



WP/14/209

IMF Working Paper

Vertical Fiscal Imbalances and the Accumulation of Government Debt

Iñaki Aldasoro & Mike Seiferling

IMF Working Paper

Statistics Department

Vertical Fiscal Imbalances and the Accumulation of Government Debt

Prepared by Iñaki Aldasoro & Mike Seiferling¹

Authorized for distribution by Claudia H. Dziobek

November 2014

This Working Paper should not be reported as representing the views of the IMF.

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

Abstract

Delegating fiscal decision making power to sub-national governments has been an area of interest for both academics and policymakers given the expectation that it may lead to better and more efficient provision of public goods and services. Decentralization has, however, often occurred on the expenditure and less on the revenue side, creating “vertical fiscal imbalances” where sub-national governments’ expenditures are not financed through their own revenues. The mismatch between own revenues and expenditures may have consequences for public finance performance. This study constructs a large sample of general and subnational level fiscal data beginning in 1980 from the IMF’s *Government Finance Statistics Yearbook*. Extending the literature to the balance sheet approach, this paper examines the effects of vertical fiscal imbalances on government debt. The results indicate that vertical fiscal imbalances are relevant in explaining government debt accumulation suggesting a degree of caution when promoting fiscal decentralization. This paper also underlines the role of data covering the general government and its subectors for comprehensive analysis of fiscal performance.

JEL Classification Numbers: H60, H74, H77, C33

Keywords: fiscal decentralization, vertical fiscal imbalances, panel data, public debt, GFSY

Authors’ E-Mail Address: ji.aldasoro@gmail.com, mseiferling@gmail.com

¹ We would like to thank Louis-Marc Ducharme, Claudia Dziobek, Alfredo Leone, and participants in the IMF Statistics Brown Bag seminar, and Mark De Broeck, Julio Escolano, Luc Eyraud, Eva Jenkner, Muriel Jolivet, Joana Pereira, and an anonymous referee for very helpful comments and suggestions. All remaining errors are the authors’ sole responsibility.

Contents	Page
I. Introduction	3
II. Review of the Literature.....	4
III. Vertical Fiscal Imbalances: Measurement.....	6
IV. An Overview of the Data.....	8
A. Vertical Fiscal Imbalances.....	8
B. Government Debt Data.....	14
C. Control Variables	15
V. Empirical Analysis.....	18
VI. Concluding Remarks	26
References.....	29
Tables	
1: Summary Statistics – Vertical Fiscal Imbalances.....	10
2: Summary Statistics – Government Gross Debt	15
3: Panel Unit Root Tests	19
4: Main Regression Results	22
5: Regressions with Interaction.....	25
6: Instrumental Variable Regressions	28
Figures	
1: Average Vertical Fiscal Imbalances (1973–2011).....	10
2: Average Expenditure (left) and Revenue (right) Decentralization (1973–2011)	11
3: Average Vertical Fiscal Imbalances (VFI) by Country and Subnational (SN)	12
4: Composition of Vertical Fiscal Imbalances (average).....	13
5: Changes in Vertical Fiscal Imbalances (average).....	13
6: Vertical Fiscal Imbalances and General Government Debt.....	19
Appendix Tables	
A1: Countries and Sample Size for VFI.....	33
A2: Countries and Sample Size for General Government Debt	34
A3: Control variables.....	35
A4: Summary Statistics for Control Variables	36
A5: Additional Panel Unit Root Tests for Main Regressors.....	37
A6: Diagnostics and Model Specification Tests.....	38

I. INTRODUCTION

Fiscal decentralization has been a longstanding area of interest for both policymakers and academics. The idea of devolving authority and decision-making power to lower tiers of government has been put into practice in many countries. International institutions have endorsed fiscal decentralization, with the chief goal of achieving a more efficient fiscal balance between central and sub-national governments for instance World Bank (2000), OECD, and Stegarescu (2004). The policy builds on theoretical arguments based on the principles of welfare economics as a normative anchor. In Europe it is explicit in the Maastricht Treaty and is referred to as the “principle of subsidiarity,”² whereas Canada, Switzerland, and the U.S have had long traditions of decentralized governments (Oates, 1999).

More recent studies distinguish between the *devolution of powers to tax* and the *devolution of powers to spend*. The move towards decentralization has not been homogeneously implemented on the revenue and expenditure side. It has materialized more substantially on the latter than on the former (Dziobek et al., 2011), creating “vertical fiscal imbalances.” Vertical fiscal imbalances (vfi) attempt to measure the extent to which sub-national governments’ expenditures are financed through their *own* revenues including the incurrence of subnational debt liabilities.

There are several channels through which vertical fiscal imbalances can impact fiscal performance. For example, vertical fiscal imbalances are an important potential indicator of soft subnational budget constraints (Rodden et al., 2003; Kornai et al., 2003; Crivelli et al., 2010).³ Distorted incentives may arise in the context of soft budget constraints at the subnational level, potentially forcing the central government to increase transfers and increase debt in the process (Rodden et al., 2003). Investors’ perception of soft budget constraints may lead to higher sovereign risk, thereby increasing borrowing costs and the total deficit. High reliance on transfers (i.e., high vertical fiscal imbalances) by subnational governments can also lead to overspending and/or a lack of proper commitment to tax collection by such governments (Velasco, 1999). If the vertical imbalance is financed by subnational borrowing, there are also potential impacts on the cost of central government borrowing through a crowding-out effect. Furthermore, if subnational governments face insolvency, the central government balance sheet could end up suffering from the realization of explicit or implicit guarantees creating further fiscal risks (IMF, 2009).

² In Europe, the move towards decentralization in many member countries takes place simultaneously with the creation of a supranational authority with increasing powers.

³ While vertical fiscal imbalances might lead to a deterioration of public finances for example, by increasing the primary deficit of the general government as in Eyraud and Lusinyan, (2013), it is not obvious that this effect will persist over time and translate into a higher level of debt.

Nevertheless, the mismatch between revenue and expenditure decentralization is not necessarily bad. Some degree of imbalance is in fact inevitable. As noted by Dziobek et al., (2011), the pattern of decentralization points to the possibility that administratively complex taxes are more efficiently collected at the national level. Rather than a reflection of adverse intergovernmental dynamics, vertical imbalances may therefore be a reflection of efficiency of tax collection and optimal public finance structures. Additionally, in a context where general government fiscal consolidation efforts are seen as critical, a high degree of taxing autonomy by subnational authorities may undermine efforts undertaken by the central governments (Eyraud and Lusinyan, 2013). Furthermore, intergovernmental grants are an important tool in fiscal federalism that can have at least three potential roles, the internalization of spillover benefits across jurisdictions, fiscal equalization, and an improved overall tax system (Oates 1999). A measure of the effects of vertical fiscal imbalances on fiscal discipline could be the change of general government debt, a possibility explored further in this paper.

Using a globally representative panel of countries based on the IMF's *Government Finance Statistics Yearbook*, this paper builds a comprehensive new database on vertical fiscal imbalances to examine the relationship between the accumulation of general government debt and vertical fiscal imbalances for a larger sample of countries than has been used in past empirical work of this topic.

II. REVIEW OF THE LITERATURE

The first generation of the fiscal decentralization literature traces its origins to the seminal contribution from Oates (1972), who argued that goods and services provided in a decentralized manner will be better tailored to meet the needs of those affected by such expenditures. There might also be gains in efficiency and one could argue that such decentralization results in an increased accountability of public officials. Where households have full mobility, they are able to “vote with their feet” by relocating to jurisdictions that provide the type and quantity of public goods that better fit their preferences, increasing the potential benefits from fiscal decentralization (Tiebout, 1956). A second argument in favor of fiscal decentralization builds on the view put forward by Brennan and Buchanan (1980), normally referred to as the “Leviathan hypothesis.” According to this approach, decentralization is a mechanism that can help constrain the size of the public sector and provide incentives for the efficient provision of public services. Competition between different levels of government at the decentralized level can curtail the ability of non-benevolent (“Leviathan”) governments to overtax their citizens, resulting in social welfare gains.

As noted by Oates (2006) and Rodden et al. (2003) there are also good reasons for the existence of potentially detrimental effects of fiscal decentralization. For example, the existence of soft budget constraints at the sub-national government level may create incentives for governments to operate in an irresponsible manner under the expectation that

the central government will come to the rescue, if necessary, should an adverse fiscal outcome materialize.⁴ The failure of subnational governments, in this case, to fully internalize the cost of their expenditure will result in larger subnational deficits and debt along with increased fiscal risk for the central government through implicit or explicit guarantees.

Since the seminal contributions to the theory of fiscal federalism by Tiebout (1956), Musgrave (1959) and Oates (1972), there has been a keen interest in the empirical relationship between fiscal decentralization and a variety of measures of economic performance. With the arrival of the “second generation” of fiscal federalism, Brennan and Buchanan, (1980) provided further insights on the relationship between size of government and economic performance, following the Leviathan hypothesis. Oates (1985), Marlow (1988) and Jin and Zou (2002) among others investigate this issue, with mixed results.

Closely related is the literature that looks at fiscal decentralization and its effect on fiscal balances. A driving concern of this literature is the question of whether fiscal decentralization can lead to coordination problems between different levels of government, generating a deficit bias in fiscal policy-making. De Mello (2000) finds evidence of such deficit bias arising from fiscal decentralization in a sample of 30 countries. This effect is found to be stronger for developing countries. Filgueira et al. (2002) find evidence linking decentralization to higher deficits for the case of Uruguay, whereas Freitag and Vatter (2008) find the link to be operational in Switzerland only in times of crisis.

Narrowing the focus to vertical fiscal imbalances, Rodden et al. (2003) present several case studies investigating vertical fiscal imbalances and soft budget constraints. Karpowicz (2012) looks at four European episodes of narrowing vertical fiscal imbalances and concludes that such reduction was achieved mostly through a progressive devolution of revenues to subnational governments. Rodden (2002) finds that large and persistent aggregate deficits occur when subnational levels of government are highly dependent on intergovernmental transfers while simultaneously enjoying high borrowing autonomy. Crivelli et al. (2010) look at the effect of transfer dependency, a related measure, on subnational health spending. In particular, they are interested in the interaction between transfer dependency and high borrowing autonomy, which they identify as indicative of a soft budget constraint. Their findings suggest that countries with higher transfer dependency where subnational governments enjoy higher borrowing autonomy are more likely to have higher healthcare spending than those with more restrictions on borrowing for lower tiers of government.

⁴ For an interesting application of soft budget constraints to subnational health spending in OECD countries (see Crivelli et al., 2010). Wildasin (1997, 2004) presents a theoretical approach to soft budget constraints and vertical fiscal relations based on game-theoretic concepts.

Our paper is closely related to past work by Eyraud and Lusinyan (2013) and Baskaran (2010). The former looks at the effect that vertical fiscal imbalances have on fiscal performance and introduce a new way of calculating vertical fiscal imbalances. Using a panel of OECD countries, they find consistent support across a range of specifications for the hypothesis that higher imbalances are associated with deteriorations in the primary balance of the general government. Their findings suggest that, on average, for each 10 percentage point decrease in vertical fiscal imbalances, the general government fiscal balance improves by 1 percent of GDP. Baskaran (2010) explores the effect of fiscal decentralization and transfer dependency on general government net debt using a panel of 17 OECD countries. His findings suggest a positive effect of expenditure decentralization on the reduction of government indebtedness. On the other hand, he does not find any evidence that revenue decentralization or transfer dependency are relevant in explaining changes in net government debt.

III. VERTICAL FISCAL IMBALANCES: MEASUREMENT

Fiscal decentralization is a multidimensional phenomenon which is not easily summarized in a single indicator (Dziobek et al., 2011). It can take place on the expenditure side or the revenue side, with the former being more popular in past empirical analyses. Empirical evidence has shown that the decentralization of expenditure does not always correlate with decentralization in revenue, creating “vertical fiscal imbalances.” Vertical fiscal imbalances attempt to measure the extent to which subnational governments' expenditures are financed through *own* revenues rather than transfers from the central government or borrowing by the subnational governments.

No consensus exists regarding the accurate measurement of vertical fiscal imbalances. The concept has its origins in the literature on fiscal federalism, where it is identified as “transfer dependency” (Ruggeri and Howard, 2001; Boadway and Tremblay, 2005; and Oates, 2006). For this reason, most of the literature proxies vertical fiscal imbalances with transfer dependency (transfers received by the subnational governments as a share to their total revenues or spending, sometimes also referred to as “grant share.”) In practice, this strikes a reasonable balance between theory and measurement. In substance, any definition of vertical fiscal imbalances refers to the mismatch between the spending and taxing capabilities of subnational governments vis-a-vis central governments. Transfer dependency and related measures make this idea operational and straightforward to interpret.

However, in most cases this measure is limited to the flows and neglects the alternative option of subnational borrowing as a means to finance expenditures. Expanding the analysis to the balance sheet provides a more complete picture. Borrowing (or selling off assets) constitutes a relevant way of action in the choice set of subnational governments. Incorporating subnational government borrowing is important in accounting for the dynamics of vertical fiscal imbalances.

In light of this, our approach follows that of Eyraud and Lusinyan (2013), who construct a modified measure of vertical imbalances building on transfer dependency but going beyond it by incorporating subnational government borrowing. Denoting r^{own} and s^{own} as subnational government own revenue and spending (with r and s representing total revenues and spending by subnational governments, and R and S as revenues and spending by the general government), $t^{(+)}$ and $t^{(-)}$ as transfers received and paid, respectively, by the subnational government⁵, and, b as net borrowing by the subnational government; then vertical fiscal imbalances (vfi) can be defined as:

$$vfi = 1 - \frac{r^{own}}{s^{own}} \quad (1)$$

Furthermore, following Eyraud and Lusinyan (2013), $s = r^{own} + t^{(+)} + b = s^{own} + t^{(-)}$, then equation (1) can be re-written as:

$$vfi = 1 - \frac{s^{own} + t^{(-)} - t^{(+)} - b}{s^{own}} \quad (2)$$

$$\Rightarrow vfi = \frac{t^{(+)} - t^{(-)}}{s^{own}} + \frac{b}{s^{own}} \quad (3)$$

This measure of vfi goes beyond ‘transfer dependency’ (which is given by the first element in the right hand side, $\frac{t^{(+)} - t^{(-)}}{s^{own}}$)⁶, by incorporating net borrowing of the subnational government as a share of its own spending, namely $\frac{b}{s^{own}}$. Furthermore, with a simple transformation it is possible to see that the two most common measures of fiscal decentralization, namely revenue ($d^r = \frac{r^{own}}{R}$) and spending ($d^s = \frac{s^{own}}{S}$) decentralization, are both embedded in this definition of vertical fiscal imbalances:

⁵ We use the terms “transfers” and “grants” interchangeably throughout the paper. By subnational government we mean local and state governments (where applicable).

⁶ The most common measure of transfer dependency is the ratio of transfers received by subnational governments to their total revenues or spending, so what we refer to as “transfer dependency” is a slightly modified and more complex version.

$$vfi = 1 - \frac{r^{own}}{s^{own}}$$

$$\Rightarrow vfi = 1 - \frac{r^{own}/R}{s^{own}/S} \left(1 - \frac{S-R}{S}\right) \quad (4)$$

$$\Rightarrow vfi = 1 - \frac{d^r}{d^s} (1 - B) \quad (5)$$

where B is the general government deficit as a share of spending.

IV. AN OVERVIEW OF THE DATA

A. Vertical Fiscal Imbalances

Computing cross-country comparable vertical fiscal imbalance indicators (as outlined above) requires data on general government plus its subsectors. To build such measures, we rely extensively on the IMFs *Government Finance Statistics Yearbook (GFSY)* database, which is based on the *Government Finance Statistics Manual 2001 (GFSM 2001)*, itself based on the international “gold standard” of macroeconomic accounting, the *System of National Accounts 2008 (SNA 2008)*. Despite some shortcomings, *GFSY* represents the state of the art in government finance balance sheet statistics.

GFSY is a unique global dataset providing detailed public finance data which is constructed following internationally recognized methodological standards allowing for comparability across countries and over time. It follows an integrated reporting across countries though advanced countries typically have more detailed and more complete data which has an impact on comparability, although this problem is inherent in all global databases. While full cross-country reporting is a long term goal rather than a reality, comparability across countries using this dataset is “as good as it gets” when it comes to government finance statistics. *GFSM 2001* introduced accrual reporting in addition to cash statements, and an increasing number of countries is in fact switching to accrual reporting. Since the measures we derive from the dataset are ratios between contemporaneous magnitudes, this does not present a problem when we merge the accrual and cash data.⁷ For an overview of the dataset, its methodological aspects, weaknesses and strengths we refer to Seiferling (2013a).

⁷ An inescapable issue is that in a cross-country comparison some countries will have only accrual reporting whereas others will only have cash reporting.

Regarding the measurement of transfers, a remark is in order. Transfers in the *GFSM* framework are recorded as “to/from other levels of government”, without specifying if the recipient/sender is a local, state or central government. In many countries this distinction is not material, but in cases where three subsectors of general government exist (central, local, and state), transfers may in fact be cross sub-national (i.e., transfers from a local to a state government or vice-versa). For such cases, under the *GFSM* framework we could potentially be attributing transfers paid to/received from the central government when in fact they take place across subnational levels of government. For this reason, we explicitly identified the countries where this might be an issue and compared the computed νfi data with those from Eyraud and Lusinyan (2013), which are based on OECD data that explicitly identify transfer recipients at both national and sub-national levels. This exercise led to the replacement of the νfi series for Belgium and the U.S. (the former only for period up to 1995) with OECD rather than *GFSY* data.⁸

Table A1 in the Appendix presents the list of countries for which we have built series of vertical fiscal imbalances. The sample size varies between countries because of data availability. In particular, we establish a cut-off and work only with those countries that have at least 10 consecutive years of data. This results in a total of 47 countries. The last year in our sample is 2011, and 36 out of the 47 countries have full series starting in 1995.⁹ This is a substantial improvement relative to previous studies.¹⁰ Relative to Eyraud and Lusinyan (2013), the sample size is significantly larger, giving our empirical framework greater robustness outside of a somewhat homogenous sample of OECD countries (485 versus 1194 observations). Enlarging the sample to include non-OECD countries does not alter the main features of the data: the means are remarkably similar, with a mean νfi in Eyraud and Lusinyan’s sample of 40.1, and a mean νfi of 40.5 in our sample. Standard deviations are also in line with recent studies.

A closer look at these aggregate measures shows substantial heterogeneity both over time and across countries (Table 1). Heterogeneity over time is captured in Figure 1, which shows average νfi for different (constant) samples of countries. Average vertical fiscal imbalances

⁸ We also used OECD data for Canada and Italy prior to 1995 since GFS has no data available. Bulgaria in 2008 and Luxembourg presents a gap in 1998, which we filled by averaging the adjacent years.

⁹ This number is reduced to 27 countries if we start in 1990 and to 19 countries starting in 1980. There are 9 countries for which we are able to construct full series of νfi for the period 1972–2011. Switzerland has data starting in 1972 but has five missing years (1985–1989) so the sample effectively starts in 1990 for this country. Estonia has data available starting in 1995, though in 1996 there is a spike that temporarily doubles the νfi and we are not able to relate this to any policy decision; for this reason we drop 1995 and 1996 for this country.

¹⁰ For instance Baskaran (2010) works with a subsample of 17 OECD countries. Eyraud and Lusinyan (2013) have a maximum of 28 countries in one of their regressions and present νfi data for 28 OECD countries.

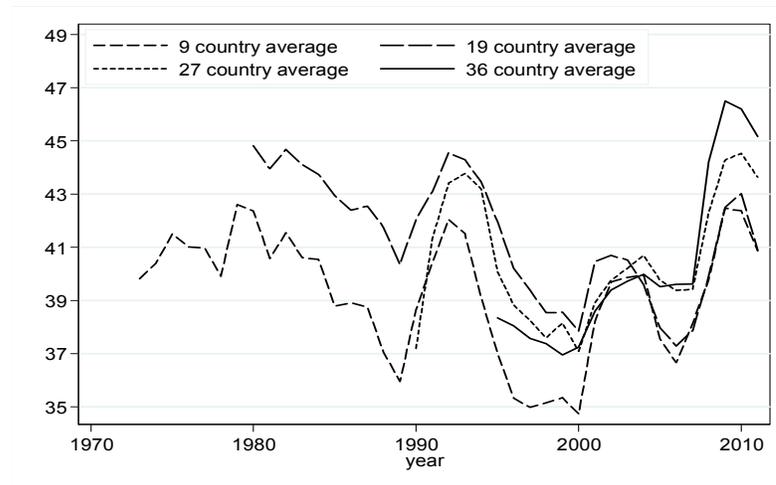
have remained within a relatively narrow band, between 35 and 45 percent. Prior to the financial crisis of the 2008 there is a general downward trend in vfi , temporarily interrupted at the beginning of the 1990s. The financial crisis of 2007/2008 generated a notable increase in average vfi . It is too early to tell whether such a phenomenon implies a permanent change. It points to an interesting research question for the future: do crises increase fiscal centralization? The underlying data show a correlation between macroeconomic distress and fiscal centralization, however, a more systematic analysis is needed.

Table 1: Summary Statistics – Vertical Fiscal Imbalances

Variable	Obs.	Mean	Std. Dev.	Min	Max
Vertical Fiscal Imbalance	1194	40.51	19.80	3.31	88.26
Revenue Decentralization	1176	20.29	13.15	1.45	61.09
Expenditure Decentralization	1174	31.52	14.84	3.90	64.20

Source: Own calculations based on GFSY; complemented with OECD (see Table A1).
Calculated with all available observations.

Figure 1: Average Vertical Fiscal Imbalances (1973–2011)

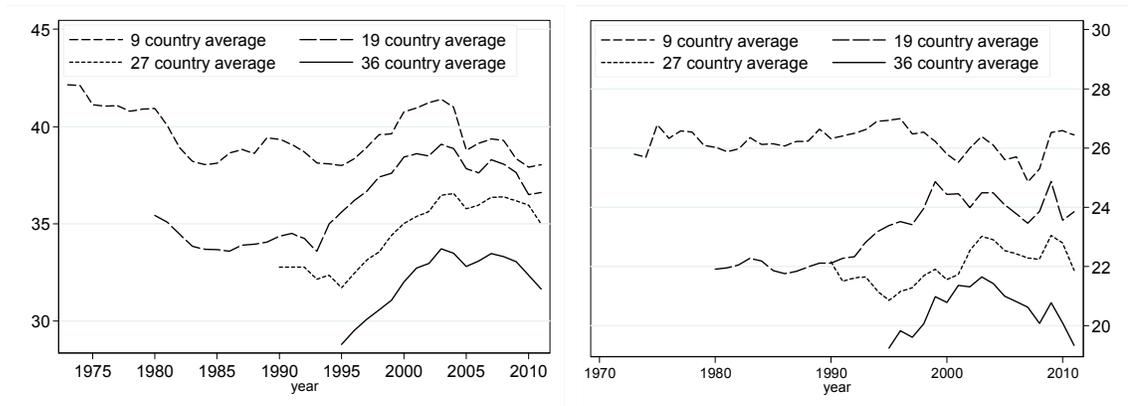


Source: Authors calculations based on GFSY data; complemented with OECD

- 9 countries: AT, AU, CA, DK, FI, IE, LU, UK, US
- 19 countries = 9 + NL, DE, FR, IL, IT, IN, NO, ZA, ES, SE
- 27 countries = 19 + BE, BG, HU, IS, PE, PL, CH, TH
- 36 countries = 27 + BY, CZ, GR, LV, MD, PT, RO, SI, SK

Figure 2 shows the series underlying the construction of vertical fiscal imbalances, namely revenue and expenditure decentralization. As noted earlier, the expenditure decentralization shows an upward trend during the mid-1990s until about 2003, while for revenue the tendency is less clear. Furthermore, there is a difference in levels between the two types of decentralization.

Figure 2: Average Expenditure (left) and Revenue (right) Decentralization (1973–2011)



Source: Own calculations based on GFSY; complemented with OECD

Note: Average xdec in %; constant sample.

9 countries: AT, AU, CA, DK, FI, IE, LU, UK, US

19 countries = 9 + NL, DE, FR, IL, IT, IN, NO, ZA, ES, SE

27 countries = 19 + BE, BG, HU, IS, PE, PL, CH, TH

36 countries = 27 + BY, CZ, GR, LV, MD, PT, RO, SI, SK

Figure 3 illustrates the diversity of vertical fiscal imbalances across countries. The left panel shows a longer time span (1980–2011) for a sample of 19 countries, while the right panel increases country coverage at the expense of a reduced number of years (1995–2011). In both cases the overall sample average (longdash line) is very close to 40 percent, as already indicated in Table 1. The average νfi ranges from 14 percent in Germany to 73 percent in the Netherlands in the left panel, and from 13 percent in Iceland to 81 percent in Peru in the right panel. The position of countries within the range of νfi is very much in line with what would be expected. Federal countries such as Canada, Germany, Switzerland, or the United States are located to the left of the charts in the low vertical fiscal imbalance region, whereas countries with a unitary government such as Ireland, the Netherlands, Peru, or the U.K., are located on the right side of the spectrum. This confirms that federal countries are characterized by a decentralized government, in which lower tiers are not so reliant on transfers from the central government or borrowing; countries characterized by unitary governments, on the other hand, present subnational governments which are more dependent on transfers from the central government.

The inclusion of non OECD countries in the analysis does not change this message. The position of countries in the spectrum of Figure 4 is driven by the nature of government (federal or unitary) rather than the level of economic development.¹¹

Bars in Figure 3 are colored according to a binary indicator of borrowing autonomy for subnational governments, with dark (light) blue indicating that such borrowing is allowed (not allowed) and grey indicating that no information is available. The prohibition to borrow does not seem to be associated with higher or lower levels of vertical fiscal imbalances: we fail to see light or dark blue bars grouped either to the right or the left of the chart. However, given limited data, this means borrowing autonomy does not guarantee a specific position in the spectrum of vertical fiscal imbalances. Borrowing autonomy may interact with vertical fiscal imbalances affecting general government debt. In the empirical analysis below we will investigate this issue further.¹²

Figure 3: Average Vertical Fiscal Imbalances (VFI) by Country and Subnational (SN) Borrowing Autonomy

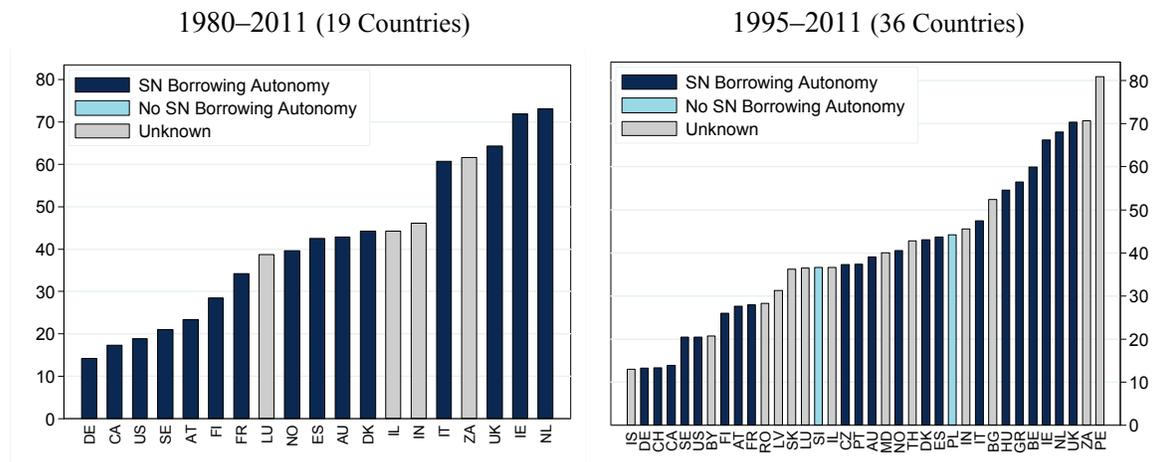
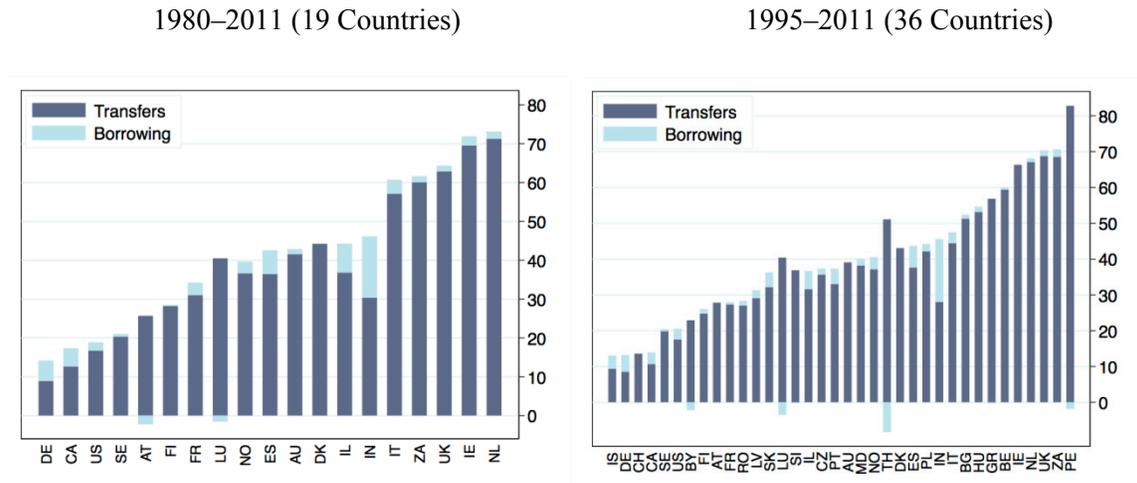


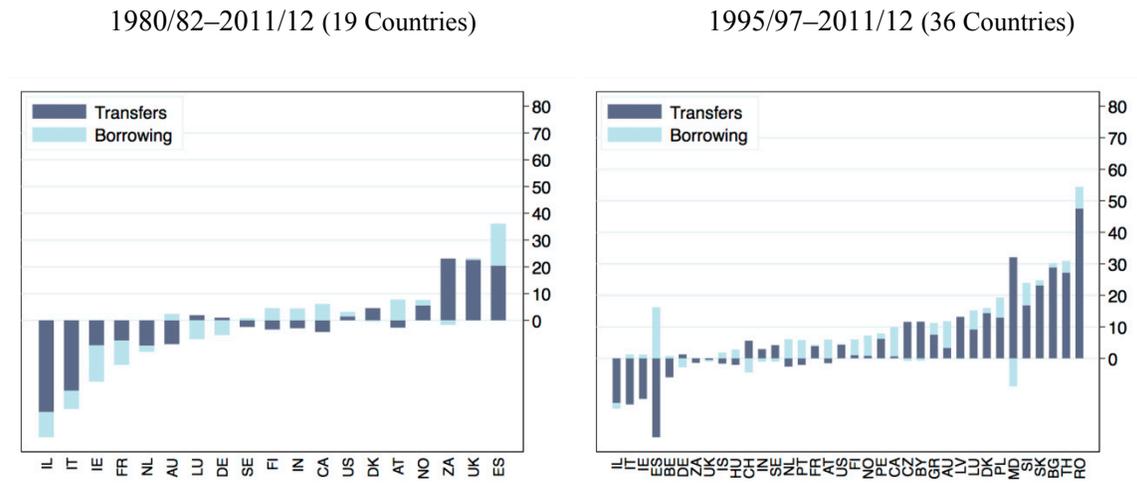
Figure 4 presents the composition of vertical fiscal imbalances for the two subsamples of Figure 3. Transfers represent the bulk of vertical fiscal imbalances in most countries. But, echoing the argument put forward by Eyraud and Lusinyan (2013), subnational borrowing is relevant when it comes to explaining changes in vertical fiscal imbalances. While on average, subnational borrowing is not large relative to transfers, it is important in explaining changes in vertical fiscal imbalances over time (Figure 5). Hence, subnational borrowing should be taken into account in regression analysis when assessing the effect of changes in vertical fiscal imbalances.

Figure 4: Composition of Vertical Fiscal Imbalances (average)



Source: VFIs are authors calculations based on *GFSY*; complemented with OECD.

Figure 5: Changes in Vertical Fiscal Imbalances (average)



Source: VFIs are authors calculations based on *GFSY*; complemented with OECD data. Changes are computed as three year averages (1980-1982, 1995-1997, 2009-2011) to mute the results of outliers. Due to data unavailability, data for IN in 2009-2011 corresponds to 2009, for SK 1995-1997 the data are the average of 1996-1997, and for CH 2009-2011 data are the average of 2009-2010.

B. Government Debt Data

The definition and measurement of public debt comes with significant implications for fiscal analysis (Dippelsman et al., 2012). While an internationally accepted definition of public debt is well established in the *Public Sector Debt Statistics Guide*, and harmonized with the state-of-the-art statistical manuals (*The System of National Accounts 2008*, *Balance of Payments and International Investment Position Manual*, and *Government Finance Statistics Manual*), many countries and databases continue to show government debt in a variety of nonstandard ways.

Many countries disseminate data for subsectors of the general government. Some countries report data for budgetary central government while others include extra budgetary accounts. Furthermore, debt data covering only subsectors of the general agent are often compared with data from countries which include local and state governments. As a result, many cross-country panels compare ‘apples and oranges’ in specifications when attempting to explain government debt dynamics.¹³

This comes at a cost of sample size as most countries historically have data on the central government while time series on general government started more recently. Focusing on central government debt (or budgetary central government) would not fit our needs because we would not capture the possibility that subnational governments increase their borrowing in the wake of increased vertical fiscal imbalances, either by their own decision or pushed by central governments.

We construct our government debt database using a combination of *GFSY* and OECD data. Table 2 presents summary statistics for general government gross debt. The sample size is reduced relative to what we have for vertical fiscal imbalances, but remains an improvement relative to previous studies.¹⁴ For a sample of 775 observations,¹⁵ the average level of general government gross debt relative to GDP is 60 percent, with a standard deviation of 27.5 percent.

¹³ The issue is further complicated by different instrument coverage of debt. For details see Dippelsman et al. (2012).

¹⁴ For instance, Baskaran (2010) presents 392 observations for net financial liabilities and 401 for gross financial liabilities of the general government.

¹⁵ See Table A2 for the details of countries and coverage and IMF (2014) You Tube video.

Table 2: Summary Statistics – Government Gross Debt

Variable	Obs.	Mean	Std. Dev.	Min	Max
General Government Debt (percent of GDP)	775	59.92	27.52	6.10	140.71

Source: Own calculations based on GFSY and OECD.

Calculated with all available observations.

As is the case for vfi , the evolution of debt varies considerably across countries. One of the consequences of the recent financial crisis has been a dramatic increase in government debt in some of the countries considered. This increase has been particularly acute in countries with recapitalization of banks in the financial sector.¹⁶ This may raise valid concerns regarding the wisdom of including crisis years in the analysis. To tackle these concern, instead of dropping the crisis years altogether we re-estimate the benchmark model excluding the crisis years as a robustness measure.¹⁷

C. Control Variables

Beyond vertical fiscal imbalances, general government gross debt is affected by several variables. Furthermore, some important determinants of public debt are not captured by standard macroeconomic aggregates and involve political economy indicators of governance and the workings of the political system. There are also demographic considerations that might help explain differences in levels and accumulation of debt across countries. We employ a series of control variables that have been identified in previous studies as potential determinants of public debt and that might be related to vertical fiscal imbalances.¹⁸

Our main control variables are macroeconomic in nature: central government net lending/borrowing, real per capita GDP growth, and the real interest rate on long term government bonds. The first of these three variables is directly linked to government debt on an accounting basis and is critical in explaining government debt dynamics. The same applies to real GDP growth, which directly affects the capacity of the economy to deal with the burden of debt and helps to control for business cycle effects¹⁹. For both control variables the expected sign is negative: an improved fiscal position as measured by the central government deficit should lead to lower debt accumulation, whereas larger economic growth should

¹⁶ The most notable examples are Iceland, Ireland, Portugal, Spain, United Kingdom, and the United States.

¹⁷ Additionally, time dummies are included in all regressions.

¹⁸ Table A3 summarizes the control variables considered in the analysis, whereas Table A4 presents summary statistics for these variables.

¹⁹ As robustness checks we also considered the unemployment rate as an alternative to real per capita GDP growth in controlling for business cycle effects.

reduce the debt burden. The real interest rate summarizes two effects that are expected to be relevant in explaining the evolution of debt: the first is the interest rate on long term government bonds, which directly captures the nominal costs of additional indebtedness; the second is the inflation rate, which can be used to finance deficits via the inflation tax. For this variable we do not have strong priors regarding the expected sign of the estimated parameter.

We also consider the openness of the economy, measured as the ratio of exports plus imports to GDP, to account for the effect globalization can have on fiscal outcomes, in particular on debt accumulation. Since it might also affect vertical fiscal imbalances through pressures for decentralization, excluding it from the analysis could lead to omitted variable bias (Sharma, 2005). While in theory the prior for the sign of the parameter on openness is ambiguous, based on the results in Baskaran (2010) it seems reasonable to expect higher openness to lead to increased levels of indebtedness. This would suggest that more open economies suffer more fiscal instability than closed ones.

On the demographic side we consider total population, which has been found to influence fiscal performance in previous studies for example Baskaran (2010). As noted by Treisman (2002) countries with a larger population tend to have greater decentralization, hence controlling for population might help in addressing concerns of biased estimates due to omitted variables. Furthermore, considering population as a control variable is a reasonable way of taking country size into consideration without using geographical area, which does not change over time and is hence not appropriate for regressions with fixed effects.²⁰

There are political variables that might affect debt accumulation. Some are qualitative in essence and therefore hard to quantify by definition. To account for the effect that political variables might have we rely on the *Database of Political Institutions* (DPI) compiled by the Development Research Group of the World Bank and presented in Beck et al. (2001), with subsequent updates. Among the many variables presented in DPI, we focus on a subset that we consider of relevance for our purposes. We use an index of government fragmentation, computed as the sum of the squared seat shares of all parties in the government (higher numbers indicate lower levels of government fragmentation). More fragmented governments might be more prone to suffer common pool problems, thereby affecting debt accumulation through relaxed fiscal discipline. For this indicator, higher scores indicate less fragmentation so a priori we expect a negative sign for the estimated coefficient.

Purely political factors can influence the interplay between subnational and central governments and at the same time affect public debt. The DPI database presents variables

²⁰ Following Baskaran (2010), we also consider in robustness regressions the “dependency ratio” (ratio of people below age 15 and above 65 over working age population) as a means of capturing the effect of having more income-earners weathering the fiscal cost of debt. Population in the school-age group, and above 65 years old are other demographic variables considered.

related to the political cycle at the executive and legislative levels. For instance, there are dummy variables indicating whether executive or legislative elections were held in any given year. Most importantly, the database presents a variable indicating the years left in the current term. Proximity to the end of the current term can affect the relationship between levels of government. For instance, more power could be given to subnational governments in exchange for crucial support in upcoming elections, or the amount distributed in transfers can be increased for similar purposes. Arguably, such shortsightedness can also affect the level of debt the public sector chooses to have. There are, however, no clear-cut reasons to expect the parameter to be either positive or negative.

One might argue that vertical fiscal imbalances have their origin in restrictions, legal or otherwise, which hamper the ability of sub-national levels of government to tax or spend. For this reason in regressions with interaction terms we use a variable that measures whether sub-national governments have authority over taxing, spending and/or legislating. This variable, also taken from the DPI database, assigns a 1 whenever one of the three alternatives is satisfied and zero otherwise.

A potentially important factor that can interact with vertical fiscal imbalances in a relevant way is the autonomy enjoyed by subnational governments to borrowing.²¹ To incorporate borrowing autonomy into the analysis we use four measures. The first two are taken from Crivelli et al. (2010) and the last two from the World Bank (2012). Crivelli et al. (2010) construct a composite indicator that measures six components of borrowing regulations: domestic borrowing prohibition, international borrowing prohibition, limits on government debt, limits on debt service, limits on borrowing for specific purposes, and requirement of prior approval from higher levels of government. The composite indicator takes into account how many of these conditions hold and it ranges from 0 (no borrowing autonomy) to 100 (complete borrowing autonomy).²² We also follow Crivelli and co-authors and build a dummy variable that accounts for high levels of borrowing autonomy, by assigning a 1 whenever the composite index is higher than 75 and 0 otherwise.

From the World Bank we take two indicators of borrowing autonomy, coming from the *Database on Regulatory Framework for Subnational Borrowing*. A dummy variable taking the value of 1 whenever subnational government borrowing is allowed and 0 when such borrowing is prohibited. This indicator was already used in Figure 3 above. The second is a composite index of the regulatory framework for subnational borrowing, with values ranging

²¹ We saw above, in Figure 4 that borrowing autonomy by subnational governments does not seem to be associated with higher or lower vertical fiscal imbalances. In the empirical analysis that follows we want to interact borrowing autonomy with vertical fiscal imbalances via multiplicative terms to see whether the overall effect of vertical fiscal imbalances on government debt is significantly affected.

²² For details see Crivelli et al. (2010).

from 20 (borrowing not permitted) to 100 (market discipline). These borrowing autonomy indicators are to be used in interaction terms since they do not vary through time for a given country and therefore cannot be used as independent variables in fixed effects regressions. It is nonetheless intuitive that such indicators play a more significant role when interacting with, for example, high values of vertical fiscal imbalances.

We make use of the *World Governance Indicators* (WGI) database from the World Bank to control for the effect the rule of law in any given country might have on debt accumulation. It is to be expected that countries with better scores in terms of governance will have a lower level of debt, other things equal. One drawback of these data is that they are limited in country coverage, which results in a substantially shorter sample for analysis.

Finally, we include in the set of control variables the *Regional Authority Index* of Hooghe et al. (2010). This index measures regional authority along eight dimensions, institutional depth, policy scope, fiscal autonomy, representation, law making, executive control, fiscal control and constitutional reform. Yearly scores for each of these are put together in the overall index for regions and tiers of government and then aggregated at the country level. The drawback of this dataset is that, in its current vintage, it runs only up to 2006.

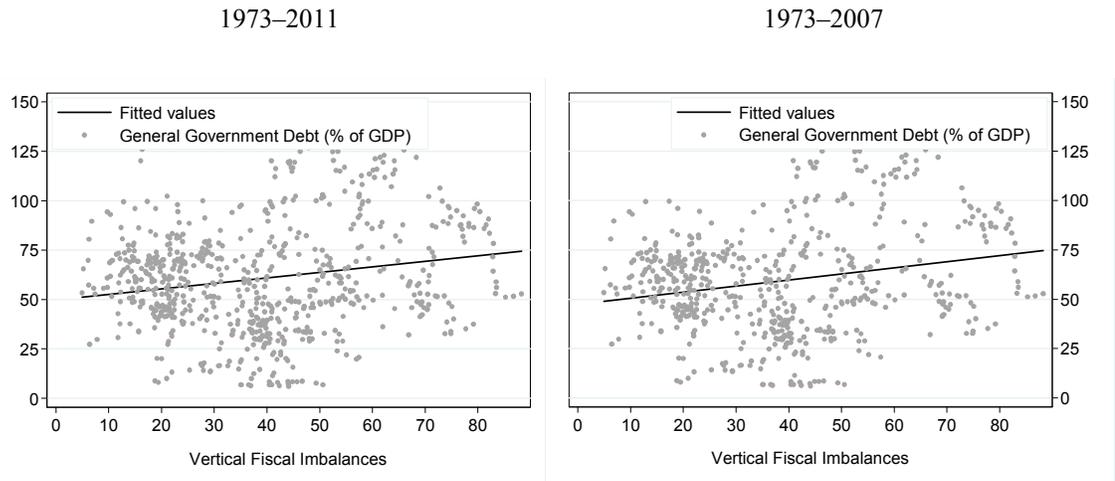
V. EMPIRICAL ANALYSIS

Given conflicting theoretical arguments, we do not have strong *a-priori* expectations regarding the relationship between vfi and government debt. Based on empirical evidence linking vertical fiscal imbalances and governments' primary balances, it seems reasonable to expect a positive relationship where an increase of vertical fiscal imbalances leads to government gross debt accumulation. Preliminary evidence is given below in Figure 6 which shows the two-way relationship between vertical fiscal imbalances and general government debt.

The unconditional plots suggest a positive relationship between vertical fiscal imbalances and government debt, as expected. Furthermore, excluding the recent crisis does not seem to affect the relationship. To arrive at solid conclusions this needs to be validated with a more complete statistical analysis. When attempting the econometric analysis, some important considerations need to be addressed.²³

²³ Due to lack of data on general government debt we are not able to fully utilize the expanded *GFSY dataset* on vertical fiscal imbalances for the empirical analysis. Nevertheless the regressions presented below involve a considerably larger number of observations relative to previous studies, through a combination of some more countries and much more years.

Figure 6: Vertical Fiscal Imbalances and General Government Debt



Source: Own calculations based on *GFSY* and OECD.
All countries 1973–2007 (where available, see Table A2).

Our dependent variable, general government debt as a percentage of GDP, shows a high degree of persistence suggesting the possibility of a first order stationary process. We conducted the Im, Pesaran and Shin (2003) panel unit root test for three different balanced subsamples. The results, shown in Table 3, indeed point to the non-stationarity of the level series and stationarity of the first differenced series.²⁴ Hence we use the first difference of government debt as a percentage of GDP as left-hand side variable, which also enables us to analyze the effects of vertical fiscal imbalances on the *accumulation* of government debt.

Table 3: Panel Unit Root Tests

Im-Pesaran-Shin	1972–2011	1980–2011	1995–2011
Levels	2.20 (1.00)	1.67 (0.95)	0.31 (0.62)
# Observations	457	488	681
First differences	-7.39 (0.01)	-7.52 (0.00)	-8.80 (0.00)
# Observations	445	475	657

Note: p-values in parenthesis

²⁴ Analogous evidence is gathered from the Fisher panel unit root test. For a review of panel unit root tests see Breitung and Pesaran (2005).

While the rationale for first differencing the government debt series seems straightforward, first differencing vertical fiscal imbalances and other covariates is less so. Table A5 presents Panel unit root tests for the main regressors considered in the analysis, pointing to their stationarity in levels, ruling out the possibility of estimating the full model in first differences as done for example by Baskaran (2010). Another implication of Tables 3 and A5 is that cointegrating relationships between the dependent variable and the regressors are out of the question, precluding the use of estimators for non-stationary heterogeneous panels with large country and time dimensions such as the mean-group or pooled mean-group estimators.²⁵

We work with an unbalanced panel with a large T dimension relative to the number of countries (the N dimension of the panel). The number of countries is not necessarily small, but it is smaller than the T dimension, unless we deliberately decide to conduct the analysis starting in 1990 or 1995. For this reason, the dynamic panel bias that estimators such as difference or system General Method of Moments (GMM) were aimed to address is not a major problem in our case; but, as we saw above, estimating a dynamic model does not seem to be a good empirical strategy. Therefore, intuitive and popular choices like the Arellano-Bond and Blundell-Bond/Arellano-Bover estimators are not appropriate for our analysis.

The main specification that we test is given by the following equation:

$$\Delta d_{it} = \beta \cdot vfi_{it} + \rho \cdot xdec_{it} + \mathbf{X}_{it} \cdot \boldsymbol{\gamma} + \alpha_i + \theta_t + \varepsilon_{it} \quad (6)$$

where i and t denote countries and years ($i=1, \dots, N$; $t=1, \dots, T$), Δd_{it} is the first difference of general government gross debt as a percentage of GDP, vfi_{it} stands for the vertical fiscal imbalance of country i in year t as defined in Section III, $xdec_{it}$ is expenditure decentralization of country i in year t , \mathbf{X}_{it} is a vector of control variables, α_i are country-specific fixed effects, θ_t represent time dummies, and ε_{it} is a country- and year-specific error term. In our main specification \mathbf{X}_{it} is composed of the lag of central government net lending/borrowing (i.e., surplus/deficit) as a percentage of GDP, lag of real per capita GDP growth and lag of the real interest rate.²⁶ We also include expenditure decentralization since we want to assess the effect of vertical fiscal imbalances on the accumulation of government debt controlling for a given level of expenditure decentralization. Following Eyraud and

²⁵ When running regressions with these estimators, we cannot say with statistical certainty that the coefficient on lagged government debt is different from 1, again suggesting that first differencing the series is the best strategy.

²⁶ In addition to the fiscal balance, debt dynamics might also be affected by stock-flow adjustments. Seiferling (2013b) shows that properly measured stock-flow residuals are in many cases not statistically different from zero. Hence we choose to leave them out of the analysis. We use lags of these control variables in order to avoid potential endogeneity issues, given the link between them and government debt through accounting relationships.

Lusinyan (2013), revenue decentralization is not included in the regression specification since the *ceteris paribus* condition under which one interprets the estimated coefficients would generate at least two important problems: first, when both revenue and expenditure decentralization are held constant there exists a direct accounting relationship linking fiscal performance (as captured by net lending/borrowing) to vertical fiscal imbalances, thereby generating a problem of multicollinearity and potentially capturing artificial relationships between the variables of interest; second, the *ceteris paribus* interpretation of coefficients is questionable when all variables are included since the accounting relationship implies that this cannot be the case.

Additional specifications include other regressors, as we will see below. We also entertain the possibility that some factors interact with vertical fiscal imbalances in a meaningful way. Our interest lies mostly in the statistical and economic significance of β , the coefficient on vertical fiscal imbalances²⁷.

Table A6 presents model diagnostics and specification tests for the estimation of equation (6) in its benchmark specification (i.e. including vertical fiscal imbalances, expenditure decentralization, central government deficit and real per capita GDP growth). Autocorrelation, group heteroskedasticity and cross sectional dependence in the residuals are detected, whereas there is no evidence for a multicollinearity problem. For these reasons we perform our analysis using panel fixed effects estimation with robust standard errors clustered at the country level.

Table 4 presents the results for the main regressions. Country coverage ranges from 28 to 30 depending on the parsimony of the specification, while the total number of observations is usually in the neighborhood of 600 (the exception being the regression including rule of law). Overall, this marks a substantial increase in the observations used for analysis relative to previous studies.

In addition to vertical fiscal imbalances and expenditure decentralization, our benchmark regression – number (2) – includes lagged central government net lending/borrowing as a share of GDP, lagged real per capita GDP growth and lagged real interest rate on long term government bonds. All coefficients present the expected signs. An improved fiscal position or higher economic growth lead to a reduction in public debt. A higher real interest rate, on the other hand, leads to increased government debt. We take this as evidence that higher interest rates increase the repayment costs of the existing stock of debt and this effect dominates other potential countervailing effects.²⁸

²⁷ In the regressions with interaction terms the focus of interest will be the combined effect of vertical fiscal imbalances, that is, the direct effect plus the effect of the interaction term.

²⁸ For instance, one may expect that higher interest rate would make debt financing a less appealing option.

Table 4: Main Regression Results – Dependent Variable: First Difference of General Government Gross Debt (Percent of GDP)

(t-values in parenthesis)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VFI	0.08** (2.19)	0.07** (2.14)	0.07** (2.31)	0.07* (2.05)	0.07** (2.12)	0.03 (0.46)	0.06* (1.97)
Expenditure Decentralization	-0.28*** (-3.29)	-0.20*** (-3.20)	-0.17** (-2.60)	-0.22*** (-2.88)	-0.20*** (-3.20)	-0.26** (-2.54)	-0.17** (-2.65)
Lag of Central Gov. Deficit		-0.34*** (-5.45)	-0.40*** (-6.80)	-0.26*** (-3.95)	-0.34*** (-5.28)	-0.34*** (-3.42)	-0.36*** (-5.99)
Lag of Real pc GDP growth		-0.48*** (-3.54)	-0.52*** (-3.96)	-0.42*** (-3.11)	-0.49*** (-3.56)	-0.34** (-2.37)	-0.49*** (-3.63)
Lag of real interest rate		0.28** (2.19)	0.21* (1.83)	0.26* (1.93)	0.29** (2.23)	0.22 (0.90)	0.23* (1.87)
Openness			-0.07*** (-3.21)				-0.07*** (-3.24)
Population				0.03*** (3.57)			0.02*** (3.11)
Election					0.21 (1.63)		0.23* (1.80)
Rule of Law						6.73** (2.08)	
Observations	695	603	601	603	599	416	597
Countries	30	28	28	28	28	28	28
Within R2	0.28	0.39	0.38	0.33	0.39	0.40	0.40
Overall R2	0.08	0.17	0.18	0.14	0.17	0.24	0.18

Fixed effects estimation with robust standard errors clustered at the country level. Time dummies included in all regression but not reported. t-values in parenthesis.

*, **, *** denote significance at the 10, 5, and 1 percent level respectively.

Most importantly, the coefficient on vertical fiscal imbalances is consistently positive and statistically significant at standard confidence levels.²⁹ The coefficient on vertical fiscal imbalances in this regression implies that a 10 percentage point increase translates into an increase of 0.7 percentage point in the change in general government gross debt as a percentage of GDP. The direction and magnitude of this effect is very close to that obtained in Eyraud and Lusinyan (2013), who found that a 10 percentage point increase in vertical fiscal imbalances would lead to a 1 percentage point increase in government deficits. The marginal effect from equation 2 is plotted in Figure 6 below with all other values held at their means.

Including additional regressors (models (3)–(7)) does not affect dramatically the size and statistical significance of the coefficient of interest in our benchmark model (2). The coefficient on vertical fiscal imbalances is stable across specifications, supporting the hypothesis that higher vertical fiscal imbalances are statistically and economically significant in explaining higher general government debt to GDP.

The coefficient on openness (models (3) and (7)) turns out to be negative and statistically significant, implying that more open economies tend to accumulate less debt, a result that runs counter to the one presented in Baskaran (2010). Higher population (models (4) and (7)) positively affects the accumulation of debt, as expected.³⁰ On the other hand, more distance to the next election tends to be associated with higher debt accumulation, though the results are insignificant in model (5) and significant at the 10 percent level in model (7). This could be explained by the fact that recently elected governments enjoy more political capital to undertake debt financing.

Table 5 presents the results of our benchmark regression with multiplicative terms, with vertical fiscal imbalances being interacted with several variables. The overall effect of vertical fiscal imbalances on government debt should be gauged in this case by the combined effect which takes into account the direct effect plus that stemming from the interaction term. This is shown in Table 5 in bold fonts and is calculated by using the coefficient on *vfi*, plus the coefficient of the interaction term evaluated at the mean of the variable with which *vfi* is being interacted.

²⁹ The exception is the regression including the rule of law. In this regression the coefficient is lower and it becomes statistically insignificant at the 10 percent confidence level (something similar occurs in Eyraud and Lusinyan, 2013). Rule of law is available from 1995 onwards and with missing data that we interpolate (see the note to Table A3), so the results from column (6) need to be taken with a grain of salt.

³⁰ We also used the dependency ratio as a regressor instead of population, since the former might have more relation to spending pressures. As it turned out to be statistically insignificant without affecting the size and significance of the coefficient on vertical fiscal imbalances, we do not report the results here.

The overall effect of vertical fiscal imbalances on the accumulation of government debt remains largely unchanged when we include multiplicative terms in the regression specification. Exceptions are the regressions including interactions with subnational authority to tax/spend, the measure of government fragmentation and the indicator of high borrowing autonomy.³¹ The interaction term with government fragmentation is statistically significant at the 10 percent level and shows a non-negligible negative value, in line with expectations, suggesting that vertical fiscal imbalances in the context of less fragmented governments lead to a reduction in government debt. In any case, for this model the overall effect of vfi is insignificant.

The effect of vertical fiscal imbalances on government debt is strengthened in those countries that present a high level of expenditure decentralization (model (1)) and particularly in those countries which score high on the regional authority index (model (2)). This tends to be the case for federal countries, where the autonomy enjoyed by subnational levels of government is relatively high. When there are many years left in office for the current government, vertical fiscal imbalances also show a slightly stronger effect on the accumulation of government debt (relative to the benchmark regression in Table 4).

As an alternative to real per capita GDP growth as a control for business cycle effects we also used the unemployment rate. Vertical fiscal imbalances remain statistically significant across most of the specifications at the 10 percent level, though the coefficient is reduced from 0.07 to 0.06. The alternative variable used to control for the business cycle remains significant across specifications.

Excluding the recent crisis from the analysis does not affect the main conclusions: the coefficient on vfi continues to be statistically significant across specifications, with an average value of 0.07. The main difference with the full sample estimations is that the central government deficit becomes statistically insignificant when excluding the crisis years. We also included sequentially the dependency ratio and school age population and conclusions remained unaltered.

As a final robustness test, we explore the potential for reverse causality between government debt and vertical fiscal imbalances in the context of our model. Our approach has been to include vertical fiscal imbalances as a right-hand side variable to assess its impact on the accumulation of government debt, controlling for other relevant covariates. Yet it is possible

³¹ We included interaction terms with all measures of borrowing autonomy discussed above. The results mimic those of model (6) in Table 5 and for the sake of space are not reported here.

Table 5: Regressions with Interaction Terms Dependent Variable: First Difference of General Government Debt (Percent of GDP)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VFI	-0.07 (-1.06)	0.28*** (4.81)	0.07* (2.04)	0.02 (1.06)	0.09* (1.96)	0.07* (2.03)	0.14** (2.72)	0.07** (2.14)	0.07** (2.14)
Expenditure Decent.	-0.40*** (-3.15)	-0.22*** (-3.50)	-0.20*** (-3.22)	-0.14* (-1.92)	-0.17*** (-2.79)	-0.15*** (-3.28)	-0.15 (-1.82)	-0.20*** (-3.19)	-0.20*** (-3.19)
Lag of CG Deficit	-0.35*** (-5.76)	-0.05 (-0.21)	-0.34*** (-5.44)	-0.63*** (-4.17)	-0.32*** (-5.32)	-0.37*** (-5.00)	-0.01 (-0.04)	-0.34*** (-5.45)	-0.35*** (-5.40)
Lag of RpcGDP growth	-0.47*** (-3.46)	-0.65*** (-3.43)	-0.50*** (-3.59)	-0.05 (-0.15)	-0.40*** (-3.19)	-0.54*** (-3.31)	-0.51 (-1.67)	-0.48*** (-3.45)	-0.48*** (-3.57)
Lag of real interest rate	0.28** (2.24)	0.29* (2.04)	0.26* (2.00)	-0.12 (-0.61)	0.24* (1.78)	0.34** (2.28)	0.42* (1.98)	0.28** (2.18)	0.28** (2.18)
VFI*Expenditure Decent.	0.00** (2.23)								
VFI*RAI		-0.01*** (-4.56)							
VFI*Election			0.00 (1.25)						
VFI*Authority				0.02 (0.65)					
VFI*Fragmentation					-0.06* (-1.79)				
VFI*High Borr. Autonomy						-0.04 (-0.61)			
VFI*Fiscal Autonomy							-0.03* (-1.94)		
VFI*Legislative								-0.00 (-0.31)	
VFI*Executive									-0.01 (-0.31)
Combined effect of VFI	0.09** (2.77)	0.12** (2.96)	0.08** (2.25)	0.04 (1.22)	0.04 (1.33)	0.05 (1.26)	0.07** (2.93)	0.07** (2.14)	0.07** (2.14)
Observations	603	192	599	304	597	505	192	599	599
Countries	28	10	28	15	28	21	10	28	28
Within R2	0.40	0.37	0.38	0.45	0.41	0.48	0.44	0.39	0.39
Overall R2	0.15	0.05	0.16	0.21	0.23	0.31	0.19	0.17	0.17

Fixed effects estimation with robust standard errors clustered at the country level. t-statistics in parenthesis.

For details on variables see Tables A3 and A4.

*, **, *** denotes significance at the 10, 5 and 1 percent level respectively. Time dummies included in all regressions but not reported.

"Combined Effect VFI" computes the total effect of VFI considering also interaction terms. The combined effect is equal to the coefficient on VFI plus the interaction term coefficient at the average of the interacted variable.

to argue, in particular in times of crisis, that causality between vertical fiscal imbalances and government debt runs both ways.³² To address concerns that our main results might be biased due to potential endogeneity issues, in Table 6 we present the results from instrumental variable regressions.

A good instrument should be correlated with vertical fiscal imbalances and indirectly related to general government debt.³³ In the models presented below, vertical fiscal imbalances are instrumented by their own lag, the share of population above 65 years and a measure of fiscal autonomy taken from the *Regional Authority Index* developed by Hooghe et al. (2010).³⁴ The lag of vertical fiscal imbalances is related to the current value of vertical fiscal imbalances due to some persistence in the series, and at the same time is uncorrelated with the error term. Using the lag of the variable to be instrumented is a standard approach in macroeconomic applications using instrumental variables. The share of population above 65 years of age is also arguably related to vertical fiscal imbalances to the extent that some healthcare and other expenses related to elderly citizens are assigned to subnational levels of government. The fiscal autonomy indicator measures the extent to which subnational levels of government can independently tax their citizens. As noted by Eyraud and Lusinyan (2013), this indicator reduces the need for transfers and borrowing without being directly linked to government debt. The results of Table 6 should be interpreted as a complement rather than a substitute to the results presented in Table 4.

The second stage regressions show that vertical fiscal imbalances remain statistically significant and with a parameter estimate in line with previous results. Furthermore, the tests for the relevance of instruments and for over-identifying restrictions provide re-assuring evidence that the instruments fulfil the necessary conditions.³⁵ We conclude that endogeneity does not seem to be a relevant issue in our sample.

VI. CONCLUDING REMARKS

There has been a trend in policy to advocate greater decentralization with the goal of improving the efficiency of the entire general government. This prompted increased interest

³² The literature on the determinants of fiscal decentralization found no evidence of reverse causality between decentralization and fiscal performance Treisman (2006) or Panizza (1999) among others). For this reason and to keep the instrumental variable analysis simple we do not instrument for expenditure decentralization.

³³ Additionally, since our first stage regression uses fixed effects, the instrument should be time-varying.

³⁴ Other variables which have the potential to be reasonable instruments (such as the school-age population and the dependency ratio) were used in IV regressions but turned out to be poor instruments. Table 6 presents the most robust specifications.

³⁵ Furthermore, the instruments are not relevant in explaining general government debt when added to our benchmark regression (2) from Table 4.

in studying the effects of fiscal decentralization on fiscal performance. In this paper we examine decentralization from a multidimensional viewpoint in recognition of the subnational imbalances between the expenditure and revenue sides. Past research into fiscal performance and vertical fiscal imbalances has found evidence that greater imbalances are likely to increase government deficits for a sample of OECD countries. We build on these findings constructing the most comprehensive dataset to date using IMF *GFSY* data, to re-examine the relationship between vertical fiscal imbalances and the accumulation of general government debt over time and across countries.

Controlling for several potential determinants of the accumulation of debt across a wide variety of specifications, the results are quite robust and point to the relevance of vertical fiscal imbalances in explaining the accumulation of general government debt. In particular, our findings suggest that higher vertical fiscal imbalances lead to increased government debt. The robustness of these results along with their consistency with past results provides additional evidence that there exists a relationship between how subnational governments finance their expenditures and the fiscal performance of the general government.

These results call for a degree of caution when promoting fiscal decentralization. While de-centralization has been shown to have many benefits, our findings suggest that where increases in subnational expenditures are financed by sources outside of the subnational government, this imbalanced decentralization may lead to a deterioration in fiscal performance (increased debt/deficit). In this respect, vertical fiscal imbalances should be considered in the design and implementation of fiscal decentralization strategies with specific explicit or implicit measures in place to ensure efficient and responsible subnational governance.

Table 6: Instrumental Variable Regressions Dependent Variable: First Difference of General Government Debt
(Percent of GDP, unless otherwise specified)

	(1)	(2)	(3)
VFI	0.07* (1.97)	0.07** (2.08)	0.11* (1.99)
Expenditure Decentralization	-0.18** (-2.77)	-0.18*** (-2.80)	-0.17** (-2.39)
Lag of CG Deficit	-0.34*** (-5.45)	-0.34*** (-5.41)	-0.05 (-0.27)
Lag of RpcGDP growth	-0.43*** (-3.38)	-0.43*** (-3.38)	-0.78*** (-3.39)
Lag of Real Interest Rate	0.14 (1.04)	0.14 (1.04)	0.34** (3.23)
<i>First stage regression (dependent variable: VFI)</i>			
<i>Included instruments</i>			
Expenditure Decentralization	0.04 (0.50)	0.11 (1.59)	0.25 (1.64)
Lag of CG Deficit	0.10* (1.86)	0.09 (1.52)	0.15 (1.71)
Lag of RpcGDP growth	-0.12* (-1.86)	-0.18*** (-3.08)	0.04 (0.36)
Lag of Real Interest Rate	0.09 (1.29)	0.12 (1.67)	0.09 (0.92)
<i>Excluded instruments</i>			
Lag of VFI	0.79*** (16.19)	0.77*** (15.78)	0.80***
Population >65		-0.71*** (-2.96)	
Fiscal Autonomy			-8.94*** (-3.60)
F-test of excluded instruments	262.17	152.34	1079.88
(p-value)	0.00	0.00	0.00
Hansen J-statistic	-	0.31	0.43
(p-value)	-	0.58	0.51
Observations	600	600	191
Countries	28	28	10
Centered R2	0.188	0.188	0.252

Fixed effects estimation with robust standard errors clustered at the country level. t-statistics in parenthesis.

For details on variables see Tables A3 and A4.

*, **, *** denotes significance at the 10, 5 and 1 percent level respectively.

Time dummies included in all regressions but not reported.

REFERENCES

- Baskaran, T., 2010, "On the Link between Fiscal Decentralization and Public Debt in OECD Countries," *Public Choice*, 145, pp. 351–78.
- Bayoumi, T., 1991, "The 1990 Reform of U.K. Local Authority Finance," *IMF Staff Papers*, Vol. 38, No. 1.
- Beck, T., Clarke, G., Groff, A., Keefer, P., and Walsh, P., 2001, "New Tools in Comparative Political Economy: The Database of Political Institutions," *World Bank Economic Review*, 15:1, pp. 165–76.
- Blöchliger, H., and Vammalle, C., 2012, *Reforming Fiscal Federalism and Local Government: Beyond the Zero Sum Game* (Paris: Organization for Economic Cooperation and Development).
- Boadway, R., and Tremblay, J. F., 2005, "A Theory of Vertical Fiscal Imbalance," IFIR Working Paper No. 2006–04.
- Breitung, J., and Pesaran, M. H., 2005, "Unit Roots and Cointegration in Panels," Deutsche Bundesbank Discussion Paper 42/2005.
- Brennan, G., and Buchanan, J., 1980, *The Power to Tax: Analytical Foundations of a Fiscal Constitution* (Cambridge: University Press).
- Crivelli, E., Leive, A., and Stratmann, T., 2010, "Subnational Health Spending and Soft Budget Constraints in OECD Countries," IMF Working Paper 10/147.
- De Mello, L., 2000, "Fiscal Decentralization and Intergovernmental Fiscal Relations: A Cross-Country Analysis," *World Development*, Vol. 28, No 2, pp. 365–80.
- Dippelsman, R., Dziobek, C., and Gutiérrez Mangas, C., 2012, "What Lies Beneath: The Statistical Definition of Public Sector Debt," IMF Staff Discussion Note 12/09.
- Dziobek, C., Gutiérrez Mangas, C., and Kufa, P., 2011, "Measuring Fiscal Decentralization - Exploring the IMF's Databases," IMF Working Paper 11/126.
- Eyraud, L., and Lusinyan, L., 2013, "Vertical Fiscal Imbalances and Fiscal Performance in Advanced Economies," *Journal of Monetary Economics*, 60 (5), pp. 571–87.

- Freitag, M., and Vatter, A., 2008, “Decentralization and Fiscal Discipline in Sub-national Governments: Evidence from the Swiss Federal System,” *The Journal of Federalism*, 38 (2), pp. 272–94.
- Filgueira, F., Kamil, H., Lorenzo, F., Moraes, J. A., Rius, A., 2002, “Decentralization and Fiscal Discipline in Subnational Governments: The Bailout Problem in Uruguay,” Inter American Development Bank, Research Network Paper #459.
- Hooghe, L., Marks, G., and Schakel, A., 2010, *The Rise of Regional Authority: A Comparative Study of 42 Democracies*, (London: Routledge).
- Im, K.S., Pesaran, M.H., and Shin, Y., 2003, “Testing for Unit Roots in Heterogeneous Panels,” *Journal of Econometrics*, 115, pp. 53–74.
- International Monetary Fund, 2009, *Macro Policy Lessons for a Sound Design of Fiscal Decentralization*. (Washington).
- International Monetary Fund, 2013, *Public Sector Debt Statistics: Guide for Compilers and Users*, (Washington).
- International Monetary Fund, 2014, *Government Finance Statistics Manual 2014—Pre-publication Draft* (Washington).
- International Monetary Fund, 2014, “Why Government Finance Statistics Manual?” [IMF Statistics E-Learning Videos on YouTube](#).
- Jin, J., and Zou, H., 2002, “How Does Fiscal Decentralization Affect Aggregate, National and Subnational Government Size?” *Journal of Urban Economics*, Vol. 52 (2), pp. 270–93.
- Karpowicz, I., 2012, “Narrowing Vertical Fiscal Imbalances in Four European Countries,” IMF Working Paper 12/91.
- Kornai, J., Maskin, E., and Roland, G., 2003, “Understanding the Soft Budget Constraint,” *Journal of Economic Literature*, Vol. 41 (4), pp. 1095–36.
- Marlow, M. L., 1988, “Fiscal Decentralization and Government Size,” *Public Choice*, Vol.56 (3), pp. 259–69.
- Musgrave, R. M., 1959, *The Theory of Public Finance* (New York: McGraw-Hill).

- Oates, W. E., 1972, *Fiscal Federalism* (New York: Harcourt Brace Jovanovich).
- , 1985, “Searching for Leviathan: An Empirical Study,” *American Economic Review*, Vol. 75 (4), pp. 748–58.
- , 1999, “An Essay on Fiscal Federalism,” *Journal of Economic Literature*, Vol. 37 (September), pp. 1120–49.
- , 2006, “On the Theory and Practice of Fiscal Decentralization,” IFIR Working Paper No. 2006–05.
- Panizza, U., 1999, “On the Determinants of Fiscal Centralization: Theory and Evidence,” *Journal of Public Economics*, Vol. 74 (1), pp. 97–139.
- Rodden, J., G. Eskelund, and J. Litvack, 2003, *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (MIT Press).
- Ruggeri, G. C., and Howard, R., 2001, “On the Concept and Measurement of Vertical Fiscal Imbalances, SIPP Public Policy Paper No. 6, December.
- Seiferling, M., 2013a, “Recent Improvements to the Government Finance Statistics Yearbook Database in Response to Analytical Needs,” IMF Working Paper 13/15.
- , 2013b, “Stock-Flow Adjustments, Government’s Integrated Balance Sheet and Fiscal Transparency,” IMF Working Paper 13/63.
- Sharma, C.K., 2005, “Why Decentralization? The Puzzle of Causation. Synthesis,” Vol. (3) 1, pp. 1–17.
- Stegarescu, D., 2004, “Public Sector Decentralization: Measurement Concepts and Recent International Trends,” ZEW Discussion Paper No. 04–74.
- Thornton, J., 2007, “Fiscal Decentralization and Growth Reconsidered,” *Journal of Urban Economics*, Vol. 61, pp. 64–70.
- Tiebout, C.M., 1956, “A Pure Theory of Local Expenditures,” *The Journal of Political Economy*, 64 (5), pp. 416–24.

- Treisman, D., 2002, "Defining and Measuring Decentralization: A Global Perspective," UCLA Working Paper.
- , 2006, "Explaining Fiscal Decentralisation: Geography, Colonial History, Economic Development, and Political Institutions," *Journal of Commonwealth and Comparative Politics*, Vol. 44, 3.
- Velasco, A., 1999, "A Model of Endogenous Fiscal Deficits and Delayed Fiscal Reforms," In: Poterba, J.M., von Hagen, J. (Eds.), *Fiscal Institutions and Fiscal Performance*. Chicago: University of Chicago). Ch. 2, pp. 37–58.
- Wildasin, D.E., 1997, *Externalities and Bailouts: Hard and Soft Budget Constraints in Intergovernmental Fiscal Relations*.
- , 2004, "The Institutions of Federalism: Towards an Analytical Framework," *National Tax Journal*, Vol. LVII, No. 2, Part 1, (June).
- World Bank, 2000, *World Development Report 1999/2000*, (New York: Oxford University Press).
- , 2012, *Database on Regulatory Framework for Subnational Borrowing*. <http://www1.worldbank.org/publicsector/decentralization/qualitativeindicators.htm>.

APPENDIX

Table A1: Countries and Sample Size for VFI

Country	Code	Full sample	Cash/Non-Cash
Australia	AU	1972-2011	Non-Cash starts 1999
Austria	AT	1973-2011	Non-Cash starts 1995
Belarus	BY	1995-2011	Only Cash
Belgium	BE	1985-2011 (*)	Non-Cash starts 1995
Bulgaria	BG	1990-2011 (+)	Only Cash
Canada	CA	1972-2011 (*)	Non-Cash starts 1991
Chile	CL	2000-2011	Only Non-Cash
Croatia	HR	2002-2011	Only Cash
Czech Republic	CZ	1993-2011	Only Cash
Denmark	DK	1972-2011	Non-Cash starts 1995
El Salvador	SV	2002-2011	Only Non-Cash
Estonia	EE	1997-2011	Only Non-Cash
Finland	FI	1972-2011	Non-Cash starts 1995
France	FR	1978-2011	Non-Cash starts 1995
Germany	DE	1974-2011	Non-Cash starts 1995
Greece	GR	1995-2011	Only Non-Cash
Honduras	HN	2003-2011	Only Non-Cash
Hungary	HU	1981-2011	Non-Cash starts 1995
Iceland	IS	1990-2011	Non-Cash starts 1998
India	IN	1974-2009 (#)	Only Cash
Ireland	IE	1972-2011	Non-Cash starts 1995
Israel	IL	1976-2011	Non-Cash starts 2000
Italy	IT	1980-2011 (*)	Non-Cash starts 1991
Kazakhstan	KZ	2002-2011	Only Cash
Latvia	LV	1994-2011	Only Cash
Lithuania	LT	2000-2011	Only Non-Cash
Luxembourg	LU	1972-2011 (+)	Non-Cash starts 1999
Moldova	MD	1995-2011	Only Cash
Morocco	MA	2002-2011	Only Non-Cash
Netherlands	NL	1975-2011	Non-Cash starts 1995
New Zealand	NZ	2001-2011	Only Non-Cash
Norway	NO	1980-2011	Non-Cash starts 2000
Peru	PE	1990-2011	Only Cash
Poland	PL	1984-2011	Non-Cash starts 2001
Portugal	PT	1995-2011	Only Non-Cash
Romania	RO	1995-2011	Non-Cash starts 2002
Russia	RU	2002-2011	Only Non-Cash
Slovak Republic	SK	1996-2011	Non-Cash starts 2003
Slovenia	SI	1992-2011	Only Cash
South Africa	ZA	1977-2011	Non-Cash starts 2000
Spain	ES	1977-2011	Non-Cash starts 1995
Sweden	SE	1978-2011	Non-Cash starts 1995
Switzerland	CH	1990-2010	Non-Cash starts 2002
Thailand	TH	1990-2011	Non-Cash starts 2003
Ukraine	UA	1999-2011	Only Cash
United Kingdom	UK	1973-2011	Non-Cash starts 1995
United States	US	1972-2011 (**)	-

Notes: Based on GFSY; countries with at least 10 consecutive years of observations

(*) Series complemented with OECD data: BE (1985-1994), CA (1972-1990), IT (1980-1994)

(**) Series taken entirely from OECD data

(#) Missing data for subnational borrowing 1999-2001, interpolated.

(+) Missing data for LU (1998) and BG (2008) filled by averaging adjacent years.

Table A2: Countries and Sample Size for General Government Debt

Country	Code	Full sample	GFSY/OECD
Australia	AU	1989-2011	Full OECD
Austria	AT	1972-2011	GFSY from 1995
Belgium	BE	1972-2011	GFSY from 1995
Canada	CA	1972-2011	Full OECD
Czech Republic	CZ	2002-2011	Full OECD
Estonia	EE	1995-2011	Full GFSY
Finland	FI	1972-2011	GFSY from 1995
France	FR	1972-2011	GFSY from 1995
Germany	DE	1991-2011	GFSY from 1995
Greece	GR	1995-2011	Full OECD
Hungary	HU	1991-2011	GFSY from 1995
Iceland	IS	1998-2011	GFSY from 2001
Ireland	IE	1998-2011	Full GFSY
Israel	IL	1995-2011	Full OECD
Italy	IT	1972-2011	GFSY from 1995
Lithuania	LT	2004-2011	Full GFSY
Luxembourg	LU	1998-2011	GFSY from 2001
Netherlands	NL	1972-2011	GFSY from 1995
New Zealand	NZ	1993-2011	GFSY from 2004
Norway	NO	1972-2011	GFSY from 2000
Poland	PL	1995-2011	Full OECD
Portugal	PT	1995-2011	Full GFSY
Slovak Republic	SK	1995-2011	GFSY from 2003
Slovenia	SI	2001-2011	Full GFSY
Spain	ES	1972-2011	GFSY from 1995
Sweden	SE	1972-2011	GFSY from 1995
Switzerland	CH	1990-2011	GFSY from 2002
United Kingdom	GB	1972-2011	GFSY from 1995
United States	US	1972-2011	Full OECD

Table A3: Control variables

Variable Name	Description	Source
CG net lend./borr.	Central Government net lending/borrowing (in % of GDP)	GFSY (IMF)
GDP pc Growth	Real GDP per capita growth (in %)	WEO (IMF)
Inflation	Change in CPI index (in %)	WEO (IMF)
Output gap	Difference (in %) between real and estimated potential GDP	WEO (IMF)
Unemployment	Unemployment rate	WEO (IMF)
Interest rate	Interest rate on long term Government bonds	OECD
Openness	Trade (exports + imports) to GDP ratio (in %)	World Bank - WDI
School	Share of school-age population (between 0 and 14 years old) in total population (in %)	World Bank - WDI
Dependency ratio	Share of population below 15 and above 65 years old) in working age population (in %)	World Bank - WDI
Population > 65	Share of population above 65 years old in total population (in %)	World Bank - WDI
Population	Population	World Bank - WDI
Fragmentation	Herfindahl index of government fragmentation (sum of the squared seat shares of all parties in the government)	DPI Dataset, Beck et al. (2001)
Authority	Subnational government authority to tax, spend and/or legislate - Composite index measuring six components of borrowing regulation for SNG; =0 if no autonomy on borrowing decisions, =100 if complete autonomy	DPI Dataset, Beck et al. (2001) Crivelli et al. (2010)
Borrowing Autonomy	- Dummy =1 if composite index from Crivelli et al. (2010) greater or equal to 75, =0 otherwise - Dummy variable =1 if is SNG borrowing is allowed, =0 if not allowed	Crivelli et al. (2010) World Bank (2012)
Election Legislative	- Composite index on regulations for SNG borrowing; =20 borrowing not allowed, =100 market discipline Years left in current term	World Bank (2012) DPI Dataset, Beck et al. (2001)
Executive	Dummy =1 if legislative election held that year (zero otherwise)	DPI Dataset, Beck et al. (2001)
RAI	Dummy =1 if executive election held that year (zero otherwise) Regional Authority Index: measure of the authority of regional governments across eight dimensions: institutional depth, policy scope, fiscal autonomy, representation, law making, executive control, fiscal control, constitutional reform	DPI Dataset, Beck et al. (2001)
Fiscal Autonomy	Sub-indicator of RAI. Index ranging from 0 to 4, measuring the extent to which subnational governments can independently tax their citizens (higher numbers indicate more autonomy)	Hooghe et al. (2010) Hooghe et al. (2010)
Rule of Law	Indicator ranging from -2.5 to 2.5, with higher scores indicating better governance (*)	World Bank - WGI

(*) Values for 1997, 1999 and 2001 obtained via interpolation; 1995 assumed equal to 1996

Table A4: Summary Statistics for Control Variables

Variable	N° Obs.	Mean	Std. Dev.	Min	Max
CG net lend./borr.	1315	-1.79	4.02	-30.93	20.01
Real pc GDP growth	1603	2.19	4.00	-22.53	14.83
Real Interest Rate	874	2.98	3.22	-13.99	15.55
Openness	1589	77.76	41.80	7.60	333.53
REER	1744	94.48	31.40	5.59	476.72
Population	1880	44.30	135.95	0.21	1221.16
Dependency Ratio	1880	64.88	4.23	49.16	72.57
School-age Population	1880	23.58	7.65	13.27	47.70
Output Gap	1161	0.02	3.15	-13.38	17.78
Unemployment	1415	7.52	4.65	0.00	28.15
Legislative	1500	0.27	0.44	0.00	1.00
Executive	1501	0.07	0.26	0.00	1.00
Election	1393	1.78	1.34	0.00	7.00
Rule of Law	782	0.78	0.96	-1.29	2.00
Govt. Fragmentation	1427	0.70	0.28	0.08	1.00
Borrowing Autonomy	840	74.60	16.77	33.33	100.00
High Borrowing Aut.	840	0.52	0.50	0.00	1.00
Authority	706	0.62	0.49	0.00	1.00

Note: Calculated with all available observations. See Table A3 for details.

Table A5: Additional Panel Unit Root Tests for Main Regressors

<i>Im-Pesaran-Shin</i>	VFI	CG Deficit	GDPpc growth	Real Int. Rate
Levels	-2.19 (0.01)	-5.25 (0.00)	-15.13 (0.00)	-1.64 (0.05)
# Observations	1096	1192	1509	814
First differences	-14.81 (0.00)	-17.48 (0.00)	-31.82 (0.00)	-16.52 (0.00)
# Observations	1047	1134	1462	784

Note: p-values in parenthesis

Table A6: Diagnostics and Model Specification Tests

<i>Diagnostic/Specification test</i>	<i>Test Statistic</i>
Autocorrelation	
Wooldridge test for serial correlation (H ₀ : No first order serial correlation)	F(1,27)=4.523**
Heteroskedasticity	
Modified Wald test for groupwise heteroskedasticity (H ₀ : Homoskedasticity)	$\chi^2(28)=3622.93***$
Cross-sectional dependence	
Pesaran test of cross-sectional dependence (H ₀ : Cross-section independence in residuals)	
- First difference of Gov. Debt (% GDP)	N(0,1)=28.94***
- Vertical Fiscal Imbalances	N(0,1)=11.94***
- Expenditure decentralization	N(0,1)=3.91***
- Lag of Central Gov. Deficit	N(0,1)=36.18***
- Lag of real pc GDP growth	N(0,1)=49.24***
- Lag of real interest rate	N(0,1)=30.93***
Multicollinearity	
Variance inflation factors (VIF) (Rule of thumb: >20 indicative of possible multicollinearity)	
- Vertical fiscal imbalances	1.11
- Expenditure decentralization	1.19
- Lag of Central Gov. Deficit	1.24
- Lag of real pc GDP growth	1.15
- Lag of real interest rate	1.20
- Mean VIF	1.08

Note: Results based on benchmark model. *** (**,*) indicate rejection of H₀ at the 1% (5%, 10%) level.