might be an indication that fiscal decentralization requires a certain level of economic development to be managed.

A criticism of Davoodi and Zou' work was made by Akai and Sakata (2002) on the cultural bias of the data set. According to Akai and Sakata, using data in which the cultural, historical, and institutional differences between countries are substantial makes it difficult to determine the true effect of fiscal decentralization unless adjustments are made to the data in order to account for these differences (this idea is also defended by Bird and Vaillancourt, 1998). To control the cultural and historical bias, Akai and Sakata used data for one country (the 50 States of USA) and found that decentralization of State's government contributed to State's economic growth.

Ebel and Yilmaz (2002) reproduced the model of Davoodi and Zou, using their own measures of decentralization. They found that tax autonomy and non-tax autonomy have a positive correlation with economic growth, while tax sharing has a negative one. Since in most developing economies tax sharing and grants are the main tools of decentralization, it can explain the findings of Davoodi and Zou. In any case, results of Ebel and Yilmaz suggest that the level of subnational governments' control over their revenues can influence economic performance.

Public sector size. The relation between fiscal decentralization and the public sector size relies on the theory of the Leviathan State elaborated by Brennan and Buchanan (1980). By analogy on the conventional theory of monopoly in the private sector, Brennan and Buchanan modelled the government as a monolithic entity that systematically seeks to maximize its total revenue. According to them, the capacity of government to maximize its revenue is only limited by constitutional constraints, among which is decentralization. Mobility of citizen and competition between subnational governments will limit their tax pricing power and encourage more efficient allocation of public services. Consequently, other things being equal, the State should be smaller the greater it is decentralized.

However, the theory of the Leviathan State has limited empirical support. Oates (1985) conducted a study on this relationship using subnational governments' share of revenue and expenditure as proxies for decentralization. He found no empirical support of the Leviathan hypothesis. Ehdaie (1994) pointed an important weakness of Oates (1985) study, arguing that taxing and spending decisions should not be taken separately in the decentralization process. Computing measures of fiscal decentralisation and fiscal collusion, he found that decentralization of taxing power has a negative correlation with the public sector size, while the amount of transfers has no significant correlation. More recently, Jin and Zou (2002), adding the time series dimension to cross-section analysis, found that expenditure decentralization leads to a larger State, while revenue decentralization leads to a smaller State, and finally that vertical imbalances increase the public sector size.

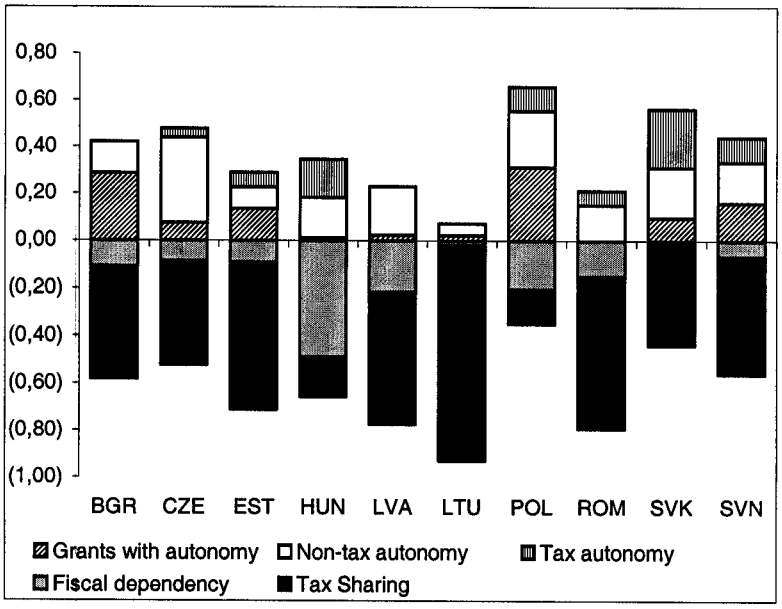
As they have done for previous study, Ebel and Yilmaz (2002) replicated the model of Oates with their own indicators of decentralization. Their results were that fiscal autonomy leads to a smaller State while fiscal dependency and tax sharing have no significant impact. They also found that non-tax autonomy has a positive impact on the public sector size, which makes the interpretation of their results difficult. It should be mentioned though that in the sample used by Ebel and Yilmaz, countries have experimented unusual variation of the size of their public sector in the past decade (Bird and Banta, 1999), which can explain in part their mixed results.

II - Econometric models and data sources

The OECD data on government finance

It has been argued that measures of decentralization based on GFS data overestimate decentralization. Ebel and Yilmaz (2002) have illustrated this, using data published by the OECD (2001) on six European transition countries. Such data are now available for a larger sample of countries (adding Bulgaria, Romania, Slovak Republic and Slovenia to the previous sample). This larger sample will be used here to reproduce the analysis of Ebel and Yilmaz.

Figure 1 : ***Subnational governments revenue sources (1999)***
10 European transition countries



Source : OECD, *Fiscal Design Across Levels of Government*, 2001, 2002.
Note : Every vertical bar represents 100 % of subnational governments revenue. Parts that appear above the horizontal axis represent the own source revenues (grants with autonomy, non-tax autonomy and tax autonomy). Parts that appear under, with scale in parentheses, represent dependent revenues (fiscal dependency and tax sharing).

Figure 1 illustrates the different sources of subnational governments revenues for the ten European transition countries. Like GFS data, OECD identifies three main sources of subnational revenues: tax revenues, non-tax revenues and intergovernmental grants.

However OECD survey gives some additional information on tax revenues that allows further subdivisions into "own tax revenue" and "tax sharing". The first represents the portion of subnational tax revenue on which subnational governments have significant control (over rates and/or bases). The other, tax sharing, represents the portion on which subnational governments have no significant control. The main source of own tax revenue for the sample used here is taxes on property, while the main source of tax sharing is taxes on income, profits and capital gains (see Table 2).

More detailed information about intergovernmental grants is also given in OECD data, allowing their subdivision as either general-purpose or specific grants. General-purpose grants are ones that can be used as own revenue when they are provided based on objective criteria. But their allocation may as well be made at the central government's discretion. Specific grants are earmarked for certain purposes. Their allocation may be conditional across subnational governments as well as unconditional, in which the latter gives more autonomy. Some details on grants are given in the last two columns of Table 2.

Non-tax revenues from OECD surveys include income from business operations, property, administrative fees, duties, and fines. Usually, non-tax revenues are considered as fully controlled by subnational governments. However central government can set some prices for local services or administrative fees. In the liberal interpretation given here to the revenue autonomy, non-tax revenue will always be considered as own source revenue. Some details about non-tax revenue are given in Table 2.

Table 2 : ***Details on subnational government revenue sources (1999)***
10 European transition countries

Country	Tax Revenue		Non-tax Revenue	Grant	
	Own-Taxes	**Tax-Sharing**		**General Purpose**	**Specific**
Bulgaria	-None	-60 % from taxes on payroll and workforce -30 % from taxes on income, profits and capital gains.	-Fees bring over 50% of revenue -S.n. governments set the fees within the limits provided by law	-Mainly objective criteria without own tax effort -Redistribution purposes -20 % discretionary	-Social assistance grants -Conditional, based on standard costs
Czech Republic	-70 % from taxes on property -25 % from taxes on goods and services	-Mainly taxes on income, profits and capital gains -Small contribution from taxes on goods and services	-Fees represent 30 % of revenue -S.n. governments set the prices except for rents and water supplies -Capital gains from sales of stocks were important in 1999	-None	-Operating grants are mainly unconditional and represent about 60 % of revenues -Capital grants (40 %) are mainly conditional and based on actual costs
Estonia	-Mainly taxes on property	-Mainly taxes on income, profits and capital gains	-Sales of goods and services is the major source of revenue -No regulation on fines and sales from central government	-Exclusively objective criteria without own tax effort -Redistribution purpose	-Conditional and based on standard costs
Hungary	-More than 80 % from business taxes and tourism -Less than 20 % from taxes on property	-Mainly taxes on income, profits and capital gains	-Charges and fees are the major source -No restriction from central government	-Mainly discretionary	-Mainly conditional, based on standard costs. -Development purposes
Latvia	-None	-Nearly 80 % from taxes on income, profits and capital gains -Small contribution from taxes on property	-Service fees is the major source of revenue (60 %) -No central government control on revenues	-Objective criteria without own tax effort. -Equalization system	-Operating grants (mainly for salaries), conditional and based on standard costs.

Table 2 (continued)

Country	Tax Revenue		Non-tax Revenue	Grant	
	Own-Taxes	**Tax-Sharing**		**General Purpose**	**Specific**
Lithuania	-None	-Mainly taxes on income, profits and capital gains. -Small contribution from taxes on property	-Mostly fees -S.n. governments set rates	-Objective criteria without own tax effort -Important decrease in 1999 due to raise of income tax revenues	-Oriented to State social policy implementation -Conditional grants based on standard costs reduced in 1999 (30 %) -Conditional grants based on actual costs raised in 1999 (70 %)
Poland	-Mainly taxes on property (Real estate tax)	-Mainly taxes on income, profits and capital gains	-Service fees is the major source of revenue -No central government control on revenues	-Objective criteria without own tax effort -Redistribution and education purposes	-Mainly operating grants -60 % based on actual costs -40 % based on standard costs
Romania	-Mainly taxes on property -Small contribution of taxes on income, profits and capital gains	-Mainly taxes on income, profits and capital gains -Small contribution from taxes on property	-Service fees is the major source of revenue -Fees are regulated by subnational governments	-None	-All grants are conditional and based on actual costs -Mostly capital grants
Slovak Republic	-80 % from taxes on property -20 % from taxes on goods and services	-Mainly taxes on income, profits and capital gains -Small contribution from taxes on property	-Mainly fees, sales, and fines -Prices of services set by s.n. governments -Administrative fees, rents and waste disposal charges are set by central government	-None	-All unconditional -Operating grants
Slovenia	-Mainly taxes on property -Small contribution from taxes on goods and services	-Mainly personal income tax -Some taxes on property and goods and services	-Rental revenue is the major source -The majority of non-tax revenues are within the competence of s.n. governments	-Objective criteria without own tax effort -Financial adjustment purposes	-Conditional grants based on standard costs serves for promotion of bilingualism -Conditional co-investment grants are based on actual costs

Source : OECD, Fiscal Design Across Levels of Government, 2001, 2002.

Comparison of the GFS and OECD aggregate data for subnational share of government expenditure and revenue shows little differences (Table 3). However, a deeper analysis of OECD data subdivisions reveals that in most countries, subnational governments do not have a significant control over their revenues (Table 4). On average for this sample, about 50 % of subnational governments revenues came from tax sharing in 1999. Subnational governments barely levied an average 25 % of their own revenues. The extreme case was Lithuania where tax sharing represented 91 % of subnational government revenues and where only 4,8 % of subnational revenues were collected by subnational governments.

Table 3 : **Comparison of GFS data with Fiscal design surveys of OECD (1999)**
10 European transition countries

Country	Subnational share of government expenditure (GFS)	Subnational share of government expenditure (OECD)	Subnational share of government revenue (GFS)	Subnational share of government revenue (OECD)
Bulgaria	19,0	19,1	18,1	18,6
Czech Republic	16,3	18,3	20,9	20,8
Estonia	17,9	19,7	21,8	22,2
Hungary	21,2	23,7	25,2	26,7
Latvia	21,6	23,1	24,6	26,0
Lithuania	22,0	19,6	21,9	22,9
Poland	28,7	27,6	32,4	28,9
Romania	9,2	9,4	11,7	11,9
Slovak Republic	5,5	7,0	6,3	4,9
Slovenia	8,0	11,6	11,6	11,9
Mean	**17,0**	**17,9**	**19,4**	**19,5**

Source : OECD, Fiscal Design Across Levels of Government, 2001, 2002.

Table 4 : ***Composition of subnational governments' revenue (1999)***
10 European transition countries

Country	Tax Revenue		Non-tax Revenue	Grant		Total
	Own-Taxes	Tax-Sharing		General Purpose	Specific	
Bulgaria	0,0	47,2	13,4	36,3	3,2	100
Czech Republic	3,9	43,8	36,3	0,0	16,0	100
Estonia	6,3	62,1	9,1	13,4	9,1	100
Hungary	16,3	16,8	17,0	1,7	48,2	100
Latvia	0,0	56,0	20,4	2,3	21,3	100
Lithuania	0,0	91,0	4,8	2,3	1,9	100
Poland	10,4	14,4	24,6	30,5	19,9	100
Romania	6,1	64,1	14,9	0,0	14,9	100
Slovak Republic	25,2	43,8	21,4	0,0	9,7	100
Slovenia	10,6	49,3	17,5	15,9	6,6	100
Mean	**7,9**	**48,9**	**17,9**	**10,2**	**15,1**	**100**

Source : OECD, Fiscal Design Across Levels of Government, 2001, 2002.

Table 5 provides further details on subnational own revenues. The first column presents own revenues over which subnational governments had policy control in 1999. As mentioned earlier, non-tax revenue is considered as own source revenue here. The second and third columns report intergovernmental grants that could be considered as own source revenues. Following Ebel and Yilmaz (2002), "we risk the overestimation bias and include general-purpose grants with objective criteria and non-conditional specific grants in the decentralization variable". The main argument is that subnational governments have at least expenditure autonomy over these grants. This transformation pushes the average subnational governments' revenue autonomy from barely 25 % up to 37 % for the whole sample in 1999. In Bulgaria and Poland, where subnational governments received nearly 30 % of their own revenues from such grants, the change is major. However, even with this liberal interpretation, the measure of decentralization suggested here is obviously different than the ones based on GFS. In every case, the degree of subnational governments' fiscal autonomy is far from 100 %.

Table 5 : ***Subnational governments' own source revenues as share of their total revenues (1999)***
10 European transition countries

	Own-Taxes + Non-Tax Revenue	General Purpose Grants (with objective criteria)	Specific Grant (not conditional)	Total Own Source Revenues
Bulgaria	13,4	28,6	0	42
Czech Republic	40,2	0	7,5	47,7
Estonia	15,4	13,5	0	28,9
Hungary	33,3	0,3	0,9	34,5
Latvia	20,4	2,3	0	22,7
Lithuania	4,8	2,3	0	7,1
Poland	35,1	30,6	0	65,7
Romania	21	0	0	21
Slovak Republic	46,6	0	9,7	56,2
Slovenia	28,1	15,9	0	44
Mean	**25,8**	**9,4**	**1,8**	**37,0**

Source : OECD, Fiscal Design Across Levels of Government, 2001, 2002.

New measures of decentralization

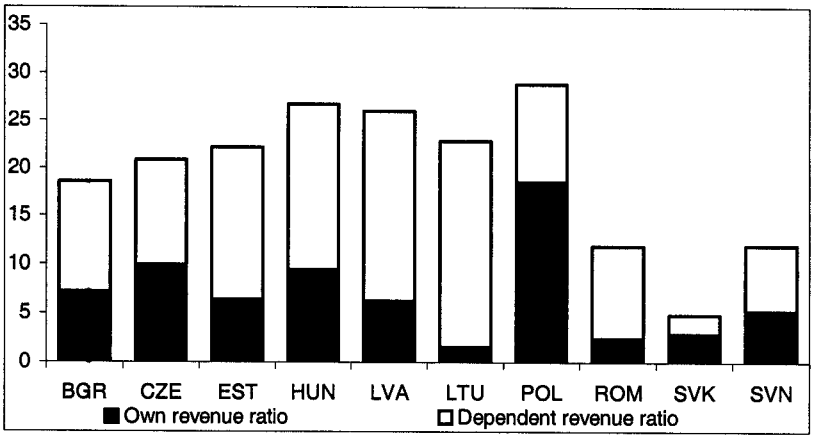
In order to estimate the effects of decentralization it is important to find a good measure for it. Ebel and Yilmaz have shown that expenditure or revenue share were not reliable measures of decentralization because they did not take any consideration of subnational governments' control over their revenues. The new indicators they proposed were interesting in the way that they illustrated which element of decentralization had positive or negative effect on economic outcomes. However, they were incomplete, revealing nothing about the effects of overall decentralization.

To fill this gap, three new measures of decentralization are proposed in this paper. The first one, called "revenue autonomy", is the ratio of subnational governments own source revenue over its total revenue. Own source revenue is defined in the previous section of this text. It is the sum of tax autonomy, non-tax autonomy and intergovernmental grants

considered as own revenue (Table 5). This new variable is illustrated in the upper part of Figure 1. The importance of such a measure is to take into account global effects of fiscal autonomy. For example, if one country has considerable proportion of non-tax revenue, like Czech Republic, and another has a considerable proportion of tax autonomy, like Slovak Republic, they will not give the same indications on the effects of each element. However, in the overall, both countries have a similar level of fiscal autonomy.

It is important to know how much subnational governments are in control of their own revenues, but it is essential to keep in mind that the size of subnational governments also matters. It is agreed that subnational shares of government expenditure or revenue are not the best approximations of decentralization, but this does not mean that they are irrelevant. For example, subnational governments in Slovak Republic have a very high level of control over their revenues (see Figure 1). One could think of a high degree of decentralization. However, subnational governments in Slovak Republic represent a small proportion of aggregate government revenues (see Figure 2). Hence Slovak Republic has a high degree of autonomy over a relatively small share of revenue. In this case, should Slovak Republic be classified as more or less decentralized?

Figure 2 : ***Subnational share of governments revenues (1999)***
10 European transition countries



Source : OECD, Fiscal Design Across Levels of Government, 2001, 2002.

The solution to this problem is a measure of decentralization that takes into consideration the interaction between the relative size of subnational governments and their fiscal

autonomy. Such a measure will be computed here as the "own revenue ratio". It is the ratio of subnational governments' own revenue, to aggregate government revenue. Opposed to this, we can also easily compute the "dependent revenue ratio", which is the ratio of subnational governments revenue controlled by central government, to aggregate government revenue. These measures are illustrated as parts of revenue share in Figure 2.

The models

This paper is replicating the study of Ebel and Yilmaz (2002) in which there was replications of three other studies, DeMello (2000), Davoodi and Zou (1998) and Oates (1985). Even if the same three models are used in each replication, new variables for decentralization measurement have been added along the way. To proxy variables used for decentralization in original models, Ebel and Yilmaz have added four new indicators, and on top of this, three new proxies are added in this paper: revenue autonomy, own revenue ratio and dependent revenue ratio. This means that without any change on the number of models used, the number of estimations has been multiplied.

All estimations are based on an unbalanced panel data model with fixed effects such as :

$$Y_{it} = \delta_1 + \delta_2\theta_{it} + \delta'_3\alpha_i + \delta'_4\lambda_t + \delta'_5 X_{it} + \varepsilon_{it}$$

where $i \in [1,N]$ and $t \in [1,T]$ refers to country i at time t; δ_1 and δ_2 are scalar parameters while δ'_3, δ'_4 and δ'_5 are vectors; Y_{it} is the dependent variable; θ_{it} is the measure of decentralization; α_i is a vector for country fixed effects; λ_t is a vector for time fixed effects; X_{it} is a vector of control variables; and ε_{it} is the error term that is assumed to be serially uncorrelated. Differences of magnitude in variables across observation units indicate a possible presence of heteroskedasticity in ε_{it}.

A major inconvenient of using OECD surveys is the availability of data. Surveys have been conducted on an occasional basis and data are available only for three unbalanced years (1997 to 1999 for Czech Republic, Estonia, Hungary, Latvia, Lithuania and Poland; and 1998 to 2000 for Bulgaria, Romania, Slovak Republic and Slovenia). Given the small size of the unbalanced panel sample of this study (30 observations), only simple basic econometric tools can be used for estimations. Feasible General Least Square correcting for panel heteroskedasticity is too costly in degree of freedom to be estimated (adding 10 more coefficients to estimate). The solution to this has been to ignore panel heteroskedasticity and to consider instead the sample as equivalent to a 30 observations cross-section heteroskedastic sample when using feasible GLS.

All the variables used in regressions are summarized in Table 6. In the replication of the DeMello model there are two dependent variables (Y_{it}), subnational government budget balance and central government budget balance. It is important to note that in the previous estimations of DeMello, and Ebel and Yilmaz, the dependent variables were the budget balance in terms of ratio of "deficit" to GDP. In order to avoid sign confusion (when treating deficit as positive and surplus as negative), this study measured budget balance as the ratio of "surplus" to GDP. In this case, sign of estimated coefficients will be inversed. In the DeMello study, three measures of decentralization (θ_{it}) were used: tax revenue ratio, grant ratio and spending ratio. In addition here, the four indicators of Ebel and Yilmaz, and the three new variables proposed earlier in this text are used. In this replication, only the countries' fixed effects (α_i) are considered. Neither DeMello nor Ebel and Yilmaz used any time fixed effects in their estimations. Also a joint F-test on fixed effects in this model revealed that time dummy coefficients were not significant, while country dummy were significant. The set of control variables (X_{it}) included in this model is the same as in the DeMello study: age dependency ratio, money growth, GDP growth and terms of trade adjustment.

Table 6 : ***Definition and statistics of data***
(grouped by models)

Panel A : Model of DeMello

Variables		Definition	Cross-Sect.	Obs.	Mean	Max.	Min.	Std. Dev.	Data Source
Dependent (3-year moving average smoothing)	Central government balance	Ratio of central government surplus over GDP	10	30	-0,001	0,005	-0,005	0,002	GFS, IMF
	Subnational government balance	Ratio of subnational governments surplus over GDP	10	30	-0,016	0,021	-0,045	0,018	GFS, IMF
Decentralization (DeMello)	Subnational tax revenue ratio	Ratio of subnational tax revenue over total subnational government revenue	10	30	0,530	0,910	0,247	0,143	GFS, IMF
	Subnational grant revenue ratio	Ratio of subnational grant revenue over total subnational government revenue	10	30	0,284	0,510	0,041	0,110	GFS, IMF
	Subnational spending ratio	Ratio of subnational government spending to aggregate government spending	10	30	0,162	0,287	0,055	0,063	GFS, IMF
Decentralization (Ebel and Yilmaz)	Subnational Tax Autonomy	Ratio of subnational tax revenue on which subnational governments have control over total subnational government revenue	10	30	0,078	0,252	0,000	0,075	OECD
	Subnational Tax Sharing	Ratio of subnational tax revenue on which subnational governments have no control on total subnational government revenue	10	30	0,476	0,910	0,144	0,181	OECD
	Subnational Fiscal Dependency	Ratio of subnational grant revenue excluding general purpose grants with objective criteria and unconditional specific grants over total subnational government revenue	10	30	0,155	0,531	0,000	0,140	OECD
	Subnational Non-Tax Autonomy	Ratio of subnational non-tax revenue over total subnational government revenue	10	30	0,177	0,363	0,040	0,076	OECD
New decentralization measures	Subnational Revenue Autonomy	Ratio of own source revenues over total revenues of subnational governments	10	30	0,370	0,657	0,071	0,158	OECD
	Subnational own revenue ratio	Ratio of subnational own source revenue over aggregate government revenue	10	30	0,068	0,212	0,016	0,040	OECD
	Subnational dependent revenue ratio	Ratio of subnational dependent revenue over aggregate government revenue	10	30	0,121	0,204	0,028	0,053	OECD
Control Variables (3-year moving average smoothing)	Age dependency ratio	Ratio of population of age less than 15 and over 65 to population of 15 to 65	10	30	0,466	0,498	0,425	0,019	WDI, World Bank
	Money growth	Money and quasi-money (M2) annual growth rate	10	30	0,237	1,232	0,026	0,226	WDI, World Bank
	GDP growth	GDP annual growth rate	10	30	0,031	0,061	-0,042	0,024	WDI, World Bank
	Terms of trade adjustment ratio	Current exportations deflated with import price index less exportations in constant value in share of GDP	10	30	0,006	0,059	-0,030	0,023	WDI, World Bank

Panel B : Model of Davoodi and Zou

Variable		Definition	Cross-Sect.	Obs.	Mean	Max.	Min.	Std.	Data Source
Dependant (3-year moving average smoothing)	GDP per capita growth	GDP per capita annual growth rate	10	30	0,036	0,074	-0,040	0,026	WDI, World Bank
Decentralization (Davoodi and Zou)	Spending ratio net of grants	Ratio of subnational government spending to aggregate government spending, net of grants	10	30	0,109	0,213	0,042	0,046	GFS, IMF
Decentralization (Ebel and Yilmaz)	Subnational Tax Autonomy	Ratio of subnational tax revenue on which subnational governments have control over total subnational government revenue	10	30	0,078	0,252	0,000	0,075	OECD
	Subnational Tax Sharing	Ratio of subnational tax revenue on which subnational governments have no control on total subnational government revenue	10	30	0,476	0,910	0,144	0,181	OECD
	Subnational Fiscal Dependency	Ratio of subnational grant revenue excluding general purpose grants with objective criteria and unconditional specific grants over total subnational government revenue	10	30	0,155	0,531	0,000	0,140	OECD
	Subnational Non-Tax Autonomy	Ratio of subnational non-tax revenue over total subnational government revenue	10	30	0,177	0,363	0,040	0,076	OECD
New decentralization measures	Subnational Revenue Autonomy	Ratio of own source revenues over total revenues of subnational governments	10	30	0,370	0,657	0,071	0,158	OECD
	Subnational own revenue ratio	Ratio of subnational own source revenue over aggregate government revenue	10	30	0,068	0,212	0,016	0,040	OECD
	Subnational dependent revenue ratio	Ratio of subnational dependent revenue over aggregate government revenue	10	30	0,121	0,204	0,028	0,053	OECD
Control Variables (3-year moving average smoothing)	GNI per capita, Atlas method	GNI per capita in constant US$ (x1000)	10	30	3,891	9,933	1,307	2,361	WDI, World Bank
	School enrolment	Ratio of students enrolled in secondary school to population of secondary school age	10	30	0,919	1,062	0,793	0,072	WDI, World Bank
	Population growth	Annual population growth rate	10	30	-0,003	0,002	-0,012	0,004	WDI, World Bank
	Investment	Gross capital formation : ratio of total investment including inventories over GDP	10	30	0,253	0,327	0,149	0,048	WDI, World Bank

Panel C : Model of Oates

Variable		Definition	Cross-Sect.	Obs.	Mean	Max.	Min.	Std.	Data Source
Dependent Variable	Public sector size	Ratio of aggregate government current expenditures (excluding capital expenditures) over GDP	10	30	0,391	0,463	0,286	0,049	OECD
Decentralization (Oates)	Subnational Revenue ratio	Ratio of subnational governments revenue to aggregate government revenue	10	30	0,188	0,324	0,063	0,065	GFS, IMF
	Subnational Spending ratio	Ratio of subnational governments spending to aggregate government spending	10	30	0,162	0,287	0,055	0,063	GFS, IMF
Decentralization (Yilmaz)	Subnational Tax Autonomy	Ratio of subnational tax revenue on which subnational governments have control over total subnational government revenue	10	30	0,078	0,252	0,000	0,075	OECD
	Subnational Tax Sharing	Ratio of subnational tax revenue on which subnational governments have no control on total subnational government revenue	10	30	0,476	0,910	0,144	0,181	OECD
	Subnational Fiscal Dependency	Ratio of subnational grant revenue excluding general purpose grants with objective criteria and unconditional specific grants over total subnational government revenue	10	30	0,155	0,531	0,000	0,140	OECD
	Subnational Non-Tax Autonomy	Ratio of subnational non-tax revenue over total subnational government revenue	10	30	0,177	0,363	0,040	0,076	OECD
New decentralization measures	Subnational Revenue Autonomy	Ratio of own source revenues over total revenues of subnational governments	10	30	0,370	0,657	0,071	0,158	OECD
	Subnational own revenue ratio	Ratio of subnational own source revenue over aggregate government revenue	10	30	0,068	0,212	0,016	0,040	OECD
	Subnational dependent revenue ratio	Ratio of subnational dependent revenue over aggregate government revenue	10	30	0,121	0,204	0,028	0,053	OECD
Control Variables	Urban population ratio	Ratio of urban population over total population	10	30	0,643	0,747	0,503	0,072	WDI, World Bank
	GDP per capita	GDP per capita in constant 1995 US$ (x1000)	10	30	4,043	11,659	1,372	2,757	WDI, World Bank
	Population	Population (x1000000)	10	30	10,467	38,666	1,387	11,297	WDI, World Bank

In his study, DeMello used five-year average data to smoothen over short-term effects. Here, with a limited sample that covers only three years for each cross section, no such average could be used. However, centred three-year moving averages* have been applied on dependent and control variables to minimize any short-term effects. What is estimated here is not the relation between decentralization and budget balance on a short-term or year-to-year basis. It is the relation between decentralization and government balance on an average medium-term basis.

In the growth model of Davoodi and Zou, the dependent variable (Y_{it}) is the annual per capita GDP growth rate. Davoodi and Zou only used one proxy for decentralization (θ_{it}) in their study: subnational share of government expenditure, net of grants. Measures of decentralization from Ebel and Yilamz as well as the new measures of this study will also be included as θ_{it} in this replicated model. As it was the case in the Davoodi and Zou study, countries fixed effects (α_i) as well as time fixed effects (λ_t) will be considered in this model. Joint significance F-test on both sets of dummies reveals that both effects are significant in this model. The set of control variables (X_{it}) included in the replication is the same one as in the original study, except for the tax rate variable, which was dropped due to non-significance. Variables that remain are GDP per capita, secondary school enrolment ratio (or human capital investment), annual population growth and gross capital formation as ratio of GDP (which is considered as investment).

As DeMello, Davoodi and Zou used five-year and ten-year average data to lower short-term effects. Hence to smoothen the data in this replication, three-year centred moving averages have been applied on dependent and control variables the same way as in the previous model.

Finally, in the Oates model, the dependent variable (Y_{it}) is the public sector size measured as total aggregate government current expenditure in share of GDP. In the

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* A three-year moving average is a process by which data X_t is replaced by $(X_{t-1} + X_t + X_{t+1})/3$.

original model, two proxies for decentralization (θ_{it}) were used: revenue share and expenditure share. Again, measures of decentralization of Ebel and Yilmaz and the new measures of this study will be added as θ_{it}. For the same reason as in the DeMello replication, only countries fixed effects (α_i) will be considered. Joint F-test on fixed effects in this model revealed that time dummy coefficients were not significant, while country dummy were significant. The set of control variables (X_{it}) will be the same as in the original study, including urban population ratio, GDP per capita and total population. Because no average data was used in the Oates study (it was a cross-section analysis over one-year data), no smoothing has been applied on variables here.

Every model is estimated with each indicator of decentralization, once in a multiple regression including control variables, and once again in a simple regression. Because of the limited size of the sample they have used in their replications, Ebel and Yilmaz have not used any control variables in their regressions. Simple regression results obtained here will serve as comparison with results of the Ebel and Yilmaz study.

III – Results and analysis

Economic stability

Estimation results of the DeMello model are presented in Table 7. Sign and significance of coefficients of all decentralization variables are also grouped in Table 8 to help the analysis. Panel A of Table 7 reports results obtained with the same decentralization variables as those used in the study of DeMello. Even with the same model and variables, results obtained here are different. This suggests that characteristics of the sample used here have a different impact on estimations. In his estimations, DeMello found that there was a negative relation between tax revenue ratio and government balance. Here, this relation only appears to be true for central government balance, while the opposite is found for subnational governments balance. Spending share was also found to worsen fiscal position in the DeMello study. Here, it has a positive and significant impact on subnational governments balance and no significant impact at the central government level. One similarity between the two studies is the positive and statistically significant coefficient for the grant ratio variable at the central government level. No significant relation was found here at the subnational level. Panel B reports estimation results with the same decentralization variables, but with no control variable. It only serves for comparison purposes. It indicates that there is no major discrepancy among signs of significant coefficients (see also Table 8).

In their study, Ebel and Yilmaz did not use any control variables and only tested one dependent variable: subnational government balance. They found that tax autonomy improves fiscal position while fiscal dependency worsens it. The sample they used is a sub-sample of the one used here, so estimation results of both studies were expected to be similar. However, the augmented sample used here does not confirm the results of Ebel and Yilmaz. As it is reported in Panel D of Table 7, the only significant effect among their four indicators is a positive relation between non-tax autonomy and subnational governments balance.

Table 7 : ***Replication of the DeMello model : Decentralization and fiscal positions***

Panel A : Multiple regressions with DeMello's decentralization variables

		Multiple regressions					
		Subnational government balance	Central government balance	Subnational government balance	Central government balance	Subnational government balance	Central government balance
Decentralization measure variables	Log subnational tax revenue ratio	0,04 (0,019)	-0,015 (0,000)				
	Log subnational spending ratio			0,059 (0,000)	-0,001 (0,530)		
	Log subnational grant ratio					-0,007 (0,210)	0,002 (0,004)
Control Variables	Log age dependency ratio	0,093 (0,418)	-0,045 (0,024)	0,304 (0,002)	0,009 (0,759)	0,099 (0,428)	0,033 (0,177)
	Money growth	0,001 (0,761)	0,003 (0,000)	0,004 (0,073)	0,001 (0,359)	0,004 (0,257)	0,0003 (0,651)
	GDP growth	-0,028 (0,587)	0,018 (0,147)	-0,009 (0,851)	-0,002 (0,812)	-0,008 (0,911)	-0,004 (0,529)
	Terms of trade adjustement ratio	-0,536 (0,006)	0,133 (0,003)	-0,373 (0,051)	0,071 (0,051)	-0,566 (0,010)	0,156 (0,000)
	Adj R-square	0,9911	0,9494	0,9946	0,939	0,9853	0,9215
	Control variable joint significance P-Value	0,0222	0,0000	0,0001	0,2573	0,027	0,0077
	Nom. Obs.	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Panel B : Simple regressions with DeMello's decentralization variables

		Simple regressions					
		Subnational government balance	Central government balance	Subnational government balance	Central government balance	Subnational government balance	Central government balance
Decentralization measure variables	Log subnational tax revenue ratio	-0,002 (0,791)	-0,006 (0,000)				
	Log subnational spending ratio			0,037 (0,000)	-0,001 (0,429)		
	Log subnational grant ratio					0,002 (0,760)	0,001 (0,000)
	Adj R-square	0,9872	0,9194	0,9822	0,931	0,9833	0,9181
	Nom. Obs.	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Panel C : Multiple regressions with Ebel and Yilmaz decentralization variables

		Multiple regressions							
		Subnational government balance	Central government balance	Subnational government balance	Central government balance	Subnational government balance	Central government balance	Subnational government balance	Central government balance
Decentralization measure variables	Log subnational tax autonomy	-0,013 (0,593)	-0,018 (0,000)						
	Log subnational tax sharing			-0,015 (0,452)	-0,007 (0,001)				
	Log subnational fiscal dependency					-0,004 (0,382)	0,002 (0,000)		
	Log subnational non-tax autonomy							-0,04 (0,001)	0,005 (0,208)
Control Variables	Log age dependency ratio	0,036 (0,789)	0,137 (0,000)	0,056 (0,667)	0,078 (0,013)	0,071 (0,566)	0,035 (0,288)	0,052 (0,559)	0,009 (0,681)
	Money growth	0,003 (0,406)	-0,001 (0,120)	0,005 (0,350)	0,001 (0,171)	0,003 (0,555)	0,001 (0,112)	0,002 (0,377)	0,001 (0,282)
	GDP growth	-0,048 (0,628)	-0,059 (0,000)	-0,042 (0,643)	0,017 (0,034)	-0,023 (0,757)	-0,004 (0,661)	0,029 (0,586)	-0,003 (0,699)
	Terms of trade adjustement ratio	-0,257 (0,162)	0,136 (0,000)	-0,372 (0,058)	0,165 (0,000)	-0,578 (0,012)	0,175 (0,000)	-0,504 (0,000)	0,09 (0,056)
	Adj R-square	0,9873	0,9866	0,9852	0,9615	0,9777	0,9336	0,9891	0,9361
	Control variable joint significance P-Value	0,1433	0,0000	0,071	0,0002	0,0344	0,0005	0,0000	0,0992
	Nom. Obs.	30	30	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Panel D : Simple regressions with Ebel and Yilmaz decentralization variables

		Simple regressions							
		Subnational government balance	Central government balance	Subnational government balance	Central government balance	Subnational government balance	Central government balance	Subnational government balance	Central government balance
Decentralization measure variables	Log subnational tax autonomy	0,002 (0,734)	-0,007 (0,000)						
	Log subnational tax sharing			-0,012 (0,514)	-0,001 (0,452)				
	Log subnational fiscal dependency					0,002 (0,639)	0,001 (0,173)		
	Log subnational non-tax autonomy							-0,034 (0,004)	0,001 (0,646)
	Adj R-square	0,9872	0,9554	0,9672	0,9124	0,9686	0,9328	0,9884	0,9514
	Nom. Obs.	30	30	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Panel E : Multiple regressions with new decentralization variables

		Multiple Regressions					
		Subnational government balance	Central government balance	Subnational government balance	Central government balance	Subnational government balance	Central government balance
Decentralization measure variables	Log subnational revenue autonomy	-0,014 (0,295)	0,005 (0,038)				
	Log subnational own revenue ratio			-0,01 (0,362)	0,003 (0,108)		
	Log subnational dependent revenue ratio					0,069 (0,003)	-0,002 (0,583)
Control Variables	Log age dependency ratio	0,116 (0,367)	0,034 (0,154)	0,113 (0,292)	0,068 (0,024)	0,255 (0,027)	0,013 (0,649)
	Money growth	0,006 (0,116)	0,0003 (0,710)	0,007 (0,099)	0,0001 (0,942)	0,002 (0,433)	0,001 (0,380)
	GDP growth	0,038 (0,532)	-0,002 (0,729)	0,048 (0,464)	-0,005 (0,382)	-0,032 (0,559)	-0,004 (0,614)
	Terms of trade adjustement ratio	-0,59 (0,003)	0,128 (0,000)	-0,505 (0,006)	0,138 (0,000)	-0,556 (0,003)	0,088 (0,019)
	Adj R-square	0,9739	0,9383	0,9828	0,9273	0,9918	0,9525
	Control variable joint significance P-Value	0,007	0,0071	0,0129	0,0036	0,0004	0,127
	Nom. Obs.	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Panel F : Simple regressions with new decentralization variables

		Simple Regressions					
		Subnational government balance	Central government balance	Subnational government balance	Central government balance	Subnational government balance	Central government balance
Decentralization measure variables	Log subnational revenue autonomy	0,01 (0,028)	0,002 (0,028)				
	Log subnational own revenue ratio			0,001 (0,937)	0,002 (0,007)		
	Log subnational dependent revenue ratio					0,002 (0,918)	-0,0002 (0,926)
	Adj R-square	0,9912	0,9405	0,9904	0,9505	0,9764	0,923
	Nom. Obs.	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Results presented in Panel C of Table 7 are obtained by estimating Ebel and Yilmaz equations with control variables (adding the dependent variable for central government balance). These results are not different from the ones presented in Panel D concerning subnational governments balance. The number of significant coefficients is higher though with central government balance. It is found that coefficients of the tax autonomy and the tax sharing variables are significant and negative, while the coefficient of the fiscal dependency variable is significant and positive (see also Table 8).

Estimated coefficients of the new decentralization variables appear in Panel E of Table 7. They show that subnational government balance is not significantly affected by subnational governments' revenue autonomy, or by own revenue ratio. The only significant relation found concerning subnational governments balance is a positive one with subnational dependent revenue ratio. Following DeMello, it implies that revenue dependency of subnational governments improves their fiscal positions. Concerning central government, Panel E reports different results. Subnational governments revenue autonomy has a significant and positive relation with central government balance, while subnational own revenue ratio and dependent revenue ratio have no significant one. In this case, one can say that fiscal autonomy of subnational governments improves fiscal positions of the central government.

Results presented in Table 7 reflect the multidimensional character of decentralization. However, it is difficult to draw any clear conclusions from them. Table 8 helps the analysis by grouping together coefficients' sign and significance for all decentralization variables. As argued by DeMello, coordination failures may induce subnational governments to spend inefficiently and beyond their means. When looking at the relations between subnational governments balance and all the decentralization variables presented on the left side of Table 8, the only significant relation that supports this is the negative and significant coefficient of the non-tax revenue variable. Every other significant coefficients are positive, giving no support to the argument of DeMello. The significant and positive coefficient of the subnational spending ratio variable implies that decentralization, measured without considering revenue autonomy, has a positive

influence on fiscal balance. Subnational revenue autonomy is not significantly damaging fiscal positions of subnational governments, while revenue dependency seems to improve it. Hence, none of these results suggests a negative relation between decentralization, defined as revenue autonomy, and subnational government balance.

Table 8 : ***Sign and significance of estimated coefficients, decentralization variables of the DeMello Model***

Variables	Subnational government balance		Central government balance	
	Multiple regression	Simple regression	Multiple regression	Simple regression
Log subnational tax revenue ratio	(+)**	(-)	(-)*	(-)*
Log subnational spending ratio	(+)*	(+)*	(-)	(-)
Log subnational grant ratio	(-)	(+)	(+)*	(+)*
Log subnational tax autonomy	(-)	(+)	(-)*	(-)*
Log subnational tax sharing	(-)	(-)	(-)*	(-)
Log subnational fiscal dependency	(-)	(+)	(+)*	(+)
Log subnational non-tax autonomy	(-)*	(-)*	(+)	(+)
Log subnational revenue autonomy	(-)	(+)**	(+)**	(+)**
Log subnational own revenue ratio	(-)	(+)	(+)	(+)*
Log subnational dependent revenue ratio	(+)*	(+)	(-)	(-)

* Significant at the 1 % level. **Significant at the 5 % level. ***Significant at the 10 % level.

Results for central government balance reported on the right side of Table 8 are less convincing. Tax revenue has a negative impact on fiscal positions, while the opposite is found for grant revenue. On the other hand, new decentralization variables suggest a positive and significant relation between revenue autonomy and central government balance. It is difficult to say if decentralization is really worsening fiscal positions of central government, but evidence suggests that fiscal autonomy is not. The important

point here is to notice that for both levels of government, revenue autonomy has a different impact on macroeconomic stability, than does revenue dependency.

The DeMello model shows some important weaknesses concerning control variables. The p-value of their joint significance test is, in some estimations, higher than 5 %, which should lead to the rejection of the whole set of control variables at this degree of significance (see Table 7). The variable of age dependency ratio is sometimes positive and significant (which is totally counterintuitive), sometimes not significant and one time negative and significant. Sign contradiction on a significant coefficient is a major question for the validity of a model. The same problem also appears for the variable of GDP growth. Results for the variable of the money growth show the wrong (negative) sign, but are at least stable. The coefficient of the terms of trade adjustment variable is significant in most estimations. It is positive with central government balance and negative with subnational government balance, which is confusing. The small size of the sample might explain discrepancies. It is also possible that the model is not well designed to explain fiscal imbalances of European transition economies.

Economic growth

Table 9 reports estimation results of the Davoodi and Zou model. Sign and significance of coefficients of all decentralization variables are also grouped in Table 10. No significant relation is found between spending ratio net of grants and economic growth (Panel A of Table 9). This supports the findings of Davoodi and Zou for industrialised countries, but not for developing countries. This could be explained by the fact that countries in the sample share some key characteristics with developed economies.

Table 9 : ***Replication of the Davoodi and Zou model : Decentralization and economic growth***

Panel A : Davoodi and Zou, and Ebel and Yilmaz decentralization variables

		Multiple regressions					Simple regressions				
		Per capita GDP growth					Per capita GDP growth				
Decentralization measure variables	Subnational spending ratio net of grants	0,246 (0,254)					-0,083 (0,466)				
	Subnational tax autonomy		-0,052 (0,828)					-0,121 (0,667)			
	Subnational tax sharing			0,05 (0,228)					-0,071 (0,023)		
	Subnational fiscal dependency				-0,093 (0,072)					0,019 (0,698)	
	Subnational non-tax autonomy					0,198 (0,013)					0,217 (0,024)
Control Variables	GDP per Capita	-0,093 (0,032)	-0,06 (0,056)	-0,071 (0,046)	-0,063 (0,041)	-0,032 (0,144)					
	School enrollment	-0,081 (0,538)	0,007 (0,953)	-0,188 (0,280)	-0,156 (0,398)	-0,162 (0,334)					
	Population Growth	-0,905 (0,522)	-2,12 (0,091)	-4,03 (0,013)	-3,34 (0,024)	-1,15 (0,330)					
	Investment	0,406 (0,010)	0,294 (0,014)	0,42 (0,020)	0,466 (0,009)	0,437 (0,001)					
	Adj R-square	0,9221	0,9467	0,9927	0,9045	0,969	0,836	0,9016	0,8909	0,824	0,8686
	Control variable joint significance P-Value	0,0325	0,0282	0,0081	0,029	0,0185					
	Nom. Obs.	30	30	30	30	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Panel B : New decentralization variables

		Multiple regressions			Simple regressions		
		Per capita GDP growth			Per capita GDP growth		
Decentralization measure variables	Subnational revenue autonomy	0,112 (0,084)			0,223 (0,000)		
	Subnational own revenue ratio		0,083 (0,679)			0,386 (0,061)	
	Subnational dependent revenue ratio			-0,449 (0,182)			-0,767 (0,003)
Control Variables	GDP per Capita	-0,037 (0,217)	-0,058 (0,065)	-0,059 (0,052)			
	School enrollment	0,001 (0,996)	0,036 (0,755)	-0,22 (0,245)			
	Population Growth	-1,783 (0,297)	-1,699 (0,164)	-3,193 (0,048)			
	Investment	0,274 (0,030)	0,26 (0,031)	0,382 (0,003)			
	Adj R-square	0,9729	0,93	0,9379	0,9808	0,8971	0,946
	Control variable joint significance P-Value	0,198	0,0885	0,0195			
	Nom. Obs.	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Estimation results of the Davoodi and Zou model using indicators of Ebel and Yilmaz also appear in the Panel A of Table 9. Since no control variables were used in the Ebel and Yilmaz study, simple regression results reported on the right side of this panel serve for comparison. In the Ebel and Yilmaz study, tax autonomy and non-tax autonomy both had a significant and positive relation with per capita GDP growth, and tax sharing had a significant negative one. Except for tax autonomy, which is not significant here, results reported on the right side of Panel A are similar to the ones of Ebel and Yilmaz. However, when controlling for other variable effects, the tax sharing coefficient looses its significance (left side of Panel A). Non-tax revenue still has a positive and significant coefficient and fiscal dependency now gets a negative and significant one (see also Table 10).

Table 10 : ***Sign and significance of estimated coefficients, decentralization variables of the Davoodi and Zou Model***

Variables	**Per capita GDP growth**	
	Multiple regression	**Simple regression**
Subnational spending ratio net of grants	(+)	(-)
Subnational tax autonomy	(-)	(-)
Subnational tax sharing	(+)	(-)**
Subnational fiscal dependency	(-)***	(+)
Subnational non-tax autonomy	(+)***	(+)***
Subnational revenue autonomy	(+)***	(+)*
Subnational own revenue ratio	(+)	(+)***
Subnational dependent revenue ratio	(-)	(-)*

* Significant at the 1 % level. **Significant at the 5 % level. ***Significant at the 10 % level.

Estimation results of multiple regressions presented on the left side of Panel B (Table 9) show a positive and significant coefficient for the subnational revenue autonomy variable and no significant coefficient for the two other variables. This implies that, even if subnational share of governments' revenue has no significant impact on economic

growth, the composition of revenue has a significant impact on it. Other things being equal, economies with a higher level of subnational governments' fiscal autonomy tend to grow faster. Also, simple regressions results presented on the right side of Panel B suggest a positive and significant correlation between subnational own revenue ratio and economic growth, and a negative and significant correlation for the subnational dependent revenue ratio (see also Table 10). This amplifies the importance of subnational governments fiscal autonomy when analysing the effect of decentralization on economic growth. Decentralization of fiscal power to subnational governments seems to improve economic performance, while decentralization of expenditures coming with centrally controlled revenues seems to be an obstruction to economic growth.

Coefficients of control variables of the Davoodi and Zou model reported in Table 9 show similarities with the original study. Economies with smaller GNI per capita and smaller population growth tend to grow faster. Higher investment share of GDP brings higher economic growth. School enrolment has the wrong (negative) sign, but is never significant. Also, as in previous regressions, p-value of joint significance test for the set of control variables is sometimes high (over 5 %). This is an indication of the weakness of the model. Here again the reduced size of the sample might be part of the explanation.

Public sector size

Table 11 presents estimation results of the Oates model. Sign and significance of decentralization coefficients are grouped in Table 12. In the first two lines of Panel A (Table 11) appears the estimated coefficients of Oates decentralization variables. It shows a significant and positive relation between decentralization, measured as subnational share of government revenue and expenditure, and the public sector size. According to the theory of the Leviathan State, this relation should be negative. In this case, results presented in Panel A (Table 11) are similar to the ones of the original study: there is no evidence of the Leviathan State theory.

Table 11 : ***Replication of the Oates model : Decentralization and public sector size***

Panel A : Oates, and Ebel and Yilmaz decentralization variables

		Multiple regressions						Simple regressions					
		Public sector size						Public sector size					
Decentrali-zation measure variables	Subnational revenue ratio	0,112 (0,073)						0,044 (0,650)					
	Subnational spending ratio		0,154 (0,018)						0,027 (0,746)				
	Subnational tax autonomy			-0,772 (0,001)						-0,389 (0,062)			
	Subnational tax sharing				0,051 (0,280)						0,089 (0,045)		
	Subnational fiscal dependency					-0,059 (0,335)						-0,087 (0,097)	
	Subnational non-tax autonomy						0,097 (0,031)						0,136 (0,000)
Control Variables	Urban population ratio	-2,092 (0,027)	-2,98 (0,014)	-3,746 (0,000)	-1,801 (0,077)	-1,598 (0,104)	-1,752 (0,069)						
	GDP per capita	-0,002 (0,820)	0,001 (0,903)	-0,001 (0,903)	0,006 (0,391)	0,008 (0,357)	0,008 (0,239)						
	Population Growth	-0,394 (0,001)	-0,35 (0,002)	-0,431 (0,000)	-0,318 (0,010)	-0,328 (0,008)	-0,253 (0,012)						
	Adj R-square	0,9678	0,961	0,9863	0,9686	0,968	0,9719	0,9461	0,9514	0,9435	0,9697	0,9539	0,944
	Control variable joint significance P-Value	0,0003	0,0013	0,0000	0,0265	0,0218	0,0218						
	Nom. Obs.	30	30	30	30	30	30	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Panel B : New decentralization variables

		Multiple regressions			Simple regressions		
		Public sector size			Public sector size		
Decentrali-zation measure variables	Subnational revenue autonomy	-0,181 (0,167)			-0,104 (0,005)		
	Subnational own revenue ratio		0,217 (0,258)			-0,049 (0,802)	
	Subnational dependent revenue ratio			0,222 (0,420)			0,548 (0,021)
Control Variables	GDP per Capita	-1,508 (0,183)	-2,763 (0,020)	-1,216 (0,193)			
	Population Growth	-0,003 (0,755)	0,006 (0,441)	-0,002 (0,879)			
	Urban population ratio	-0,196 (0,075)	-0,227 (0,011)	-0,418 (0,001)			
	Adj R-square	0,9505	0,9524	0,964	0,9493	0,9446	0,9596
	Control variable joint significance F-statistic	0,155	0,0081	0,0037			
	Nom. Obs.	30	30	30	30	30	30

P-Values are in parentheses, showing levels of significance.

Estimation results of the coefficients of Ebel and Yilmaz variables also appear in Panel A of Table 11. Simple regression results presented on the right side suggest a negative and significant coefficient for tax autonomy and a positive and significant one for non-tax autonomy. These results are the same as in the Ebel and Yilmaz study. Simple regression results in Panel A also reveal a significant and positive coefficient for tax sharing and a negative and significant one for fiscal dependency. These results are a little hard to explain. However, when controlling for the effects of other variables (left side of Panel A), only coefficients of tax autonomy and non-tax autonomy remain significant, with respect to results of the Ebel and Yilmaz study. Table 12 also illustrates this.

Table 12 : ***Sign and significance of estimated coefficients, decentralization variables of the Oates Model***

Variables	**Public sector size**	
	Multiple regression	**Simple regression**
Subnational revenue ratio	(+)***	(+)
Subnational spending ratio	(+)**	(+)
Subnational tax autonomy	(-)*	(-)***
Subnational tax sharing	(+)	(+)**
Subnational fiscal dependency	(-)	(-)***
Subnational non-tax autonomy	(+)**	(+)*
Subnational revenue autonomy	(-)	(-)*
Subnational own revenue ratio	(+)	(-)
Subnational dependent revenue ratio	(+)	(+)**

* Significant at the 1 % level. **Significant at the 5 % level. ***Significant at the 10 % level.

Panel B of Table 11 reports estimation results of the new decentralization variables. Multiple regression results suggest that no variable has a significant impact on the public sector size. This is coherent with the findings of Oates. However, simple regression results presented on the right side of Panel B show a negative and significant correlation between revenue autonomy, as well as own revenue ratio, and the public sector size. They also show a positive and significant correlation between subnational dependent

revenue ratio and the public sector size (see also Table 12). These correlations indicate that decentralization of dependent revenue might have a different impact on the public sector size than decentralization of fiscal autonomy. Results presented here are not strong enough to confirm the Leviathan theory, but they at least suggest that fiscal autonomy can have an impact on the public sector size.

Estimated coefficients of the control variables in this model are similar to the ones estimated by Oates (Table 11). Everything else being constant, higher urbanization and higher population seem to bring smaller aggregate public sector size. The GDP per capita coefficient was expected to be positive, but is not significant here. The p-value of joint significance test for control variables is over 5 % for only one estimation. Overall, the Oates model seems to work well enough.

Conclusion

As already mentioned, a multidimensional process like decentralization is hard to define and measure. In empirical study, the measurement problem is crucial, since it may be far-reaching in policy design. This paper has presented an empirical analysis on the importance of considering subnational governments' fiscal autonomy when measuring decentralization. In the past, data was too thin to conduct such analysis. The new data published by the OECD (2001, 2002) have allowed to compute new decentralization measures, based on the level of subnational governments' fiscal autonomy, and to estimate their impacts on economic performance.

Estimation results obtained on the relation between fiscal decentralization and macroeconomic stability lead to two conclusions. First, the negative relation between decentralization and macroeconomic stability does not seem to exist in European transition countries. Second, macroeconomic stability seems to be sensitive to the degree of subnational governments' fiscal autonomy.

Empirical results on the relation between decentralization and economic growth lead to similar conclusions. Subnational share of governments' expenditure does not seem to be related to economic growth in European transition countries. However, the degree of revenue autonomy of subnational governments does seem to be positively related to growth.

Finally, even if less convincing, empirical results on the relation between decentralization and the public sector size seem to point in the same direction. No negative relation seems to exist between decentralization and the public sector size for European transition economies. However some negative correlation is observed between fiscal autonomy and the public sector size. This correlation disappears in the multiple regression analysis, but it at least suggests that public sector size could be influenced by the fiscal autonomy of subnational governments.

The collection of more data on fiscal design across levels of governments should be a major concern for future work on decentralization. The main weakness of most of studies on the subject is scarcity of data. Even in this paper, the small size of the sample restricts statistical capacity. Results are not wrong, but they are not strong. More country analyses are needed and data should cover longer periods of time. Better data will bring better empirical analysis on decentralization. It will help to understand this ongoing process that already affects most developing and transition economies.

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