On the link between fiscal decentralization and public debt in OECD countries

Thushyanthan Baskaran

Abstract Excessive borrowing by subnational governments is considered to be one of the perils of fiscal decentralization. On the other hand, fiscal decentralization might ensure the fiscal stability of the public sector by constraining Leviathan governments. Since the impact of decentralized government on fiscal outcomes is therefore ambiguous from a theoretical perspective, we explore this question empirically with a panel of 17 OECD countries over the 1975–2001 period. Our findings suggest that expenditure decentralization significantly reduces public indebtedness, whereas tax decentralization and vertical fiscal imbalances are insignificant.

Keywords Fiscal decentralization · Public debt · Soft budget constraints

JEL Classification H71 · H77 · H30

1 Introduction

Public sector decentralization has become an important policy goal of major international organizations. The World Bank, for example, claims that fiscal decentralization, when carefully implemented, can decrease political instability, increase government efficiency, and contribute to the overall level of welfare (World Bank 2000); and it thus has supported several decentralization projects in its client countries during the last two decades (World Bank Independent Evaluation Group 2008).

Within economics, the presumption that fiscal decentralization has primarily beneficial consequences stems from two lines of thought. First, from the famous decentralization theorem, which states that a decentralized provision of public goods is capable of addressing varying preferences between inhabitants of geographically and culturally disparate regions (Oates 1972; Tiebout 1956); and second from the Public Choice tradition, where it is argued that the division of the state into several tiers and the existence of competing jurisdictions

T. Baskaran (✉)
University of Heidelberg, Heidelberg, Germany
e-mail: thushyanthan.baskaran@awi.uni-heidelberg.de

restricts the ability of Leviathan governments to over-tax citizens (Brennan and Buchanan 1980).

This sympathetic outlook on fiscal decentralization has not remained without criticism, and several potential drawbacks have been identified in the literature. For example, it is well known that fiscal decentralization might decrease the ability of governments to conduct stabilization policies and to redistribute income (Musgrave 1959). The primary reason for a growing disenchantment, however, is that fiscal decentralization may distort the incentives of subnational and federal politicians if it is ill-designed. This drawback, it is often argued, causes decentralized states to be more prone to macroeconomic instability, higher deficits, and unsustainable levels of debt (Goodspeed 2002).

Yet while both theoretical contributions and case studies seem to indicate that fiscal decentralization leads to suboptimal fiscal and economic outcomes, systematic econometric evidence remains scarce. This paper therefore aims to explore empirically the validity of this claim with panel data for 17 OECD countries over the 1975–2001 period. To this end, we review in Sect. 2 the empirical and theoretical literature on fiscal decentralization and public finances more thoroughly. In Sect. 3, we describe how we operationalize the general notion of fiscal decentralization, and discuss the dependent and the independent variables used in the econometric analysis. In Sect. 4, we discuss our specification and introduce the empirical model. In Sect. 5, the results are presented. In Sect. 6, we conclude.

2 Literature review

One important strand of the literature on fiscal federalism argues that decentralization endangers the fiscal stability of the public sector by causing "soft budget constraints".[1] In the relevant contributions, a principal-agent relationship between federal and subnational governments is assumed, and conditions under which moral hazard might prevail on the latter's part are identified.

Goodspeed (2002), for example, develops a model that covers two periods. In the first period, subnational governments provide a local public good by either taxing citizens or by borrowing. The objective of the federal government is to maximize its reelection probability. This probability is modeled as a function of net-consumption levels in each jurisdiction. Since second period net-consumption in a jurisdiction is diminished by first-period debt because subnational governments have to repay the principal and interest, the federal government can increase net-consumption and thus the probability of its reelection by granting appropriate bailout transfers. These incentives of the federal government are taken into account by subnational governments in the first stage, i.e., when they decide on the level of borrowing—which leads to inefficiently high levels of subnational borrowing.[2]

Apart from the soft budget constraint concept, there are alternative, albeit related, arguments as to why fiscal decentralization could contribute to fiscal imbalances. A strand of the literature in concerned with the impact of intergovernmental transfer schemes. The basic idea behind these approaches is that vertical transfers might contribute to common pool problems. If the federal government allocates grants to subnational jurisdictions at its discretion, the latter have an incentive to appear as if they are needy: They might then run high

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[1] See Kornai et al. (2003) for an extensive discussion of the soft budget constraint concept.

[2] Wildasin (1997) develops a related model to study the consequences of soft budget constraints in intergovernmental relations for social welfare.

deficits in order to "prove" that they are under-financed. Since the marginal cost of federal funds is distributed over the whole federation whereas the benefits are concentrated within each individual jurisdiction, such a behavior is reasonable from the perspective of individual subnational governments (Weingast et al. 1981).

Another strand of the literature is concerned with the "technical" problems of coordinating the policies of different tiers of government. If there are several independent governments which may spend and tax at their own discretion, a concerted fiscal policy could be impossible to maintain, and might manifest itself in a deficit-bias at all tiers of government (De Mello 1999).

While a considerable number of contributions address the possibility that decentralized states could exhibit a deficit bias, only few theoretical studies try to argue that fiscal decentralization might induce subnational and federal politicians to reduce the level of indebtedness. Thus, more indirect arguments, which essentially address different issues, must be drawn upon.

Public Choice theory has made important contributions in this respect. In this literature, the government is perceived as a revenue-maximizing Leviathan, and fiscal decentralization is believed to force governments to refrain from expropriatory taxation because citizens can leave jurisdictions where the government behaves as a revenue-maximizer (Hayek 1939; Brennan and Buchanan 1980).[3] Also, contrary to the traditional view that tax sharing arrangements and vertical fiscal imbalances lead to inefficiencies by enabling governments to "collude" and thereby avoid the competitive pressures generated by fiscal decentralization, there are some arguments in this literature which suggest that they can be welfare-enhancing. For example, Köthenbürger (2005) shows that equalization schemes can complement tax competition in achieving more efficiency by indirectly "taxing" the tax revenue extracted by Leviathan governments.

These Public Choice arguments can be adapted straightforwardly to explain public indebtedness by arguing that levels of debt should be lower when citizens take future tax burdens into account in their mobility decisions, or if these are capitalized in residential property prices.

The question of how fiscal decentralization is related to debt accumulation is not well explored in the empirical literature. Rather, the impact of fiscal decentralization on the size of government seems to have evoked more interest among applied econometricians.[4] Oates (1985), for example, explores Brennan and Buchanan's Leviathan hypothesis both with US state-level data and with international data, but fails to find a significant relationship. On the other hand, using time-series data at the federal level, Marlow (1988) finds that fiscal decentralization is negatively related to total government size in the United States.

In a study with panel data on 32 industrial and developing countries, Jin and Zou (2002) reach more differentiated conclusions by disaggregating the general concept of fiscal decentralization into different "representations". That is, they recognize that fiscal decentralization

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[3]The idea that competition between public entities can improve the functioning of government must not only apply to horizontal tax competition between subnational governments. For example, Eichenberger and Schelker (2007) show for Swiss cantons that the existence of so called Finance Commissions, which are elected separately from the government as an independent review body of budget decisions, leads to smaller tax burdens. However, it should also be mentioned that there are some contributions arguing that competition by public institutions alone is not sufficient to generate efficient outcomes, e.g., Apolte (2001).

[4]There are also a number of studies that investigate the impact of fiscal decentralization on non-fiscal variables empirically. For example, Fisman and Gatti (2002) show for US states that vertical federal transfers are associated with higher rates of conviction for abuse of public office. They conclude on the basis of this finding that vertical fiscal imbalances and soft budget constraints might lead to higher rates of corruption.

could either pertain to the expenditure or the revenue side of the budget, and that the effects might vary according to the side of the budget that is considered. Indeed, they discover the existence of conflictive effects. Their results confirm that it is important to perceive fiscal decentralization as a general concept that encompasses several different aspects. That is, expenditure and revenue decentralization, and vertical fiscal imbalances (i.e., differences between subnational expenditure and revenue autonomy) should be treated as different and independent representations of fiscal decentralization, and analyzed as such.

The fact that there is only a limited number of studies on the impact of fiscal decentralization on government indebtedness does not imply that researchers have not attempted to analyze the determinants of public debt in general. On the contrary, there is a large literature that is concerned with this issue, and recognizing the contributions therein is important for the correct specification of the econometric model further below.

Since the traditional "normative" approaches explain the varying levels of indebtedness between countries only insufficiently,[5] the more recent literature tends to focus on "political" explanations (Alesina and Perotti 1995). One line of research explores whether there are ideological differences in the borrowing policies of governments. Two noteworthy studies are Neck and Getzner (2001), who conduct a case study on the politico-economic determinants of public debt growth in Austria; and Seitz (2000), who analyses the determinants of subnational deficits in Germany. Both studies, however, find that economic factors are generally more relevant than ideological variables.

Another line of research on the political determinants of public debt explores whether government fragmentation (in parliamentary systems) or, respectively, divided government (in presidential systems) has an effect on fiscal outcomes. The theoretical expectation is that the common pool problem is more severe when governments consist of many coalition partners (parliamentary systems) or when different parties control the presidency and the legislature (presidential systems). Volkerink and de Haan (2001) indeed find that some forms of fragmented government lead to larger deficits. However, Elgie and McMenamin (2008) show that their results cannot be generally replicated when a different sample is used.

The effect of fiscal institutions on public borrowing is also analyzed in several studies. Feld and Kirchgässner (2001), for example, argue that direct-democratic institutions like budget referendums might prevent inefficient and selfish actions by politicians who operate within the general framework of a representative democracy. In their empirical analysis with panel data on Swiss municipalities, they indeed find that such direct democratic institutions lead to lower public indebtedness. With respect to the United States, Kiewiet and Szakaly (1996) reach the same conclusion for "guaranteed debt".

A related literature studies the impact of budget procedures on debt accumulation. Both numerical as well as procedural rules have been analyzed. Examples of numerical rules are the budget balance requirements in US states or the Maastricht criteria that stipulate, inter alia, upper limits for public debt and/or deficits. Procedural rules, on the other hand, relate to the stringency of the procedures that govern the various stages at which the budget is formulated.

Cabasés et al. (2007), for example, explore the effectiveness of borrowing restrictions with data on Spanish municipalities, and find that they impose some discipline on the borrowing policies of local governments. Lagona and Padovano (2007) criticize the methodology with which the impact of budget rules is usually analyzed. They argue that the application of indices to measure the stringency of rules implies the need for arbitrary classifica-

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[5]That is, contributions which perceive the need for "consumption smoothing" and "macro-economic stabilization" as the main determinants of the government's borrowing policy.

tions. Instead, they propose a nonlinear principal component analysis approach. However, their results, too, indicate that more stringent rules lead to larger fiscal balances and smaller budget sizes. Using data on US states, Bohn and Inman (1996) also confirm the finding that fiscal outcomes are significantly related to budget rules.

As stated above, there are only a few empirical studies which *primarily* consider the impact of fiscal decentralization on fiscal balances.[6] De Mello (2000) focuses on the effect of fiscal decentralization on the deficit of the federal and subnational governments separately. He finds that subnational tax autonomy generally leads to an increase in subnational deficits, which implies that decentralization might aggravate soft budget constraints and coordination failures.

Fornasari et al. (2000) find in their study on 32 developing and industrial countries that expenditure decentralization generally contributes to a larger government sector, but that subnational deficits are unrelated to the fiscal balance of the central government. However, once a revenue measure of decentralization is used, decentralization turns out to be negatively related to central government budget deficits. They also differentiate between a "long-run" analysis using cross-section averages and a "short-run" analysis using the within-panel variation, and find that expenditure decentralization increases central government deficits when the within-variation is used.

Freitag and Vatter (2008) find in a study with data from Switzerland that more decentralized cantons tend to have smaller deficits in times of economic crisis. However, they fail to observe significant differences between centralized and decentralized cantons when the economy is doing well.

Further studies on this and related questions are Stein (1998), who observes that decentralization expands the public sector's size but not the deficit of the total government sector in Latin America; Rodden (2002) who controls in some models for the degree of revenue and expenditure decentralization, and finds that both tend to increase total government deficits; and Schaltegger and Feld (2009) who find for Switzerland that less centralized cantons are more likely to conduct successful fiscal adjustments.

Our review of the literature shows that some studies find that fiscal decentralization endangers the fiscal stability of the public sector, while others point in the opposite direction. Since each study estimates idiosyncratic models and uses different datasets, the existing literature is by no means conclusive, which suggests that it might be worthwhile to accumulate additional evidence on this issue. We can think of two major drawbacks of existing studies. First, most studies use questionable variables for measuring the degree of fiscal decentralization and might thus reach wrong conclusions. Second, the focus on subnational instead of consolidated government borrowing might be problematic because fiscal decentralization, if it indeed leads to inefficiencies, must not necessarily lead to a worsening of *subnational* finances. We describe in the next section how we try to address these drawbacks.

3 Data

Since both the theoretical and empirical literature suggest that decentralization might have an impact on public finances but do not offer a clear finding, we explore the question further

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[6]There are some studies which control for the impact of fiscal decentralization while being ultimately interested in different questions. For example, Singh and Plekhanov (2005) use in a study of the effectiveness of subnational borrowing restrictions a decentralization measure as a control variable. They find in some models that decentralization tends to significantly increase subnational deficits. But given that this question is not the main focus of their analysis, this conclusion should be considered as preliminary.

with the following innovations: First, by using a new measure which captures the effective (or "real") degree of tax decentralization better than those variables that are traditionally used; second, by using data on consolidated government debt instead on federal and subnational debt or deficits separately; third, by using panel data; and fourth, by conducting several robustness checks.

3.1 Decentralization measures

A major problem for applied econometric work in fiscal federalism is to find an accurate measure of fiscal decentralization. Most authors use indicators derived from the IMF's GFS yearbook.[7] It is widely recognized that these measures do not necessarily capture the true degree of subnational autonomy and importance (Ebel and Yilmaz 2002). On the expenditure side, they do not distinguish whether subnational governments decide on the level and composition of expenditures autonomously, or whether they simply act as spending agencies of the federal government. On the revenue side, they do not distinguish whether subnational governments have autonomous revenue-raising powers, or whether revenues originate mostly from federal grants and tax sharing arrangements. An additional problem with the IMF's GFS measures is that they are incomplete insofar as many values are missing.

Despite these shortcomings, we use two variables derived from the IMF's GFS yearbook and made available in a World Bank dataset to measure the degree of expenditure decentralization and the vertical fiscal imbalance. The measure for expenditure decentralization is constructed as usual by simply dividing all expenditures made by subnational governments by total government expenditures, while the measure for the vertical fiscal imbalance is constructed by dividing subnational revenues from federal grants by total subnational revenues. While recognizing that these measures are not without fault, we nonetheless believe that they provide a satisfactory approximation of these important aspects of subnational autonomy. Furthermore, this particular World Bank database is the only dataset of which we are aware that provides these measures (i) for all OECD countries, (ii) with a panel structure, and (iii) in an easily accessible way.

We call the first measure, since it relies of subnational expenditures, simply *expenditure decentralization*, and the second measure, since it relies of the share of grants received by subnational governments, *grant share*.

Measures more accurate than those from the IMF's GFS yearbook for the degree of tax decentralization are provided in a database constructed by Stegarescu (2005). Building on a particular classification of tax revenues put forward in OECD (1999), Stegarescu derives three different indicators of tax decentralization. These indicators are constructed by differentiating subnational taxes with regard to the degree of autonomy subnational governments have over them. Tax revenue is classified as originating from: (i) taxes for which subnational governments determine both rates and bases ("own taxes"), (ii) the first type of taxes *plus* shared taxes for which subnational governments are involved in determining the revenue split ("shared taxes"), and (iii) the first two types of taxes *plus* all remaining taxes. The tax decentralization measures are then calculated by dividing the tax revenue in each of the three classes by total government tax revenues.

Even though three different measures are provided in Stegarescu (2005), we use in this study primarily the first variable. In the following, we label this variable *tax decentralization*.

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[7]Studies which explore other dimensions of decentralization use a number of alternative measures. Political decentralization, for example, is usually measured by whether the constitution classifies a country as a federation or as a unitary state, and by whether subnational officials are elected (Treisman 2002).

Table 1 Definition and source of decentralization measures

Label	Description	Source
Exp. decentralization	Subnational share of total government expenditures	World Bank/IMF GFS
Tax decentralization	Subnational revenue from taxes for which subnational governments determine rates *and/or* define bases as share of general government tax revenue	Stegarescu (2005)
Grant share	Subnational revenue from federal grants as share of total subnational revenues	World Bank/IMF GFS

Table 2 Summary statistics for decentralization measures

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Exp. decent.	35.232	(14.167)	1.455	65.67	390
Tax. decent.	19.166	(15.039)	0	55.36	446
Grant share	40.239	(18.071)	5.215	86.908	384

Summary statistics are generally calculated with all available observations

Note that the number of observations reported in this table is larger than the number reported in the regression tables because (i) of the use of first-differences to estimate the econometric models and (ii) missing values for some variables

Table 3 Cross-correlation between decentralization measures

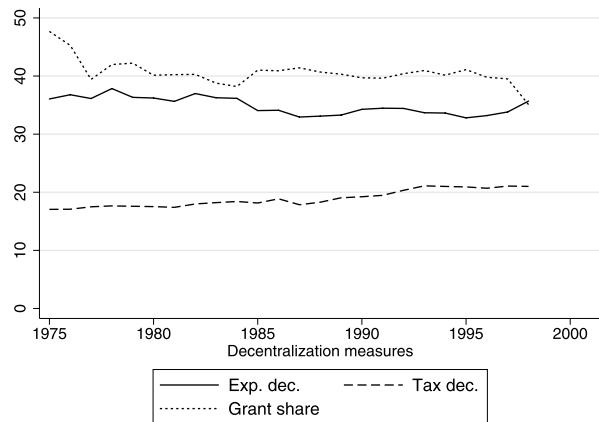| Variable	Exp. decent.	Tax. decent.	Grant share
Exp. decent.	1.000		
Tax. decent.	0.677	1.000	
Grant share	−0.222	−0.445	1.000

Correlation coefficients are calculated with all available observations

We confine ourselves to this variable (except in a robustness check[8]) for two reasons. First, since in our sample subnational governments have control over the revenue split for shared taxes only in four countries (Austria, Belgium, Germany, and Spain), the second measure adds little information to the first. Furthermore, two out of these four countries (Austria and Germany) display almost no variation over time in this variable. The third measure from the Stegarescu dataset, on the other hand, is discarded because it lumps all types of taxes together. It is therefore not much different from the revenue decentralization measure reported in the IMF's GFS yearbook.

A concise description of the measures of fiscal decentralization that are used in this study and their sources is provided in Table 1. Summary statistics are provided in Table 2. A cross-correlation matrix between them can be found in Table 3. In Fig. 1, we show the evolution of their average value for the countries in our sample over time.

[8]We conduct in the empirical part of the paper a robustness check in which *tax decentralization* is measured by the second variable, i.e., the one where shared taxes are also considered. However, we find in this robustness check that none of our results change.

Fig. 1 Development of
decentralization measures, mean
across countries

The correlation matrix shows that expenditure and tax decentralization are fairly strongly and positively correlated. Expectedly, the grant share and tax decentralization variables are negatively correlated. The correlation of the expenditure decentralization and the grant share variables also is negative, but somewhat weaker. These findings suggest that (i) in OECD countries additional subnational expenditures tend to be financed with "own taxes", and (ii) that "own tax" revenues and grant receipts are substitutes in financing subnational jurisdictions.

Both the summary statistics and Fig. 1 suggest that expenditures have been more decentralized than taxes for the whole period of our analysis.[9]

3.2 Dependent and independent variables

In this section, we briefly discuss the dependent and control variables that we use in our econometric models. The variables, their definitions and their sources are listed in Table 4. We report summary statistics on the variables used in the baseline models in Table 5. Summary statistics on the variables used in the robustness checks and the instrumental variables regressions can be found in Table 6.

We use as our primary measure of debt the net financial liabilities of the general government. Net financial liabilities are preferred to gross financial liabilities because they take both public assets and liabilities into account. Obviously, if the government uses debt to acquire some financial or physical asset, the fact that its net financial position remains unchanged should be mirrored by the data. We consider the liabilities of the general government instead of those of the central or subnational tier only because subnational overborrowing must not necessarily lead to deterioration of subnational finances when the center quietly increases transfers (and vice versa). Neglecting this issue might lead to the wrong conclusions with regard to the impact of fiscal decentralization.

Data on net financial liabilities for the 1975–2001 period is available from the OECD, but the time series for some countries (e.g., Spain) are rather short and exhibit several missing values.

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[9]The series are shown only up to 1998 instead up to 2001 in Fig. 1, because after 1998, both the expenditure and grant share variables exhibit missing observations for many countries.

Table 4 Definition and source of variables

Label	Description	Source
Baseline models		
Net financial liabilities	Net financial liabilities in % of GDP	OECD Economic Outlook No. 83
Population	population	OECD Population and Labor Force Dataset
GDP growth	GDP per capita growth, calculated as log differences of GDP per capita (measured in US$, constant prices & PPP)	OECD Economic Outlook No. 83
Unemployment	Unemployment rate	OECD Economic Outlook No. 83
Inflation	Growth in the CPI index	OECD Key Economic Indicators
Working age	Share of people between 15 and 65 years	OECD Population and Labor Force Dataset
Openness	Trade-to-GDP ratio	OECD Macro Trade Indicators
Interest rate	Long-term interest rate on government bonds	OECD Economic Outlook No. 83
Ideology	Index of the ideology of government, higher values indicate more leftist ideology	CPDS I Dataset 1960–2006
Fragmentation	Herfindahl index of government concentration, higher values indicate less fragmented governments	DPI 2006 Dataset
Germany dummy	Pre-unification dummy for Germany	Own calculation
Robustness checks		
Gross-financial liabilities	Gross-financial liabilities in % of GDP	OECD Economic Outlook No. 83
Maastricht debt	Debt according to Maastricht criteria in % of GDP	OECD Economic Outlook No. 83
Shared taxes decent.	Tax decent. + subnational revenue from taxes for which subnational governments are involved in determining revenue split as share of general government tax revenue	Stegarescu (2005)
Instruments		
EMU	Dummy = 1 if EMU member state *and* Year > 1992	Own calculation
Election	Years left in current term of government until next election	DPI 2006 Dataset (Beck et al. 2001)
Industrial production	Index of industrial production, base year = 2005	OECD Main Economic Indicators
Labor cost	% Change of average cost of labor per unit of output in industry	OECD Main Economic Indicators

Table 5 Summary statistics for dependent and independent variables (baseline models)

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Net financial liabilities	26.611	(34.705)	−86.634	115.229	392
Population (in Mil.)	37.324	(57.305)	0.218	285.226	459
Inflation	7.036	(8.178)	−0.691	83.95	458
Working age	66.03	(1.869)	60.78	70.157	452
Openness	62.181	(27.208)	16.1	166.35	459
GDP growth	2.065	(2.053)	−8.244	7.69	459
Unemployment	6.771	(3.363)	1.064	19.108	459
Interest rate	9.859	(3.942)	4.5	29.742	442
Ideology	2.554	(1.534)	1	5	455
Fragmentation	0.703	(0.269)	0.181	1	445
Germany	0.035	(0.184)	0	1	459

Summary statistics are generally calculated with all available observations

Note that the number of observations reported in this table is larger than the number reported in the regression tables because (i) of the use of first-differences to estimate the econometric models and (ii) missing values for some variables

Table 6 Summary statistics for variables used in robust and GMM models

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Gross financial liabilities	59.289	(27.065)	7.939	140.693	401
Maastricht debt	66.726	(25.541)	13.965	134.018	143
Shared taxes decent.	23.917	(15.895)	0	55.36	446
EMU	0.222	(0.416)	0	1	459
Election	1.618	(1.27)	0	4	453
Industrial production	71.709	(16.596)	32.9	104.5	436
Labor cost	3.934	(5.629)	−6.600	35.9	423

Summary statistics are generally calculated with all available observations

Note that the number of observations reported in this table is larger than the number reported in the regression tables because (i) of the use of first-differences to estimate the econometric models and (ii) missing values for some variables

While net financial liabilities are our preferred measure of government debt, we also conduct further below robustness checks with alternative measures. In particular, we consider gross financial liabilities and government debt calculated according to the requirements of the Maastricht treaty.[10]

We use several economic, demographic and political control variables that might be important determinants of fiscal outcomes, and at the same time correlated with fiscal decen-

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[10]Government debt calculated according to the requirements of the Maastricht treaty is particularly useful for cross-country comparisons since it is based on internationally consistent definitions. However, we do not use this particular variable as the primary measure of debt since important federal countries such as the USA or Australia would have to be discarded (only data for EMU member states are available), and because they do not cover the historical post-oil price crisis period (only data from 1990 onwards are available) where the degree of fiscal decentralization might have had an important effect on the growth of debt.

tralization. We discuss in this section the variables included in the baseline models. The variables used in the robustness checks are discussed in subsequent sections.

The population variable is included to control for scale and/or congestion effects in the production of public goods. If the production function exhibits decreasing returns to scale because of the scarcity of some factor (e.g., land), increased expenditure requirements might lead to an expansion of debt. Even though we scale the debt burden for the size of the economy by dividing it by GDP, a country's population size could still have an additional independent effect, and omitting it might lead to biased estimates because more populous states might be also more decentralized (Treisman 2002).[11]

GDP growth and the unemployment rate are included to control for business cycle effects. The inflation rate is included because deficit-finance and an expansion of the money supply are alternative ways to fund public expenditures. The working age variable, which measures the share of the population between 15 and 65, is included to control for the extent that income-earners can shoulder the current and future tax burden due to the existing stock of debt.

We control for the ideology of the ruling party at the federal level by including an index that runs from 1 (far-right) to 5 (far-left). This variable is taken from the CPDS I database constructed by Armingeon et al. (2008). Several contributions have argued that there might be significant differences in the fiscal behavior of ideologically opposed parties. For example, the case that left-wing governments are more likely to conduct expansionary policies and to increase inflation is often made (Hibbs 1977). The effect of ideology on public debt is less obvious, however. While expansionary fiscal policies might on the one hand lead to more spending, some authors argue that left-wing parties are also more likely to increase taxes, with no obvious effect on the level of indebtedness (Borrelli and Royed 1995). We therefore have no strong priors with regard to the sign of the estimated coefficient.

We also include a Herfindahl-Hirschman Index, which measures the extent of government fragmentation, since several studies suggest that more fragmented governments tend to be more susceptible to common pool problems. This index assumes higher values when the government is less fragmented. It is taken from the DPI 2006 dataset provided by Beck et al. (2001).

The openness variable is included to control for the effect of globalization on fiscal outcomes. Omitting this variable might result in biased estimates since globalization could be correlated with the degree of fiscal decentralization and at the same time with public debt (Sharma 2005). However, the expected sign of the coefficient is ambiguous. On the one hand, more open countries might be forced to implement more prudent fiscal policies because investors and firms can more easily leave "inefficient" countries (De Mello 2005). On the other hand, globalization might constrain the ability of governments to raise taxes, forcing them, at least temporarily, to substitute debt for tax revenues (Razin and Sadka 1991).

The interest rate variable is included to control for the costs of borrowing. The expected sign of the coefficient is ambiguous. On the one hand, an increase in the interest rate should make borrowing a less appealing source of finance. On the other hand, short-term debt is often refinanced by acquiring new debt. Since the point in time at which some fraction of the debt is due is fairly exogenous, higher interest rates might simply inflate the repayment costs of the existing stock of debt, thereby leading to more public borrowing.

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[11]While other studies have found that geographical area is a more significant predictor of fiscal decentralization than population size (Treisman 2006), we do not use geographical area as a control variable in our analysis because it is time-invariant and cannot be included in fixed effects models.

Finally, we include a dummy variable for Germany before 1991 to control for the fact that this country was unified in October 1990 and therefore transformed, in some way, into a different country with a greater population, larger GDP, and various other changes.[12]

The careful reader will recognize that one potentially important determinant of public debt is missing from the set of control variables: a measure of how subnational borrowing is regulated, i.e., whether subnational governments are allowed to borrow, and whether special restrictions are imposed upon them by the federal government. This omission needs further explanation since earlier studies, such as that of Rodden (2002), point to the importance of subnational borrowing restrictions for fiscal outcomes. We do not control explicitly for the subnational borrowing regime because available data on borrowing restrictions for the countries in the sample does not exhibit time-wise variation and therefore cannot be included in fixed effects models, which we determine further below as the appropriate specification (see Sect. 4.2).

Note that we also do not control explicitly for the constitutional structure of countries since constitutional features rarely vary over time and are thus multi-collinear with the country fixed effects. That is, we do not directly control for whether a country has a presidential or parliamentary system, whether it exhibits a proportional or plurality electoral rule, and whether it has direct democratic institutions. We also do not directly control for the constitutional standing of subnational governments, that is, whether a country is unitary or a federation.[13] However, these constitutional features are indirectly controlled for through the country fixed effects.

Obviously, only those observations for which all variables had non-missing values can be used in the empirical models. Unfortunately, this requirement reduces the number of available observations considerably, primarily because data on net financial liabilities and the decentralization measures is unavailable for a number of OECD countries. The final dataset consists of 17 countries,[14] and therefore includes just above half of the OECD member states.

3.3 Bivariate relationships

For a preliminary evaluation of the relationship between fiscal decentralization and public debt, bivariate plots between the average net financial liabilities, which is our primary measure of government debt, and the average of each of the three decentralization measures in the countries in our sample are provided in Figs. 2, 3 and 4.

These figures indicate that net financial liabilities are on average negatively related to both expenditure and tax decentralization, and positively related to the grant share variable. Therefore, both expenditure and tax decentralization seem to lead to sounder fiscal policies, whereas vertical fiscal imbalances that are created by top-down grants seem to increase the level of indebtedness.

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[12]Note also that some data for Germany before 1991 are unavailable in the OECD's Economic Outlook No. 83 database. In these cases, we use previous versions of the Economic Outlook database to obtain the data for Germany before 1991.

[13]Note that Belgium ceased to be a unitary country and became officially a federation in 1994. It is also sometimes argued that Spain is effectively a federation even though it still is formally unitary. Based on the variation in Belgium (and perhaps in Spain) a federation dummy could be theoretically included in models with country fixed effects. However, we would have to base the conclusions with regard to this variable on the within variation in at most two countries. Since this does not seem to be reasonable, we do not pursue this approach any further.

[14]Australia, Austria, Belgium, Canada, Denmark, Spain, Finland, France, Great Britain, Germany, Iceland, Italy, Netherlands, Norway, Portugal, Sweden, United States.

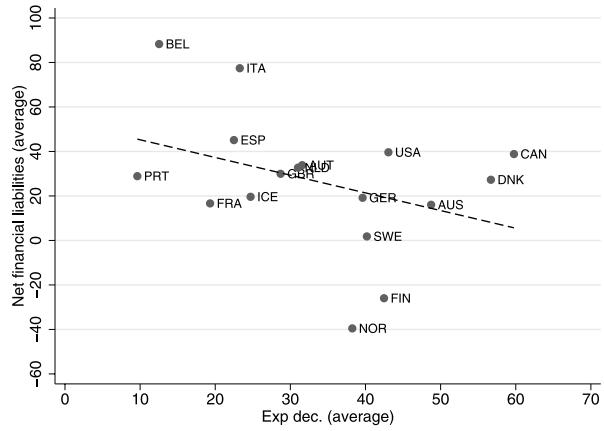**Fig. 2** Net financial liabilities and exp. decentralization

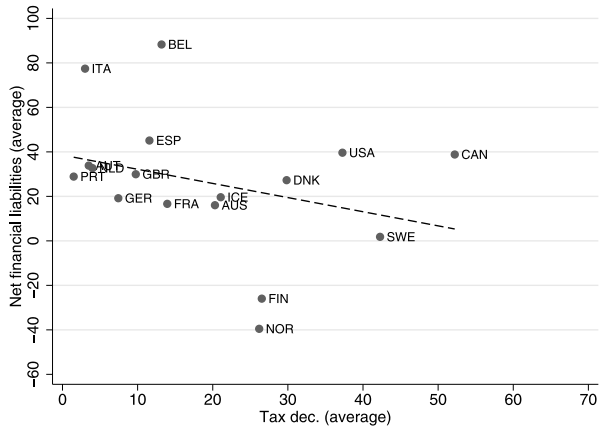**Fig. 3** Net financial liabilities and tax decentralization
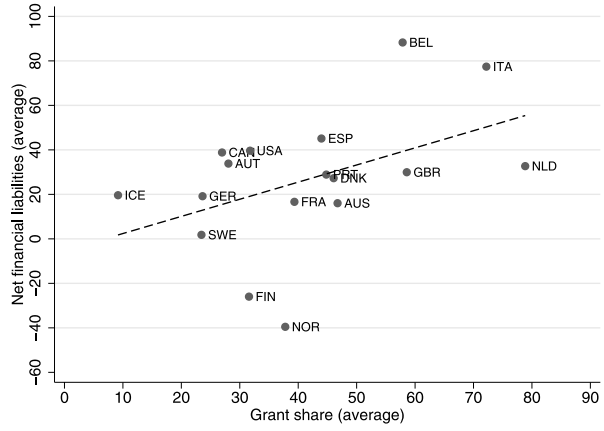

Fig. 4 Net financial liabilities and grant share

Table 7 Panel unit root tests

	Net financial liabilities	Exp. decent.	Tax decent.	Grant share
Levels				
Levin-Lin-Chu	1.826 (0.966)	0.936 (0.825)	0.280 (0.610)	−0.454 (0.325)
Obs.	354	349	403	342
First-differences				
Levin-Lin-Chu	−4.981 (0.000)	−7.944 (0.000)	−9.843 (0.000)	−8.739 (0.000)
Obs.	342	346	395	330

Panel unit root tests are calculated with all available observations

p-values in parentheses

However, the perils of basing conclusions on simple correlations are well known. Therefore, more sophisticated econometric methods are employed in the following sections to analyze the causal impact of fiscal decentralization on public debt.

4 Specification

In this section, we describe our econometric approach. We first investigate whether our main variables of interest are stationary, and then discuss the econometric specification.

4.1 Stationarity

The dependent variable, net financial liabilities, and the three decentralization variables exhibit a significant degree of inertia.[15] When simple autoregressive models are estimated with OLS, we find for each of the variables of interest that the coefficient on the autoregressive term is close to unity. The first-differences, on the other hand, display much less inertia. When the autoregressive models are estimated with the first differences, the coefficient on the autoregressive term is always well below unity.[16]

Next, we investigate the degree of persistence in the variables of interest by using the Levin-Lin-Chu panel unit root test. The results are collected in Table 7. The tests are calculated for both the levels and the first differences of the variables of interest.[17] With respect to the specification, we include a linear trend and individual intercepts in the tests for the levels, but only individual intercepts for the tests with the first differences.[18] The lag length for the tests is automatically determined using the Schwarz Information Criterion.

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[15]We are grateful to the referees of the journal for insisting that we investigate this issue.

[16]Note that we neither control for autocorrelation in the error process, which could lead to inconsistent estimates in models with lagged dependent variables, nor take the panel characteristics of our data into account in these regressions. They are purely explorative.

[17]Note that the panel unit root tests are calculated with Eviews while the econometric models further below are estimated with Stata. The Stata package has superior panel data facilities. However, it lacks, as far as we know, the ability to calculate panel unit root tests with *unbalanced* panel data, forcing us to use the Eviews package instead for calculating these tests.

[18]The reason for considering a trend for the level of variables but not for the first differences is that the unit root tests would be biased towards finding a unit root (and thus to conclude that the process is difference stationary) if we do not formulate the correct alternative hypothesis. The appropriate alternative for the level

According to the results reported in Table 7, the levels of the variables of interest possess a unit root whereas the first differences are stationary.[19] Based on this evidence, we conclude that the econometric model should be specified in first-differences. We thus transform all dependent and independent variables listed in Table 4[20] into first-differences in the models estimated further below.

4.2 Econometric model

We use the following general linear specification as the starting point of our analysis:

$$\Delta y_{it} = \alpha_i + \omega_t + \beta Z_{it} + DEC_{it} + \epsilon_{it}, \tag{1}$$

with y_{it} denoting the net financial liabilities to GDP ratio in country i at period t, α_i country fixed effects, ω_t time fixed effects (year dummies), and ϵ_{it} the error-term. Δ is the first-difference operator. The Z and DEC vectors are defined as follows:

- $Z =\{\Delta$ Population, Δ Inflation, Δ Working Age, Δ Openness, Δ GDP Growth, Δ Unemployment, Δ Interest rate, Δ Ideology, Δ Fragmentation, Germany $\}$
- $DEC =\{$ Δ Exp. decent., Δ Tax. decent., Δ Grant share$\}$

We check for the validity of hypothesis tests (and thus implicitly for the validity of the functional form) by investigating whether the residuals from estimating the fully specified model in (1) (that is, when cross-section and time fixed effects are included) are normally distributed. Graphical inspection indicates that the residuals are indeed normally distributed.[21] We also check explicitly the validity of the linear specification by investigating

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variables is, in our case, that they are trend-stationary (and therefore do not possess a unit root). For example, the net financial liabilities to GDP ratio has trended upwards in almost all countries in our sample. When a trend variable is not included in the test equation, such a trending behavior can only be captured by the estimated model by finding a unit root with drift *even if* the series is in reality trend stationary. On the other hand, it is unreasonable to presume that the first differences are trending. Therefore, trends are not considered for the unit root tests on the first differences. See, in particular, Elder and Kennedy (2001) for a more detailed discussion of this issue.

[19]Eviews also displays by default in addition to the Levin-Lin-Chu test the Breitung, Im-Pesaran-Shin, ADF and Phillips-Perron tests. For brevity, we do not report the results from these alternative tests in this paper. They are, however, available upon request. These alternative tests lead to the same conclusion as the Levin-Lin-Chu test with respect to the first-differences, and unambiguously indicate that they are stationary. With respect to the levels, there is some disagreement, e.g., sometimes the unit root hypothesis is rejected. However, in order to avoid the danger of spurious correlations as far as possible, we choose to work with the hypothesis that the levels of the variables of interest are I(1), as indicated by the Levin-Lin-Chu test.

[20]Except the dummy variables and the election variable (which is a count variable).

[21]More formal tests (with the *sktest* and *iqr* test facilities implemented in Stata) suggest the presence of two outliers: Belgium in 1981 and the Netherlands in 1987. Without these two observations, the hypothesis of normally distributed residuals is never rejected. Even though these two observations seem to be outliers, we leave them in the sample since there is no apparent reason that would justify their exclusion. Given that our sample size is around 300, these two observations should not have an undue effect on the estimated coefficients. In order to be sure, we nonetheless check further below whether our results are robust to these two and other potential outliers. We indeed find that the results do not change when potential outliers are excluded. In any case, the presence of a few outliers does not indicate that the linear functional form chosen by us is wrong. That is, there is no systematic evidence that an alternative functional form, e.g., log-log, is more appropriate.

The first outlier is apparently generated by the fact that net financial liabilities to GDP ratio in Belgium has risen by a staggering 16.4 percentage points from 1980 to 1981, presumably because of the economic

whether the dependent variable needs to be transformed to be normally distributed, but find that no transformations are needed.[22]

Next, we explore whether the random or the fixed effects model is the correct specification. Both the Hausman-test and the F-test on the significance of the country fixed effects indicate that the fixed effects model is the more appropriate specification (results are not shown but available upon request). We therefore report results only for fixed effects models.

We then conduct a modified Wald-test for group-wise heteroscedasticity (Baum 2000) on the fixed effects model, and find that the null is usually rejected. In order to make inferences that are robust to this as well as to other types of heteroscedasticity, we always use robust standard errors for hypothesis tests.

Finally, a test for autocorrelation in the idiosyncratic error ϵ_{it} does not reject the null hypothesis of no autocorrelation.[23] We therefore make no adjustments in our specifications in order to control for autocorrelation.

5 Results

We first describe the results from estimating the baseline models according to (1). We then investigate whether these results are robust to alternative definitions of government debt and tax decentralization, and to other changes of the baseline model. Thereafter, we explore whether outliers influence the results unduly. Finally, we check whether potential endogeneity in some of the control variables is a problem.

5.1 Baseline results

The results for the baseline models are collected in Table 8. In the first model (FE 1), none of the decentralization variables are included. In subsequent models, each of the decentralization variables is separately included. More precisely, in the second model (FE 2) only the expenditure decentralization variable is included. Only the tax decentralization variable is included in the third model (FE 3). In the fourth model (FE 4), only the grant share variable is included. Finally, we include in the fifth model (FE 5) all three decentralization variables simultaneously. Since the last model has the most complete specification, we consider this to be our preferred model.[24]

Despite the different specifications, it is reassuring that there are no contradictory findings among the estimates collected in Table 8. This is particularly true for the decentralization variables. That is, the coefficient on the expenditure decentralization variable is significantly negative in both model 2 and 5, while the coefficient on the tax decentralization and

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difficulties in the wake of the second oil crisis. The second outlier is generated by the fact that the net financial liabilities to GDP ratio in the Netherlands has fallen by 14.8 percentage points from 1986 to 1987. In contrast to Belgium, we have no convincing economic explanation for this large reduction. We speculate that it came about by a change in the definition of net financial liabilities in that particular year.

[22]We use the *ladder* and *gladder* diagnostic commands implemented in Stata to investigate whether transformations are necessary.

[23]We use the test proposed in Wooldridge (2002). That we fail to find autocorrelation is an expected result since (i) the model is specified in first differences and (ii) fixed effects are additionally included.

[24]We keep the sample size constant in these models. We therefore use only those observations for which all three decentralization variables are jointly available. This approach ensures that the results do not differ merely because of differences in the number of available observations.

Table 8 Regressions of change of debt to GDP ratio on decentralization measures; 1975 to 2001

	FE 1	FE 2	FE 3	FE 4	FE 5
Δ Population	−1.038[***]	−1.050[***]	−1.040[***]	−1.039[***]	−1.053[***]
	(−11.118)	(−11.323)	(−11.084)	(−11.075)	(−11.214)
Δ Inflation	−0.095	−0.092	−0.101	−0.094	−0.096
	(−0.587)	(−0.555)	(−0.620)	(−0.580)	(−0.581)
Δ Working age	−1.822	−1.636	−1.833	−1.829	−1.655
	(−1.644)	(−1.439)	(−1.646)	(−1.643)	(−1.447)
Δ Openness	0.183[**]	0.171[**]	0.185[**]	0.184[**]	0.174[**]
	(2.176)	(2.076)	(2.186)	(2.181)	(2.075)
Δ GDP growth	0.123	0.121	0.118	0.122	0.117
	(0.996)	(0.987)	(0.958)	(0.984)	(0.941)
Δ Unemployment	0.262	0.158	0.270	0.264	0.169
	(1.098)	(0.633)	(1.141)	(1.108)	(0.685)
Δ Interest rate	−0.543[***]	−0.556[***]	−0.540[***]	−0.541[***]	−0.552[***]
	(−2.717)	(−2.789)	(−2.699)	(−2.715)	(−2.773)
Δ Ideology	0.438	0.473[*]	0.433	0.440	0.468[*]
	(1.541)	(1.689)	(1.521)	(1.547)	(1.667)
Δ Fragmentation	−0.683	−0.733	−0.681	−0.675	−0.725
	(−0.389)	(−0.423)	(−0.384)	(−0.382)	(−0.413)
Germany	−1.651	−1.571	−1.655	−1.661	−1.583
	(−1.308)	(−1.274)	(−1.307)	(−1.307)	(−1.270)
Δ Exp. decent.		−0.235[**]			−0.229[**]
		(−2.108)			(−2.047)
Δ Tax decent.			−0.051		−0.047
			(−0.412)		(−0.335)
Δ Grant share				−0.025	−0.015
				(−0.372)	(−0.207)
N	293	293	293	293	293
F	34.257	30.427	33.404	32.692	28.625
$\bar{R}^2$	0.439	0.444	0.437	0.437	0.440
RMS error	2.916	2.903	2.921	2.921	2.914

t-statistics are shown in parentheses

Hypothesis tests are based on robust standard errors

Estimates for cross-section and time fixed effects are not shown

[*]Significance level at 10%; [**]Significance level at 5%; [***]Significance level at 1%

the grant share variable is not significantly different from 0 in any of the models where these variables are included.

In addition to expenditure decentralization, four of the remaining control variables are significant. One of these is the population variable, which is consistently negative. This suggests that an increase in population leads to less government indebtedness, presumably because scale economies in the production of public goods reduce fiscal pressures in larger countries. The openness variable is consistently positive, which suggests that open economies have to cope with more fiscal instability than relatively closed ones. The esti-

mated coefficient on the interest rate variable is consistently negative, which indicates that governments borrow less when the costs of borrowing increase. Finally, the coefficient on the ideology variable is consistently positive and significant in two models (one of the two is the preferred model), which indicates that left-wing governments used to borrow more during the time-frame of our analysis.

Note also that the Germany dummy is consistently negative and, while being insignificant, displays relatively large t-statistics (in absolute terms). This result reaffirms that Germany has borrowed significantly more after unification. Another variable with relatively high but insignificant t-statistics is the working age variable. The coefficient is consistently negative, thus suggesting that a "less dependent" population is associated with more stable fiscal outcomes. The unemployment rate has a positive, albeit insignificant, coefficient in all models. There is thus some evidence that a higher unemployment rate increases fiscal pressures. Finally, note that the fragmentation variable is consistently negative. Even though the coefficient is insignificant, this suggests that common pool problems are indeed more severe when governments are fragmented. Overall, we find that the control variables perform rather reasonably, thereby strengthening our confidence in the estimates.

We may thus reach as a preliminary conclusion that fiscal decentralization is not harmful for fiscal outcomes. That is, neither expenditure or tax decentralization nor vertical fiscal imbalances seem to increase government indebtedness. We rather find evidence that points in the opposite direction: The consistently negative and significant coefficient on the expenditure decentralization variable suggests that this representation of fiscal decentralization leads to improvements in the fiscal stance of the public sector.

In fact, the debt reducing effect of expenditure decentralization is remarkably large. The numerical value of the coefficients imply that an increase of one percentage point in the subnational to total government expenditures ratio reduces the debt to GDP ratio by about 0.23 percentage points. This result suggests, for example, that about 10.8 percentage points of the (on average) 49 percentage point difference in net financial liabilities between Belgium and Canada can be explained by the (on average) 47 percentage point difference in expenditure decentralization between these two countries. As a comparison, let us relate this figure to the differences in net financial liabilities that can be explained by different population sizes. According to our estimates, an increase of the population by one million reduces the net financial liabilities to GDP ratio by one percentage point. Since the difference in population sizes between Belgium and Canada is about 17 million, 17 percentage points of the difference in the net financial liabilities to GDP ratios can be explained by population size differences. That is, differences in the level of expenditure decentralization are almost as important as differences in population sizes for explaining cross-country differences in indebtedness.

Apparently, the beneficial features of fiscal decentralization dominate the potentially harmful aspects that tend to be emphasized by the theoretical literature on soft budget constraints and common pool problems. However, we recognize that our estimates in this section could suffer from a number of problems. Therefore, we must investigate whether these findings are robust before we reach any definite conclusion.

5.2 Robustness checks

In this section, we explore the robustness of the results from the baseline regressions. These robustness checks are always conducted on the basis of our preferred model (model FE 5 in Table 8).

5.2.1 General robustness checks

We begin by reporting results from six different types of general robustness checks in Table 9. First, we use panel corrected standard errors to conduct hypothesis tests (Beck and Katz 1995). According to the results reported in the first column (Robust 1) of the table, using panel corrected standard errors does not change the results with regard to the decentralization variables. The results from the baseline models with regard to the remaining control variables also are largely confirmed.

In the second column (Robust 2), we present results that are obtained by estimating a model where gross financial instead of net financial liabilities are used as the measure of government debt. We find that expenditure decentralization still displays a negative coefficient. However, it ceases to be significant. On the other hand, the grant share variable, while displaying as in the baseline models a negative coefficient, turns out to be significant. It is not particularly surprising that the results for this model differ to some extent from those for the baseline model given that the correlation coefficient between the first differences of gross and net financial liabilities in our sample is only about 0.77. We discuss this issue further below in more detail.

In the third column (Robust 3), we collect the results from estimating a model where an alternative measure of tax decentralization is used. Whereas tax decentralization in the baseline models is defined as the share of subnational revenues from taxes for which they can set rates and define bases autonomously ("own taxes") to total government tax revenue, this new measure is defined as the share of subnational revenues from "own taxes" and those "shared taxes" for which they have a say in determining the revenue split. Such shared taxes are particularly relevant for subnational governments in evolving federations like Spain and Belgium, but also in traditionally federal countries like Germany and Austria.

Even though a different measure of tax decentralization is used, we find that the results in the third column of Table 9 do not differ from those for the baseline models.

In the fourth column (Robust 4), we present the results from estimating a model where we use as dependent variable a measure of public debt that is calculated according to the requirements of the Maastricht treaty. Obviously, the sample size is smaller for this model since only data for EMU countries after 1990 is available. We find that while expenditure decentralization continues to have a negative effect, it looses its significance. One explanation for this result might be that the period in the aftermath of the oil price shock has to be excluded when this measure of government indebtedness is used, and that expenditure decentralization could have played a particularly important role in arresting the growth of public debt precisely in this period. Note also that the two remaining decentralization variables continue to be insignificant.

In the final column (Robust 5), we report the results from estimating our preferred model in five-year averages.[25] We use five-year averages to investigate the possibility that the results in the baseline models are driven by business cycle effects. If the revenue elasticities with respect to economic growth are different for the central and subnational tiers, the tax decentralization and grant share variables might falsely indicate variability in subnational tax autonomy and the vertical fiscal imbalance and thus lead to incorrect estimates. Averaging the data over five years should reduce such business cycle driven variability. However, we find that our main conclusions from the baseline models are confirmed.

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[25]Since our dataset includes the year 2001, the last period lasts from 1996 to 2001 and is thus technically a six-year average.

Table 9 Regressions of change of debt to GDP ratio on decentralization measures; 1975 to 2001; robustness checks

	Robust 1 (PCSE)	Robust 2 (Gross debt)	Robust 3 (Shared taxes)	Robust 4 (Maastricht)	Robust 5 (5 years averages)
Δ Population	−1.053***	−0.431***	−1.060***	−6.821	−0.325
	(−19.467)	(−4.319)	(−11.185)	(−1.343)	(−0.615)
Δ Inflation	−0.096	−0.081	−0.099	−0.947***	0.120
	(−0.459)	(−0.365)	(−0.595)	(−2.781)	(0.193)
Δ Working age	−1.655*	0.712	−1.645	0.765	−1.746
	(−1.751)	(0.571)	(−1.431)	(0.281)	(−0.951)
Δ Openness	0.174*	0.218***	0.179**	−0.098	0.575
	(1.872)	(2.889)	(2.116)	(−0.467)	(1.664)
Δ GDP growth	0.117	−0.012	0.112	0.330	−0.118
	(0.893)	(−0.082)	(0.900)	(0.820)	(−0.167)
Δ Unemployment	0.169	0.740**	0.162	1.393***	−0.178
	(0.693)	(1.991)	(0.660)	(3.038)	(−0.247)
Δ Interest rate	−0.552***	−0.354	−0.548***	0.627	−0.935
	(−3.105)	(−1.353)	(−2.742)	(0.951)	(−1.274)
Δ Ideology	0.468*	0.160	0.477*	−0.634	0.990
	(1.692)	(0.409)	(1.693)	(−0.706)	(0.914)
Δ Fragmentation	−0.725	−3.753	−0.759	0.067	1.968
	(−0.631)	(−1.468)	(−0.430)	(0.019)	(0.242)
Germany	−1.583***	−2.311*	−1.631		0.604
	(−4.495)	(−1.740)	(−1.297)		(0.320)
Δ Exp. decent.	−0.229**	−0.067	−0.229**	−0.090	−1.055**
	(−2.128)	(−0.514)	(−2.065)	(−0.280)	(−2.040)
Δ Tax decent.	−0.047	−0.030	−0.062	0.158	0.411
	(−0.338)	(−0.188)	(−0.832)	(0.609)	(0.674)
Δ Grant share	−0.015	−0.137*	−0.019	−0.060	0.023
	(−0.149)	(−1.911)	(−0.281)	(−0.630)	(0.093)
N	293	293	293	85	68
F/χ^2	5910.903	10.867	28.556	10.260	22.298
$\bar{R}^2$		0.424	0.441	0.701	0.724
RMS error	3.010	3.248	2.912	2.336	1.526

t-statistics are shown in parentheses

Hypothesis tests are based on robust standard errors (except in PCSE model)

Estimates for cross-section and time fixed effects are not shown

Model significance is evaluated either with a F (in FE models)—or a χ^2 (in PCSE model) statistic

*Significance level at 10%; **Significance level at 5%; ***Significance level at 1%

Overall, we find in this set of robustness checks that the results with regard to the decentralization variables from the baseline regressions are confirmed. Expenditure decentralization is apparently negatively related to public indebtedness, whereas tax decentralization and the share of grants in subnational revenues seem to be unrelated to government borrowing.

The only exceptions to this general result are those where alternative definitions of public debt are used.

While we can explain the insignificance of the expenditure decentralization variable in the "Maastricht" model by alluding to the fact that data is available only from 1990 onwards for the Maastricht measure of public debt, the insignificance of expenditure decentralization in the model with gross financial liabilities as dependent variable is more difficult to explain. Presumably, gross and net financial liabilities measure different aspects of the fiscal stance of the government. This is particularly evident in a country like Norway that exhibited on average negative net financial liabilities of about −40% of GDP (and thus possessed more assets than it had liabilities) during the time frame of our study, whereas its gross financial liabilities were on average a positive 36% of GDP. Considering the fact that gross financial liabilities measure only one side of the government's balance sheet, we believe that we should not base our conclusions on this measure of indebtedness. It is reassuring, however, that even when gross financial liabilities are used as dependent variable, the sign of the expenditure decentralization variable remains negative, and that the two remaining decentralization variables continue to be insignificant—thereby largely confirming our previous results.

5.2.2 Outliers

We report in Table 10 the results from robustness checks where we re-estimate our preferred model after the exclusion of potential outliers. We use both "model-based" and heuristic techniques to determine potential outliers. In the first column of Table 10 (Outlier 1), we exclude all observations for which the (absolute) studentized residual is larger than 2. Ten observations are excluded when this definition of what constitutes an outlier is applied.[26] We find that the results for the decentralization variables do not change.

For the models for which the results are reported in the remaining columns, we use more heuristic methods to determine potential outliers. In the second column (Outlier 2), we exclude all observations for which net financial liabilities are negative. This procedure affects mainly Norway and Finland, and reduces the sample size by 57 observations compared to the baseline regressions. We find that the results remain relatively stable despite the rather large reduction in the sample size. That is, even though expenditure decentralization looses its significance, it still displays a negative coefficient and exhibits a relatively large t-statistic. The remaining decentralization variables continue to be insignificant.

In the third column (Outlier 3), we collect the results from estimating our preferred models without the United States. We conjecture that the USA might be an outlier due to the large deficits incurred during the arms race with the Soviet Union during the late 1980s, and the relatively decentralized public sector. However, we find that the results remain essentially the same.

In the fourth (Outlier 4) and fifth (Outlier 5) column, we present the results when Belgium and Spain, respectively, are excluded. These two countries might influence the results unduly because of the rapid process of decentralization that was initiated in both during the late 1980s. However, we find that the results do not differ from the baseline model.

In view of these results, we conclude that our findings in the baseline models are robust to outliers.

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[26]As mentioned above, Belgium in 1981 and the Netherlands in 1987 belong to the set of excluded observations.

Table 10 Regressions of change of debt to GDP ratio on decentralization measures; 1975 to 2001; outliers

	Outlier 1 (Studentized r)	Outlier 2 (Negative debt)	Outlier 3 (Without USA)	Outlier 4 (Without BEL)	Outlier 5 (Without ESP)
Δ Population	−1.009***	−1.043***	−1.056***	−1.091***	−1.049***
	(−11.752)	(−9.967)	(−10.708)	(−11.648)	(−10.971)
Δ Inflation	−0.202	−0.035	−0.128	−0.092	−0.070
	(−1.474)	(−0.178)	(−0.699)	(−0.573)	(−0.422)
Δ Working age	−1.821*	−1.978	−1.923	−2.433**	−1.439
	(−1.737)	(−1.471)	(−1.519)	(−2.075)	(−1.255)
Δ Openness	0.094	0.194**	0.167*	0.176**	0.173**
	(1.468)	(2.064)	(1.854)	(2.037)	(2.067)
Δ GDP growth	0.142	0.101	0.130	0.159	0.119
	(1.549)	(0.627)	(0.954)	(1.487)	(0.948)
Δ Unemployment	0.285	0.196	0.155	0.126	0.208
	(1.298)	(0.678)	(0.596)	(0.505)	(0.793)
Δ Interest rate	−0.648***	−0.342	−0.542**	−0.537***	−0.536***
	(−3.401)	(−1.623)	(−2.556)	(−2.784)	(−2.647)
Δ Ideology	0.401*	0.455	0.483*	0.533*	0.527*
	(1.711)	(1.234)	(1.717)	(1.877)	(1.855)
Δ Fragmentation	−0.784	−1.488	−0.764	−1.352	−0.891
	(−0.512)	(−0.635)	(−0.441)	(−0.785)	(−0.502)
Germany	−1.453	−1.590	−1.494	−0.763	−1.655
	(−1.251)	(−1.212)	(−1.200)	(−0.620)	(−1.307)
Δ Exp. decent.	−0.216**	−0.199	−0.241**	−0.240**	−0.223**
	(−2.158)	(−1.455)	(−2.114)	(−2.157)	(−1.983)
Δ Tax decent.	0.030	−0.064	−0.064	0.087	−0.039
	(0.233)	(−0.342)	(−0.451)	(0.539)	(−0.242)
Δ Grant share	−0.062	−0.000	−0.029	−0.019	−0.010
	(−0.977)	(−0.000)	(−0.384)	(−0.245)	(−0.137)
N	283	236	270	273	286
F	36.039	20.310	40.680	33.198	29.191
$\bar{R}^2$	0.543	0.429	0.435	0.487	0.440
RMS error	2.381	2.955	2.991	2.733	2.930

t-statistics are shown in parentheses

Hypothesis tests are based on robust standard errors

Estimates for cross-section and time fixed effects are not shown

*Significance level at 10%;   **Significance level at 5%;   ***Significance level at 1%

5.2.3 Endogeneity issues

In this section, we present the last set of robustness checks where we attempt to control for potential endogeneity of the interest, inflation and unemployment rate variables. These variables could be simultaneously determined with government borrowing for the following reasons.

First, it is a reasonable conjecture that lenders might demand risk premiums of governments that are highly leveraged, which would then result in higher borrowing costs. Second, inflation might exhibit reversed causality with government borrowing. That is, countries with a large stock of debt might have an interest in increasing the inflation rate in order to reduce the real debt burden. Third, there might also be a reversed relationship between unemployment and government borrowing. That is, governments might engage in deficit finance to combat unemployment. For these reasons, the estimates might be biased when the potential endogeneity of these three variables is not taken into account.

Unfortunately, it is difficult to find *time-varying* variables that could be used as instruments for these potentially endogenous covariates. As shown further below, the variables we have chosen "work" in the sense that over-identification tests indicate that they are not directly related to government borrowing. The reader should be aware, however, that they are not completely satisfactory from a theoretical perspective.

We use four variables as our main instruments. First, a dummy variable (entitled *EMU* in Table 4) that is 1 for all countries that signed the Maastricht treaty (EU 15) from 1993 onwards and else 0 (for Austria, Finland and Sweden—the former EFTA countries—, this variable is 1 from 1995 onwards since they did not join the EU until that year). The Maastricht treaty imposed significant restrictions on the autonomy of the monetary policy of member states and could therefore be correlated with inflation, unemployment and interest rates. While it also imposed some restrictions for fiscal policy, we find that it was not significantly related to the growth of net financial liabilities when we estimate our preferred model with this variable included.[27] Also, the over-identification tests reported in Table 11 do not suggest that this is an invalid instrument.

Second, we use an index that measures industrial production. This index is constructed by the OECD and considers the goods produced by establishments engaged in mining, manufacturing and the production of gas, electricity, and water. We presume that this variable might be a reasonable instrument since changes in inflation, unemployment and interest rates are likely to be correlated with changes in industrial output.

We use the growth rate of unit labor costs in industry production as the third instrument. As for the change in industrial output, this variable might be related to the potentially endogenous variables. The unit labor cost variable is defined as the average cost of labor per unit of output. This variable is also obtained from the OECD.

The fourth instrument is a variable that measures the number of years until the next election. We presume that governments try harder to influence unemployment and inflation rates in a more favorable direction when an election year approaches.

The results from the regressions with instrumental variables are collected in Table 11. In the first column (GMM 1), we present results when we only instrument the unemployment rate. The results in the second column (GMM 2) are obtained by instrumenting only the inflation rate. The third column (GMM 3) presents results for a model where only the interest rate is instrumented. In the fourth column (GMM 4), we collect the results for a model where all potentially endogenous variables are instrumented simultaneously.

We use all available instruments in most models, instead of choosing heuristically the instrument set for each individual model. The only exception is the model where the unemployment rate is instrumented. In this model, the over-identification test is rejected at the 10% level when the industrial production index is included. We therefore do not use that instrument in this particular model.

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[27]Results are not shown but available upon request.

Table 11 Regressions of change of debt to GDP ratio on decentralization measures; 1975 to 2001; GMM estimations

	GMM 1 (Unemployment)	GMM 2 (Inflation)	GMM 3 (Interest rate)	GMM 4 (Joint)	GMM 5 (Joint & additional IV)
Δ Population	−1.335***	−1.062***	−1.138***	−1.082*	−1.055***
	(−6.605)	(−10.935)	(−5.733)	(−1.881)	(−10.279)
Δ Inflation	−0.465*	0.429	−0.723	0.644	0.307
	(−1.706)	(0.819)	(−0.866)	(0.108)	(0.585)
Δ Working age	0.192	−1.316	−0.191	−1.686	−1.861
	(0.129)	(−1.183)	(−0.069)	(−0.198)	(−1.440)
Δ Openness	0.325***	0.153*	0.234*	0.110	0.173*
	(2.928)	(1.802)	(1.672)	(0.169)	(1.831)
Δ GDP growth	−0.146	0.236	−0.059	0.315	0.186
	(−0.687)	(1.309)	(−0.196)	(0.175)	(0.864)
Δ Unemployment	−2.702	0.351	0.683	1.325	0.164
	(−1.641)	(1.215)	(0.808)	(0.300)	(0.255)
Δ Interest rate	−1.087***	−0.915***	4.217	1.102	−1.506*
	(−2.956)	(−3.024)	(0.644)	(0.066)	(−1.651)
Δ Ideology	0.232	0.301	0.190	0.321	0.279
	(0.788)	(1.094)	(0.318)	(0.292)	(1.087)
Δ Fragmentation	−0.214	−0.084	−4.517	−2.377	0.453
	(−0.119)	(−0.049)	(−0.735)	(−0.165)	(0.223)
Germany	−3.039**	−1.820	−2.133	−1.630	−1.644
	(−2.173)	(−1.526)	(−1.113)	(−0.418)	(−1.379)
Δ Exp. decent.	−0.652**	−0.291**	−0.187	−0.194	−0.297**
	(−2.434)	(−2.481)	(−0.789)	(−0.557)	(−1.983)
Δ Tax decent.	0.095	−0.008	−0.054	0.016	−0.043
	(0.391)	(−0.053)	(−0.180)	(0.042)	(−0.316)
Δ Grant share	0.074	−0.014	−0.103	−0.063	−0.024
	(0.649)	(−0.190)	(−0.529)	(−0.248)	(−0.330)
N	287	287	287	287	282
F	13.008	26.806	6.640	6.065	22.143
RMS error	3.399	2.872	4.405	3.338	2.889
Overid. test	0.454	0.189	0.705	0.286	0.161
Underid. test	0.060	0.049	0.880	0.915	0.046

t-statistics are shown in parentheses

Hypothesis tests are based on robust standard errors

Estimates for cross-section and time-fixed effects are not shown

The p-values (not the test-statistics) for the under- and overidentification tests are reported at the bottom of the table

*Significance level at 10%; **Significance level at 5%; ***Significance level at 1%

All models are estimated with the GMM estimator. The GMM estimator is more efficient than the simple TSLS estimator because it assigns weights to the moment conditions according to their variance.

Note first that according to the over-identification tests (Hansen J) in Table 11, the instrumental variables are valid in a statistical sense in models GMM 1 to GMM 4. It is therefore reassuring that the results in the first two models confirm the main results from the baseline models. That is, expenditure decentralization is negatively and significantly related to government borrowing, and the two remaining decentralization variables are insignificant.

However, once we attempt to instrument the interest rate, we find that the instruments are weak predictors of this particular variable, as evidenced by the large p-value reported for the under-identification test in model GMM 3. We obtain similar results when all three potentially endogenous variables are instrumented simultaneously, as evidenced by the results reported for model GMM 4.

This is not surprising considering the fact that even though the instrumental variable technique ensures consistency, it is less efficient than OLS and thus leads to larger standard errors. This inefficiency problem seems to be particularly severe in the third and fourth model. The F statistic is significantly lower than in the previous models, and not only the decentralization but also the remaining control variables are generally insignificant. Therefore, we should suspect that the insignificance of the expenditure decentralization variable in models GMM 3 and 4 is due to the fact that the set of instruments is weak, and not because expenditure decentralization is genuinely irrelevant for government borrowing. Note, however, that even in these models, expenditure decentralization continues to display a negative coefficient.

In order to confirm that the insignificance of the expenditure decentralization variable in models GMM 3 and 4 is due to weak instruments, we estimate a fifth model (GMM 5). In this model, we once again treat the first differences of the unemployment, inflation, and interest rates as endogenous, as we did in the fourth model, and instrument all three simultaneously. But we also increase the number of instruments. In addition to the main set of instruments, we additionally use the second lag of the *levels* of the unemployment, inflation, and interest rates. The second lags are not directly related to the first differences and thus in principle valid instruments. While this approach is probably not perfect—i.e., using lags as instruments might be inappropriate if the series display strong autocorrelation—the diagnostic tests in the fifth column of Table 11 perform well, thereby increasing our confidence in the results.

The results in model GMM 5 confirm our conjecture with respect to models GMM 3 and 4. That is, when additional instruments are used, expenditure decentralization displays once again a significantly negative effect on public borrowing. Several other control variables, too, become significant again.

Given these results, we believe that the conclusions from the baseline models are robust to endogeneity problems.

6 Conclusion

The aim of this paper was to explore the relationship between fiscal decentralization and public finances. At the outset, we discussed some theoretical arguments as to why fiscal decentralization might lead to unsustainable levels of debt. However, it was also pointed out that fiscal decentralization might have beneficial effects, such as its ability to constrain inefficient government intervention, which might offset the negative aspects. Therefore, an empirical analysis seemed warranted.

In the analysis, which used both decentralization variables derived from the IMF's GFS yearbook (and obtained from a World Bank database) and measures provided by Stegarescu

([2005](#)), we found that a high degree of expenditure decentralization tends to significantly reduce public indebtedness, while tax decentralization and vertical fiscal imbalances were insignificant. That is, even though theoretical contributions tend to emphasize the dangers of fiscal decentralization for fiscal stability, we obtained in our empirical investigations the opposite result. It seems that fiscal decentralization has not been harmful in OECD countries during the 1975–2001 period. In fact, the results for expenditure decentralization indicate that more devolution of spending authority would actually have improved the incentives of politicians to implement sound fiscal policies.

This study has, in our opinion, several implications for future research. For theoretical contributions, the fact that the three representations of fiscal decentralization considered by us apparently have different effects on fiscal outcomes implies that they should be treated as distinct and mutually independent features of a decentralized public sector. In most existing theoretical models, only expenditure or only tax decentralization is considered, and the other variant usually treated as a "residual". Hence, analyzing complex fiscal interactions such as subnational tax competition and the existence of soft budget constraints within one unified model framework could lead to new and interesting theoretical insights.

With respect to empirical research, it might be interesting to scrutinize in more detail why the three representations of fiscal decentralization have different effects. An obvious question to ask is, for example, why exactly expenditure decentralization has such a particularly strong effect in reducing government indebtedness. Is it because subnational governments have better access to dispersed information? Is it because they are more responsive to the wishes of their constituencies? Or do they believe that low levels of indebtedness are an advantage in jurisdictional competition since they signal low future taxes?

Equivalently, it might also be rewarding to explore in more detail why tax decentralization and vertical fiscal imbalances seem to have an insignificant effect. Do the beneficial features of tax competition such as the ability to constrain Leviathan governments exactly offset the potentially negative effects resulting from, for example, horizontal tax competition? Are common pool problems because of vertical fiscal imbalances held in check by the greater extent of hierarchical control that is likely to accompany top-down financing through federal grants? Or do the variables that measure these features of decentralization turn out to be insignificant because they are genuinely irrelevant for fiscal outcomes?

All of these are exciting questions that are likely to be of importance for the ongoing discussion of the merits of fiscal decentralization.

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