WP/16/84

IMF Working Paper

Do Subnational Fiscal Rules Foster Fiscal Discipline? New Empirical Evidence from Europe

by Ananya Kotia and Victor Duarte Lledó

INTERNATIONAL MONETARY FUND

 WP/16/84

IMF Working Paper

Fiscal Affairs Department

Do Subnational Fiscal Rules Foster Fiscal Discipline? New Empirical Evidence from Europe[1]

Prepared by Ananya Kotia and Victor Duarte Lledó

Authorized for distribution by Benedict Clements

April 2016

Abstract

This paper studies how fiscal rules interact with the intergovernmental fiscal framework to foster fiscal discipline among European subnational governments. We use political variables describing the fiscal attitudes of the central government as instruments to obtain consistent estimates of the impact of subnational fiscal rules on fiscal balances. The results suggest that the discipline-enhancing effect of fiscal rules is weaker when there are large "vertical fiscal imbalances" that is, large differences in revenue and spending assignments across the different levels of government. These findings imply that separate reforms to reduce excessive vertical fiscal imbalances complement a rules-based fiscal framework that is aimed at fostering fiscal discipline.

JEL Classification Numbers: E61, E62, H63, H77

Keywords: Fiscal policy, fiscal rules, fiscal discipline, intergovernmental relations, Europe

Authors' E-Mail Addresses: ananyakotia@gmail.com; vlledo@imf.org.

[1] We would like to thank Benedict Clements, Ernesto Crivelli, Xavier Debrun, Dirk Foremny, Vitor Gaspar, Sanjeev Gupta, Mark Hallerberg, Fred Lima, Tigran Poghosyan, Andrea Schaechter, Rene Tapsoba, Fred Toscani, Tao Wu, and participants at the IMF Fiscal Affairs Department Seminar Series for helpful discussions and valuable comments. Jeffrey Pichocki and Younghun Kim provided excellent editorial and research assistance.

Contents **Page**

Figures

Appendices

I. INTRODUCTION

The need to put national and subnational fiscal positions to a sound footing, following the Eurozone debt crisis, has brought fiscal rules back to the forefront of the policy debate in Europe (OECD, 2014; Lledó and Pereira, 2015). Fiscal rules have been associated with a greater probability of stabilizing debt (Molnar, 2012). However, their influence depends crucially on key design characteristics such as sufficient flexibility, a clear institutional mechanism to check deviations from targets, and an unambiguous link between numerical targets and the ultimate objective (Kumar and others, 2009). Improving their effectiveness is, therefore, critical for the success of on-going national fiscal consolidation strategies and has become central to the current discussion on reforming the European Union (EU) fiscal governance framework (Andrle and others, 2015).

Though these concerns plague both national and subnational rules, the debate has primarily focused on the former. There is an extensive body of empirical and theoretical work on the effectiveness of national fiscal rules (see, for instance, Debrun and others, 2008), but the literature on the discipline-enhancing effect of subnational fiscal rules is largely confined to theoretical analyses and qualitative case studies.[2] Furthermore, empirical assessments of the effectiveness of subnational fiscal rules have often overlooked a key feature in the design of the intergovernmental fiscal framework: the presence of vertical fiscal imbalances (VFIs). A vertical fiscal imbalance occurs when there is a gap between own spending (total spending minus transfers paid) and own revenues (total revenues minus transfers received).[3] This gap often occurs when the devolution of spending responsibilities outpaces the devolution of revenue mandates, leaving subnational governments with limited tax autonomy to comply with their spending obligations.

A vast analytical literature identifies large VFIs as one of the main sources of fiscal indiscipline at the subnational level (Rodden and others 2003; Oates, 2006). High levels of VFIs may worsen fiscal outcomes of subnational governments (SNGs henceforth) through two channels: the common pool and moral hazard problems. The first occurs when a bulk of subnational spending is financed out of own revenues and from a common-pool of resources. SNGs that suffer from high levels of VFI may fail to internalize the full cost of fulfilling their spending mandates. This may lead to overspending due to a softening of their budget constraint (Rodden, 2002). Moral hazard, on the other hand, occurs due to insufficient tax autonomy, which may generate bail out expectations among SNGs that are unable to fulfill their spending obligations (Von Hagen and Eichengreen, 1996). Over-borrowing and soft SNG budget constraints may ensue. Recent studies such as Asatryan and others (2012) and Eyraud and Lusinyan (2013) have found evidence to support a negative relationship between VFIs and fiscal discipline at subnational and general government levels, respectively.

---

[2] Braun and Tommasi (2004), Ter-Minassian (2007, 2015), and Crivelli and Shah (2009) review the theory and distill policy lessons from country experiences. Empirical assessments have been largely confined to intra-country studies, such as those of U.S. states, Swiss cantons, and Canadian provinces (see below).

[3] We measure VFIs as the share of subnational own spending not financed through own revenues (more details in section III.B).

For analogous reasons, the problems of moral hazard and of the common pool of resources may diminish the effectiviness of fiscal rules. The soft budget constraints that result from the common-pool and moral hazard problems, work together to lower the cost of non-compliance of subnational fiscal rules faced by SNGs. This relationship between VFIs and the effectiveness of fiscal rules at the subnational level has not received much attention in the literature so far. We find empirical evidence to support this testable hypothesis, namely, that an increase in the level of VFIs, reduces the effectiveness of subnational fiscal rules by decreasing their marginal impact on subnational fiscal outcomes.

The main contribution of this paper is, therefore, to close the gap in the empirical literature by evaluating the impact of subnational fiscal rules on fiscal balances and assess how they operate at varying levels of VFIs. Two studies have looked at similar issues. Plekanov and Singh (2007) find that VFIs undermine the effectiveness of subnational borrowing controls in a sample of advanced and developing countries, while Foremny (2014) has shown strong subnational fiscal rules to be effective only among non-federal EU countries, where VFIs are presumably lower. We build on these studies by showing that there is a significant interaction effect between subnational fiscal rules and VFIs. In doing so, we also extend the work of Eyraud and Lusinyan (2013) by looking at the impact of VFIs on fiscal performance when the strength of subnational fiscal rules varies.

Our second contribution is methodological. It is well known that potential concerns of reverse causality and simultaneity may bias the estimates of the impact of fiscal rules on fiscal performance. To the best of our knowledge, Foremny (2014) is the only paper dealing with the endogeneity of subnational fiscal rules in Europe. Our identification strategy builds on Foremny (2014). We exploit the fact that rules applied to SNGs have largely been imposed by the central government and are thus influenced by national political factors. These factors, such as the timing of national elections and the fragmentation in the national government coalitions, encapsulate the central government's fiscal attitudes toward fiscal discipline, and ultimately, their preference for strong rules. However, these national political variables do not directly affect subnational fiscal outcomes. They may, therefore, be used as valid instruments for the strength of fiscal rules at the subnational level. Foremny's approach consists of using an instrumental variable estimate of a fiscal reaction function. However, this approach restricts the reaction function to a static specification to avoid the Nickel bias (Nickel, 1981). Therefore, to address the endogeneity biases, while at the same time maintaining the dynamic nature of the specification (by including a lagged dependent variable), we use national political variables as external instruments in a first difference GMM framework.[4]

Against this backdrop, we construct indices capturing the strength of subnational fiscal rules across a number of attributes of rule design and a measure of VFIs for our sample. We then proceed to estimate a dynamic fiscal reaction function in which we regress the subnational primary balance on the rule strength indices, while controlling for macroeconomic factors, and

[4] Foremny (2014) also addresses the Nickle bias by estimating FD GMM specifications, but does not make use of external instruments in his GMM specification to address the endogeneity of subnational fiscal rules.

including country and time fixed effects. We find that stronger fiscal rules (as captured by larger values for the overall fiscal rule strength index) and better design characteristics (as captured by larger values for the strength of specific design attribute indices) have a positive effect on subnational primary balances. In particular, the disciplining effect of the non-compliance and flexibility attributes seems to be larger in magnitude than other attributes.[5]

Subsequently, we augment our fiscal reaction function to include a term for the interaction between the rule strength indices and our measure of VFIs. The coefficient on the interaction term is negative and statistically significant over a range of specifications and estimators. The results, which are in line with our testable hypotheses, suggest that the marginal impact of fiscal rules on subnational primary balance falls as VFIs rise. In particular, for high levels of VFIs (i.e., if the ratio of revenue to expenditure decentralization falls below the threshold of 0.5), the point estimate of the marginal impact of the strength of subnational rules on subnational primary balance falls below zero. However, the estimate is not statistically different from zero, at such high levels of VFI, indicating that subnational fiscal rules may cease to be effective when VFIs are high. These results are noteworthy as they show that, apart from design characteristics of rules themselves, the design of the intergovernmental fiscal framework is a crucial determinant of the success of subnational fiscal rules in fostering fiscal discipline.

The rest of the paper is organized as follows. Section II gives some background on the rationale for the adoption of subnational of fiscal rules and discusses design attributes and institutional preconditions that make them effective. Some stylized facts about fiscal discipline and fiscal rules at the subnational level are discussed in Section III. Section IV outlines the empirical strategy and is followed by results and robustness checks in Section V. Section VI concludes.

II. Subnational Fiscal Rules and Fiscal Discipline

A. Why Adopt Subnational Fiscal Rules?

Ensuring fiscal discipline at the subnational level is particularly challenging, given the pervasiveness of the so-called *deficit bias* in the conduct of subnational fiscal policy. Deficit bias manifests in a government's adverse incentives to over-spend, under-tax, or excessively borrow. Deficit bias at the subnational level is commonly associated with the presence of soft budget constraints (SBCs).

The theoretical origins of SBCs are attributed to two conditions. The first is the *common pool* nature of the resources used to finance subnational government spending. This prevents SNGs from fully internalizing the cost of their public expenditure, leading them to over-spend and over-borrow (Halleberg and von Hagen 1999). The second is the situation of *moral hazard* encountered by government officials. It arises when the central government fails to commit

[5] They are followed closely by the coefficient on the statutory base index in a number of specifications. The fact that attribute indices are highly correlated among themselves prevent us from formally ascertaining the relative importance of the different attributes of fiscal rules (more below).

credibly not to bail out SNGs. Moral hazard becomes entrenched after a history of bailouts, and intensifies, when SNGs are economically or politically too sensitive to fail (Wildasin, 1997; Rodden and others, 2003; and Bordignon, 2006, Crivelli and Stall, 2013).[6]

A vast case-study literature has identified fiscal rules as a good compromise among available institutional arrangements to foster fiscal discipline at the subnational level.[7] Fiscal rules may be more palatable to SNGs (who may enjoy varying degrees of constitutionally established autonomy) than administrative controls imposed by the center. They may also offer more stability and predictability than subnational fiscal targets that are set by intergovernmental fiscal bodies as part of cooperative arrangements. Such arrangements may be subject to frequent re-negotiation due to unanticipated changes in the political power balance of subnational leaders in governing coalitions. Lastly, in countries where the preconditions for effective market discipline are absent, fiscal rules may offer a better alternative to harden subnational budget constraints.[8]

B. What Makes Subnational Fiscal Rules Effective?

Fiscal rules, whether national or subnational, are no panacea. Their effectiveness has been shown to depend on their design and implementation. The latter is particularly linked to the existence of sound budgeting, or more broadly, public financial management (PFM) procedures. The effectiveness of subnational fiscal rules also depends on the design of the intergovernmental fiscal framework.

Specific design attributes have been advocated to increase the effectiveness or strength of fiscal rules in constraining budgetary outcomes. Design attributes such as rule coverage, legal basis, monitoring and enforcement mechanisms, media visibility, and sufficient flexibility influence the effectiveness of rules through a number of specific channels with a common thread: they increase the political cost of reneging on rules.

- Increasing rule *coverage* to encompass, as closely as possible, the consolidated public sector (regional and local administrations, public enterprises, and foundations), increases rule strength by limiting the scope of creative accounting (Von Hagen and Wolff, 2006; Buti and others, 2007).

- Strong rules are also characterized by a *legal basis* that makes them hard to modify or amend (Inman, 1996). Fiscal rule frameworks embedded in constitutional laws need parliamentary

[6] Earlier studies have advocated soft budget constraints to be more pervasive among larger or wealthier jurisdictions (Wildasin, 1997). Recent analyses have challenged this "too-big to fail" hypothesis. Crivelli and Staal (2013), for instance, proposed a model to back growing evidence that numerous bailouts at the SNG level in Europe and elsewhere have been granted to rather small jurisdictions.

[7] See Ter-Minassian (2015) for a recent review of the literature.

[8] Such preconditions include the availability of timely and reliable information on subnational finances, government responsiveness to early market signals, no privileged access to financing, an adequate base of own subnational revenues, and no history of bailouts by the central government. See Lane (1993) and Ter-Minassian (2015) for a discussion of these preconditions.

"super-majorities" to be established and changed, and are stronger than rules set in ordinary legislation.

- Rule strength also increases with the quality of *monitoring and enforcement mechanisms* (Bohn and Inman, 1996). These include the existence of an independent body in charge of monitoring the rules, a system of automatic mechanisms that trigger corrective actions to prevent non-compliance, and sanctions that are imposed in the event of non-compliance. In the context of the European Union (EU), recent proposals have been made to strengthen further the enforcement of EU-imposed fiscal rules (Andrle and others, 2015). These proposals include greater automaticity in enforcement, once fiscal rules are breached, and the adoption of sanctions that better reflect prevailing economic circumstances (e.g., administrative constraints on new hiring in bad times rather than financial sanctions).

- Even in the absence of a strong legal basis or adequate monitoring and enforcement mechanisms, rules may succeed in inducing fiscal discipline if they have a high degree of *media visibility* (Debrun and others, 2008).

- Rules can be designed to be flexible by allowing for cyclical adjustments and escape clauses in the case of exceptional economic circumstances. Unlike other design attributes, the disciplining effect of *rule flexibility* is likely to be ambiguous. On the one hand, cyclical adjustments—by stripping away cyclical increases in revenues from the measure of fiscal targets (e.g., budget balances)—reinforce fiscal discipline in good times by imposing targets above the original (non-adjusted) nominal targets. On the other hand, cyclical adjustments tend to relax nominal targets in bad times, thus being less conducive to fiscal discipline relative to the original (non-adjusted) nominal targets. Escape clauses are similarly expected to relax nominal targets when triggered in bad times. However, well-defined escape clauses may serve to minimize deviations from the rule. Therefore, the net impact of cyclical adjustments and escape clauses on fiscal discipline are likely to be ambiguous.

- Effective rules require *sound and uniform subnational PFM procedures* across SNGs to ensure that they are properly monitored and enforced. Sound PFM arrangements achieve this by promoting consistent practices across SNGs at all budgeting stages (Plekanov and Singh, 2006 and Fainboim and others, 2015). Such procedures include: (i) shared medium and long-term fiscal objectives to guide budget formulation and fiscal targets; (ii) shared macroeconomic assumptions to ensure consistent budgetary projections across all levels of the government; (iii) timely and frequent production of in-year fiscal reports, annual accounts, and financial statements at each government level, followed by an independent and external audit; and (iv) common budget classification and accounting standards. Best-practice PFM procedures are often embedded together with numerical fiscal rules in *fiscal responsibility laws* (Crivelli and Shah, 2009).

Sound design and PFM procedures may not suffice to improve the effectiveness of rule-based frameworks if inherent flaws in the intergovernmental fiscal framework are pervasive. They can, at best, improve fiscal outcomes where a coordination failure or a lack of fiscal discipline is the result of a lack of information and instruments, or due to procedures that constrain capacity and distort incentives to implement sound policies. But PFM procedures are less effective if they distort the incentives of the central and subnational government officials as the result of flaws

that are embedded in the intergovernmental fiscal framework. Such flaws include ill-designed transfer systems, mismatches between revenue and spending responsibilities, and unclear or unfunded spending mandates, and may result in poor compliance and enforcement of rules (Braun and Tommasi, 2004; Escolano and others, 2012; and Ter-Minassian, 2015).

VFIs deserve special attention. They often occur when the devolution of spending responsibilities outpaces the devolution of revenue mandates, leaving subnational governments with limited tax autonomy to comply with their spending obligations. VFIs may be desirable up to a point as intergovernmental transfers are an important policy instrument to promote risk-sharing and redistribution across SNGs. Large VFIs, however, may undermine SNG fiscal discipline by softening their budget constraints through the common pool and moral hazard channels as follows. First, large VFIs intensify transfer dependency and common-pool financing of SNG expenditure obligations. As a result, SNGs and, in particular, their local constituents will not have to incur the full (economic and political) cost of fulfilling their spending mandates, resulting in a soft budget constraint. This may induce overspending (Rodden, 2002). Second, large VFIs also raise bailout expectations that may lead to moral hazard. With insufficient tax autonomy, high-VFI SNGs depend on the central government to finance a significant portion of their spending. In this situation, voters and creditors may exercise additional pressure on the central government to bail-out SNGs which would otherwise not be able to meet their spending mandates (Von Hagen and Eichengreen, 1996). Over-borrowing and soft SNG budget constraints would ensue. A parallel literature shows that granting additional tax autonomy to SNGs promotes fiscal responsibility (Oates, 2006). In fact, tax autonomy is as important as strict subnational borrowing controls in hardening budget constraints when VFIs are initially very large (Plekanov and Singh, 2006), such as in the case of federations (Foremny, 2014).[9]

VFIs also undermine the compliance and enforcement of subnational fiscal rules. First, by intensifying the common-pool financing of SNG expenditure obligations, VFIs reduce the costs borne by SNGs and their constituents to fulfil their spending mandates. This reduces the economic and political costs of overspending and reneging from fiscal targets, which helps in defraying the associated non-compliance costs imposed by fiscal rules (e.g., through the imposition of financial sanctions). Second, for the reasons mentioned above, as SNG tax autonomy falls, it becomes costlier for the central government to commit to a non-bailout policy. Such situations of moral hazard make it difficult for the center to enforce fiscal rules at the subnational level. Therefore, higher levels of VFIs—by reducing the costs of non-compliance and increasing the costs of enforcing fiscal rules— reduce the marginal disciplining impact of stronger fiscal rules on SNG fiscal balances.

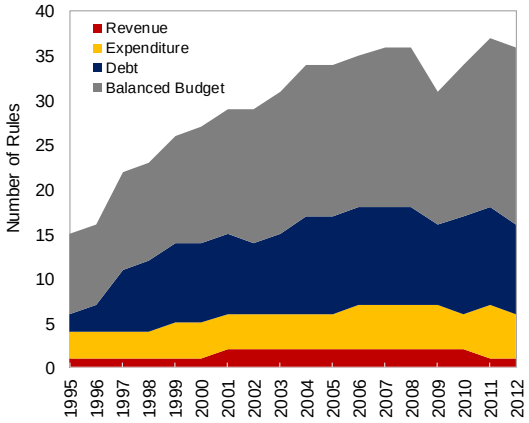
[9] Closing VFIs often requires restraining the access to soft financing such as bank credit, usually from the state-owned banking sector. Crivelli (2012) shows that in the case of emerging European countries, this has been done mainly through banking sector reform and privatization (e.g. by reducing the role of state-owned banks in providing subsidized credit to SNG owned pubic enterprises).

III. Subnational Fiscal Rules and Fiscal Discipline in Europe

A. Subnational Fiscal Rules

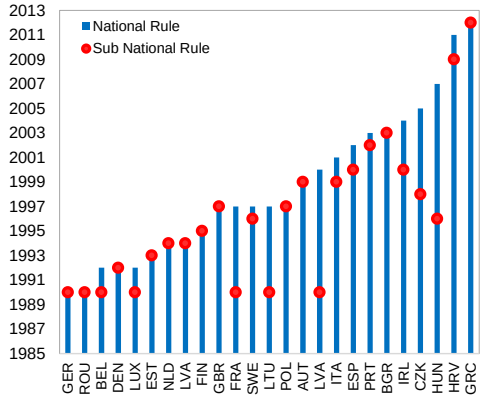
Subnational fiscal rules have gained prominence in Europe over the last two decades. This was a period marked by successive reforms in the EU fiscal governance framework, with particular emphasis on improving the coverage of supranational fiscal rules, and embedding them in national legislation. As a result, the number of subnational rules adopted in the region more than doubled between 1995 and 2012 (Figure 1). Most of the rules adopted were either budget balance or debt rules. In most cases, subnational fiscal rules were imposed by the center and adopted in conjunction with national fiscal rules (Figure 2).

Figure 1. Subnational Fiscal Rules: Evolution by Type



Source: European Commission.

Figure 2. Adoption of National versus Subnational Fiscal Rules

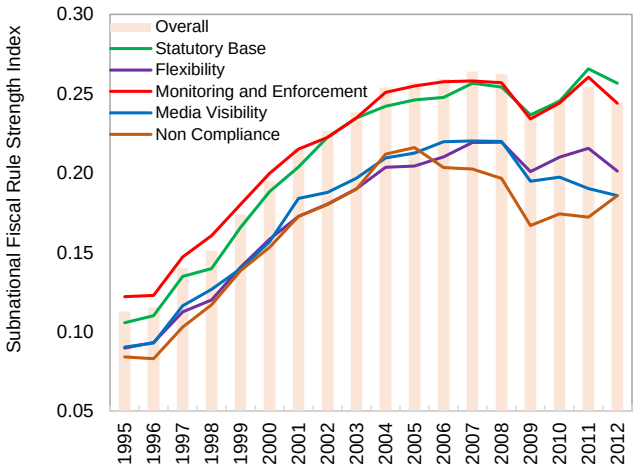


Source: European Commission.

Subnational fiscal rules have not only grown in number but also have also become stronger (Figure 3). Using a database from the European Commission (EC) measuring the strength of all the fiscal rules present in each EU country, we construct an index capturing the *overall* strength of the rules that apply to SNGs. We also construct five additional sub-indices that quantify the strength of different design attributes of these rules: (i) the *statutory base* of the rule; (ii) the

existence of mechanisms for rule *monitoring and enforcement;* (iii) whether *non-compliance* with the rule leads to sanctions; (iv) the *media visibility* of the rule; and (v) the *flexibility* of the rule.[10]

Figure 3. Median Subnational Fiscal Rule Strength in Europe, 1995–2012



Source: Authors' calculation.
Note: Appendix 2 details the construction of the index.

The strength of subnational fiscal rules increased steadily for the median EU country over the past two decades, except for 2009, when some countries suspended their rules in response to the global financial crisis (IMF, 2009).[11] The otherwise steady strengthening of subnational fiscal rules during this period has been achieved mainly by raising their legal profile (i.e., embedding them in national legislation) and by assigning their monitoring to independent fiscal institutions that were formed during this period. Rule strengthening, however, was subject to significant cross-country variation (Figure 4).

B. Subnational Fiscal Balances: VFIs versus Rule Strength

Subnational fiscal balances in Europe have deteriorated for most of the last two decades. Since 1995, primary balance for the median EU SNG has fallen from a surplus of 0.2 percent of GDP to a deficit of almost 0.5 percent of GDP in 2009 (Figure 5).[12] Fiscal positions remained balanced in the run-up to the global financial crisis. The post-crisis period saw a sharp worsening in SNG balances that largely reflected coordinated efforts to stimulate the economy by national governments across Europe, followed by an equally sharp adjustment (Lledó and Pereira, 2015).

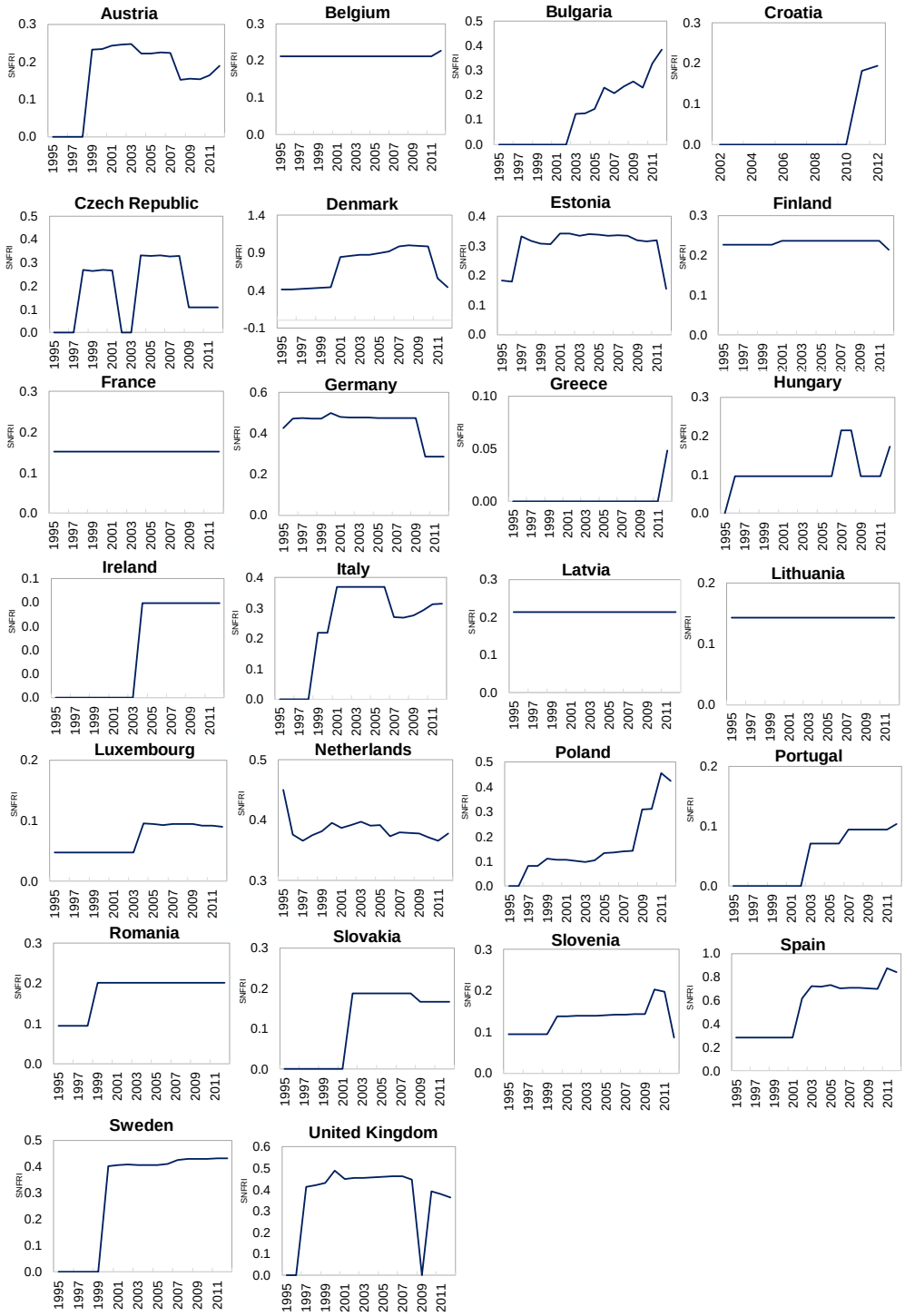
[10] See Appendix 2 for details.

[11] This was the case, for instance, in the United Kingdom, where both the balanced budget rule (U.K.'s golden rule) and the debt rule (U.K.'s sustainable investment rule) have been held in abeyance after 2008.

[12] The median EU primary balance is computed for 26 out the 28 current EU members during the period 1995–2012, which is the sample used in our subsequent empirical analysis. See Appendix 1 for additional details.

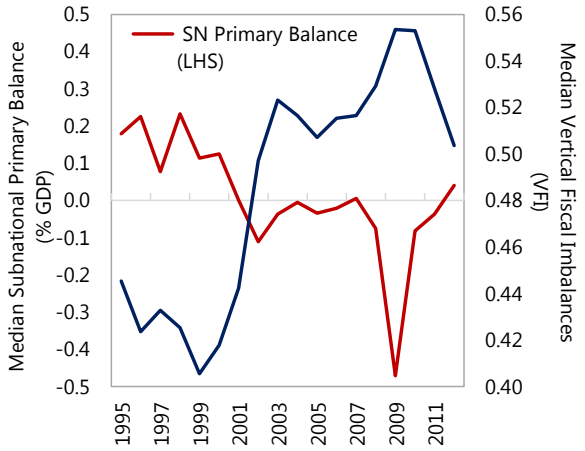
As in the case of subnational fiscal rules, changes in the median fiscal position, however, masks significant cross-country variation (Figure 6).

Figure 4. Subnational Fiscal Rule Strength in Europe, 1995–2012



Source: European Commission and authors' calculation.
Note: Appendix 2 details the construction of the index.

Figure 5. Evolution of Median VFI Level and Subnational Primary Balances, 1995–2012



Source: Eurostat and authors' calculation.
Note: See Appendix 1 for details.

We measure VFIs as the share of subnational own spending not financed through own revenues.[13] Rising VFIs have accompanied the worsening subnational fiscal balances. An asymmetry between expenditure and revenue decentralization has characterized the recent changes in the intergovernmental fiscal frameworks in Europe and other OECD countries (Blochliger and Vammalle, 2012). In most cases, the devolution of spending responsibilities has outpaced the devolution of revenue mandates resulting in significant increases in the level of VFIs. This is illustrated in Figure 5, which shows that the median level of VFI has risen by almost a third over the last two decades.

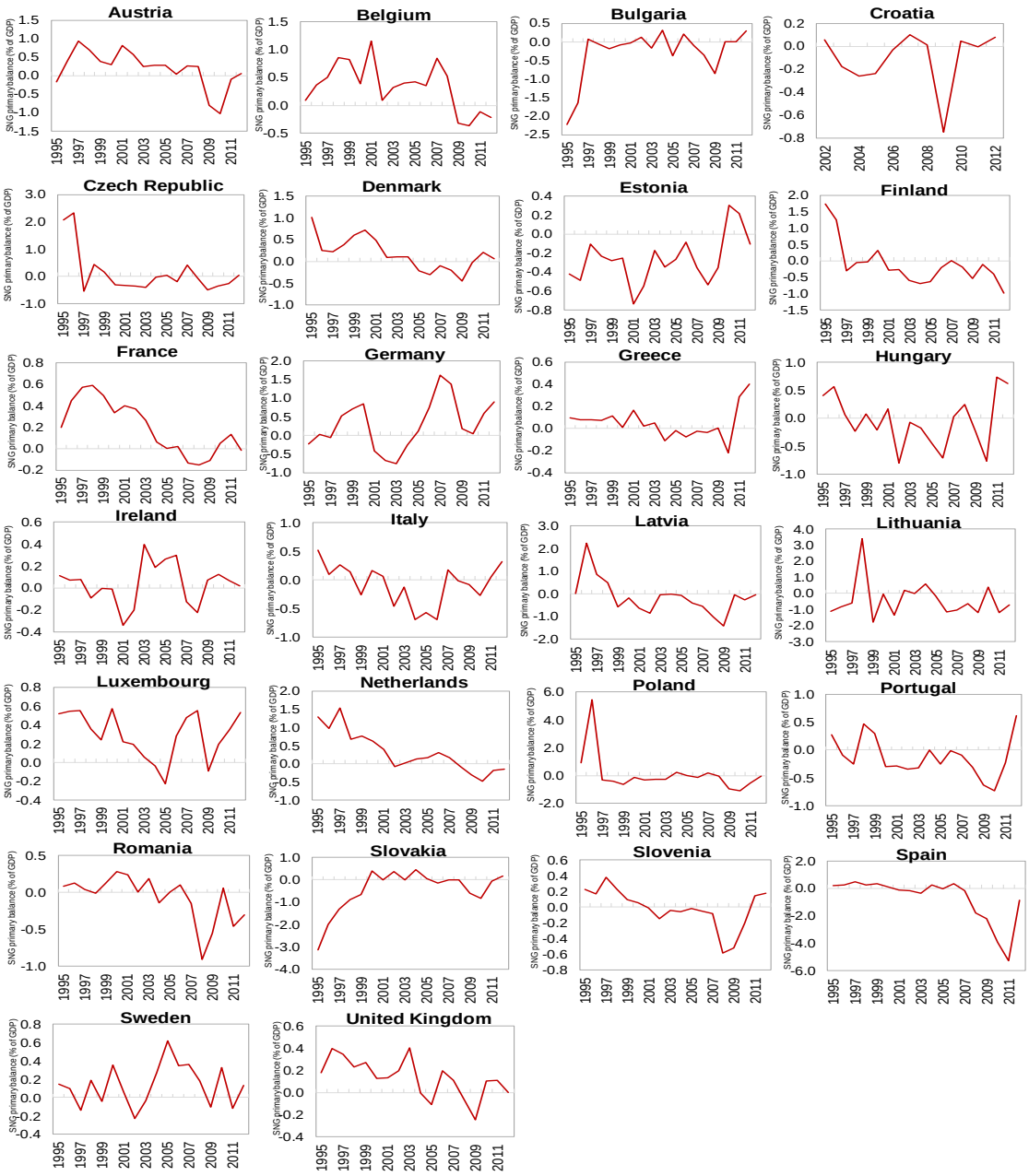
At first sight, subnational fiscal rules do not appear to have a direct effect on fiscal performance (Figure 7). The absence of a strong correlation between the strength of subnational fiscal rules and fiscal performance could also indicate that compliance with such rules is weak and contingent on specific circumstances.[14] The rest of the paper will examine these issues closely.

---

[13] Following Eyraud and Lusinyan (2013), VFIs are defined as $\left[1-\frac{Own\ Revenue}{Own\ Spending}\right]$, which can be shown to be equivalent to $\left[1-\frac{Revenue\ Decentralisation}{Expenditure\ Decentralisation}(1-GG\ Deficit)\right]$. Here, own revenue (spending) corresponds to total subnational revenue (spending) minus transfers received by the central government and other public entities (transfer paid to the central government and other public entities). Revenue (expenditure) decentralization corresponds to the share of own revenue (own spending) to general government total revenue (general government total spending). GG deficit is the overall fiscal deficit of the general government as a share of general government total spending.

[14] Andrle and others (2015) have shown weak compliance with supranational fiscal rules to be pervasive and detrimental to fiscal performance among EU countries. Since 1999, about half of the countries in their sample have missed the 60 percent debt-to-GDP target more than half of the time. Compliance with the "close to balance or surplus position" over the medium-term has also been rare, reflecting difficulties in building buffers in

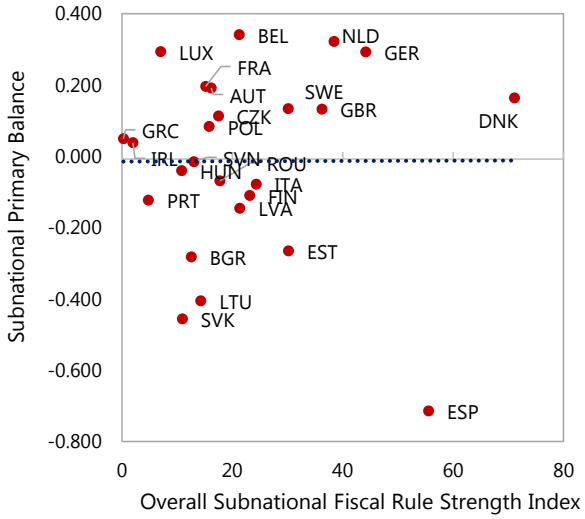
Figure 6. Subnational Primary Balances in Europe, 1995–2012
(percent of GDP)



Source: Eurostat and authors' calculation.
Note: See Appendix 1 for details.

good times. In the euro area-18 as a whole, there has not been a single year with a structural deficit below 1 percent of potential GDP. Simulation shows that stronger compliance with this latter rule would have allowed EU countries to have entered the crisis with a debt ratio of just under 60 percent of GDP—about 10 percentage points below the actual level in 2008 (Eyraud and Wu, 2015).

Figure 7. Mean SN Primary Balance versus SN Fiscal Rules, 1995–2012



Source: European Commission and authors' calculations.

IV. Empirical Strategy

A. Testable Hypothesis

A review of the literature and the arguments of the previous sections indicate that the intergovernmental fiscal framework—in particular, the degree of VFIs— may influence the discipline-enhancing effect of subnational fiscal rules on SNGs.

To deepen our understanding on this issue, we pursue a more formal empirical analysis to test two hypotheses about the effectiveness of subnational fiscal rules and their interaction with VFIs.

Hypothesis 1: Subnational government fiscal discipline increases with rule strength.

Hypothesis 2: The effectiveness of stronger subnational fiscal rules in promoting fiscal discipline at the subnational level diminishes as VFIs rise.

B. Model Specification

To assess these testable hypotheses, we estimate a fiscal reaction function, which specifies the relationship linking primary balance at the subnational level to the strength of subnational fiscal rules, VFIs, their interaction, and relevant macroeconomic controls. Our sample covers 26 European countries from 1995 to 2012.[15] We model the following fiscal reaction function on the lines of Bohn (1998) and Debrun and others (2008):

[15] Appendix 1 defines all variables used in the empirical analysis and identifies their sources. Data on political institutions are only available up to 2012, limiting the sample to this year.

$$SNPB_{it} = \alpha SNPB_{i,t-1} + \beta SNFRSI_{ait} + \gamma SNFRSI_{ait} * VFI_{it} + \delta X_{it} + \eta_i + \rho_t + \varepsilon_{it}, i = 1, \dots, N;\ t = 1, \dots, T \quad (1)$$

Here, i and t denote countries and years respectively; $SNPB$ denotes the sum of primary balances of all SNGs within a country, as percent of GDP. $SNFRSI_a$ is the strength index for attribute a of subnational fiscal rules, where a may denote the overall strength index, statutory base, monitoring and enforcement, non-compliance, media visibility, or flexibility. X denotes two macroeconomic controls— output gap,[16] which captures the influence of cyclical factors, and the percent of population above the age of 65, a proxy for spending needs of lower-level governments. VFI, as previously defined, denotes the level of vertical fiscal imbalances.

Our model includes country (η_i) and time (ρ_t) specific fixed effects. The importance of these fixed effects cannot be overemphasized. η_i controls for time invariant, country specific characteristics that are unobserved or hard to measure. ρ_t controls for common shocks that affect all the countries in the sample, such as those propagated through the recent global financial crisis. One of the limitations of a number of similar studies such as Eyraud and Lusinyan (2013) and Foremny (2014) is that they exclude the crisis period from their sample, despite the inclusion of time dummies in their respective specifications.[17]

Our specifications include a lagged dependent variable for two reasons. First, it captures the persistence of subnational primary balances. Second, even if the lagged dependent variable is not of primary importance, controlling for the persistence of the dependent variable by using a dynamic specification may be important for recovering consistent estimates of other parameters of interest (Bond, 2002).

A positive and statistically significant value of β would support Hypothesis 1. Stronger subnational fiscal rules with respect to a given attribute *a* improve fiscal balances at the subnational level. Although there is considerable empirical evidence to support an analogous hypothesis for fiscal rules at the national level among European countries, evidence to support the effectiveness of fiscal rules among subnational European governments remains limited.[18] Using a similar fiscal reaction function, Foremny (2014) finds that subnational fiscal rules are effective only among EU unitary countries. On the other hand, Escolano and others (2012) find

[16] Due to unavailability of data on subnational output gap, we use output gap at the national level as a proxy. Output gap refers to de-trended national GDP.

[17] Eyraud and Lusinyan (2013) excluded the post-2007 period on the basis that the global financial crisis likely disrupted intergovernmental fiscal relations, creating breaks in the series. Foremny (2014) also uses data for a smaller set of EU 15 countries.

[18] At the national level, evidence of a positive impact of stringent fiscal rules on fiscal balances has been limited mostly to the EU, and includes Hallerberg and von Hagen (1999), Ayuso-i-Casals and others (2007), Debrun and others (2008), and Escolano and others (2012). At the subnational level the evidence has been mainly limited to intra-county studies, such as those on U.S. states (Alt and Lowry, 1994 and Bohn and Inman, 1996; to name a few); Canadian provinces (e.g., Imbeau and Tellier, 2004), and Swiss cantons (Krogstrup and Walti, 2008, among several others).

more stringent subnational fiscal rules to have no impact on fiscal balances for the general government as a whole.

Hypothesis 2 would be corroborated by a negative and statistically significant value of γ, the coefficient on the interaction term, $FRSI_{it} * VFI_{it}$. It would imply that the marginal impact of stronger subnational fiscal rules on subnational primary balances ($\beta + \gamma * VFI$) would diminish as VFIs rise. Using a sample of 28 OECD countries, Eyraud and Lusinyan (2013) find general government fiscal balances to decline as VFIs increase. Our analysis extends their work in two respects. First, we focus on SNG fiscal performance. Second, rather than focusing on the direct impact of VFIs on subnational fiscal outcomes, we discover a critical, and yet unexplored interaction between VFIs and the functioning of fiscal rules at the subnational level.

C. Estimation Framework

The dynamic nature of our empirical model, the need to control for common and idiosyncratic shocks, our modest sample, and the potential endogeneity of fiscal rules, put a premium on the choice of an estimation framework capable of consistently assessing our testable hypotheses.

To address these challenges, we choose to employ two alternative estimators: (i) a first difference Arellano Bond (1991) GMM estimator—FD GMM, and (ii) a bias corrected Least Squares Dummy Variable—LSDVC. We choose FD GMM as our baseline estimation framework and rely on LSDVC to check the robustness of our results (more on this later).[19]

The dynamic nature of our empirical model prevents us from obtaining consistent estimates of the coefficients in equation (1) using Ordinary Least Squares (OLS) or Fixed Effects (FE) estimators. Both FD GMM and LSDVC allow for fixed effects and have been shown to generate consistent estimates by addressing the inconsistency introduced by the lagged dependent variable in a panel data set up (Nickel, 1981).[20]

FD GMM addresses the concerns of reverse causality by using the political variables, described above, as external instruments for the strength of fiscal rules.[21] These political variables act as *external* instruments, i.e., we do not include them as explanatory variables in our model specification. They are valid instruments as they are correlated with the strength of fiscal rules but uncorrelated with subnational fiscal outcomes. Similar to Foremny (2014), we rely on the fact that in Europe, subnational fiscal rules are imposed by the central governments on subnational governments. This allows us to use political characteristics at the national level, that encapsulate

[19] We have chosen not to employ System-GMM, another commonly used estimator for dynamic panel data models. Augmenting the set of internal instruments further (i.e. by including moment conditions for the equations in levels, in addition to those in first-differenced equations, could lead to the problem of over-identification, and bias the estimates in small samples.

[20] See Bond (2002) and Roodman (2006) for a discussion of how FD GMM addresses the Nickel bias. The LSDVC estimator uses higher-order asymptotic expansion techniques to approximate the small sample bias of the LSDVC estimator thus correcting for the Nickel bias. See Bruno (2005) for additional details.

[21] Standard instrumental variable estimators cannot be used given the dynamic nature of our model.

the center's fiscal attitudes towards fiscal discipline, as instruments for the strength of subnational fiscal rules. Our instrument set includes the level of fragmentation of national government coalitions and a dummy variable for elections to national parliaments. These *national* political variables are related to the strength of the rules, but there is no reason to believe that they would be related to ε_{it}, the unexplained part of the *subnational* primary balance, $SNPB_{it}$, in equation (1). To our knowledge, this is the first paper in the literature to employ the FD GMM estimator with external instruments for this purpose.

Notwithstanding the benefits of FD GMM mentioned above, we address some further challenges to FD GMM estimators that arise due to our sample size, which is modest, relative to large micro-data sets to which such estimators are usually applied. The number of instruments in GMM models rise at a quadratic rate with the time dimension of the sample. This can lead to concerns regarding possible overfitting in samples with a small cross-sectional dimension such as ours. Overfitting may lead to biased estimates that converge to fixed effects estimates. Overfitting may also significantly reduce the power of the Hansen test of the validity of instruments. We address this concern in two steps. First we use only certain lags of variables as instruments. All the GMM results presented in the next section use lags $t-3$ and $t-4$ only. Second, we combine our instruments into smaller sets by using the *collapse* option in Roodman's *xtabond2* package for Stata. This method generates an instrument set which contains one instrument for each lag distance and instrumenting variable, making the instrument count linear in the time dimension of the sample.

LSDCV does not suffer from problems of overfitting discussed above. However, unlike GMM, it is not capable of addressing concerns of endogeneity and reverse causality. We, therefore, use LSDCV mainly as a robustness check for the results obtained by the FD GMM estimator.

V. RESULTS

A. Baseline Estimation Framework

We start by testing hypothesis 1. Table 1 presents FD GMM results of the fiscal reaction function in equation (1), but without the interaction term with VFIs. The model is estimated for the overall index (column (1)), as well as for five sub-indices of the different rule attributes. As advanced in the previous section, we reduce the number of instruments to 28 by collapsing the instrument matrix and using only lags $t-3$ and $t-4$ of all variables. To address potential concerns of reverse causality, we augment the instrument matrix to include two external instruments: a dummy variable for central legislative elections and the Herfindahl index of government fragmentation.

Table 1. FD GMM Estimates of the Fiscal Reaction Function
(Dependent Variable: Subnational Primary Balance/GDP)

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dependent Variable	0.129	0.113	0.140	0.051	0.161	0.101
	(0.11)	(0.11)	(0.11)	(0.11)	(0.13)	(0.10)
Overall	0.032*					
	(0.02)					
Statutory Base		0.032*				
		(0.02)				
Monitoring and Enforcement			0.029*			
			(0.02)			
Non Compliance				0.048***		
				(0.02)		
Media Visibility					0.030*	
					(0.02)	
Flexibility						0.032*
						(0.02)
VFI	0.011	0.009	0.014	0.021	0.011	0.007
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Output Gap	-0.001*	-0.001*	-0.001**	-0.001**	-0.001*	-0.001**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population > 65	0.011*	0.010*	0.012	0.014*	0.008	0.012*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Number of Observations	321	321	321	321	321	321
m1	-2.02	-1.92	-1.92	-1.39	-2	-1.84
m2	0.16	0.04	0.27	0.71	-0.01	0.2
Instruments	28	28	28	28	28	28
Hansen	5.86	5.37	5.86	7.07	4.6	5.61

Note: Heteroskedasticity and autocorrelation consistent asymptotic standard errors in parentheses. m1 and m2 are serial correlation tests of order 1 and 2 respectively using residuals in first differences. Hansen is a test of the overidentifying restrictions (see Sargan, 1958; Hansen, 1982) and is asymptotically distributed chi square under the null hypothesis that these moment conditions are valid; parentheses contain degrees of freedom. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

The results provide tentative evidence to support hypothesis 1. With the exception of the non-compliance sub-index coefficient, the coefficients of all the remaining indices are positive but significant only at the 10 percent level, suggesting that stronger subnational fiscal rules increase subnational primary balances. The magnitudes of these coefficients are economically meaningful. An increase in the SNFRI from its median value to its 75th percentile would lead to an increase in the SNPB of 0.4 percent of GDP. This increase in SNFRSI is sufficient to raise the level of median SNPB up to its 90th percentile. Even though this result has been widely hypothesized, there has been very limited empirical evidence to support it. Foremny (2014), the only other paper that uses cross-country data on subnational fiscal rules, finds no direct evidence for the effectiveness of subnational fiscal rules. In a similar fiscal reaction function, he finds that the coefficient on the SNFRSI is small and insignificant, and that only the interaction of SNFRSI with the form of fiscal governance (a dummy variable that equals one if a country is a federation and zero if unitary) is significant.

Table 2 presents FD GMM results for equation 1 and includes the interaction term between the strength of fiscal rules and VFI. The coefficients of interest are the ones for $FRSI_{ait}$ and the interaction term, $FRSI_{ait} * VFI_{it}$. All the coefficients on the overall and the attribute indices are positive and significant, at least at the five percent level. These results corroborate the evidence in Table 1, in favor of hypothesis 1, i.e., stronger fiscal rules improve the primary balance at the

subnational level. While there is indication that the coefficients on the indices of non-compliance, flexibility, and statutory base are larger than those on indices for the other attributes, at this stage, we refrain from making inference on the relative importance of these attributes. All the attributes are highly correlated among each other, with our overall strength index (SNFRI), as well as with an alternative overall index that we constructed using principal component analysis.[22]

Table 2. FD GMM Estimates of the VFI Impact on the Effectiveness of SNGs Fiscal Rules

(Dependent Variable: Subnational Primary Balance/GDP)

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dependent Variable	0.108	0.112	0.118	0.099	0.109	0.075
	(0.09)	(0.10)	(0.09)	(0.08)	(0.10)	(0.08)
Overall	0.064**					
	(0.03)					
Overall*VFI	-0.114*					
	(0.06)					
Statutory Base		0.072**				
		(0.03)				
Statutory Base*VFI		-0.143**				
		(0.07)				
Monitoring and Enforcement			0.056**			
			(0.03)			
Monitoring and Enforcement*VFI			-0.104*			
			(0.06)			
Non Compliance				0.087**		
				(0.03)		
Non Compliance*VFI				-0.136*		
				(0.07)		
Media Visibility					0.062**	
					(0.03)	
Media Visibility*VFI					-0.111*	
					(0.06)	
Flexibility						0.076**
						(0.04)
Flexibility*VFI						-0.130**
						(0.06)
VFI	0.026	0.027*	0.026	0.031*	0.021	0.021
	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Output Gap	-0.001***	-0.001***	-0.001***	-0.001**	-0.001**	-0.001***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population > 65	0.006	0.003	0.007	0.009**	0.007	0.008*
	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
Number of Observations	321	321	321	321	321	321
m1	-2.42	-2.44	-2.4	-2.5	-2.19	-2.2
m2	-0.43	-0.61	-0.46	0.1	-0.39	-0.42
Instruments	30	30	30	30	30	30
Hansen	3.35	1.9	3.12	4.41	3.09	4.14

Note: See notes Table 1.

[22] Correlation coefficients among all the attributes are above 0.8. As a result, regression coefficients for each of the attributes are statistically insignificant when they are jointly estimated in the same equation. We constructed an alternative index for the overall rule strength using the first principal component, capturing more than 80 percent of the variance of the original data. This index is highly correlated with our overall rule strength index (SNFRSI). The scoring coefficients, used as weights for this index are shown to be very similar across the different indices of rule attributes. Results are available upon request.

The estimated SNFRSI regression coefficient implies that a 10 percent increase in the overall SNFRSI would raise subnational primary balance by 0.63 percent of GDP. The coefficient on the interaction terms between the rule indices and VFIs are negative and significant at the five percent level, suggesting that the effectiveness of subnational fiscal rules diminishes as VFIs rise. The estimated coefficients on the other covariates (output gap, population above 65) are consistent with priors.[23] The coefficient on VFIs is positive but insignificantly different from zero in most specifications. This result differs from Eyraud and Lusinyan (2013), who find a robust negative correlation between VFIs and general government primary balance. It may suggest that as the level of VFI increases, so do central government transfers, keeping subnational primary balances from declining.

Figure 8 translates the results of Table 2 into a standard marginal effects plot. It shows that the marginal impact of subnational fiscal rules on subnational primary balances $\left(\frac{\partial SNPB}{\partial FRSI}\right)$ falls as VFIs rise. Superimposing the plot of the marginal impact of subnational fiscal rules on the levels of VFIs in different EU countries shows that the former becomes negative as the level of VFIs rises above 0.5, i.e., if the ratio between revenue and expenditure decentralization falls below 0.5.[24] These estimates imply that for subnational fiscal rules to be effective in enforcing fiscal discipline, revenue decentralization at the subnational level cannot lag significantly behind expenditure decentralization. This is an important finding, as it shows that rules on their own, no matter how strong, may fail to induce fiscal discipline at the subnational level if the level of VFIs is too high. This corroborates qualitative case studies, which form the bulk of the existing evidence on the effectiveness of fiscal rules (IMF, 2009).

B. Robustness Checks

We check the robustness of our main results to alternative estimators and specifications. In particular, we estimate equation (1) using an LSDVC estimator, alternative dependent variables, and additional controls. Our main results remain valid.

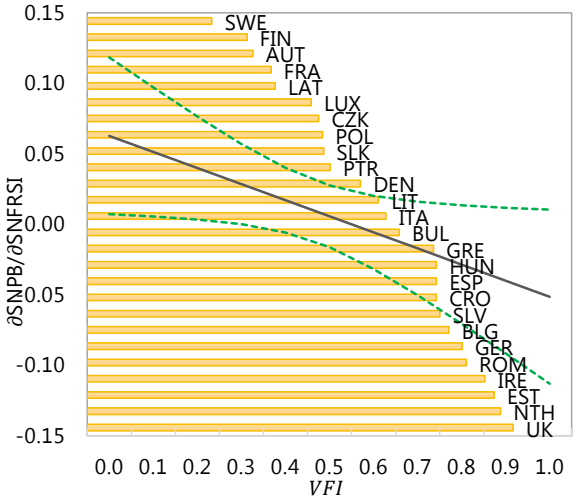
As a first robustness check, we estimate equation (1) using the LSDVC estimator instead of the FD GMM framework used in the previous section. As summarized in Table 3, the coefficient on the overall index of rule strength and the attributes sub-indices are positive and statistically significant at conventional levels. The coefficients on the interaction term between VFI and the fiscal rule indices remain negative and significant. However, the point estimates are roughly half the size of those estimated using FD GMM.

---

[23] The subnational nature of our analysis led us to estimate the fiscal reaction function without controlling for general government debt. Results in Table 2 (available upon request) are robust to including the lagged general government debt-to-GDP ratio as an additional control.

[24] From the definition of VFIs on footnote 6 and using GG Deficit of 0.06, $\frac{\partial PB}{\partial FRSI} < 0$ if $VFI > 0.5$. The mean GG deficit was calculated by taking the mean of GG deficits of all the countries for each year and then averaging them across time.

Figure 8. VFI Impact on Fiscal Rule Effectiveness



Source: Estimated FD GMM Results (Table 2).
Note: Fiscal Rule effectiveness defined as the marginal effect of SNFRSI on SNPB.

Next, we look at whether the choice of the dependent variable matters. Equation 1 is reestimated by FD GMM using two alternative measures of fiscal outcomes: the overall subnational fiscal balance as a percent of GDP (see Table 4) and the subnational primary fiscal balance as a percent of total subnational revenue (see Table 5).[25] The coefficients of the impact of fiscal rules and their interaction with VFIs are statistically significant and remain of the same sign as those obtained under our baseline specification. The magnitudes of the coefficients in Table 4 are surprisingly close to that of the baseline specification reported in Table 2. Table 5, on the other hand, shows much larger magnitudes. This is not surprising given that we normalize the dependent variable in Table 5 by subnational revenues, whereas the dependent variable in the baseline regression is normalized by GDP.

[25] The first measure allows for a more comprehensive view of the subnational fiscal position at the cost of introducing terms that are not under the discretion of subnational officials (e.g., debt service). The second measure has been defended as a better proxy of subnational fiscal effort as it relates the size of deficits to the actual subnational capacity to finance them.

Table 3. LSDVC Estimates of the VFI Impact on the Effectiveness of SNGs Fiscal Rules
(Dependent Variable: Subnational Primary Balance/GDP)

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dependent Variable	0.364***	0.369***	0.361***	0.361***	0.392***	0.355***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)
Overall	0.020*					
	(0.01)					
Overall*VFI	-0.049**					
	(0.02)					
Statutory Base		0.027**				
		(0.01)				
Statutory Base*VFI		-0.059**				
		(0.02)				
Monitoring and Enforcement			0.017*			
			(0.01)			
Monitoring and Enforcement*VFI			-0.047**			
			(0.02)			
Non Compliance				0.004		
				(0.01)		
Non Compliance*VFI				-0.028		
				(0.02)		
Media Visibility					0.032**	
					(0.02)	
Media Visibility*VFI					-0.060**	
					(0.03)	
Flexibility						0.031**
						(0.01)
Flexibility*VFI						-0.073***
						(0.02)
VFI	0.009*	0.008*	0.008*	0.003	0.007	0.014**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Output Gap	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population > 65	0.001**	0.001***	0.001**	0.001*	0.002***	0.001**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Observations	347	347	347	347	347	347

Note: Variance-covariance matrix for the above estimates is computed by bootstrap using 1000 repetitions. The correction of the bias is at the rate O(1/T). The bias correction was initialized using the Arellano Bond (1991) First Difference GMM estimator. Parentheses contain degrees of freedom. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

These results support earlier findings which show that shifting the financing of subnational expenditure from transfers and borrowing to own revenue, improves SNG fiscal performance (Asatryan and others, 2012). However, this enhanced SNG tax autonomy indirectly acts upon subnational fiscal performance by increasing the discipline-enhancing effect that comes with the adoption or strengthening of existing rules.

Table 6 shows the robustness of our results by augmenting the baseline specification to add an explanatory variable- expenditure decentralization (the share of subnational expenditure in the general government expenditure), and two macroeconomic controls- CPI inflation and the unemployment rate.

Table 4. Robustness Check 1—FD GMM Estimates of the VFI Impact on the Effectiveness of SNGs Fiscal Rules

(Dependent Variable: Subnational Overall Balance/GDP)

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dependent Variable	0.237	0.235	0.298	0.176	0.236	0.039
	(0.34)	(0.32)	(0.31)	(0.29)	(0.40)	(0.38)
Overall	0.060**					
	(0.03)					
Overall*VFI	-0.107*					
	(0.06)					
Statutory Base		0.065**				
		(0.03)				
Statutory Base*VFI		-0.120*				
		(0.07)				
Monitoring and Enforcement			0.046*			
			(0.02)			
Monitoring and Enforcement*VFI			-0.094*			
			(0.06)			
Non Compliance				0.086**		
				(0.04)		
Non Compliance*VFI				-0.147*		
				(0.08)		
Media Visibility					0.056*	
					(0.03)	
Media Visibility*VFI					-0.102*	
					(0.05)	
Flexibility						0.082**
						(0.04)
Flexibility*VFI						-0.131**
						(0.06)
VFI	0.014	0.014	0.012	0.023	0.007	0.011
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Output Gap	-0.001*	-0.001*	-0.000	-0.001*	-0.000	-0.001**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population > 65	0.008*	0.007	0.008	0.011**	0.008	0.010**
	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Number of Observations	321	321	321	321	321	321
m1	-1.64	-1.76	-1.97	-1.58	-1.42	-0.81
m2	-0.03	-0.23	0.17	0.37	-0.03	-0.71
Instruments	30	30	30	30	30	30
Hansen	0.082	0.91	1.26	3.22	0.92	1.26

Note: See notes Table 1.

Table 5. Robustness Check 2—FD GMM Estimates of the VFI Impact on the Effectiveness of SNGs Fiscal Rules

(Dependent Variable: Subnational Primary Balance as Percent of Subnational Revenue)

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dependent Variable	0.054	0.066	0.057	0.061	0.055	0.018
	(0.08)	(0.08)	(0.08)	(0.08)	(0.09)	(0.09)
Overall	0.454**					
	(0.19)					
Overall*VFI	-0.729**					
	(0.35)					
Statutory Base		0.528**				
		(0.23)				
Statutory Base*VFI		-0.953**				
		(0.45)				
Monitoring and Enforcement			0.402**			
			(0.18)			
Monitoring and Enforcement*VFI			-0.642*			
			(0.36)			
Non Compliance				0.576***		
				(0.18)		
Non Compliance*VFI				-0.896*		
				(0.49)		
Media Visibility					0.462**	
					(0.22)	
Media Visibility*VFI					-0.709*	
					(0.38)	
Flexibility						0.536**
						(0.21)
Flexibility*VFI						-0.816**
						(0.34)
VFI	0.137	0.154	0.141	0.181	0.116	0.096
	(0.11)	(0.11)	(0.12)	(0.13)	(0.12)	(0.12)
Output Gap	-0.007***	-0.007***	-0.007***	-0.008***	-0.006***	-0.007***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population > 65	0.047	0.022	0.058	0.068*	0.049	0.064*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)
Number of Observations	321	321	321	321	321	321
m1	-2.32	-2.19	-2.23	-2.12	-2.3	-1.82
m2	-0.56	-0.69	-0.52	-0.23	-0.53	-0.57
Instruments	30	30	30	30	30	30
Hansen	7.37	10.87	10.46	1.86	4.18	2.69

Note: See notes Table 1.

Table 6. Robustness Check 3—FD GMM Estimates of the VFI Impact on the Effectiveness of SNGs Fiscal Rules—Augmented Model

(Dependent Variable: Subnational Primary Balance)

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dependent Variable	0.083	0.084	0.070	0.097	0.083	0.087
	(0.09)	(0.09)	(0.08)	(0.09)	(0.10)	(0.10)
Overall	0.061**					
	(0.03)					
Overall*VFI	-0.115**					
	(0.05)					
Statutory Base		0.063**				
		(0.03)				
Statutory Base*VFI		-0.137**				
		(0.06)				
Monitoring and Enforcement			0.058**			
			(0.03)			
Monitoring and Enforcement*VFI			-0.106**			
			(0.05)			
Non Compliance				0.086***		
				(0.03)		
Non Compliance*VFI				-0.164**		
				(0.07)		
Media Visibility					0.067*	
					(0.04)	
Media Visibility*VFI					-0.115**	
					(0.06)	
Flexibility						0.068*
						(0.04)
Flexibility*VFI						-0.129*
						(0.07)
VFI	0.032	0.032	0.034	0.034	0.030	0.028
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)
Output Gap	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population > 65	0.009	0.007	0.010	0.008	0.011	0.010
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Expenditure Decentralization	-0.049	-0.047	-0.051	-0.047	-0.052	-0.045
	(0.04)	(0.03)	(0.04)	(0.03)	(0.05)	(0.04)
Unemployment	-0.0002	-0.0003	-0.0002	-0.0003	-0.0001	-0.0002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CPI Inflation	-0.0002	-0.0003	-0.0001	-0.0003	-0.0001	-0.0001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of Observations	321	321	321	321	321	321
m1	-2	-2.12	-1.85	-2.2	-2.08	-1.78
m2	-0.56	-0.72	-0.62	-0.45	-0.47	-0.52
Instruments	36	36	36	36	36	36
Hansen	0	0	0	0	0	0

Note: See notes Table 1.

VI. CONCLUSION

This paper estimates a dynamic fiscal reaction function using data from 26 European countries to assess whether, and to what extent, does the disciplining effect of subnational fiscal rules depend on rule design and on the design of the intergovernmental fiscal framework. In particular, we focus on the degree of vertical fiscal imbalances resulting from the distribution of expenditure mandates and revenue assignments across government levels.

Two main findings deserve to be mentioned. First, we find empirical evidence suggesting that stronger fiscal rules improve subnational fiscal balances. Our index of the overall strength of subnational fiscal rules in Europe is positively correlated with subnational fiscal balances, even after correcting for possible endogeneity biases. There is considerable variation in the magnitudes of coefficients on the strength indices of different rule attributes. For instance, magnitudes of the coefficients on the non-compliance and flexibility attributes are relatively larger. Though we do not make specific inference in this study, these findings leave scope for further research on the relative importance of the different attributes of fiscal rules.

Second, we find that the design of the intergovernmental fiscal framework matters. In particular, the discipline-enhancing effect of fiscal rules diminishes as the level of vertical fiscal imbalances rises. It falls to zero when VFIs rise to the extent that expenditure decentralization becomes more than twice that of revenue decentralization. This underscores previous concerns in the literature about the macro-fiscal implications of partial fiscal decentralization. VFIs are likely to be larger in federations, and more generally, among fiscally decentralized countries. In this respect, we use a larger dataset and address concerns of endogeneity, to confirm the results of previous studies, which show that an appropriately designed framework of fiscal rules would not in itself guarantee fiscal discipline at the subnational level.

Our results, which are robust to a wide range of different estimators and specifications, carry some noteworthy policy implications. They suggest that reforms aimed at increasing the discipline-enhancing impact of subnational fiscal rules should strive to address weaknesses in rule design. Moreover, independent reforms seeking to eliminate excessive vertical fiscal imbalances should also be considered. Our findings suggest that the latter are particularly critical for those European countries, in which the ratio of expenditure decentralization is more than twice that of revenue decentralization. In such countries, VFIs are so large that subnational fiscal rules may cease to be effective. Reforms that align subnational revenue and expenditure mandates could be considered as a prerequisite for ensuring the effectiveness of subnational fiscal rules in fostering fiscal discipline.

Appendix 1. Data

Our sample covers from 1995 to 2012 the following 26 European Union members: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom. Data for Croatia is available from 2002 leading to only 11 observations in total for this country. The sample has 461 observations.

We have collected data from multiple sources. Table A1 defines the variables and identify these sources. Table A2 provide standard summary statistics.

Table A1. Variables Used in the Empirical Analysis

Variable	Definition	Source
Subnational primary balance (SNPB)	(Subnational Total Revenue - Subnational Total Expenditure - Subnational Interest Expenditure)/Gross Domestic Product	Authors' own consolidation of total revenue and expenditures across local and (when applicable) state or regional governments using non-consolidated fiscal data from Eurostat.
Subnational overall balance	(Subnational Total Revenue - Subnational Total Expenditure)/Gross Domestic Product	Authors' own consolidation of total revenue and expenditures across local and (when applicable) state or regional governments using non-consolidated fiscal data from Eurostat.
Vertical Fiscal Imbalances (VFIs)	1-(Subnational government own revenue/Subnational government own expenditure)	Authors' own consolidation of total own revenue and own expenditures across local and (when applicable) state or regional governments using non-consolidated fiscal data from Eurostat.
Output Gap	Actual - Potential GDP as percent of Actual GDP	World Economic Outlook
Population > 65	Percent of population above the age of 65	World Development Indicators
Expenditure Decentralization	Share of sub-national expenditures in general government expenditures	Authors' own consolidation of total expenditures across local and (when applicable) state or regional governments using non-consolidated fiscal data from Eurostat.
Unemployment	-	World Economic Outlook
Consumer Price Inflation (CPI)	-	World Economic Outlook
Legislative election dummy	Dummy variable = 1 if national legeslative election held int hat year and zero otherwise	Database for Political Institutions (DPI) from Beck et al. (2001)
Herfindahl Index of Government Fragmentation	The sum of the squared seat shares of all parties in the government	Database for Political Institutions (DPI) from Beck et al. (2001)

Table A2. Summary Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations	
SNPB	Overall	-0.00164	0.0069	-0.0527	0.0543	N =	461
	Between		0.0025	-0.0714	0.0034	T =	26
	Within		0.0064	-0.0457	0.0533		
SNFRSI	Overall	0.21707	0.1943	0.0000	1.0000	N =	461
	Between		0.1674	0.0027	0.7110	T =	26
	Within		0.1041	-0.1452	0.5363		
VFIs	Overall	0.48615	0.18092	-0.02042	0.85991	N =	460
	Between		0.14558	0.20573	0.70334	T =	26
	Within		0.10999	-0.00972	0.80137		
Population > 65	Overall	15.62453	2.1267	10.8351	21.1009	N =	461
	Between		1.9035	11.2568	18.9956	T =	26
	Within		1.0079	12.8670	18.5678		
Output Gap	Overall	0.15302	3.3668	-13.4956	17.5160	N =	434
	Between		0.9374	-2.4152	2.2387	T =	26
	Within		3.2465	-11.4012	15.6984		
Herfindahl Index of	Overall	-1.53164	46.558	-999.000	1.000	N =	461
Government	Between		10.921	-55.030	1.000	T =	26
frgmentation	Within		45.289	-945.501	54.499		

Appendix 2. The Subnational Fiscal Rule Strength Index

The Subnational Fiscal Rule Strength Index (SNFRSI) is derived from the European Commission (EC) dataset of domestic fiscal rules. The EC dataset includes all types of numerical fiscal rules—budget balance rule (BBR), debt rule (DR), expenditure rule (ER), and revenue rules (RR)—covering different levels of government—central (CG), regional (RG), local (LG), general government (GG), and social security (SS)—in force since 1990 across EU countries. It assigns for each rule in force in each EU country at any given year an overall strength score along with separate scores measuring the strength of the rule according to a number of design attributes. These attributes are regarded to improve the effectiveness of fiscal rules and are either part of a regulatory framework specific to the rules in question or of a broader budgetary institutional framework.

We collect from the EC database for each rule applicable to the subnational level an overall strength score as well as all the following individual scores for each rule attribute: (i) the rule statutory base; (ii) the rule adjustment margin; (iii) the nature of the body in charge of monitoring the rule; (iv) whether rule monitoring takes place in real time; (v) the nature of the body in charge of enforcing the rule; (vi) the effectiveness of enforcement mechanisms; (vii) the presence of an escape clause; and (viii) the media visibility of the rule. We assigned scores for each attribute as follows.

Attribute 1 (a1): Statutory/legal base of the rule

4 constitutional base
3 the rule is based on a legal act (e.g., Public finance Act, Fiscal Responsibility Law)
2 the rule is based on a coalition agreement or an agreement reached by different general government tiers (and not enshrined in a legal act)
1 political commitment by a given authority (central/local government, minister of finance)

Attribute 2 (a2): Adjustment margin

3 there is no margin for adjusting objectives (they are encapsulated in the document underpinning the rule)
2 there is some but constrained margin in setting or adjusting objectives
1 there is complete freedom in setting objectives (the statutory base of the rule merely contains broad principles or the obligation for the government or the relevant authority to set targets)

Attribute 3 (a3): Nature of the body in charge of monitoring rule compliance

3 monitoring by an independent authority (Fiscal Council, Court of Auditors or any other Court) or the national Parliament
2 monitoring by the ministry of finance or any other government body
1 no regular public monitoring of the rule (there is no report systematically assessing compliance)

Attribute 4 (a4): Existence of alert mechanisms
We augmented the score of this sub-criterion by 1 if there is real-time monitoring of compliance with the rule, i.e., if alert mechanisms of the risk of non-respect exist.

Attribute 5 (a5): Nature of the body in charge of enforcing the rule
3 enforcement by an independent authority (Fiscal Council or any Court) or the national Parliament
2 enforcement by the ministry of finance or any other government body
1 no specific body in charge of enforcement

Attribute 6 (a6): Enforcement mechanisms of the rule
4 there are automatic correction and sanction mechanisms in case of non-compliance
3 there is an automatic correction mechanism in case of non-compliance and the possibility of imposing sanctions
2 the authority responsible is obliged to take corrective measures in case of non-compliance or is obliged to present corrective proposals to Parliament or the relevant authority
1 there are no ex-ante defined actions in case of non-compliance

Attribute 7 (a7): Existence of Escape Clause
We augmented the score of this variable by 1 if escape clauses are foreseen and clearly specified.

Attribute 8 (a8): Media visibility of the rule
3 observance of the rule is closely monitored by the media; non-compliance is likely to trigger public debate
2 high media interest in rule compliance but non-compliance is unlikely to invoke public debate
1 no, or modest interest of the media

We constructed a SNFRSI for each attribute *a* and rule type *j* in country *i* at time *t*.[26] We did that by aggregating the product of rule j attribute strength and its coverage over each subnational government levels *l* to which rule *j* applies — $S_{alc(j)}$ and c(j), respectively —weighted by the share of public spending of this government level *l* (G_l) in the total public spending of all government levels covered by the rule ($G_{c(j)}$), as summarized in equation (A2.1).

$$SNFRS_{aj} = \sum_{l\in\{LG,RG\}} w_{lc(j)} \times c(j) \times S_{alc(j)} \quad \text{(A2.1)}$$

Where

$a \in \{a1 \dots a8\};\ j \in \{BBR, DR, ER, RR\}; and\ c(j) \in \{GG, RG, LG, (RG, LG), (CG, RG, LG)\}$

And where $w_{lc(j)} = \begin{Bmatrix} 1 & if\ c(j) \in \{RG\} or\ \{LG\} \\ \frac{G_l}{G_{c(j)}} & if\ c(j) \in \{GG, (RG, LG), (CG, RG, LG)\} \end{Bmatrix}$

An SNFRSI is then computed for each attribute *a* by aggregating $SNFRS_{aj}$ over all rules applicable to subnational governments, as summarized in equation (A2.2)

[26] To simplify the notation, we omit, henceforth, country and time subscripts.

$$SNFRS_a = \sum_j SNFRS_{aj} \quad \text{(A2.2)}$$

Lastly, we calculated SNFRSI indices for five broad categories as follows:

$$\begin{aligned} SNFRS_{flexibility} &= SNFRS_{a2} + SNFRS_{a7} \\ SNFRS_{statutory\ base} &= SNFRS_{a1} \\ SNFRS_{monitoring\ and\ enforcement} &= SNFRS_{a3} + \\ SNFRS_{a4} &+ SNFRS_{a5} \\ SNFRS_{media\ visibility} &= SNFRS_{a8} \\ SNFRS_{non-compliance} &= SNFRS_{a6} \end{aligned} \quad \text{(A2.3)}$$

REFERENCES

Alt, J.E., and Lowry, R.C., 1994, "Divided Government, Fiscal Institutions, and Budget Deficits: Evidence from the States," *The American Political Science Review*, Vol. 88, No. 4, pp. 811–28.

Andrle, M., J. C. Bluedorn, L. Eyraud, T. Kinda, P. Koeva Brooks, G. Schwartz, and A. Weber, 2015, "Reforming Fiscal Governance in the European Union," IMF Staff Discussion Note 15/09 (Washington: International Monetary Fund).

Arellano, Manuel, and Stephen Bond, 1991, "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations," *The Review of Economic Studies,* Vol 58, No. 2, pp. 277-297.

Asatryan, Z., L. P. Feld, and B. Geys, 2012, "Partial Fiscal Decentralization and Subnational Government Fiscal Discipline: Empirical Evidence from OECD Countries," *Public Choice*, Vol. 163, No. 3–4, pp. 307–20.

Ayuso, J., D. Gonzalez Hernandez, L. Moulin and A. Turrini, 2007, "Beyond the SGP: Features and Effects of EU National-Level Fiscal Rules," in *The Role of Fiscal Rules and Institutions in Shaping Budgetary Outcomes*, ed. by the European Commission, Proceedings from the 24 November 2006 European Commission workshop, European Economy Economic Papers No. 275.

Blöchliger, H., and C. Vammalle, 2012, Reforming Fiscal Federalism and Local Government: Beyond the Zero-Sum Game," *OECD Fiscal Federalism Studies*, (Paris: OECD).

Bohn, H., 1998, "The Behavior of U.S. Public Debt and Deficits," *Quarterly Journal of Economics*, Vol. 113, pp. 949–63.

———, and R.P. Inman, 1996, "Balanced-Budget Rules and Public Deficits: Evidence from the U.S. States," *Carnegie-Rochester Conference Series on Public Policy,* Vol. 45, pp. 13–76.

Bond, S.R., 2002, "Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice," *Portuguese Economic Journal*, Vol. 1, No. 2, pp. 141–62.

Bordignon, M., 2006, "Fiscal Decentralization: How to Harden the Budget Constraint," in *Fiscal Policy Surveillance in Europe*, ed. by P. Wierts, S. Deroose, E. Flores, and A. Turini (Basingstoke: Palgrave Macmillan).

Braun, M., and M. Tommasi, 2004, "Subnational Fiscal Rules: A Game Theoretic Approach," in *Rules-Based Fiscal Policy in Emerging Markets: Background, Analysis and Prospects,* ed. by. G. Kopits (Washington: International Monetary Fund).

Bruno, G., 2005, "Estimation and Inference in Dynamic Unbalanced Panel-Data Models with a Small Number of Individuals," *Stata Journal*, Vol. 5, No. 4, p. 473.

Buti, M., J. N. Martins, and A. Turrini, 2007, "From Deficits to Debt and Back: Political Incentives under Numerical Fiscal Rules," *CESifo Economic Studies*, Vol. 53, No. 1, pp. 115–52.

Crivelli, E., 2012, "Local governments' fiscal balance and privatization in transition countries," *Economics of Transition,* Vol. 20, No 4, pp. 677-603.

———, and A. Shah, 2009, "Fiscal Rules at the Local Level," *World Bank Institute* (Washington: World Bank).

———, and K. Staal, 2013, "Size, spillovers, and soft budget constraints," *International Tax and Public Finance,* Vol. 20, No.2, pp. 338–356.

Debrun, X., L. Moulin, A. Turrini, J. Ayuso-i-Casals, and M. S. Kumar, 2008, "Tied to the Mast? National Fiscal Rules in the European Union," *Economic Policy*, Vol. 23, No. 54, pp. 298–362.

Escolano, J., L. Eyraud, M. Moreno Badia, J. Sarnes, and A. Tuladhar, 2012, "Fiscal Performance, Institutional Design and Decentralization in European Union Countries," IMF Working Paper 12/45 (Washington: International Monetary Fund).

Eyraud, L., and L. Lusinyan, 2013, "Vertical Fiscal Imbalances and Fiscal Performance in Advanced Economies," *Journal of Monetary Economics*, Vol. 60, No. 5, pp. 571–87.

Eyraud, L., and T. Wu. 2015. "Playing by the Rules: Reforming Fiscal Governance in Europe," IMF Working Paper, WP/15/67(Washington: International Monetary Fund).

Fainboim, I., A. Fernandez, M. Fouad, D. Last, M. Pessoa, and S. Ylaoutinen, 2015, "Budgeting, Accounting, and Reporting," Chapter 4 in *Designing a European Fiscal Union*, ed. by C. Cottarelli and M. Guerguil, pp. 133–157 (New York: Routledge).

Foremny, D., 2014, "Subnational Deficits in European Countries: The Impact of Fiscal Rules and Tax Autonomy," *European Journal of Political Economy*, Vol. 34, pp. 86–110.

Goodspeed, T. J., 2002, "Bailouts in a Federation," *International Tax and Public Finance*, Vol. 9, No. 4, pp. 409–21.

Hallerberg, M., and J. von Hagen, 1999, "Electoral Institutions, Cabinet Negotiations and Budget Deficits in the European Union," in *Fiscal Institutions and Fiscal Performance* Poterba, ed. by J. Poterba and J. von Hagen, pp. 209–32 (Chicago: NBER, University of Chicago Press).

Imbeau, L.M., and G. Tellier, 2004, "The Political-Economy of Budget Deficits in the Canadian Provinces, 1968–2000," in *Politics, Institutions, and Fiscal Policy: Deficits and Surpluses in Federated States,* Imbeau, ed. by L.M, and Petry, F. (Lanham: Lexington Books).

International Monetary Fund, 2009, "Fiscal Rules—Anchoring Expectations for Sustainable Public Finances," IMF Staff Paper, (Washington).

Inman, R.P, 1996, "Do Balanced Budget Rules Work? U.S. Experience and Possible Lessons for the EMU," NBER Working Paper Series No. 5838 (Cambridge: National Bureau of Economic Research).

Krogstrup, S., and S. Wälti, 2008, "Do Fiscal Rules Cause Budgetary Outcomes?" *Public Choice*, Vol. 136, No. 1–2, pp. 123–38.

Kumar, M., E. Baldacci, A. Schaechter, C. Caceres, D. Kim, X. Debrun, and J. Escolano, 2009, "Fiscal Rules–Anchoring Expectations for Sustainable Public Finances," IMF Staff Paper (Washington: International Monetary Fund).

Lane, T., 1993, "Market Discipline," IMF Staff Paper (Washington; International Monetary Fund).

Lledó, V., and J. Pereira, 2015, "Intergovernmental Fiscal Relations and Fiscal Coordination during the Crisis," in *Institutions of Intergovernmental Fiscal Relations: Challenges Ahead*, ed. by KIPF and OECD (Paris: OECD Publishing).

Molnar, M., 2012, "Fiscal Consolidation: Part 5. What Factors Determine the Success of Consolidation Efforts?" OECD Economics Department Working Papers No. 936 (Paris: Organisation for Economic Co-operation and Development).

Oates, W.E., 2006, "On Theory and Practice of Fiscal Decentralization," IFIR Working Paper Series 2006–05 (Lexington: Institute for Federalism & Intergovernmental Relations).

Plekhanov, A., and R. Singh, 2006, "How Should Subnational Government Borrowing Be Regulated? Some Cross-Country Empirical Evidence," IMF Staff Papers, Vol. 53, pp. 426–52.

Rodden, J., 2002, "The Dilemma of Fiscal Federalism: Grants and Fiscal Performance around the World." *American Journal of Political Science*, Vol. 46, No. 3, pp. 670–87.

Rodden, J.; G.S. Eskeland, and J. I. Litvack, 2003, *Fiscal Decentralization and the Challenge of Hard Budget Constraints* (Cambridge: MIT Press).

Roodman, D., 2006, "How to Do Xtabond2: An Introduction to Difference and System GMM in Stata," Center for Global Development Working Paper, 103 (Washington: Center for Global Development).

Ter-Minassian, T., 2007, "Fiscal Rules for Subnational Governments: Can they Promote Fiscal Discipline?" *OECD Journal on Budgeting*, Vol. 6, No. 3, pp. 1–11.

———, 2015, "Promoting Responsible and Sustainable Fiscal Decentralization," in *Handbook of Multi-level Finance*, ed. by Ahmad, E., and Brosio, G. (Cheltenham: Edward Elgar Publishing).

Von Hagen, J., and B. Eichengreen, 1996, "Federalism, Fiscal Restraints, and the European Monetary Union," *The American Economic Review*, Vol. 86, No. 2, pp. 134–38.

Von Hagen, J., and G.B. Wolff, 2006, "What Do Deficits Tell Us About Debt? Empirical Evidence on Creative Accounting with Fiscal Rules in the EU," *Journal of Banking and Finance*, Vol. 30, No. 12, pp. 3259–79.

Wildasin, D., 1997, "Externalities and Bailouts: Hard and Soft Budget Constraints in Intergovernmental Fiscal Relations," Policy Research Working Paper Series 1843, (Washington: World Bank).