Sub-national deficits in European countries:
The impact of fiscal rules and tax autonomy

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Abstract

I empirically examine how fiscal rules and tax autonomy influence deficits of sub-national sectors across European countries. I use a new panel-data set to measure tax autonomy and the stringency of fiscal rules for EU15 regional and local government sectors over the period 1995 to 2008. I apply an instrumental variables approach to obtain an unbiased estimate of the impact of fiscal rules on deficits. I use political variables describing the central governments characteristics as instruments for fiscal rules at the sub-national level. The results show that the effectiveness of fiscal rules and tax autonomy depends on the constitutional structure. Fiscal rules decrease deficits only in unitary countries. Deficits of sub-national sectors in federations can be avoided through tax autonomy.

Keywords: sub-national deficits, fiscal rules, soft budget constraints, fiscal federalism
JEL Classification Numbers: H71, H74, E61

1. Introduction

The differences in the fiscal performance of sub-national governments across European countries are widely unexplored. The explanation of a sub-national bias towards deficits by institutional settings, such as fiscal rules and autonomy over tax instruments, is the utmost concern of the present paper. The empirical results explain why some countries are stronger affected by a deficit bias than others. Sub-national sectors in federations which have substantial autonomy over their tax instruments have lower deficits than those which have not. This paper also shows that only deficits in unitary countries can be avoided by tying the governments hands with fiscal rules, while they are ineffective in federations.

Much research has been done since the early 1990's which dealt with the question of why certain countries have experienced long periods of budget deficits that accumulated in high levels of public debt while others did not. Attention has focused on political and institutional factors, since even countries with similar underlying economic conditions showed a widespread variation in debt levels. It has been argued that to a large extent the design of the institutions which govern the budgetary process is the underlying reason for the cross-country heterogeneity in fiscal positions (among others, see von Hagen and Harden, 1994, 1995; von Hagen, 2002, 2005; Alesina and Perotti, 1996, for this line of argument).

While most attention, both theoretical and empirical, has been spent on the central or general budget and national fiscal policy, the links between sub-national debts and deficits, their institutions, and in particular the restrictions imposed on them by fiscal rules, have not yet been explored in depth. The institutional background in this context is different from that of the central level because vertical relationships between the levels of government play a crucial role. This paper aims at a closer empirical investigation of the underlying forces.

The differences in fiscal positions below the national level can be caused by a deficit bias due to a common pool externality. Budgetary inflows in almost all countries come to a certain extent from a common source in the form of transfers or grants, while budgetary outflows are targeted to specific regions or municipalities. In many cases a substantial share of revenues is generated with instruments that sub-national entities have no direct discretion over. The concept that the local or regional tax base is responsible for bailout expectations and connected through this channel to the deficit bias was introduced by von Hagen and Eichengreen (1996). They argue that, in a dynamic context, the budget constraints of governments which are highly dependent on revenues that are not generated by their own instruments might become soft. The respective decision makers at the sub-national level might expect ex-ante that, if they cause a large and unsustainable deficit, the resulting outstanding debt would have to be bailed out ex-post by a higher-level government. In other words, the central government cannot credibly commit itself to a no-bailout policy, if the respective lower level government has no power to solve fiscal problems on its own. If instead a large proportion of sub-national revenues comes from own tax resources, this might work as an implicit way of the central government

to communicate that sub-national entities have to act on their own behalf. In this case, they can be asked to implement adjustments by increasing tax rates under their control (von Hagen and Eichengreen, 1996).

A recent attempt to mitigate this time inconsistency problem of soft budget constraints was to impose fiscal rules on sub-national governments. The idea of fiscal rules is to force local or regional governments to act in the way the central level desires. The number of fiscal frameworks which impose balanced budget or debt rules on lower governmental sectors has increased over the last two decades. The introduction of the Maastricht Treaty and the Stability and Growth Pact could be seen as the cornerstone in the interest of such rules. The goal of these rules, often called "national stability pact", could easily be jeopardized if the budgetary policies of sub-national governments do not act in concert. Therefore, almost all of these national pacts impose additional restrictions on lower level governments.

I analyze what drives countries to adopt, keep, or to strengthen their framework of rules. This is an important task that helps overcome a potential problem of endogeneity. Stricter rules may be adopted by governments with stronger preferences for fiscal discipline or a severe need for consolidation. The main reasoning of the paper in this dimension is that political characteristics of the rule imposing level are good instruments for the rules themselves at the lower governmental level. They fulfill the exclusion restriction since these political variables might have an impact on the fiscal outcome of the central level, but not on the deficits of sub-national governments.

I derive my results from a panel-data set of the sub-national sectors of the EU15 countries, covering data for fiscal rules, tax autonomy, and political and fiscal variables over the period 1995-2008. Regressions of the deficits of sub-national sectors on measurements of the strictness of rules and the discretion to tax show that the effectiveness of fiscal rules and the impact of tax autonomy depend crucially on the constitutional structure and division of powers. Fiscal rules work in unitary countries and not in federations. Implicit restrictions in the form of higher tax autonomy are an effective way to constrain excessive spending for the federal countries in my sample.

This paper is organized as follows: Section 2 motivates my research question by presenting stylized facts for sub-national public finances of the EU15 countries and presents the underlying theory and the related literature. The empirical analysis starts in Section 3 with an explanation of my identification strategy. Section 4 presents my dataset, and my results are shown and discussed in Section 5. This paper comes to a close in Section 6.

2. Motivation and related literature

2.1. Sub-national public finances

European countries differ substantially in the level of sub-national debt which they have accumulated in the past. Figure 1 shows the level of debt outstanding in 2008 as a share of GDP in the top panel.

[Figure 1 about here]

The figure shows that a substantial part of the total debt in European countries is due to sub-national borrowing. Most federal countries, and in particular Germany, show relatively large ratios of debt to GDP. However, this measure can be misleading, since it does not take into account the actual size of the sub-national sector. Therefore, the bottom panel depicts the outstanding debt as a share of revenues for the same year at the sub-national sector. Measures in terms of revenues capture two important dimensions. First, they indicate the relevance of debt in terms of the capacity to generate budgetary inflows. Second, this measures the size of the sub-national sector as mentioned before.[1] While the ranking for federal countries remains largely the same, this further illustrates the differences in unitary countries. Even though the Nordic countries have much larger sub-national sectors relative to the general government sector, their debt is lower compared to countries such as Portugal or France, which are less decentralized.

Since debts are (at least formally)[2] the accumulation of deficits over time, the following questions arise. First, why did some federal countries, such as Germany, have on average larger deficits than other federal countries? And second, what drives the pattern of deficits over time in the unitary countries, even though the differences in decentralization have been taken into account? To sum it up, it is important to explore why sub-national sectors in some countries are exposed to a larger bias towards deficits than others.

2.2. Theoretical background

A well-established reasoning for differences in debts and deficits at any level of government is that the respective decision makers do not fully internalize the costs of the public goods they acquire. This is known as the common pool problem of public budgeting. Since costs are shared by the whole population, theoretical models, as those of von Hagen and Harden (1995), Velasco (2000), Hallerberg, Strauch, and von Hagen (2009), and Krogstrup and Wyplosz (2010), emphasize that these costs are not fully internalized by the spending claims of individual spending ministers, in the sub-national context by members of local or regional councils. This

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[1]The actual size might be also depicted in terms of expenditures, but note that the ordering of countries does not change if I do so.

[2]See von Hagen and Wolff (2006) for a treatment of creative accounting and stock-flow adjustments.

results in overspending, since only a small part of the additional social costs of raising the tax burden are taken into account, eventually creating a problem of $1/n$. The more interest groups are involved in deciding the budget, the more fragmented the budget process becomes, and the larger the deficit bias due to individual spending claims. This is a result of a horizontal externality since it occurs within one government.

This point, which applies to every level of government, is supplemented by one that especially lets sub-national governments be inclined to overspend and borrow extensively. This might occur because several sub-national entities are grabbing for resources out of a national common pool (von Hagen, 2005). In this case the existence of soft budget constraints creates a vertical externality. Bordignon (2006) provides a survey of this literature. When a budget constraint is considered to be soft, a sub-national government can increase expenditures without facing the full additional social costs. A hard budget constraint instead makes the entity internalize the full additional social costs, since it expects to be responsible for the consequences of its spending plans (Rodden, Eskeland, and Litvack, 2003).

The underlying problem is of a dynamic nature: sub-national governments can accumulate unsustainable debt levels if they expect ex-ante that the central government might wish to bail them out once fiscal obligations can no longer be fulfilled ex-post. In other words, sub-national governments might expect that under certain circumstances the central government will assume responsibility for the liabilities they accumulate. These expectations create a link between the future behavior of a higher-level government and the fiscal policy chosen at present. One main driving force of these expectations is intergovernmental fiscal transfers. The probability that a sub-national entity is not responsible for its fiscal decisions taken today is higher, the lower the share of own-source revenues is. In other words, the higher the dependency on central governmental grants and transfers, the higher the expectation of a bailout. This is because the central level has less room to ask for adjustments in sub-national taxes in the case of fiscal trouble, resulting in a dynamic game between the two governments (von Hagen and Eichengreen, 1996).

This "default-bailout game" between the central and sub-national level is formalized by Inman (2001) and Kornai, Maskin, and Roland (2003). The center commits itself at the first stage to a no-bailout policy. The sub-national level instead chooses to spend at a level where the local marginal benefit is higher than the marginal social costs if it has a strong belief that the commitment of the center at the first stage is not credible. Finally, the central government has to decide whether or not to provide additional transfers to the lower level in order to reduce the deficit there. If the center has strong incentives to do so, its actions will be anticipated by the lower level government. The budget constraint is the softer, the lower the costs of the center to provide additional funds compared to leaving the sub-national government alone with its deficits.

Starting with Wildasin (1997), several papers formalized the problem in partial equilibrium

models in order to analyze the effects of different issues on the prevalence of soft budget constraints (see Vigneault (2006) for an extensive overview over theoretical considerations). Wildasin (1997) focuses on the size and structure of jurisdictions. In his model the incentives of the central government to intervene in lower-level public finances is due to positive externalities of local public expenditures. Since these interventions can be anticipated at the first stage, local budget constraints are soft. The model of Goodspeed (2002) shows that a bailout forced by incentives of a lower level government to accumulate high debt has to be paid partially by other regions through increased taxation. Köthenbürger (2007) investigates the impact of fiscal equalization schemes, and Breuillé, Madiès, and Taugourdeau (2006) focus on the impact of horizontal and vertical tax competition. For federal systems, Breuillé and Vigneault (2010) recently show that the soft budget problem can be worse in a multi-tier system if regional level governments have discretion over transfer policies. In that case a soft budget constraint on the regional level yields even softer budget constraints on the local level.

2.3. Related empirical literature

The theoretical interest in soft budget constraints in the context of fiscal federalism has also triggered empirical contributions in this area. Studies focus either on cross-country evidence over aggregated fiscal policy on the sub-national level, or country specific case studies.

Rodden, Eskeland, and Litvack (2003) provide a collection of mostly descriptive case studies. Additional country specific evidence for sub-national bailouts is provided by von Hagen et al. (2000) for German states, Italian regions, and Australian and Swedish local jurisdictions.[3] Evidence for Sweden is found by Dahlberg and von Hagen (2004). They show that the ability of the central Swedish government to commit to a no-bailout policy is rather weak, while the high degree of tax autonomy at the local level helps to harden budget constraints. A recent study by Pettersson-Lidbom (2010) identifies the expectations of local Swedish governments over a future discretionary grant by an instrumental variable approach. He uses the grants received by neighboring municipalities as an instrument for the anticipation of own additional future discretionary grants. A significant soft budget effect is found, and on average debt is increased by 20 percent when the budget constraint becomes soft. Apart from these studies, there is not much more empirical evidence at the country level. The lack of empirical work can be explained by the fact that expectations over the additional allocation of funds are not easy to measure, and as shown in the various case studies, numerous aspects of intergovernmental relations can create this effect.

In order to solve the soft budget problem of time inconsistent behavior, countries characterized by little revenue raising power at sub-national levels might impose more restrictions

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[3]Among others, further contributions deal with bailouts across the German states (Seitz, 2000; Fink and Stratmann, 2011; Baskaran, 2012), Spanish regions (Sorribas-Navarro, 2011), and various Latin American countries (e.g. Echavarria, Renteria, and Steiner, 2002; Bevilaqua, 2002; Nicolini et al., 2002).

through fiscal rules on lower level governments in order to commit the local or regional level to fiscal discipline. Indeed, von Hagen and Eichengreen (1996) show that borrowing limits are more prevalent in countries where the share of sub-central government's own-source resources is small. This is because if own taxes could be adjusted, the central government could deny a bailout. It has been also pointed out that these incentives might be different according to the federal organization of countries and the devision of powers across governmental levels.

Recent empirical work on fiscal rules at the general level of government across European countries[4] has established that their effectiveness depends on the institutional and political background of the respective country. Evidence in von Hagen (2006) underpins the importance of the design of the budget process that enables the government to commit to the rule. Hallerberg, Strauch, and von Hagen (2007) show that the stringency of fiscal targets has an impact in European countries which are characterized by ideological dispersion in the government. An intensive discussion of these results is provided in Hallerberg, Strauch, and von Hagen (2009). Similar results are obtained by the study of Debrun et al. (2008), who apply another indicator to capture the strictness of rules across European Union countries.

Empirical contributions that are closely related to this paper perform cross-country comparisons at the sub-national level. This literature focuses on the differences across countries in order to investigate which institutional elements have an impact on sub-national fiscal policy. Rodden (2002, 2006) uses a panel-data set of forty-three OECD, developing, and developed countries over ten years (1986 to 1996). A first set of results is based on ten-year average regressions, capturing long-run effects. He finds that vertical fiscal imbalance (here the share of grants and shared taxes in revenues) is positively related to deficits. For a second set of results all countries are grouped in two categories, countries with high and low borrowing autonomy. For the high-autonomy group he finds that vertical fiscal imbalance is still a driving force of deficits, while there is no effect for the countries with low borrowing autonomy. As mentioned in the conclusion of that paper, more work should be done to investigate the effects of tax autonomy, and in particular the changes over time and the different degrees of borrowing autonomy. Plekhanov and Singh (2006) analyze with a panel-data set over 1982-2000 which specific institutional design of borrowing constraints prevents large sub-national deficits. Their classification of fiscal rules is based on dummies according to the way the rules are imposed. This paper finds, while averaging over all years for each country, that rules imposed by the central government and cooperative agreements reduce deficits when the vertical imbalance is large.

These days, however, almost all European sub-national governments are constrained by

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[4]For studies exploiting variation across US states see, among others, von Hagen (1991); Poterba (1994); Bayoumi and Eichengreen (1995); Poterba (1996); Fatás and Mihov (2006). Bohn and Inman (1996) find that only constitutional rules prevent deficits in US states, while statutory ones do not. Feld and Kirchgassner (2006) find that across Swiss cantons those with fiscal constraints have significantly lower deficits. In addition, Alesina et al. (1999) show for a sample of Latin American countries that well designed budget institutions reduce deficits.

fiscal restrictions. The classification into categories as in Plekhanov and Singh (2006) is not without ambiguity. Another probable shortcoming of the existing empirical literature is that none of the papers provide a panel analysis which accounts for the changes in fiscal rules and tax autonomy over time. This is because time invariant indicators are used, and institutional changes are neglected; or because some results are based on between estimations, which were carried out on the average of the variables per country over time. Fiscal rules differ over time and how stringent and transparent they are applied. In particular European countries introduced numerous rules for sub-national sectors over the last two decades. I use a continuous index, rather than a categorical approach, to investigate whether the strictness of rules has an impact.

Similar arguments apply to the characterization of own-source revenues. The concept of vertical fiscal imbalance should be taken carefully, since sometimes it was not accounted for shared taxes. Shared taxes collected by the central and then redistributed to the lower level sectors are not any different from grants. Tax rates cannot be decided indvidually at the sub-national level. I focus on the development of own-source taxes, which takes into account the distortionary nature of taxes, when central governments ask for adjustments by increasing tax rates rather than providing additional funds through bailouts or by increasing grants. This is even more important since the underlying problem of soft budget constraints is a dynamic one. Solving these issues is one of the main contributions of this paper. I estimate panel models where I carefully construct measures of the tax autonomy of sub-national sectors, the different strength of borrowing restrictions in the form of fiscal rules, and explicitly take into account the variation over time. This can be interpreted as comparing the outcome for times before major reforms of rules and tax autonomy were implemented with the time after their implementation.

A further well known problem in the literature on fiscal rules is that their correlation with deficits does not necessarily have to be causal. Studies on the national level have highlighted the lack of good quality instruments in order to address a problem of endogeneity. The explicit sub-national context instead allows finding variables that are correlated with the fiscal rules index, but are orthogonal to the error term. I exploit the fact that fiscal rules are in almost all cases imposed by a higher level of government. Earlier contributions have shown that political economy variables are able to explain the stringency of fiscal rules (see Debrun et al. (2008), for instance). However, on the national level these variables might not be simultaneously un-correlated with budgetary outcomes. In the case of sub-national sectors instead the decision makers over rules (the central government) and the decision makers over budgetary policy (the sub-national entities) are not the same. I will make use of the fact that the characteristics of central governments, which impose rules on the sub-national one, are unlikely to be correlated with their budgetary outcomes, but describe well the prevalence of rules. Solving the endogeneity problem is another contribution of this paper compared to the existing literature.

3. Identification

The main objective of this paper is to analyze if the budgetary position can be explained by autonomy over taxation and fiscal rules. I estimate a reduced form model of a fiscal reaction function according to equation (1):

$$D_{i,t} = \gamma tax_{i,t-1} + \delta rules_{i,t} + \boldsymbol{\beta}\mathbf{X_{i,t}} + \mu_i + \eta_t + \varepsilon_{i,t} \tag{1}$$

The dependent variable is a measure of the budget deficit, $D_{i,t}$, at the sub-national level. The impact of the tax-structure in terms of sub-national autonomy is captured by the parameter γ. I estimate the reaction to a lagged variable of the share of taxes which are under discretion of the respective government. I argue that using the one period lag is important since policy makers will use their knowledge from the past to build their expectations about the future. A high dependency on own-source taxes in the past indicates that it is likely that current deficits must be paid back by own resources instead of expecting to receive transfers from the central government.

The parameter δ captures the impact of fiscal rules, as an explicit way to restrict public finances. The data section spends special attention to the question of how the variables *tax* and *rules* are constructed.

The impact of other control variables is measured by the parameters in the vector $\boldsymbol{\beta}$. μ_i and η_t are individual and time fixed effects. The inclusion of individual fixed effects is, besides capturing unobserved heterogeneity, important to focus on the dynamic nature of the underlying problem. I aim at an estimate of the impact of changes in the institutional framework on budgetary outcomes in the form of annual deficits. Hence, the question is how rules and autonomy affect deficits in the short run, and the inclusion of fixed effects captures all time invariant factors.

It is important to take the connection of the sub-national level to the higher level of government into account. The mechanism to tie the hands of lower-level governments by giving them autonomy might work well in federations, where lower-level governments have substantial degrees of freedom over their policies and legal acts. On the contrary, in unitary countries the sub-national level is more or less the extension of central government policies. When the sub-national level is not much more than a branch of the central one, a credible commitment of the center to a no-bailout strategy might be impossible in any case (even in line with a positive impact of autonomy on deficits). To capture these effects, I estimate models according to equation (2) and interact a set of dummies $\boldsymbol{\Phi}$ with the main variables of interest.

$$D_{i,t} = \boldsymbol{\gamma}\boldsymbol{\Phi}'tax_{i,t-1} + \boldsymbol{\delta}\boldsymbol{\Phi}'rules_{i,t} + \boldsymbol{\beta}\mathbf{X_{i,t}} + \mu_i + \eta_t + \varepsilon_{i,t} \tag{2}$$

with

$$\mathbf{\Phi'} = \begin{bmatrix} \Phi_1 \\ \Phi_2 \end{bmatrix} \text{ and } \begin{array}{l} = 1 \text{ if unitary country, 0 otherwise} \\ = 1 \text{ if local or regional level in a federal country, else 0} \end{array}$$

The dummy variables classify the respective form of government.[5] Eventually I estimate separate coefficients on tax autonomy and fiscal rules for federal and unitary countries.

To address problems of autocorrelation and heteroskedasticity, I estimate cluster-robust forms of the variance-covariance matrix. In some cases the small number of groups relative to coefficients does not allow to cluster over countries. In that case I estimate the variance-covariance matrix according to Newey and West (1987) with standard errors that are robust to both, heteroskedasticity and autocorrelation (HAC).

As a robustness check, I also estimate dynamic models with a lagged dependent variable. Unfortunately, this implies an additional problem, since fixed effects estimates are likely to be biased as long as the time span is short (Nickell, 1981). To control for the bias introduced by the lagged dependent variable together with fixed effects, I use the bias-corrected version constructed by Bruno (2005)[6] and bootstrap the standard errors. Judson and Owen (1999) show that this is the appropriate choice for a panel with my characteristics, i.e. when neither N nor T is large.

The possibility that fiscal rules are the result of, rather than the reason for fiscal performance, requires a careful analysis of causality. I use an instrumental variable approach to overcome this hurdle. First, I estimate the factors determining the fiscal rules index. I include political determinants of the level of government which introduces the rules, indicators of the general fiscal stance of the respective country, as well as dummies for different time periods (the time of the Stability and Growth Pact, for instance) and further controls, included in $\mathbf{Z}$, into the model.

According to equation (3), I estimate a model for each value of the fiscal rules index j across countries, using the average of covariates during the time span when the rule was in force:

$$rules_j = \boldsymbol{\gamma}\overline{\mathbf{pol_j}} + \boldsymbol{\delta}\overline{\mathbf{budget_j}} + \boldsymbol{\theta}\overline{\mathbf{time_j}} + \boldsymbol{\beta}\overline{\mathbf{Z_j}} + \varepsilon_j \tag{3}$$

Furthermore I estimate a fixed effects model to capture the variance in rules over time according to the model in equation (4):

$$rules_{i,t} = \boldsymbol{\gamma}\mathbf{pol_{i,t}} + \boldsymbol{\delta}\mathbf{budget_{i,t}} + \boldsymbol{\theta}\mathbf{time_{i,t}} + \boldsymbol{\beta}\mathbf{Z_{i,t}} + \mu_i + \varepsilon_{i,t} \tag{4}$$

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[5]Austria, Belgium, Germany, and Spain are treated as federations. Please refer to Table 9 in the Appendix B for details of the classification.

[6]The regression presented later is initialized by the Arellano Bond estimator. Other methods for the initial estimation do not change the main conlcusions.

Ideally, this step offers candidates for instruments. Finally, I re-estimate equation (1) and use instruments for the fiscal rules index.

This identification procedure corrects some drawbacks of former empirical approaches. First, the focus on the within variance with time-varying indicators allows identification of the effects in the short run. Second, including the lagged value of tax autonomy creates a better reflection that decision makers form their expectations by observed values from the previous period. Last, the proper choice of instruments can eliminate a potential source of endogeneity.

4. Data

I use aggregate data for sub-national sectors to investigate the deficit bias which occurs due to the relationships between different governmental layers in European countries. All EU15 members are included over a period ranging from 1995 to 2008. I include regional and local governments as separate entities in the four federal organized member states. This provides 19 observations per year and 266 in total over the fourteen years covered by my data set.[7]

The dependent variable is a measure of the budgetary position in each year. While several possible definitions are at hand, I chose to use annual deficits as a share of revenues. Other possibilities are defining the dependent variable as the deficit per capita or as a share of GDP. I define the dependent variable as share of revenues because this measure incorporates differences in capabilities to raise government income.[8]

Two important indicators have to be computed in order to investigate the effects of fiscal rules and tax autonomy. I construct both indicators as a time-varying index that captures the development for each country over the entire time period.

First, an indicator of tax autonomy is needed to test whether the dependency on own tax resources creates incentives to balance the books. I compute an indicator of the share of own-source tax revenues in total revenues on each governmental level. The classification of own-source revenues is, unfortunately, not straightforward. Other studies rely on the degree of vertical imbalance or the share of taxes in total revenues, which can be misleading.[9] It is important to distinguish real own-source revenues from revenues which arise due to tax-sharing arrangements, i.e. taxes collected by a higher level and automatically transferred to the lower one. The OECD (1999) provides a classification of the taxing power of sub-national levels. Unfortunately, their *Fiscal Decentralization Database* provides only information for two or at most three years, 1995, 2002, and 2005. I use the *Revenue Statistics* of the OECD, the *Taxes*

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[7]Please refer to Appendix E for robustness checks on alternative sample designs. Main results remain unchanged.

[8]Taking deficits as a share of revenues or expenditures as the dependent variable follows the previous studies in this literature. However, the correlation with other possible measures, as expressing deficits as a share of GDP or in per capita terms, is high. See Table 8 in the Appendix A for details.

[9]A good example are German federal states. Their share of tax revenues in total revenues is substantial, but the share of real own-source taxes is close to zero since they cannot decide on an individual tax rate.

in Europe database of the European Commission, numerous national sources over changes in tax-systems, and the information provided by Stegarescu (2005) to construct a comparable indicator over the entire 14 years of the sample. I treat all taxes over which either discretion on rates, reliefs, or both are under the power of the sub-national entity as own-source tax revenues. This measure does not overestimate the revenue autonomy in the presence of shared taxes.

[Figure 2 about here]

Figure 2 provides a graphical representation of this indicator. The Nordic countries are characterized by the largest share of autonomous revenues while German states, both Austrian sectors, Ireland, and the Netherlands have on average very little discretion over their revenues. Variation in the indicator is generated by two different effects. On the one hand, the tax-system can be changed, equipping lower level governments with a richer set of instruments or more autonomy over existing taxes. Some governmental sectors, such as the Spanish regions and the sub-national Italian sector have implemented considerable changes within this period. On the other hand, the share of other revenues could also shift when the center re-allocates resources to lower levels of government. An increasing value of this indicator represents a higher responsibility at the sub-national level and might help to avoid soft budget constraints.

Second, I construct another indicator to depict the strength of fiscal rules, i.e. how stringent borrowing is regulated. Fiscal rules are nowadays frequently used at the sub-national level in European countries (European Commission, 2009, 2008, 2006; Sutherland, Price, and Joumard, 2005) to mitigate a deficit bias and to harden the budget constraint by imposing numerical targets on budgetary variables or limiting the access to credits. I use the data provided by the European Commission (2009) to create an index of the strictness of rules. All fiscal rules which can have an impact on the deficit are included in the calculation of the index: balanced-budget-rules, debt brakes, and other direct restrictions on borrowing.[10] The original EU index is adjusted to the situation of sub-national levels. In the non-federal countries, an average of the rules applying to different levels, weighted by their share of expenditures in the total sub-national budget, is used.[11]

[Figure 3 about here]

Figure 3 shows the development of this indicator. The restrictions are relatively stable over time in one group of countries (Belgium, Germany, Denmark, France, and Finland) while another group (Austria, Spain, Ireland, Italy, Portugal, and Sweden) has increased the strictness of rules in recent years. Most countries introduced national stability pacts as an answer to

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[10]Expenditure ceilings are very rare at the sub-national level and, as in the original EU variable, excluded for the main analysis of the impact of rules on deficits.

[11]The construction of this index is described in detail in Appendix D.

the limitations arising from European supranational rules. A third group (Greece, Luxemburg, the Netherlands, and the United Kingdom) goes without strict rules. When these fiscal arrangements worked as an effective tool to dampen a deficit bias, a negative coefficient is expected.

The other controls are summarized in Table 1. The fiscal position of the central government *def_cg_rev* is included to capture a copycat effect. Sub-national governments that observe a loose fiscal policy at the national level can follow the example given by the central government, expecting that they are not sanctioned if the higher level is profligate as well.

[Table 1 about here]

The degree of decentralization is taken into account by the share of sub-national expenditures in general government expenditures *edec*. Unfortunately, this indicator is not able to distinguish between expenditures that could be categorized as compulsory or those that are optional to provide. Nevertheless, the share of expenditures captures the weight of the sub-national sector in the general budget and how spending proportions are shared between the governmental levels. These shares differ across European countries, with varying responsibilities and discretion over their exercises.

[Figure 4 about here]

Figure 4 shows the country means over my period of study. The Nordic countries are characterized by a high level of services and responsibilities on the local level. Danish sub-national governments spend on average more than every second *Danske kroner*, followed by their Swedish and Finnish neighbors. The regional levels of Belgium, Spain, and Germany are responsible for approximately one quarter of total expenditures, accompanied by their local governments with additional, but lower expenditure shares. The less decentralized countries are France, Portugal, Luxembourg, and Greece. The plot against the average of own-source tax revenues indicates that in many cases higher expenditure decentralization is accompanied by a higher degree of autonomy over tax revenues. As noted before, this is not the case for some countries, in particular not for the German federal states, and neither for Austria, Ireland, and the Netherlands.

Additional covariates are included to capture cyclical and institutional effects and to consider the spending needs of lower-level governments. I include the output gap *outgap*, the unemployment rate *unempl*, the ratio of the working age to total population *depratio*, the log of total population *ln_totpop*, and interest expenses *intexp_rev*. All fiscal variables are computed as share of revenues.

Table 2 summarizes the additional political variables, which I take into account for the estimation of fiscal rules themselves. The motivation for the central government to impose restrictions on lower level governments could be determined by the perception that a soft budget

problem is at hand. Thus, the federal structure itself plays a role and several determinants of the deficit might also be crucial for the strictness of rules. These issues are taken into account by using some of the variables already discussed. However, the center must also believe that fiscal rules are a mean to cure the problem and must be able to implement the rules through the legislature. Hence, political variables which characterize the central government and its preferences are related to fiscal rules, since they describe general preferences for a rules based framework. Most of the data is obtained from the World Bank Database of Political Institutions 2009 (Beck et al., 2001).

[Table 2 about here]

First, to control if the ideological orientation of the government plays a role, an index over the two main government parties, reaching from zero (left-wing, single party government) to one (right-wing, single party government), is calculated. There is no general conjecture over the direction of the impact of this variable, and the sign could point in either direction.[12]

Second, the Herfindahl index measures the fractionalization of the ruling coalition. A single party government yields a value of one, while values close to zero indicate a more dispersed government. The index can be interpreted as the probability that two randomly picked members of the ruling coalition belong to the same party. The expected sign of this variable is not clear. On the one hand, a more fragmented government could be willing to restrict lower levels, because they are able to blame other coalition members when local or regional politicians complain about new rules. On the other hand, a less fragmented government might find it easier to pass new rules through the legislature.

Third, the district magnitude measures the average number of seats in the parliament per electoral district. Beside the impact on the effective number of parties,[13] the district magnitude might have an additional impact in the sub-national context. A higher value indicates that more seats are allocated within one electoral district. Hence, the connection between local politics and the politicians elected into the central parliament might be loose. On the contrary, a small district magnitude means that the representative in the central legislature could be seen as directly responsible for the respective district. A strong connection to the sub-national level might cause representatives to be cautious with imposing strict rules, because they do not want to cross with local politicians and voters.

Last, I include the predicted form of fiscal governance, according to von Hagen and Harden (1995), Hallerberg, Strauch, and von Hagen (2007), and Hallerberg, Strauch, and von Hagen (2009). This literature characterizes whether a delegation or contract approach of fiscal governance is appropriate for different countries. Centralizing the budget process could be done

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[12]Debrun et al. (2008) report evidence that more conservative orientated governments make less use of fiscal rules.

[13]The idea was developed by Duverger (1954), tested empirically by Taagepera and Shugart (1993) and put in the context of budgetary politics by Hallerberg and von Hagen (1999).

by the former approach by deligating authority to one member of the executive that is vested with special strategic power. On the national level the finance minister is typically in charge of this special function. The contract approach instead relies on agreements between all members of the cabinet with spending rights. I include the indicator developed in this literature to investigate whether central governments that are assumed to be contract countries follow this approach when designing rules for sub-national levels.

5. Results

This section presents the results of my analysis. After estimating the baseline model in the first subsection, I investigate the factors which determine the strictness of fiscal frameworks in the second subsection. The goal is to identify the driving forces behind fiscal rules to use them as instruments for instrumental variable estimations when fiscal rules are treated as endogenous. The results from the IV estimations are presented in the last subsection, where I also discuss my findings in more detail.

5.1. The impact of sub-national fiscal rules on budgetary outcomes

Table 3 presents the results of the regressions for budgetary outcomes. The dependent variable in any model is the share of the annual deficit in revenues at the sub-national sector. Positive values arise if expenditures exceed revenues and all coefficients with a negative sign improve the budgetary position by reducing deficits.

[Table 3 about here]

The first two columns show results from regressions according to equation (1), while the first column (a) does not include neither individual nor time fixed effects, but panel-corrected standard errors (PCSE). I find neither significant effects of the lagged tax autonomy nor the strength of fiscal rules when I pool all observations and include a dummy variable for federal countries. As mentioned earlier, including fixed effects is superior to cross section models since the variation within groups over time is important. Fixed effects also capture time-invariant preferences for fiscal sustainability. In addition, an F-test ($F_{(18,216)}$=6.21, p-value 0.00) indicates that significant individual effects are at present and simple cross section estimations are not efficient. I turn to fixed effect models in columns (b) to (e), since a Hausman test rejects the appropriateness of random effects ($\chi^2_{(12)}$=42.49, p-value=0.00).

Results of model (b) are similar to those from the cross section without any significant effect of tax autonomy or fiscal rules on deficits. As the means to cure the deficit bias might be different conditional on whether the respective country is a unitary one or a federation, I turn to the estimation of specification (2) from column (c) onwards.

The results of these estimations are encouraging. The lagged tax autonomy is significant for both types of government. Interestingly, coefficients are different across the two groups. According to the hypothesis of soft budget constraints, sub-national governments in federations run lower deficits when their share of own-source tax revenues in the previous year has been a relatively large share in total revenues. Given an increase in the share of revenues directly at their hands, it might be perceived that these own generated revenues also have to be used for potential future liabilities, causing lower present deficits. Sub-national sectors in unitary countries instead show up with an opposing behavior. These governments might anticipate that they are more or less the extension of the central government and giving them more autonomy does not constrain them sufficiently from profligate spending. When I estimate the model with cluster robust standard errors in column (d), or a dynamic specification in column (e), tax autonomy in unitary countries is not significant anymore. My findings are in line with those of Rodden (2002): more autonomy over revenues generated by own-source taxation is an implicit tool to constraint sub-national governments in federal organized countries. Although effective in federations, this does not work for unitary countries.

Fortunately, fiscal rules do, but only for the group of unitary countries. Sub-national governments in non-federal states overspend less when fiscal rules are stricter and the access to borrowing is limited. In this case, fiscal rules are an effective tool to mitigate a deficit bias, although tax autonomy is not. This does not hold true for entities in federally organized states, where in no specification a significant coefficient is detected. The result of the dynamic model in column (e) corroborates this result. Fiscal rules prevent only sub-national sectors in non-federal countries from running high deficits.

The other covariates are in line with expectations. Lower level governments follow the example of the center, since larger deficits on that level are positively correlated with those on the sub-national level. Countries that are more decentralized in terms of expenditure shares also run on average higher deficits. Demographic changes reveal two interesting insights. First, when the total population grows, so do deficits. Local services are often connected to the number of people that call for them; hence more people represent larger spending needs. Second, when the share of the working population grows, budgetary positions improve. All other variables do not have an impact on deficits which is significantly different from zero in any model.[14] For the rest of the paper, I consider model (d) as the preferred benchmark estimation.

5.2. The determinants of sub-national fiscal rules

Whereas national fiscal rules are often self imposed, sub-national rules are not. They are imposed by the central level, and institutional and political variables of that level have an

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[14]The dynamic model shows only a significant effect of total population, while for all other variables estimates are not significantly different from zero.

impact on the strictness of the rules themselves. Even though one can argue that in federal countries the regional level could impose rules on the local one, this has not been observed over the last decades. The new fiscal frameworks in Spain and Austria for instance were both imposed on all sub-national levels by the central government.[15] This section explores which factors induce a higher reliance on rules, and which circumstances trigger the adoption of rules.

[Table 4 about here]

The first column of Table 4 presents the results from an OLS regression according to equation (3) of each single outcome of the fiscal rules index on the average values over the period in which one set of rules was in force in a given country.[16] In other words, each value of the fiscal rules index appearing in a country is regressed on the average values of all other covariates during that time. This simple approach reveals interesting insights, at which I look with more sophisticated methods according to equation (4) in columns (b) to (e). The first two remaining models (b and c) provide cross-sectional evidence, and the last two (d and e) show results from fixed effect estimations. Models (c) and (e) include the lagged value of the rules index to account for the persistency of this variable.

The top panel of the table shows the impact of political variables on the rules index. The first variable $herfgov$ is significant and negative in almost all specifications, except the dynamic ones in models (c) and (e). A government which consists of a single party or of one big and one small coalition member, represented by a higher value of the Herfindahl fractionalization index (i.e. a less fractionalized one), tends to impose less strict rules. One-party governments might receive more leeway from their sub-national counterparts and might try to avoid this conflict. Countries that are supposed to follow a contract approach of fiscal governance at the central level (Hallerberg, Strauch, and von Hagen, 2009) impose less strict rules on their sub-national governments. The district magnitude also becomes significant and positive in the panel specifications.[17] This supports the view that rather loose connections to lower level politics increase the use of fiscal rules at the sub-national level.

None of the other political variables, and neither budgetary ones, have an impact on the rules themselves. It is important to note that this implies that sub-national deficits do not have a feedback effect on rules. The only budgetary variable which is significant in at least one specification is the lagged debt level of the general government in the panel specification (d). Central governments impose restrictions when general fiscal stress is at hand, but do not react to deficits at the sub-national level.

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[15]Self imposed rules of particular regional governments and their local counterparts are a somewhat new phenomenon. My sample covers data up to 2008, and none of the rules was self imposed by a regional level or imposed by that level on the local government sector.

[16]The interpretation of dummies that vary over time such as elections or the stability and growth pact are in this estimation an indicator over the relative number of events in the respective time span. For example, sgp takes the value 0.6 if the rules was valid during 6 years of the Stability and Growth Pact.

[17]Due to the little within variance, I check whether this result is robust when I include time dummies. The parameter is still significant at the same level.

In terms of timing, the introduction of the Stability and Growth Pact has (from 1999 onwards) increased the strength of rules. This effect is not surprising since most national stability pacts were introduced as an answer to the supranational European fiscal framework in order to force the lower level governments not to counteract central level fiscal policies. Also not surprising is that rules increase over time, as indicated by the included linear trend. Out of the other control variables only the demographic structure, the population size, the sub-national tax autonomy, and unemployment have an increasing impact on the implementation of fiscal rules.

To sum up, the fractionalization of the government in power, the district magnitude, and the predicted form of fiscal governance determine the strictness of sub-national fiscal rules. Ideology of the central government and national elections instead do not. Neither do the budgetary variables, beside the lagged overall level of debt, as long as a static model is estimated. However, constituencies in federal countries, as indicated by the two dummies against the base group of unitary countries, rely more on rules than their non federal counterparts. Given the results over the effectiveness of fiscal rules from the previous section, those countries seem to back the wrong horse. This further indicates that the political actions of the center to implement rules in unitary and federal countries might be different. In particular, the timing when the center implements rules, and whether the present or lagged political variables matter, may differ as the ultimate results have suggested.

[Table 5 about here]

The estimations presented in Table 5 show that this is indeed the case. Model (a) to (e) include separate coefficients for federations and unitary states as well as their one period lag for one of the political variables per estimated equation. For example, column (a) shows a regression with four different coefficients for the impact of the Herfindahl index on rules: the current value of federal countries, the lagged value of federal countries, the current value of unitary countries, and finally the lagged value for this group. Models (b) to (e) continue with this procedure for the other covariates. Column (f) shows the estimates of the full model, including lagged and current values of all variables simultaneously.

Model (a) shows that it is rather the one period lag than the current value of the Herfindahl index which matters. Furthermore, it can be seen that federal countries do not follow the direction described above. In this case there is a positive relationship, indicating that less fractionalization is associated with stricter rules. In federal countries the central government might impose those stricter rules in order to tie the hands of sub-national politicians, which might belong to a different party. An ideological position of central governments which is contrary to the majority of sub-national ones is a frequently observed feature in federal countries. Surprisingly ideology is now marginal significant at the 90% level for unitary countries when the lags of all variables are included in the model as shown in (f). Election year effects (b) instead are still not observable. As for fractionalization, also the district magnitude seems to

be more important one period lagged for unitary countries, but according to estimation (d) and (f) signs do not change. A higher value of this variable is still increasing the rules index. The contract approach in central governments' fiscal policy instead is different for both types of countries with respect to the timing. For the federal ones the actual one is significant and negative, while for the unitary states the one period lagged value matters.

These results, while interesting on their own, are important to answer a last open question, namely the causality between rules and fiscal outcomes. My instrumental variable approach, presented in the next sub-section, builds on the results derived above. It is important to keep in mind that the proper choice of instruments can be different for the two distinct types of countries.

5.3. Endogeneity, IV results, and discussion

The relationship between budgetary outcomes and fiscal rules might be confounded by endogeneity. The enacted fiscal policy could be the cause for - rather than the result of the adoption of fiscal rules. In this case countries with fiscal difficulties at the sub-national level might impose stricter rules. The different stringency of fiscal rules across countries could be also driven by an omitted variable, in particular preferences for fiscal discipline, as noted by Poterba (1996). If balanced budgets attain an outstanding status in some states, those countries might impose stricter rules according to their preferences. However, as those preferences are assumed to not change a lot over time, this effect is captured by including individual fixed effects. Nevertheless, it has to be secured that the impact of rules on deficits, as estimated in Section 5.1, is indeed going from tighter rules to better budgetary positions (at least in unitary countries).

I use an instrumental variables approach to solve this question. Variables that satisfy the two properties of valid instruments, namely being uncorrelated with the error of the regression of equation (2), but highly correlated with the rules index, must be found. This is usually regarded as a complicated task: explanations for the prevalence of fiscal institutions, for instance political variables which reflect preferences, might be simultaneously connected to the result of fiscal policy. This would imply that they are correlated with the variable that captures fiscal rules, but also with the error term.

The context of sub-national budgetary outcomes instead offers a convenient feature to tackle this hurdle. Rules and institutions for lower level governments are introduced by a higher level of government. The characteristics that drive the introduction of the rules, as worked out in Section 5.2, are correlated with the rules itself (and might be correlated with the budgetary outcomes of that higher governmental level), but not with the budgetary position of the governments where the rules are imposed on. The previous section has shown that political characteristics of the central government are indeed related to the strictness of rules. In addition, there was no feedback effect of deficits, which excludes that central governments

introduce rules when sub-national deficits are regarded as unsustainable. Hence, there are possible candidates for a set of excluded instruments which are correlated with the endogenous fiscal rules variables, but are not correlated with the error term in the explanatory equation. In other words, those variables are in line with the exclusion restriction in instrumental variable regressions.

[Table 6 about here]

I use the variables which are, according to the previous section, found to be correlated with the fiscal rules index as instruments. These are the interacted district magnitude, the form of fiscal governance, and the Herfindahl index of government fractionalization. The results of these regressions are shown in Table 6.[18] Column (a) repeats the estimation without instruments for comparison. Models (b) and (c) differ only in the way how standard errors are computed. The set of instruments for these two estimations contains the actual political variables for federations, but the one-period lag for unitary countries. The absolute value of the coefficient on fiscal rules in unitary countries is now approximately twice as large as before. This indicates that the earlier estimate was biased towards zero. In terms of significance both models make the same predictions, and surprisingly also tax autonomy in unitary countries is gaining significance. The positive coefficient, however, indicates that higher autonomy in this group of countries does not work as a limitation but rather as an augmentation for deficits. In contrast to federations, sub-national governments in unitary countries are more or less a branch of the center and they may assume the center to take over liabilities anyway.

The model in column (d) uses the full set of instruments (i.e. lagged and current values) for both the federal and unitary fiscal rules index. The results are similar to the previous ones, but the validity of instruments changes slightly. While none of the models is affected by overidentification (note that the Hansen J-test does always accept the null of joint validity[19]), the Kleibergen-Paap F-Statistic for weak identification in models (b) and (c) is superior to (d). Since the models with different instruments for the unitary and federal index works better, all instruments are not suited equally well for the two groups.

To shows this in detail, I present separate regressions for each type of country in Table 7.

[Table 7 about here]

The estimations labeled 'I' include only the unitary countries, while those labeled 'II' include local and regional sectors of federations. Models (a) use the full set of instruments, while (b) involves only current values and (c) only lagged values. Signs and significances of the two main variables of interest do not change compared to the estimations before. A higher degree of

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[18]I report the first stage estimations for all regressions using instruments in Appendix C.

[19]The joint null is that the instruments are valid instruments, i.e. both requirements are fulfilled: they are uncorrelated with the error term, and the excluded instruments do not have to be included into the estimated equation.

tax autonomy still mitigates the deficit bias in federations and exaggerates deficits in unitary countries. Rules continue to prevent deficits in unitary countries in all specifications, but with the additional insight that the proper choice of instruments depends on the type of the country. The Kleibergen-Paap statistic reveals that actual values are better suited as instruments for federal organized countries, while this is true for the one period lags for estimating the effect in unitary countries. Also control variables behave differently, and federal countries respond stronger to cyclical elements such as the output gap, unemployment, and deficits at the central level. At the end of the day these regressions confirm and robustify the earlier conclusions.

[Figure 5 about here]

These results are encouraging for policy makers. Figure 5 depicts the marginal effect of stricter rules in unitary countries in the top panel (a) and the effect of tax autonomy in federations in the bottom panel (b). The bars on the left show the actual value of the fiscal rules index and tax autonomy in the year 2008. Significant improvements of budgetary positions are potentially feasible through reforms of rule frameworks and the structure of tax systems. This is particularly true for countries which currently make little use of those mechanisms. A one standard deviation in unitary countries (0.303, cf. Table 1) increase in the rules index decreases the annual share of deficits in revenues on average by 2.7 percent. A one standard deviation increase in the tax autonomy of federations (0.122, cf. Table 1) causes a reduction of deficits of about 3.5 percent, *ceteris paribus*. By changing the institutional framework deficits can be reduced in the short run.

A last issue is whether these two instruments work in isolation or whether there is an interplay between the two. To check for this, I re-estimate the model and allow for interaction between the fiscal rules index and tax autonomy.[20]

[Figure 6 about here]

The top panel (a) in Figure 6 shows a plot of the marginal effect of fiscal rules in unitary countries. The interaction term is not significant in this case (p-value=0.6, cf. Table 10 in the appendix). The negative impact on deficits remains similar in terms of magnitude when tax autonomy varies.

Tax autonomy itself was identified as the proper tool for federal countries. The marginal effect in this case is depicted in the bottom panel of Figure 6. Here the interaction term is significant (p-value=0.03, cf. Table 10 in the appendix) and the figure shows that this tool becomes more effective when fiscal rules are tighter. That is, even though rules themselves do not help, an increase in tax autonomy should be considered together with the rules framework. In the policy arena, these results and in particular the fact that the effectiveness of tools to restrict deficits depends on the countries' type should be carefully taken into consideration when reforms should be implemented.

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[20]Estimates are shown in Table 10 of Appendix C.

6. Conclusion

The main goal of this paper is to explore which institutional arrangements help to keep the books of sub-national governments in balance. I focused on two different mechanisms which are feasable to constrain the sub-national sector from fiscal profligacy. On the one hand I investigated the role of own tax resources, since less autonomy creates incentives to run deficits because of bailout expectations. On the other hand, I studied the impact of fiscal rules, which a central government might impose to restrict the sub-national sector.

My main findings are that a well designed framework of fiscal rules works in unitary countries, but not per se in federations. Because of the higher legal autonomy which local and regional governments in federal countries enjoy, a rules based framework does not help in this case. Here, it is rather higher autonomy over tax instruments that might prevent large deficits at the sub-national sector as a form of market-preserving federalism (Weingast, 1995). My findings show that the proper choice of fiscal arrangements depends critically on the type of government and the constitutional structure. This complements the literature of fiscal rules on the general government level, where the political environment and the electoral system, for instance, are important determinants for the effectiveness of fiscal rules (Hallerberg, Strauch, and von Hagen, 2007). As a result, a suitable framework needs to be tailored to the characteristics of a specific country. More stringent rules do not always result in more desirable outcomes and neither does a general restriction of tax autonomy.

This paper is a further step in sub-national public finance in order to explore how deficits could be avoided and large debts prevented. My findings suggest several issues for future research. The next step should be to make use of disaggregated data for several European countries. This allows investigating additional effects which occur horizontally within the sub-national governments in combination with the vertical dimension between governmental levels, as explored in this paper. Another interesting point is the recent introduction of self-imposed fiscal rules in some regions of federal countries. Federations often grant autonomy to sub-national governments which allows them to adopt rules by themselves. The German state of Hesse for example, has held a referendum and 70% of voters opted for the introduction of a fiscal rule into the regional constitution. Since self-imposed rules might be an important signal to the markets and reflect the preferences of voters, effects might differ from those of centrally imposed rules in federations. The evaluation of the effectiveness is an interesting task for future research.

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Graphs and tables
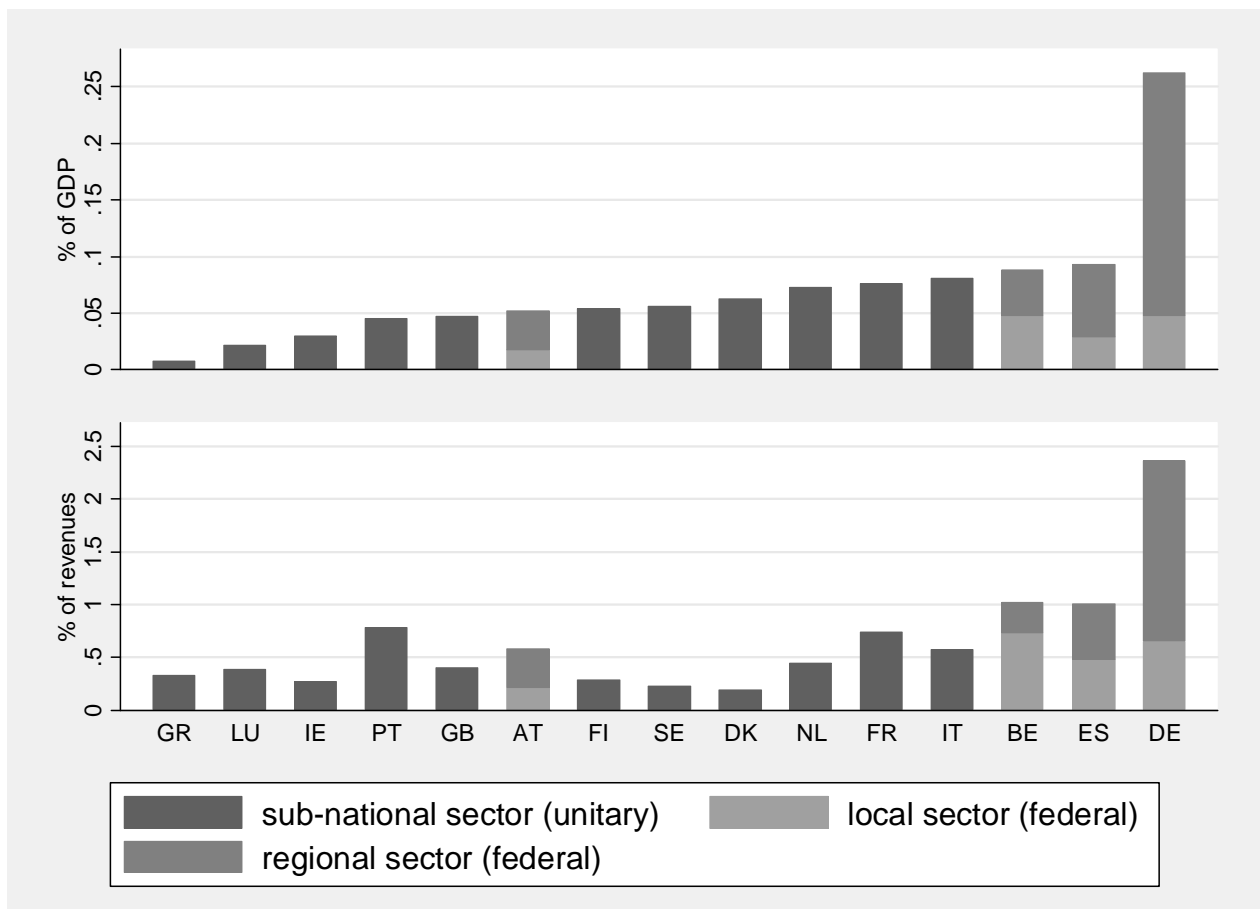
Notes: Consolidated outstanding debt in 2008. Top panel: as a share of GDP. Bottom panel: as share of revenues collected at the respective level of government.

Figure 1: Sub-national outstanding debt
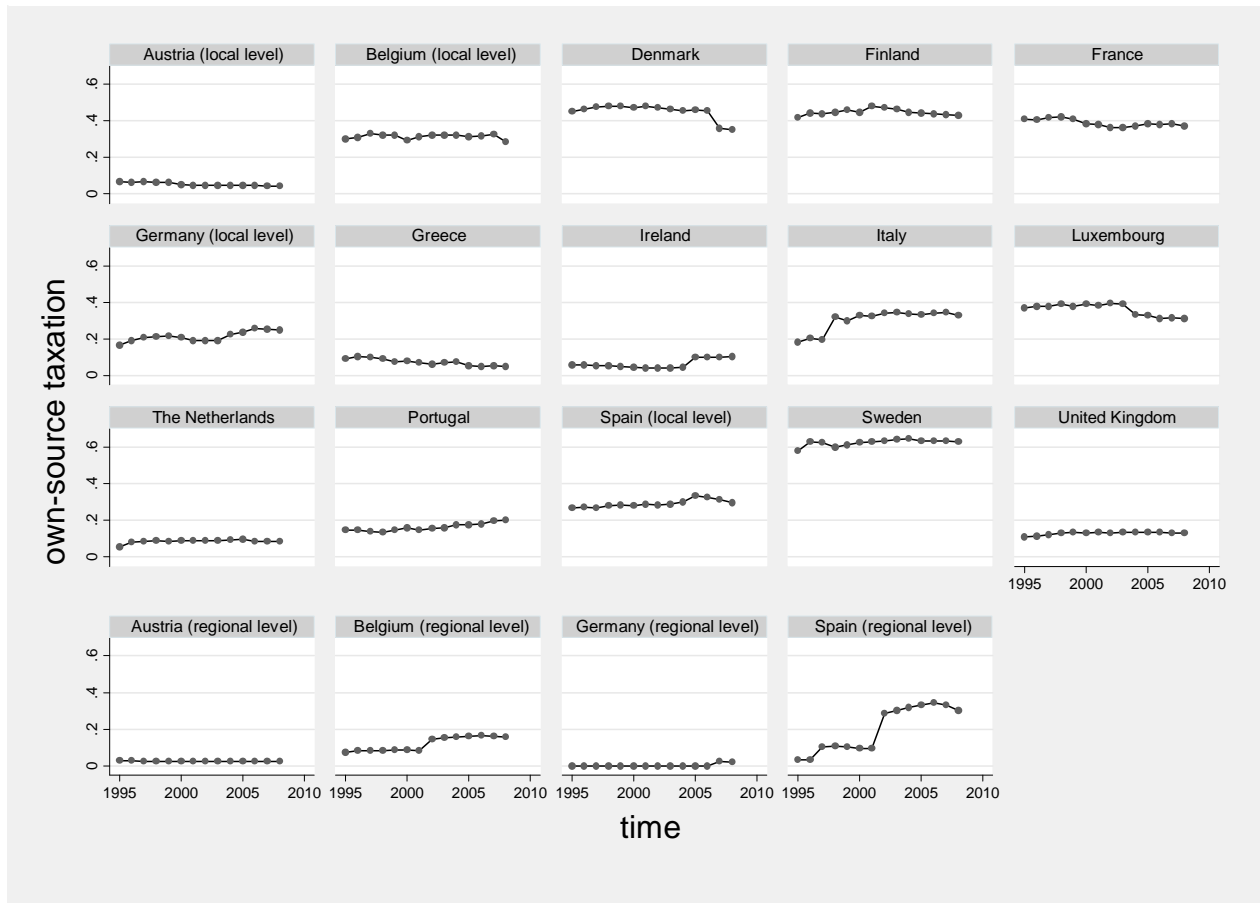
Notes: Share of tax revenues under discretion of the respective governmental level. Classification of autonomy according to the OECD fiscal decentralization database and national tax legislation.

Figure 2: Revenues from own-source taxation
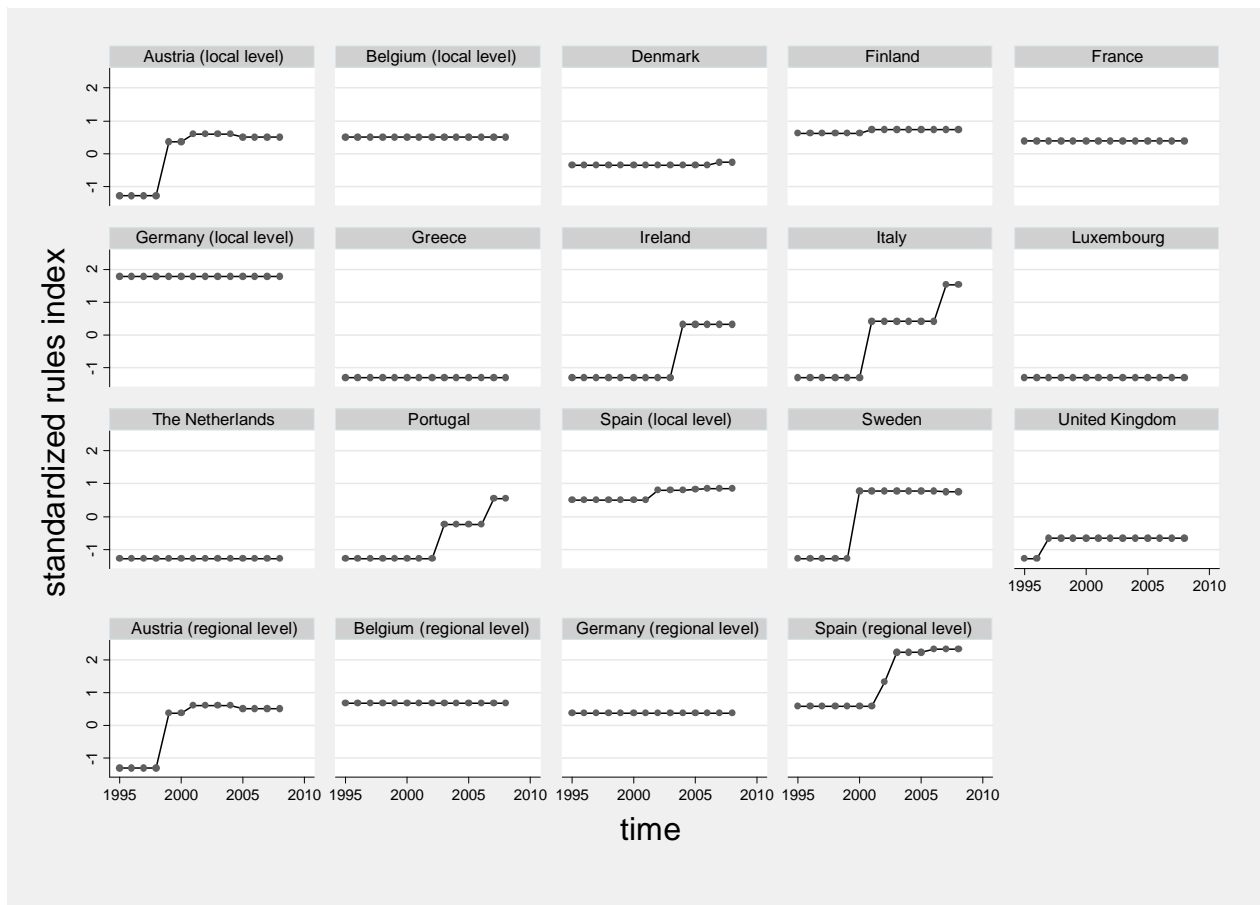
Notes: Standardized fiscal rules index. Survey information is taken from European Commission (2009). Own calculations according to appendix D.

Figure 3: Fiscal rules index
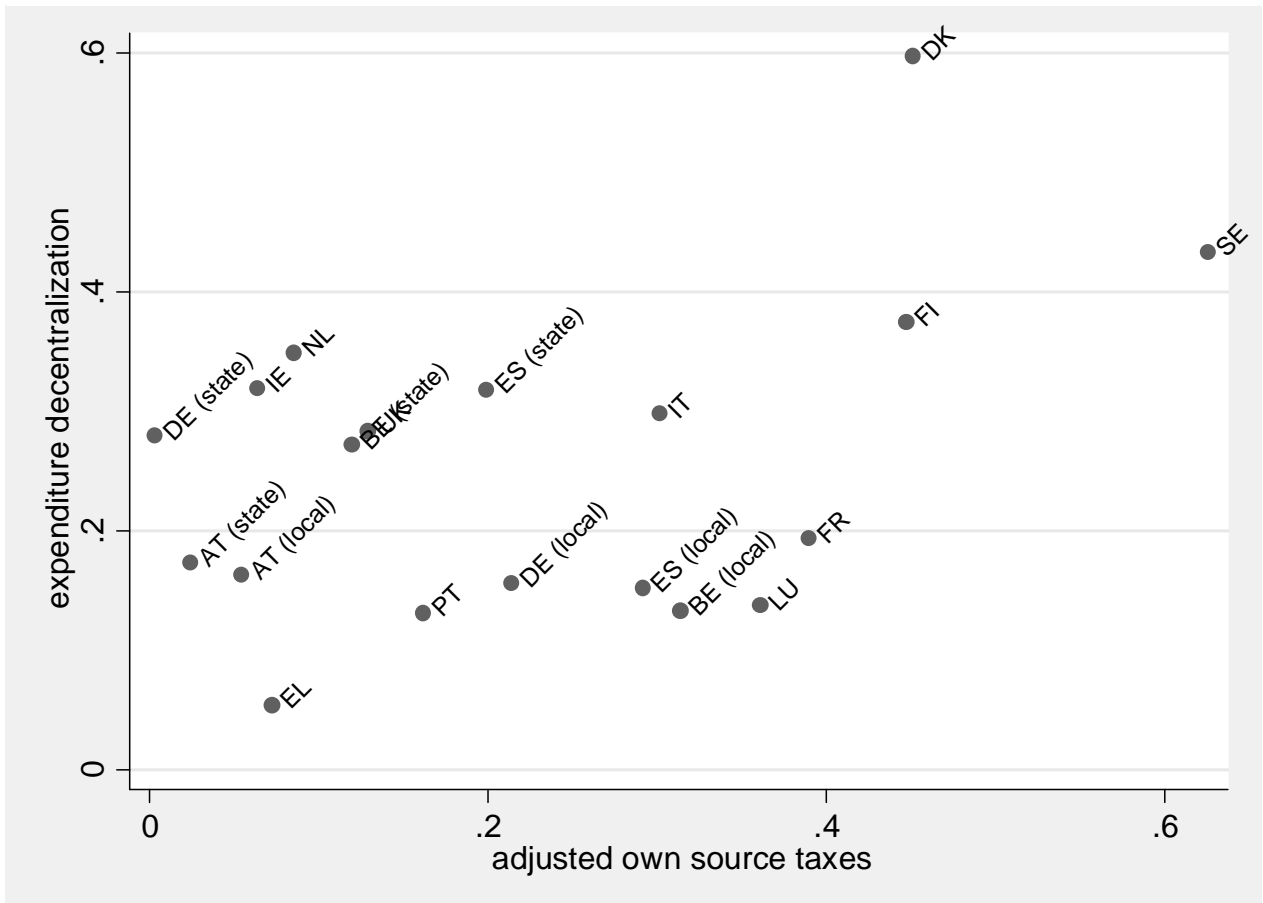
Notes: Mean by country over 1995-2008. Vertical axis: share of expenditures in general government expenditures, horizontal axis: revenues from own-source taxation as share of total sub-national revenues.

Figure 4: Decentralization over 1995-2008

Variable	Source		Mean	Std. Dev.	Min	Max
Dependent variable						
$deficit/revenues$	Eurostat	overall	0.006	0.034	-0.100	0.112
		between		0.022	-0.042	0.062
		within		0.026	-0.087	0.101
Tax autonomy						
tax^1	OECD,	overall	0.227	0.172	0.000	0.646
	own calculations	between		0.173	0.003	0.625
		within		0.037	0.061	0.370
$tax * federal$		overall	0.152	0.122	0.000	0.343
$tax * unitary$		overall	0.281	0.184	0.041	0.646
Fiscal rules						
$rules^2$	EC,	overall	0.459	0.357	0.000	1.284
	own calculations	between		0.311	0.000	1.100
		within		0.188	-0.014	1.061
$rules * federal$		overall	0.699	0.277	0.000	1.284
$rules * unitary$		overall	0.284	0.303	0.000	1.008
Controls						
$def\_cg\_rev^3$	Eurostat	overall	0.081	0.113	-0.189	0.621
		between		0.074	-0.031	0.276
		within		0.087	-0.169	0.556
$edec^4$	Eurostat	overall	0.254	0.131	0.043	0.659
		between		0.131	0.054	0.598
		within		0.029	0.116	0.360
$intexp\_rev^5$	Eurostat	overall	0.942	1.307	0.004	5.875
		between		1.303	0.007	5.382
		within		0.306	0.042	2.256
$outgap$	Eurostat	overall	0.374	1.648	-4.707	5.209
		between		0.372	-0.111	1.429
		within		1.608	-4.540	5.376
ln_totpop	Eurostat	overall	16.496	1.290	12.913	18.229
		between		1.323	12.999	18.225
		within		0.028	16.410	16.614
$depratio^6$	Eurostat	overall	0.670	0.012	0.636	0.690
		between		0.011	0.646	0.685
		within		0.006	0.640	0.687
$unempl^7$	Eurostat	overall	0.075	0.031	0.019	0.184
		between		0.027	0.034	0.123
		within		0.017	0.036	0.137

N=19, T=14 (1995-2008), n=266

Definitions: [1]revenues from own-source taxes as share of total revenues; [2]fiscal rules index; [3]central government deficit as share of revenues; [4] share of sub-national expenditures in general government expenditures; [5] interest expenditures as share of revenues; [6] share of working population in total population; [7]unemployment rate

Table 1: Summary statistics: Deficit estimation

Variable	Source		Mean	Std. Dev.	Min	Max
$ideology^1$	World Bank,	overall	0.376	0.327	0.000	1.000
	own calculations	between		0.131	0.089	0.589
	Beck et al. (2001)	within		0.301	-0.213	1.171
$herfgov^2$	World Bank	overall	0.666	0.270	0.181	1.000
	Beck et al. (2001)	between		0.257	0.221	1.000
		within		0.101	0.350	1.004
$disctrict^3$	World Bank	overall	9.402	6.050	1.000	22.500
	Beck et al. (2001)	between		5.712	1.000	20.300
		within		2.364	5.052	25.352
$contract^4$	Hallerberg et al. (2009)	overall	0.425	0.495	0.000	1.000
		between		0.465	0.000	1.000
		within		0.199	0.068	1.282
$debt\_gg\_gdp^5$	Eurostat	overall	0.634	0.265	0.061	1.304
		between		0.255	0.071	1.102
		within		0.091	0.406	1.019
N=19, T=14 (1995-2008), n=266						

Definitions: [1]index from zero (single party left-wing) to one (single party right-wing); [2]Herfindahl measure of fractionalization (probability that two randomly chosen individuals belong to different political groups); [3]district magnitude; [4] form of fiscal governance; [5]debt at the general government level as share of gdp

Table 2: Summary statistics: Central government characteristics

Dependent Variable	Cross Section	Panel Model			
Deficit/Revenues	(a)	(b)	(c)	(d)	(e)
Tax autonomy					
$tax_{(t-1)}$	-0.006	-0.101			
	(0.023)	(0.061)			
$tax_{(t-1)} * unitary$			0.195**	0.195	0.153
			(0.098)	(0.120)	(0.096)
$tax_{(t-1)} * federal$			-0.272***	-0.272***	-0.159*
			(0.069)	(0.056)	(0.087)
Fiscal rules					
$rules$	-0.012	-0.016			
	(0.011)	(0.010)			
$rules * unitary$			-0.043***	-0.043***	-0.033**
			(0.014)	(0.014)	(0.015)
$rules * federal$			0.002	0.002	0.006
			(0.014)	(0.015)	(0.020)
Controls					
def_cg_rev	0.066**	0.087**	0.076**	0.076*	0.060*
	(0.028)	(0.037)	(0.036)	(0.040)	(0.035)
$edec$	0.100***	0.147*	0.214**	0.214***	0.127
	(0.026)	(0.088)	(0.087)	(0.074)	(0.078)
$intexp\_rev$	0.002	-0.002	-0.001	-0.001	-0.003
	(0.004)	(0.007)	(0.007)	(0.007)	(0.009)
$outgap$	-0.001	-0.001	-0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$unempl$	0.173	-0.036	-0.047	-0.047	0.001
	(0.123)	(0.216)	(0.209)	(0.187)	(0.193)
ln_totpop	0.007*	0.365**	0.520***	0.520***	0.324**
	(0.004)	(0.180)	(0.167)	(0.136)	(0.133)
$depratio$	0.326	-0.565*	-0.603*	-0.603*	-0.356
	(0.258)	(0.322)	(0.331)	(0.356)	(0.396)
$trend$	0.002***	0.004	0.005	0.005	-0.000
	(0.001)	(0.008)	(0.007)	(0.005)	(0.001)
$federal$	0.005				
	(0.009)				
LDV					0.368***
					(0.069)
country/year FE	No/No	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
R^2	0.181	0.223	0.270	0.270	

Standard errors in parentheses, see notes for details
*** p<0.01, ** p<0.05, * p<0.1, n=247 N=19 T=14

Notes: Model (a): pooled regression with panel corrected standard errors; Model (b) and (c): fixed effect estimation with standard errors robust to heteroskedasticity and autocorrelation (Newey-West); Model (d): clustered standard errors at the individual level; Model (e) dynamic panel data estimation, bias correction initialized by Arellano and Bond estimator, bootstrapped standard errors with 1000 repetitions, LDV is the lagged dependent variable.

Table 3: Regressions of deficits

Dependent Variable	Cross Section			Panel Model	
Rules Index	(a)	(b)	(c)	(d)	(e)
Political variables					
herfgov	-0.641**	-0.226**	-0.066	-0.394***	-0.138
	(0.231)	(0.091)	(0.074)	(0.131)	(0.087)
election	-0.139	0.014	0.016	0.019	0.015
	(0.233)	(0.011)	(0.012)	(0.016)	(0.015)
ideology	-0.112	-0.014	-0.014	0.036	0.011
	(0.103)	(0.034)	(0.027)	(0.028)	(0.024)
district	0.014	0.003	0.004	0.018***	0.007*
	(0.008)	(0.006)	(0.003)	(0.006)	(0.003)
contract	-0.501**	-0.150**	-0.064	-0.281***	-0.006
	(0.182)	(0.070)	(0.057)	(0.069)	(0.051)
Budgetary variables					
def_rev	-0.710	-0.160	-0.156	-0.119	-0.094
	(1.754)	(0.256)	(0.244)	(0.269)	(0.320)
$def\_rev_{(t-1)}$		-0.195	-0.111	-0.356	-0.045
		(0.262)	(0.247)	(0.313)	(0.291)
$debt\_gg\_gdp_{(t-1)}$	-0.036	-0.004	-0.011	0.384**	0.083
	(0.169)	(0.094)	(0.048)	(0.153)	(0.132)
Timing					
sgp	0.374**	0.050*	0.061**	0.063*	0.072**
	(0.156)	(0.028)	(0.025)	(0.038)	(0.028)
trend		0.018***	0.002	0.020***	-0.003
		(0.005)	(0.003)	(0.006)	(0.006)
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Rules Index	(a)	(b)	(c)	(d)	(e)
Controls					
depratio	2.210	3.487*	0.565	7.055**	0.805
	(3.315)	(2.077)	(1.164)	(2.816)	(1.978)
outgap	0.050	-0.005	0.001	-0.012	-0.005
	(0.036)	(0.007)	(0.006)	(0.008)	(0.007)
unempl	3.337*	0.490	0.242	0.848	-0.597
	(1.833)	(1.155)	(1.120)	(1.757)	(1.412)
$unempl_{(t-1)}$		0.688	0.301	-1.464	0.520
		(1.080)	(0.993)	(1.528)	(1.300)
tax	0.879**	0.538*	0.422	0.717*	0.717*
	(0.363)	(0.318)	(0.339)	(0.398)	(0.390)
$tax_{(t-1)}$		0.561*	-0.135	1.350***	-0.097
		(0.313)	(0.339)	(0.407)	(0.383)
ln_totpop	0.066	0.083***	0.030*	-0.022	0.580
	(0.051)	(0.029)	(0.016)	(0.821)	(0.681)
edec	0.597	0.200	0.147	-0.594	-0.070
	(0.359)	(0.197)	(0.109)	(0.362)	(0.324)
local dummy	0.203*	0.353***	0.101**		
	(0.100)	(0.068)	(0.040)		
regional dummy	0.291***	0.436***	0.117***		
	(0.102)	(0.067)	(0.043)		
LDV			0.698***		0.803***
			(0.067)		(0.065)
Constant	-2.484	-3.780**	-0.920		
	(2.350)	(1.591)	(0.874)		
Fixed Effects	No	No	No	Yes	Yes
R^2	0.888	0.501	0.853	0.637	

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
(1) n=41, (2)-(5) n=247 N=19 T=14

Notes: Model (a): aggregated estimation according to equation 3; Models (b) and (c): pooled regression with panel corrected standard errors; Model (d): fixed effect estimation with standard errors robust to heteroskedasticity and autocorrelation (Newey-West); Model (e): bias correction initialized by Arellano and Bond estimator, bootstrapped standard errors with 1000 repetitions, LDV is the lagged dependent variable.

Table 4: Determinants of fiscal rules

Dependent Variable	Fixed Effect Panel Model					
Rules Index	(a)	(b)	(c)	(d)	(e)	(f)
Herfindahl index (fractionalization)						
$herfgov$		-0.381***	-0.387***	-0.443***	-0.358***	
		(0.129)	(0.124)	(0.132)	(0.132)	
$herfgov * federal$	-0.006					-0.078
	(0.114)					(0.116)
$herfgov_{(t-1)} * federal$	0.313***					0.359***
	(0.106)					(0.102)
$herfgov * unitary$	-0.335					-0.233
	(0.229)					(0.189)
$herfgov_{(t-1)} * unitary$	-0.482*					-0.641***
	(0.274)					(0.244)
Election year						
$election$	0.016		0.017	0.021	0.014	
	(0.014)		(0.015)	(0.016)	(0.016)	
$election * federal$		0.038				0.038
		(0.028)				(0.025)
$election_{(t-1)} * federal$		0.011				-0.008
		(0.021)				(0.016)
$election * unitary$		0.003				-0.004
		(0.024)				(0.021)
$election_{(t-1)} * unitary$		-0.010				-0.012
		(0.027)				(0.023)
Ideology (1=right-wing single party)						
$ideology$	0.056**	0.041		0.082***	0.029	
	(0.027)	(0.028)		(0.027)	(0.028)	
$ideology * federal$			-0.063			0.027
			(0.040)			(0.030)
$ideology_{(t-1)} * federal$			0.021			-0.011
			(0.032)			(0.030)
$ideology * unitary$			0.055			0.075*
			(0.052)			(0.041)
$ideology_{(t-1)} * unitary$			0.069			0.057
			(0.048)			(0.042)
District magnitude						
$district$	0.019***	0.018***	0.020***		0.017***	
	(0.006)	(0.006)	(0.007)		(0.006)	
$district * federal$				-0.005		0.009
				(0.007)		(0.007)
$district_{(t-1)} * federal$				0.006		0.009**
				(0.005)		(0.005)
$district * unitary$				0.011*		0.007
				(0.006)		(0.005)
$district_{(t-1)} * unitary$				0.019***		0.021***
				(0.004)		(0.003)

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Rules Index	(a)	(b)	(c)	(d)	(e)	(f)
Contract						
contract	-0.290***	-0.281***	-0.302***	-0.282***		
	(0.068)	(0.068)	(0.065)	(0.068)		
contract $*$ federal					-0.346***	-0.351***
					(0.089)	(0.080)
contract$_{(t-1)} *$ federal					-0.003	0.057
					(0.033)	(0.037)
contract $*$ unitary					-0.090	-0.095
					(0.056)	(0.070)
contract$_{(t-1)} *$ unitary					-0.073	-0.233**
					(0.086)	(0.098)
Controls						
def_rev	-0.217	-0.153	-0.283	0.054	-0.170	-0.121
	(0.241)	(0.278)	(0.264)	(0.252)	(0.273)	(0.223)
def_rev$_{(t-1)}$	-0.293	-0.352	-0.321	-0.264	-0.254	-0.340
	(0.275)	(0.318)	(0.320)	(0.307)	(0.313)	(0.275)
unempl	-1.005	0.561	1.345	0.542	0.459	-1.387
	(1.466)	(1.782)	(1.803)	(1.828)	(1.770)	(1.441)
unempl$_{(t-1)}$	-0.291	-1.205	-1.895	-0.856	-1.134	-0.168
	(1.256)	(1.541)	(1.603)	(1.530)	(1.526)	(1.268)
tax	0.613*	0.779*	0.877**	0.875**	0.794*	0.642*
	(0.329)	(0.403)	(0.389)	(0.386)	(0.412)	(0.363)
tax$_{(t-1)}$	1.190***	1.336***	1.351***	1.309***	1.322***	1.139***
	(0.371)	(0.407)	(0.389)	(0.392)	(0.409)	(0.383)
depratio	5.510**	6.750**	8.374***	8.798***	6.536**	7.166***
	(2.422)	(2.795)	(2.837)	(2.913)	(2.862)	(2.476)
outgap	-0.007	-0.009	-0.007	-0.008	-0.008	-0.007
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
debt_gg_gdp	0.428***	0.354**	0.410***	0.300**	0.299*	0.482***
	(0.128)	(0.153)	(0.148)	(0.152)	(0.155)	(0.141)
ln_pop_tot	0.273	-0.134	-0.706	0.067	-0.034	-0.055
	(0.658)	(0.800)	(0.850)	(0.784)	(0.809)	(0.702)
edec	-0.630*	-0.552	-0.678*	-0.423	-0.544	-0.642*
	(0.360)	(0.363)	(0.384)	(0.386)	(0.375)	(0.372)
sgp	0.054	0.061*	0.081**	0.053	0.057	0.050
	(0.036)	(0.036)	(0.037)	(0.038)	(0.038)	(0.036)
trend	0.016***	0.019***	0.019***	0.015**	0.017***	0.017***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
R^2	0.702	0.636	0.647	0.654	0.642	0.735

Robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$, n=247 N=19 T=14

Notes: Specification according to model (d) in Table 4. Fixed effect estimation with standard errors robust to heteroskedasticity and autocorrelation (Newey-West).

Table 5: Determinants of fiscal rules II

Dependent Variable	IV 2SLS Panel Model			
Deficit/Revenues	(a)	(b)	(c)	(d)
Tax autonomy				
$tax_{(t-1)} * unitary$	0.195	0.365*	0.365**	0.334**
	(0.120)	(0.190)	(0.148)	(0.141)
$tax_{(t-1)} * federal$	-0.272***	-0.284***	-0.284***	-0.289***
	(0.056)	(0.073)	(0.075)	(0.075)
Fiscal rules				
$rules * unitary$	-0.043***	-0.088**	-0.088***	-0.079***
	(0.014)	(0.041)	(0.026)	(0.024)
$rules * federal$	0.002	-0.007	-0.007	-0.001
	(0.015)	(0.027)	(0.021)	(0.021)
full set of controls	Yes	Yes	Yes	Yes
country/year FE	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Excluded Instruments	none	$herfgov_t * federal$		$herfgov_t$
		$district_t * federal$		$district_t$
		$contract_t * federal$		$contract_t$
		$herfgov_{(t-1)} * unitary$		$herfgov_{(t-1)}$
		$district_{(t-1)} * unitary$		$district_{(t-1)}$
		$contract_{(t-1)} * unitary$		$contract_{(t-1)}$
R^2	0.173	0.134	0.134	0.147
Hansen J	.	3.799	6.083	12.64
Hansen J p-value	.	0.434	0.193	0.245
K-P Weak Id. F	.	29.97	10.70	10.01

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Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1, n=247 N=19 T=14

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Notes: Two stage least square estimations. First stage regressions are presented in Table 12 of Appendix C. Set of control variables as before, results not reported here but in Table 11 of Appendix C. Model (a): repetition of the estimation without instrumenting the rules index; Model (b): cluster-robust standard errors, using the Herfindahl index, the form of fiscal governance and the district magnitude as instruments for federal countries. For unitary countries the one time lag of these variables is included; Model (c): same as (b) but with with standard errors robust to heteroskedasticity and autocorrelation (Newey-West); Model (d): present and lagged values are used as intsruments in both first stage equations, standard errors robust to heteroskedasticity and autocorrelation (Newey-West).

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Table 6: IV regressions

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Table 7: IV regressions

Dependent Variable	IV 2SLS Panel Model					
Deficit/Revenues	(a.I) federal	(a.II) unitary	(b.I) federal	(b.II) unitary	(c.I) federal	(c.II) unitary
Tax autonomy						
$tax_{(t-1)}$	-0.267**	0.316**	-0.259**	0.291**	-0.238**	0.321**
	(0.110)	(0.136)	(0.108)	(0.131)	(0.119)	(0.142)
Fiscal rules						
$rules$	-0.027	-0.091***	-0.031	-0.085***	-0.043	-0.093***
	(0.023)	(0.027)	(0.023)	(0.027)	(0.036)	(0.028)
full set of controls	Yes	Yes	Yes	Yes	Yes	Yes
country/year FE	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Excluded Instruments	$herfgov_t$ $district_t$ $contract_t$ $herfgov_{(t-1)}$ $district_{(t-1)}$ $contract_{(t-1)}$		$herfgov_t$ $district_t$ $contract_t$		$herfgov_{(t-1)}$ $district_{(t-1)}$ $contract_{(t-1)}$	
R^2	0.623	0.235	0.624	0.246	0.623	0.232
Hansen J	6.180	2.149	0.822	0.118	0.919	1.452
Hansen J p-value	0.289	0.828	0.663	0.943	0.632	0.484
K-P Weak Id. F	7.491	8.637	14.08	7.975	4.680	16.38

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$, n=104/143 N=8/11 (federal/unitary) T=14

Notes: Two stage least square estimations. First stage regressions are presented in Table 14 of Appendix C. Set of control variables as before, results not reported here but in Table 14 of Appendix C. Separate regressions for federal (a)/(c)/(e) and unitary (b)/(d)/(f) countries. Model (a)/(b): Actual and lagged instruments; Model (c)/(d): only actual instruments; Model (e)/(f): only lagged instruments. Standard errors robust to heteroskedasticity and autocorrelation (Newey-West).
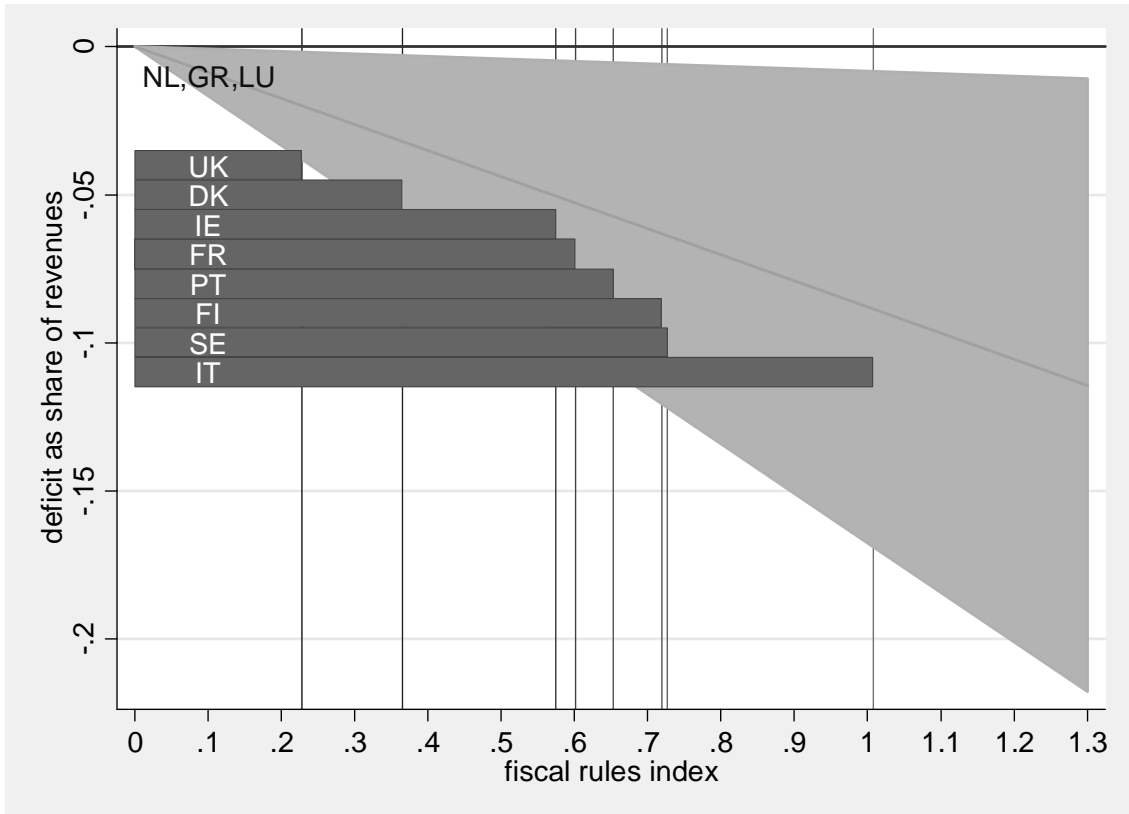
(a) Effect of fiscal rules in unitary countries
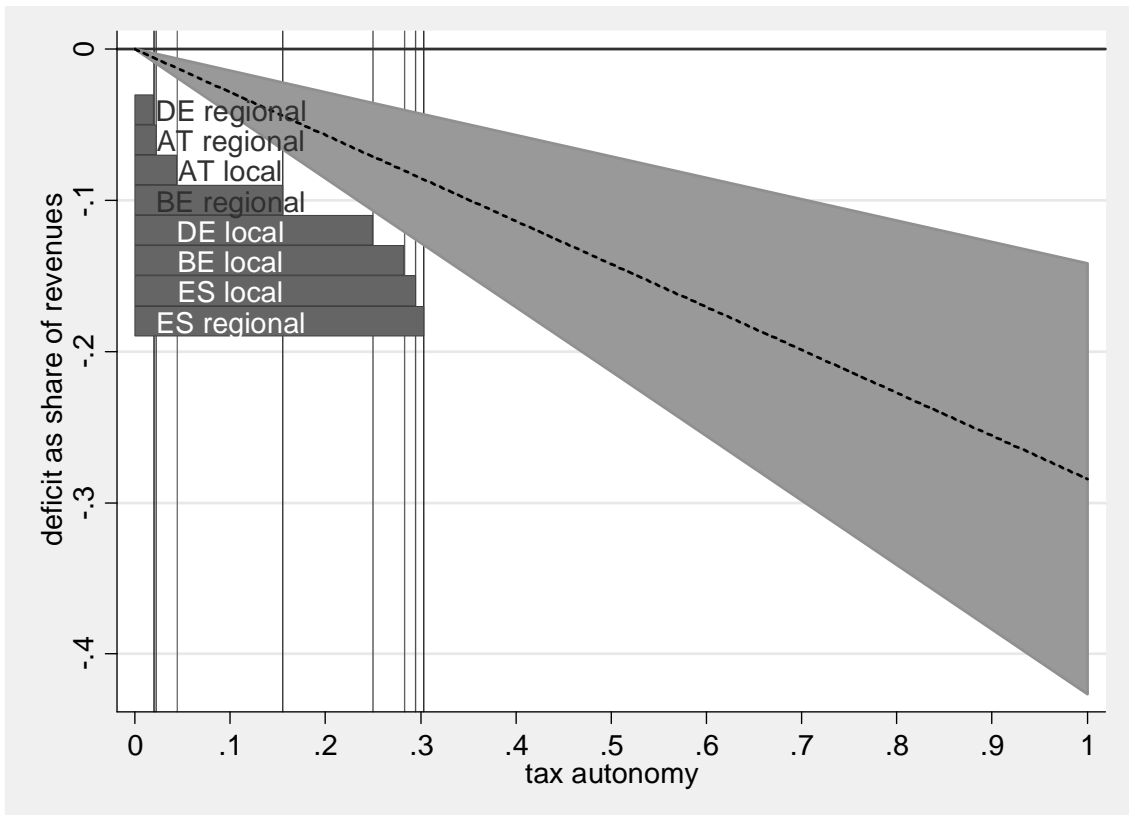
(b) Effect of tax autonomy in federations

Bars: (a) value of the rules index in 2008, (b) value of tax autonomy in 2008. Marginal effect accroding to model (b) in Table 6

Figure 5: Policy implications
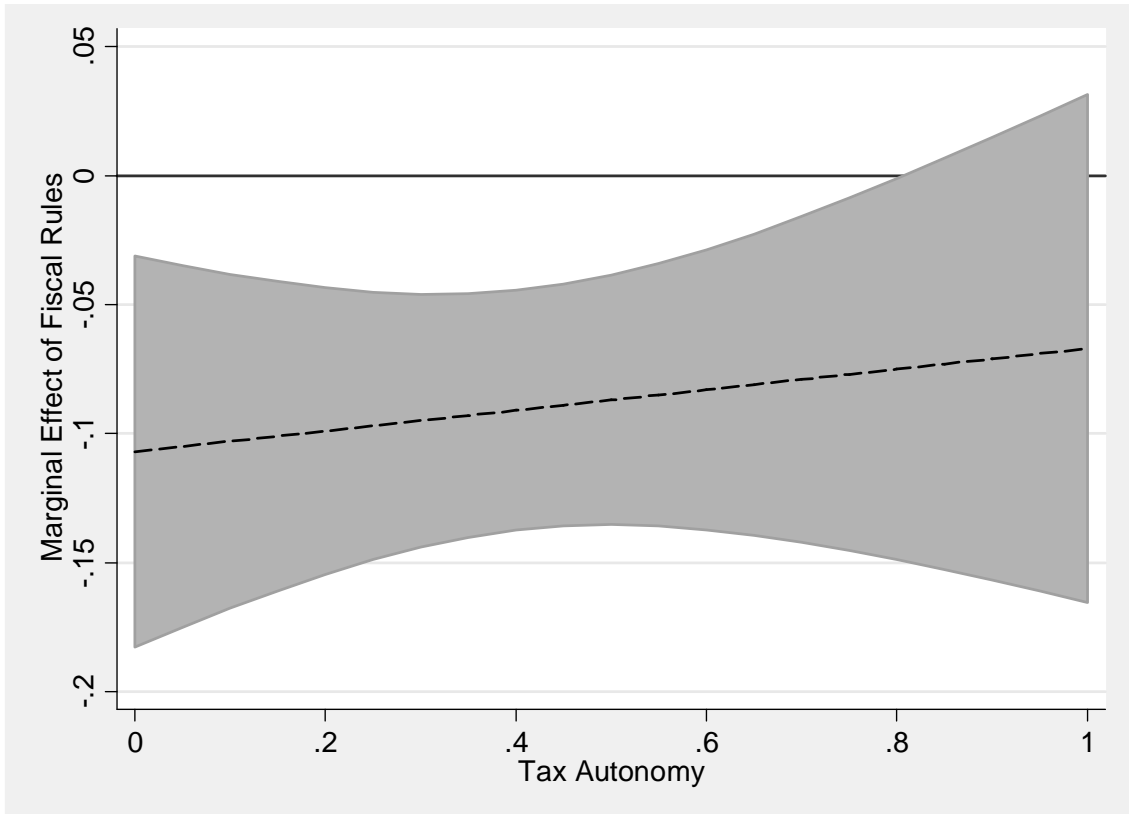
(a) Marginal interaction effect of fiscal rules in unitary countries
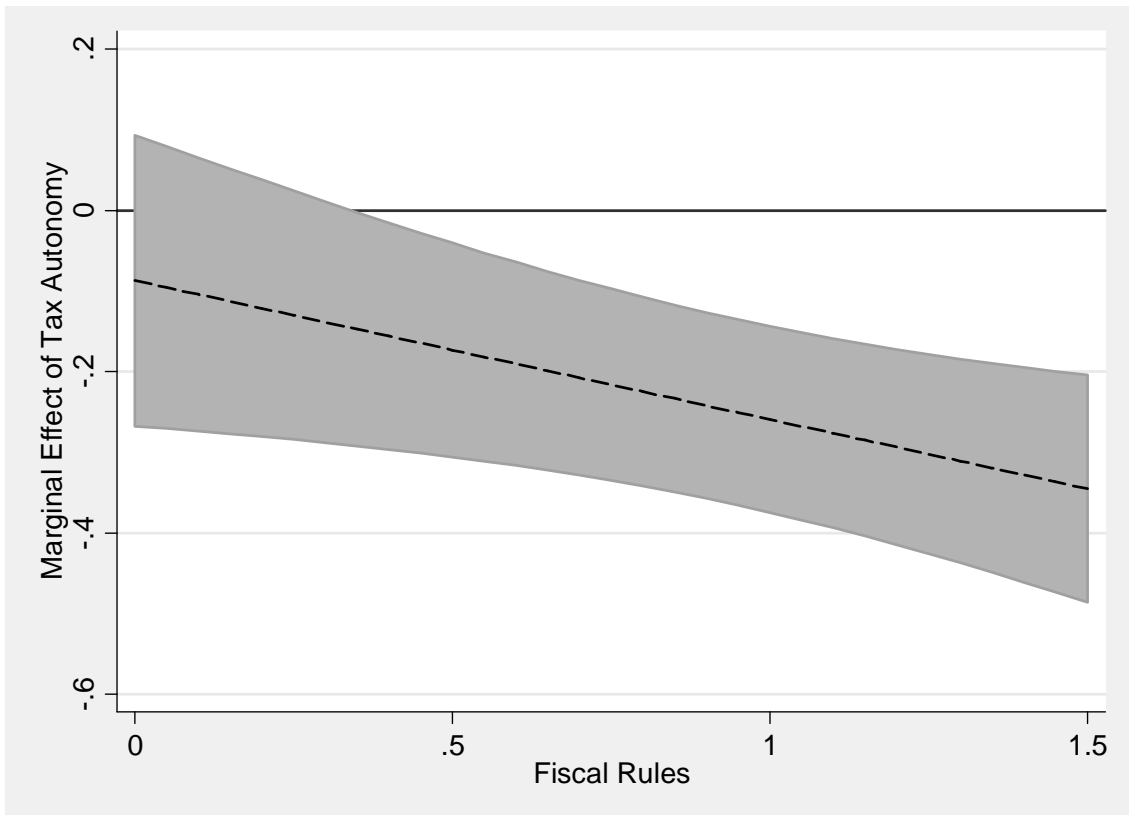
(b) Marginal interaction effect of tax autonomy in federations

Notes: (a) plot of the marginal effect of fiscal rules while allowing for interaction with tax autonomy, (b) plot of the marginal effect of tax autonomy while allowing for interaction with fiscal rules. 95% CI in gray.

Figure 6: Marginal effects interaction terms

A. Additional tables

Deficit		(1)	(2)	(3)
as share of revenues	(1)	1.000		
in Euro per capita	(2)	0.887	1.000	
as share of GDP	(3)	0.900	0.955	1.000

Notes: Correlation between different indicators of sub-national deficits.

Table 8: Correlation of deficit measures

B. Federal classification

The structure of European countries differs in many respects. One of the most important distinctions is the role and status of the sub-national sector due to the constitutional structure.

federal countries	Austria, Belgium, Germany, Spain (local and regional levels included seperately)
unitary countries	Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Sweden, United Kingdom (consoldidated sub-national values included)

Table 9: Unitary and federal classification

Three countries out of the EU15 are original federations as written down in the respective constitution (Austria, Belgium, Germany), and another country (Spain) has a very regionalized structure. All these countries have had handed over important responsibilities to the regional and local level, and these sub-national governments have significant own legislative powers. I treat this group of countries as federations in my analysis. The other group of states consists of unitary countries, but those may have a different number of sub-national levels. While Finland has only a local level sector, the remaining unitary countries (Denmark, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Sweden, and the United Kingdom) have at least one regional level, but with limited legal autonomy, compared to their federal counterparts. As indicated in Table 9, I group all these countries as unitary ones.

C. Additional regression results

C.1. Results interaction model

Dependent Variable Deficit/Revenues	Interaction Terms
Unitary countries	
$tax_{(t-1)} * unitary$	0.380**
	(0.156)
$rules * unitary$	-0.107**
	(0.039)
$rules * tax_{(t-1)} * unitary$	0.040
	(0.075)
Federal countries	
$tax_{(t-1)} * federal$	-0.087
	(0.092)
$rules * federal$	0.006
	(0.021)
$rules * tax_{(t-1)} * federal$	-0.172**
	(0.075)
Controls	
def_cg_rev	0.074*
	(0.042)
edec	0.181*
	(0.087)
intexp_rev	0.002
	(0.008)
outgap	-0.000
	(0.002)
unempl	-0.148
	(0.146)
ln_pop_tot	0.607***
	(0.172)
depratio	-0.511*
	(0.294)
trend	-0.001
	(0.001)
country/year FE	Yes/Yes
R^2	0.289

Robust standard errors in parentheses
*** p¡0.01, ** p¡0.05, * p¡0.1, n=247 N=19 T=14

Notes: Results for a regression allwong for interactions between *rules* and $tax_{(t-1)}$. Marginal effects presented in pictures 6 (a) and (b).

Table 10: Results interaction model

C.2. Details to Table 6

Dependent Variable	IV 2SLS Panel Model			
Deficit/Revenues	(a)	(b)	(c)	(d)
Controls				
def_cg_rev	0.076*	0.076*	0.076**	0.077**
	(0.040)	(0.042)	(0.037)	(0.036)
edec	0.214***	0.197**	0.197**	0.201**
	(0.074)	(0.085)	(0.088)	(0.088)
intexp_rev	-0.001	0.003	0.003	0.002
	(0.007)	(0.008)	(0.007)	(0.007)
outgap	-0.000	0.000	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
unempl	-0.047	-0.097	-0.097	-0.092
	(0.187)	(0.215)	(0.215)	(0.214)
trend	0.005	0.006	0.006	0.006
	(0.005)	(0.005)	(0.007)	(0.007)
ln_pop_tot	0.520***	0.544***	0.544***	0.542***
	(0.136)	(0.160)	(0.168)	(0.167)
depratio	-0.603*	-0.429	-0.429	-0.481
	(0.356)	(0.404)	(0.377)	(0.359)

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$, n=247 N=19 T=14

Notes: Two stage least square estimations. Table shows the results for control variables included in the estimations but not presented in the text in table 6. First stage regressions are presented below. Model (a): repetition of the estimation without instrumenting the rules index; Model (b): cluster-robust standard errors, using the Herfindahl index, the form of fiscal governance and the district magnitude as instruments for federal countries. For unitary countries the one time lag of these varibales is included; Model (c): same as (b) but with with standard errors robust to heteroskedasticity and autocorrelation (Newey-West); Model (d): present and lagged values are used as intruments in both first stage equations, standard errors robust to heteroskedasticity and autocorrelation (Newey-West).

Table 11: Results of controls according to Table 6

Equation: *rules∗*	Model (b)		Model (c)		Model (d)	
	unitary	*federal*	*unitary*	*federal*	*unitary*	*federal*
Excluded instruments						
$herfgov * federal$	-0.187*	0.221***	-0.187*	0.221***	-0.168	0.067
	(0.098)	(0.058)	(0.108)	(0.073)	(0.116)	(0.063)
$herfgov_{(t-1)} * federal$					-0.022	0.255***
					(0.098)	(0.082)
$contract * federal$	0.119**	-0.502***	0.119***	-0.502***	0.033	-0.447***
	(0.061)	(0.025)	(0.046)	(0.093)	(0.037)	(0.085)
$contract_{(t-1)} * federal$					0.114***	-0.053***
					(0.038)	(0.018)
$district * federal$	-0.000	0.007*	-0.000	0.007**	-0.008	0.011**
	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
$district_{(t-1)} * federal$					0.010*	-0.002
					(0.005)	(0.004)
$contract * unitary$					-0.061	0.019
					(0.071)	(0.022)
$contract_{(t-1)} * unitary$	-0.265**	0.032	-0.265***	0.032	-0.216**	0.026
	(0.126)	(0.025)	(0.103)	(0.020)	(0.107)	(0.018)
$district * unitary$					0.008*	0.001
					(0.005)	(0.001)
$district_{(t-1)} * unitary$	0.022***	0.001	0.022***	0.001	0.016***	-0.000
	(0.002)	(0.001)	(0.004)	(0.001)	(0.002)	(0.001)
$herfgov * unitary$					-0.256	0.044
					(0.175)	(0.046)
$herfgov_{(t-1)} * unitary$	-0.771***	0.005	-0.771***	0.005	-0.557**	-0.026
	(0.258)	(0.025)	(0.177)	(0.024)	(0.224)	(0.039)
Other						
$tax_{(t-1)} * unitary$	2.083**	0.017	2.083***	0.017	2.117***	-0.026
	(0.822)	(0.078)	(0.668)	(0.096)	(0.610)	(0.108)
$tax_{(t-1)} * federal$	-0.604*	1.839***	-0.604**	1.839***	-0.538**	1.840***
	(0.338)	(0.326)	(0.246)	(0.189)	(0.243)	(0.174)
def_cg_rev	-0.047	-0.001	-0.047	-0.001	-0.093	0.016
	(0.222)	(0.033)	(0.162)	(0.044)	(0.160)	(0.046)
$edec$	-0.594**	0.158	-0.594*	0.158	-0.686*	0.121
	(0.260)	(0.177)	(0.345)	(0.129)	(0.354)	(0.121)
$intexp\_rev$	0.004	0.013	0.004	0.013	0.004	0.011
	(0.055)	(0.016)	(0.038)	(0.014)	(0.040)	(0.014)
$outgap$	0.004	0.000	0.004	0.000	0.004	0.000
	(0.010)	(0.002)	(0.008)	(0.002)	(0.008)	(0.002)
$unempl$	-0.860	0.087	-0.860	0.087	-0.538	-0.147
	(1.644)	(0.399)	(1.171)	(0.274)	(1.140)	(0.252)
ln_pop_tot	0.421	0.313	0.421	0.313	0.277	0.196
	(0.909)	(0.459)	(0.625)	(0.324)	(0.630)	(0.312)
$depratio$	4.733*	0.180	4.733**	0.180	4.897**	0.388
	(2.664)	(0.747)	(2.285)	(0.546)	(2.380)	(0.653)
$trend$	-0.003	-0.003	-0.003	-0.003	-0.001	0.002
	(0.016)	(0.005)	(0.028)	(0.007)	(0.028)	(0.009)
R-squared	0.588	0.748	0.588	0.748	0.608	0.763

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: First stage regressions for the results presented in table 6. Endogenous variables in the second stage is the fiscal rules index for both types of government.

Table 12: First stage regressions to Table 6

C.3. Details to Table 7

Dep. Var.	IV 2SLS Panel Model					
Def./Rev.	(a.I) federal	(a.II) unitary	(b.I) federal	(b.II) unitary	(c.I) federal	(c.II) unitary
Controls						
def_cg_rev	0.162***	0.028	0.159***	0.029	0.155***	0.028
	(0.044)	(0.051)	(0.044)	(0.052)	(0.049)	(0.051)
edec	0.376*	0.021	0.378*	0.028	0.381*	0.020
	(0.227)	(0.101)	(0.226)	(0.102)	(0.223)	(0.102)
intexp_rev	-0.011	0.012	-0.010	0.012	-0.009	0.013
	(0.011)	(0.009)	(0.011)	(0.009)	(0.011)	(0.009)
outgap	0.017***	-0.001	0.017***	-0.001	0.017***	-0.001
	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)
unempl	1.262***	-0.318	1.287***	-0.309	1.347***	-0.319
	(0.290)	(0.238)	(0.294)	(0.238)	(0.322)	(0.238)
ln_pop_tot	1.113***	0.238	1.115***	0.240	1.119***	0.237
	(0.172)	(0.239)	(0.172)	(0.237)	(0.172)	(0.239)
depratio	0.884	-0.638*	0.992	-0.658*	1.258	-0.634*
	(0.823)	(0.351)	(0.811)	(0.341)	(1.053)	(0.355)
trend	0.005	0.004	0.005	0.004	0.005	0.004
	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$, n=104/143 N=8/11 (federal/unitary) T=14

Notes: Two stage least square estimations. Table shows the results for control variables included in the estimations but not presented in the text in table 7. First stage regressions are presented below. Separate regressions for federal (a)/(c)/(e) and unitary (b)/(d)/(f) countries. Model (a)/(b): Actual and lagged instruments; Model (c)/(d): only actual instruments; model (e)/(f): only lagged instruments. Standard errors robust to heteroskedasticity and autocorrelation (Newey-West).

Table 13: Results of controls according to Table 7

Equation: *rules*	Model (a.I)	Model (a.II)	Model (b.I)	Model (b.II)	Model (c.I)	Model (c.II)
Excluded instruments						
herfgov	0.079	-0.260	0.168	-0.649***		
	(0.096)	(0.170)	(0.105)	(0.148)		
herfgov$_{(t-1)}$	0.279**	-0.619***			0.242*	-0.828***
	(0.118)	(0.229)			(0.132)	(0.184)
contract	-0.450***	-0.067	-0.488***	-0.189**		
	(0.088)	(0.082)	(0.109)	(0.091)		
contract$_{(t-1)}$	-0.077*	-0.196**			-0.372***	-0.251***
	(0.039)	(0.097)			(0.107)	(0.094)
district	0.020*	0.004	0.010	0.015***		
	(0.012)	(0.004)	(0.008)	(0.006)		
district$_{(t-1)}$	-0.009	0.015***			0.011	0.018***
	(0.010)	(0.003)			(0.008)	(0.003)
Other						
$tax_{(t-1)} * unitary$		2.101***		2.749***		2.048***
		(0.540)		(0.450)		(0.584)
$tax_{(t-1)} * federal$	1.448***		1.445***		1.553***	
	(0.302)		(0.326)		(0.415)	
def_cg_rev	0.006	-0.242	-0.135	-0.190	0.043	-0.255
	(0.139)	(0.236)	(0.154)	(0.227)	(0.224)	(0.242)
edec	1.434*	-0.812**	1.278	-0.911**	1.267	-0.787*
	(0.831)	(0.408)	(0.852)	(0.433)	(1.058)	(0.408)
intexp_rev	0.057*	-0.018	0.062*	0.022	0.086*	-0.014
	(0.030)	(0.056)	(0.034)	(0.055)	(0.049)	(0.053)
outgap	0.016	0.000	0.026	0.003	0.047**	0.000
	(0.015)	(0.008)	(0.017)	(0.009)	(0.023)	(0.008)
unempl	0.585	-1.686	2.276	-1.104	2.775	-1.864
	(1.380)	(1.723)	(1.545)	(1.457)	(1.898)	(1.704)
ln_pop_tot	1.023	0.835	1.968***	0.257	1.490*	0.898
	(0.664)	(1.201)	(0.706)	(1.137)	(0.887)	(1.173)
depratio	-1.038	3.185	-0.024	3.492	4.702	3.073
	(4.082)	(2.697)	(3.286)	(2.705)	(5.066)	(2.528)
trend	0.010	-0.004	-0.002	0.006	0.006	-0.002
	(0.020)	(0.047)	(0.017)	(0.044)	(0.028)	(0.048)
R-squared	0.846	0.729	0.831	0.686	0.772	0.722

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: First stage regressions for the results presented in table 7. Endogenous variables in the second stage is the fiscal rules index for both types of government.

Table 14: First stage regressions to Table 7

D. Construction of the rules index

The construction of the rules index follows the European Commission (2009). I adopt their dataset and calculate the rules index for the sub-national sectors. All balanced budget rules and debt rules applying to the sub-national sector are taken into account. All information about the included rules are available on the webpage of the European Commission. Rules applying to the general government sector are weighted by the respective sub-national expenditure share in it. The indicator is the sum of each criterion, devided by the total number of criteria. Each criteria itself is devided by the maximum score, i.e. all variables are forced to be between zero and one.

- *Criterion 1: statutory base of the rule*
  The score of this criterion index is constructed as a simple average of the two elements below:

- *Criterion 1a: Statutory or legal base of the rule*
    - 4 is assigned for a constitutional base
    - 3 if the rule is based on a legal act (e.g. Public finance Act, Fiscal Responsibility Law)
    - 2 if 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 for political commitment by a given authority (central or local government, Minister of Finance)

- *Criterion 1b: Room for setting or revising objectives*
    - 3 if 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)

- *Criterion 2: Nature of the body in charge of monitoring respect of the rule*
  The score of this variable is augmented by one point in case there is a real time monitoring of compliance with the rule (e.g. existence of alert mechanisms in case there is a risk of non-respect of the rule).
    - 3 if there is a 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)

- *Criterion 3: Nature of the body in charge of enforcement of 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

- *Criterion 4: Enforcement mechanisms of the rule*
  The score of this variable is augmented by 1 point in case escape clauses are foreseen and clearly specified.

    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 is no ex-ante defined actions in case of non-compliance

- *Criterion 5: Media visibility of the rule*

    3 is assigned if the rule observance is closely monitored by the media, and if non-compliance is likely to trigger a public debate

    2 for high media interest in rule-compliance, but non-compliance is unlikely to invoke a public debate

    1 for no or modest interest of the media

E. Robustness check: federal specification

Throughout the text I used two different data points for each federal country, i.e. I included the local and regional level as separate observations. Table 15 shows the results of two robustness checks in order to proof whether results remain unchanged when the data is treated differently. Model (a) repeats the previous results of model (d) in table 3 for comparison.

The next column shows a regression where I merged the local and regional government in the four federal countries. Instead of 19 observations per year the dataset now consists out of 15, one for each included country. However, results remain unchanged and the main conclusions are as before.

As a last check, I estimate different coefficients for the local and regional level in federations. That means that $\mathbf{\Phi}$ now becomes the following:

$$\mathbf{\Phi}' = \begin{bmatrix} \Phi_1 \\ \Phi_2 \\ \Phi_3 \end{bmatrix} \text{ and } \begin{aligned} &= 1 \text{ if unitary country, 0 otherwise} \\ &= 1 \text{ if local level in a federal country, else 0} \\ &= 1 \text{ if regional level in a federal country, else 0} \end{aligned}$$

However, results (c) are in line with the previous findings. The signs and magnitude of coefficients for $tax_{(t-1)}$ are similar for the local and regional level. Rules remain insignificant in both cases.

Dependent Variable	Fixed Effects Panel Model		
Deficit/Revenues	(1)	(2)	(3)
Tax autonomy			
$tax_{(t-1)} * unitary$	0.195**	0.186*	0.194**
	(0.098)	(0.099)	(0.097)
$tax_{(t-1)} * federal$	-0.272***	-0.309*	
	(0.069)	(0.180)	
$tax_{(t-1)} * regional$			-0.300***
			(0.076)
$tax_{(t-1)} * local$			-0.332*
			(0.174)
Fiscal rules			
$rules * unitary$	-0.043***	-0.048***	-0.044***
	(0.014)	(0.016)	(0.014)
$rules * federal$	0.002	0.029	
	(0.014)	(0.023)	
$rules * regional$			0.016
			(0.017)
$rules * local$			-0.019
			(0.017)
Controls			
def_cg_rev	0.076**	0.120***	0.074**
	(0.036)	(0.039)	(0.037)
$edec$	0.214**	0.232**	0.200**
	(0.087)	(0.114)	(0.090)
$intexp\_rev$	-0.001	0.001	-0.001
	(0.007)	(0.010)	(0.007)
$outgap$	-0.000	-0.002	-0.000
	(0.002)	(0.002)	(0.002)
$unempl$	-0.047	-0.215	-0.059
	(0.209)	(0.242)	(0.210)
$trend$	0.005	0.002	0.006
	(0.007)	(0.009)	(0.007)
ln_pop_tot	0.520***	0.526**	0.514***
	(0.167)	(0.223)	(0.168)
$depratio$	-0.603*	-0.668*	-0.615*
	(0.331)	(0.392)	(0.340)
R^2	0.270	0.289	0.177
Number of Groups	19	15	19
Number of Observations	247	195	247
Robust standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Notes: Model (a): repetition of the estimation of model (d) in table 3 for comparison; Model (b): the local and regional level in federal countries are merged; Model (c): individual coefficients for the regional and local level in federal countries. All standard errors are robust to heteroskedasticity and autocorrelation (Newey-West).

Table 15: Separate coefficients for local and regional governments