Impact of Fiscal Decentralization on Fiscal Stance in EU: Real Deal or Econometric Illusion?

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Abstract

This paper aims to examine how cyclically-adjusted primary balance (CAPB) in EU countries responded to the expenditure and tax decentralization. We contribute to the literature by three important conclusions. First, estimation results indicate that CAPB positively responded to expenditure decentralization, and negatively responded to tax decentralization. Second, fiscal decentralization seems to be driven by the determinants exogenous to primary balance. Third, variables deemed as the "good" instruments in the existing literature fail to explain within variations of the fiscal decentralization indicators. We hypothesized that negative impact of tax decentralization on the primary balance is transmitted through the government revenues, but further research is needed to resolve this puzzle.

1. Introduction

Decentralization is broadly perceived as a process of transferring a range of powers, responsibilities and resources from the central government to elected subnational authorities, aiming to assure that subnational government structures acquire certain degree of autonomy vis-à-vis central government structures. (Borrett *et al*., 2021, OECD, 2019). The fiscal federalism, as a specific public finance issue dealing with decentralization of fiscal powers and responsibilities, has been introduced in the late 1950s by the works of Tiebout (1956) and Musgrave (1959). The initial view on the fiscal decentralization was uniformly optimistic; therefore, many decentralization reforms implemented in the twentieth century relied on the principles of the early fiscal federalism OECD, 2019).

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Practical experience and statistical evidence on decentralization reforms, accumulated over the last five decades, provides the solid ground for empirical scrutiny, with researchers and policymakers still discussing effects of decentralization on fiscal performance. Higher efficiency of the public services delivery is a frequently cited benefit of fiscal federalism, including better matching of services with local preferences, and improvements in allocative efficiency and accountability (Sow and Razafimahefa, 2015). Skeptical view on fiscal decentralization underscores that coordination failures between central and subnational governments are likely to result in subnational governments spending inefficiently and beyond their means (Thornton, 2009). The empirical evidence on association between fiscal decentralization and fiscal outcomes are mixed and seems to be affected by the scope of the sample, estimation methods and choice of decentralization measures. The proper selection of fiscal decentralization measures and issue of reverse causality between fiscal outcomes and decentralization makes econometric analysis on the subject particularly challenging.

The implications of fiscal decentralization are particularly important in the EU as a supranational entity with complex structures for policy making, spanning across all levels of government (Borrett, et al., 2021). Interestingly, only few papers examine association between fiscal decentralization and discretionary fiscal policy in EU countries (Afonso and Hauptmeier, 2009; Jílek, 2016).

Our study aims to scrutinize how fiscal stance in EU countries responded to the expenditure and tax decentralization over the period 1999-2019. More specifically, we aim to estimate basic association between fiscal stance and fiscal decentralization, and subsequently to scrutinize if variations in fiscal stance really cause variations in fiscal decentralization. The specification of empirical model utilizes concept of fiscal reaction function as a model-based approach to examine response of fiscal stance to fiscal decentralization. Regarding data availability, cyclically-adjusted primary balance is used as a measure of fiscal stance (structural balance would be better measure, but data are not available). Novelty in our approach reflects in efforts to assure exogeneity of fiscal decentralization measures within model specification, so that estimated association can be clearly interpreted as an impact of fiscal decentralization on fiscal stance.

The rest of the paper is organized as follows. The next section reviews theoretical and empirical literature on association between fiscal decentralization and fiscal outcomes. The third section shows some basic facts on fiscal decentralization measures and their association with cyclically-adjusted primary balance. Empirical strategy section presents the model specification and addresses econometric issues on its estimation. Results and discussion section gives the overview of the estimation results and discusses key empirical findings.

2. Literature review

Theoretical considerations on the fiscal decentralization and its effects can be roughly categorized into the so-called "first generation" and "second generation" theories of fiscal federalism (Oates, 2005; OECD, 2019). The first generation theory, grounded in early works on fiscal

federalism principles (Tiebout, 1956; Musgrave 1959) was formalized by the Decentralization Theorem (Oates, 1972), and concepts of fiscal equivalence (Olson, 1969) and revenue-maximizing Leviathan government (Brennan and Buchanan, 1980). The first generation theory suggests that in democratic system each government authority maximizes social welfare because of electoral pressures. Thus, decentralized system leads to provision of local public outputs tailored to the local demands, which results in higher social welfare than in a centralized system where the central government provides uniformly public output to all local jurisdictions (Oates, 2005). Detailed discussion about advantages and disadvantages of decentralization and centralization imposed by the first generation theory can be found in Boss (2012).

The second generation theory, emerging in the late 1990s, relaxed assumption on welfare-maximizing government authorities in favor of a more realistic setting of self-interested public agents making decisions under informational asymmetry constraints (Weingast; 1995; Seabright, 1996; Lockwood, 2002; Besley and Coate, 2003). The second generation theory has not questioned decentralization benefits, but challenged assumptions and implication of the first generation theory. For instance, the second generation theory stipulates that uniform provision of public goods is not a certain outcome in centralized system but depends on the legislature composition (Lockwood, 2002; Besley and Coate, 2003), and challenged the efficiency of decentralized spending in case of the soft budget constraints, when local governments rely heavily on transfers or bailouts from the central government (Weingast; 1995; Goodspeed, 2002; Goodspeed, 2017).

Despite the extensive theoretical considerations and country-specific analysis, only few studies provide cross-country evidence on fiscal decentralization (IMF, 2011). The works of De Mello (1999, 2000) and Fornasari *et al*. (2000) were among the first cross-country studies to analyze association between fiscal decentralization and fiscal balance. Empirical evidence in their studies supports skeptical views of the second generation theory about efficiency of decentralized spending. De Mello (1999, 2000) blamed coordination failures in intergovernmental fiscal relations to result in biased deficits, while Fornasari *et al*. (2000) suggested that soft budget constraints eventually increase the overall size of the government. Some latter cross-country studies also took a view that fiscal decentralization may undermine the public finances (Rodden, 2002; Darby *et al*, 2005; Wibbels and Rodden, 2005; Foremny, 2014).

In contrast to empirical findings that increase the skepticism on positive effects of fiscal decentralization, several studies conclude that decentralized spending improves (or at least does not worsen) fiscal balance (Baskaran, 2009; Neyapti 2010; Sow and Razafimahefa, 2017; Bartolini *et al*., 2018). However, things get less straightforward when effects of revenue decentralization are considered. For instance, Thornton (2009) did not find any proof that revenue decentralization affects fiscal balance while Baskaran (2009) suggests that a very high and a very low level of tax decentralization endangers public finance, while Neyapti (2010) concludes that revenue decentralization improves fiscal deficits. Some authors who examined cross-country association between fiscal decentralization and fiscal outcome opted for public debt instead of fiscal balance (Baskaran, 2010; Horváthová *et al*., 2012). Their results mostly correspond to findings that spending decentralization is beneficial for fiscal solvency, while impact of revenue decentralization is inconclusive.

It is known that a scope of sample or methods of econometric estimation can influence estimation output. Nevertheless, previous discussion shows that choice of fiscal decentralization measure can also affect the results. Assessing the degree of fiscal decentralization should take into account the transfer of taxing and spending responsibilities to the subnational governments, addressing both quantitative measures (share of subnational revenues or expenditures) and qualitative indicators (independence in deciding on spending priorities or taxation rates of own revenues) (Borrett *et al.*, 2021). Subsequently, adequate measure of fiscal decentralization should make clear distinction between those revenues and expenditures under the effective control of the central government and subnational governments, but limited availability of data on such indicators forces researchers to rely on quantitative measures (Martínez-Vázquez and McNab, 2006). Review of the studies indicates that most of the cited authors tend to add qualitative dimension (revenue autonomy) when dealing with the revenue decentralization, through decomposition of the subnational revenues into central government transfers and own revenues (fees, autonomous taxes, shared taxes). On the other hand, total of subnational expenditures usually appears as a sole measure of spending decentralization. Some authors (e.g., Sow and Razafimahefa, 2017) also use the so-called indicator of vertical fiscal imbalance, which shows how much of the subnational expenditures are covered by the own revenues. Detailed overview on the variety of fiscal decentralization indicators can be found in Borrett *et al.* (2021).

The most of the existing cross-country studies deal with the samples of OECD countries (Thornton 2009; Baskaran, 2009; Bartolini *et al.*, 2018) or some mix of developed and emerging/developing countries (De Mello, 1999, 2000; Neyapti, 2010; Sow and Razafimahefa, 2017). Regarding the scope of the countries (EU), but also the model specification, our work is closest to the studies of Afonso and Hauptmeier (2009) and Governatori and Yim (2012). Afonso and Hauptmeier (2009) estimated the EU cross-country fiscal reaction function over the period 1990-2005 and concluded that expenditure decentralization leads to higher primary spending and worsening of the primary balance, especially when the public debt is very high. Governatori and Yim (2012) come to the opposite finding that expenditure decentralization per se appears to be associated with the improved primarily balance in the EU countries over the period 1995-2010. This may seem puzzling at the first sight, as both studies deal with the same sample of countries (EU 27), source of data (Eurostat), model specification (FRF), even the same estimation method (LSDVC). However, it should be noted that Governatori and Yim (2012) kept simultaneously expenditure and revenue decentralization on the RHS of equation, as well as a several interactions between expenditure decentralization and indicators of subnational revenue structure. Regarding revenue decentralization, Governatori and Yim (2012) found strong evidence that own revenues had an adverse effect on the primary balance.

In most of the reviewed papers, including studies of Afonso and Hauptmeier (2009) and Governatori and Yim (2012), the authors took exogeneity of the fiscal decentralization measures as granted. However, from the reasons later discussed in this paper fiscal decentralization may be endogenous within model specification with fiscal outcome as a dependent variable. Without clear insight about exogeneity of fiscal decentralization, estimated associations with fiscal outcomes cannot be interpreted in terms of causality directions. Our research basically leans on the study by Governatori and Yim (2012), but we shift the focus from the

interaction between structure of subnational finance and decentralization to the issue of fiscal decentralization determinants and causality direction of its association with primary balance.

3. Stylized facts

To keep focus on elementary relations between fiscal decentralization and fiscal stance, we opt for the three basic measures of fiscal decentralization, defined at the subnational government level as the following:

— Expenditure decentralization (sng_exp_dec) - ratio between subnational local government expenditure (sng_exp) and general government expenditure (gg_exp).

— Revenue decentralization (sng_rev_dec) - ratio between subnational local government revenues (sng_rev) and general government revenue (gg_rev).

— Tax decentralization (sng_tax_dec) - ratio between subnational local government tax revenue (sng_tax) and general government tax revenue (gg_tax).

The major descriptors on the expenditures, revenues, taxes, and decentralization measures are displayed in Table 1.

Table 1
DESCRIPTIVE STATISTICS ON FISCAL VARIABLES AND DECENTRALIZATION MEASURES, 1999-2019

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Expenditures					
Total general government expenditure (gg_exp)	588	44.64	6.45	24.50	65.10
Subnational local government expenditure (sng_exp)	588	12.25	7.53	0.40	35.90
Expenditure decentralization (sng_exp_dec)	588	26.77	14.54	1.14	66.34
Revenues					
Total general government revenue (gg_rev)	588	42.29	6.30	25.00	56.70
Subnational local government revenue (sng_rev)	588	12.09	7.39	0.50	35.90
Revenue decentralization (sng_rev_dec)	588	27.62	14.32	1.30	66.11
Taxes					
Total general government tax revenue (gg_tax)	588	25.03	6.39	15.30	49.60
Subnational local government tax revenue (sng_tax)	567	4.02	3.86	0.30	15.20
Tax decentralization (sng_tax_dec)	567	14.95	12.49	1.26	52.28

Source: Author's calculations based on Eurostat data.

Note: Missing data on subnational taxes for 1999.

Two important insights stem from the descriptive statistics. First, sizable standard deviations and variation ranges indicate presence of possible outliers in subnational government

and decentralization measures. Second, descriptors on the expenditures, revenues and respective decentralization measures are quite close. Closer look in the data at country level confirms that outliers are really present, but nothing to worry about. The small EU countries in the sample (Malta, Cyprus) are responsible for outliers on the lower spectrum of data range. The Nordic countries with strong social spending (especially Denmark), and countries with state governments (especially Belgium and Spain), cause outliers on the upper spectrum.
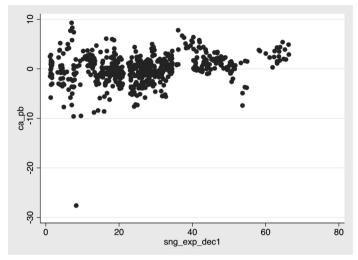
The similarity of the expenditure and revenue descriptors indicates possible issue with high co-linearity, which is apparently the reason to worry about. Table 2 displays pooled correlation coefficients among expenditures, revenues, and taxes, grouped with respect to level of government and measure of decentralization. Correlation between expenditures and revenues at the level subnational government is almost perfect. It is less surprising, as the gaps between expenditures and own revenues at the local level are more likely to be closed by subsidies from central government than borrowing. What is more surprising, high correlation between expenditures and revenues at the local level is fully translated into expenditure and revenue decentralization measures. Such a high correlation has a straightforward implication –keeping both expenditure and revenue decentralization measures into further analysis is useless. Therefore, we continue analysis considering only expenditure and tax decentralization measures.

Table 2
CORRELATION MATRIX OF EXPENDITURES, REVENUES AND TAXES

Gross government	Total general government expenditure (gg_exp)	Total general government revenue (gg_rev)	Total general government tax revenue (gg_tax)
Total general government expenditure (gg_exp)	1		
Total general government revenue (gg_rev)	0.8516	1	
Total general government tax revenue (gg_tax)	0.5822	0.7731	1
Subnational government	Subnational local government expenditure (sng_exp)	Subnational local government revenue (sng_rev)	Subnational local government tax revenue (sng_tax)
Subnational local government expenditure (sng_exp)	1		
Subnational local government revenue (sng_rev)	0.9974	1	
Subnational local government tax revenue (sng_tax)	0.823	0.8248	1
Fiscal decentralization	Expenditure decentralization (sng_exp_dec)	Revenue de-centralization (sng_rev_dec)	Tax decentralization (tax_dec)
Expenditure decentralization (sng_exp_dec)	1		
Revenue decentralization (sng_rev_dec)	0.9907	1	
Tax decentralization (sng_tax_dec)	0.6943	0.6949	1

Source: Author's calculations based on Eurostat data.

Figure 1
CYCLICALLY-ADJUSTED PRIMARY BALANCE VIS-À-VIS
EXPENDITURE DECENTRALIZATION

Source: Author's calculations based on Eurostat and AMECO data.

Note: CAPB outlier around -30 is accounted in 2010 for Ireland during the European sovereign debt crisis.
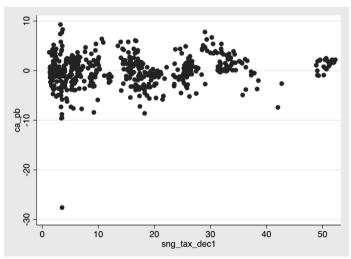
Figure 2
CYCLICALLY-ADJUSTED PRIMARY BALANCE VIS-À-VIS
TAX DECENTRALIZATION

Source: Author's calculations based on Eurostat and AMECO data.

Note: CAPB outlier around -30 is accounted in 2010 for Ireland during the European sovereign debt crisis.

Scattering two variables, assumed to be associated, gives the first insight into validity of this assumption. Figure 1 displays scatterplot of the cyclically-adjusted primary balance (y-axis) and expenditure decentralization (x-axis). Opposite to suggestions from the most of the reviewed empirical studies on significant linear impact of fiscal decentralization on the fiscal balance, scatterplot does not indicate any kind of straightforward relation between CAPB and expenditure decentralization.

The same is observed when CAPB is paired with tax decentralization, as displayed in Figure 2. Dispersion pattern in both figures is very similar: data points randomly fluctuate around zero, regardless of the size of fiscal decentralization. The only useful information that comes from the scatter is indication of heteroskedasticity, as the range of fluctuations is getting narrow with the increase in fiscal decentralization. However, scatterplot cannot be substitute to the rigorous econometric analysis, especially when the dependent variable is arguably determined by intertwining impacts of many factors, as in case of primary balance.

4. Empirical strategy

Following the objective of the paper, we propose two-step modeling approach. In the first step, we set empirical specification of the fiscal reaction function and discuss how FRF specification affects reliability of econometric estimation. In the second step, we opt for fiscal decentralization determinants that can be used as the instruments under assumption that fiscal decentralization is endogenous variable in FRF specification. Overall, we try to make econometric analysis rigorous as much as possible in order to obtain reliable results.

4.1. Specification of fiscal reaction function

Fiscal reaction function, as a model-based framework for fiscal policy assessment, has its roots in the works of Barro (1979, 1986) on tax-smoothing hypothesis, which implies that that fiscal policy decisions should be driven by the permanent component of expenditure and output[1]. This concept was formalized by Bohn (1998), who specifies fiscal reaction as a function of primary balance' response to public debt, after controlling for one-off government spending and GDP fluctuations. The latter empirical work shifted focus of fiscal reaction modeling to primary balance' response to output fluctuations, estimating whether fiscal decision makers implement pro-cyclical or counter-cyclical fiscal policy. Galí and Perotti (2003) were among the first researches who warn that actual primary balance is not always the good approximation of fiscal policy stance, as automatic adjustments to GDP fluctuations may be large when compared to discretionary value of balance.

The theoretical underpinnings of the FRF are quite straightforward: the responsible fiscal policy stance is characterized by debt-stabilizing (positive response of fiscal balance to accumulated debt) and counter-cyclical (positive response of fiscal balance to output gap) response of discretionary fiscal policy. From this follows that lagged value of debt and output

gap are the key explanatory variables in the model of fiscal reaction function. Typical empirical specification of the FRF reads as (Celasun, *et al.* (2006); Medeiros, 2012):

$$pb_{it} = \alpha + \rho pb_{it-1} + \gamma_1 d_{it-1} + \gamma_2 og_{it} + X_{it}\delta + u_{i,t}, \tag{1}$$

where

pb_{it} is a primary balance to GDP ratio;

d_{it-1} is a lagged debt to GDP ratio;

og_{it} is an estimated output gap as a share of potential GDP;

X_{it} is a vector of control variables;

u_{it} is a random error.

Estimated value of regression coefficients allows straightforward interpretation of fiscal policy behavior with respect to responsibility and economic cyclicality: if $\gamma_1 > 0$, fiscal policy is responsible; if $\gamma_2 > 0$, fiscal policy is counter-cyclical. However, we are not directly interested to test standard assumptions about the nature of the discretionary fiscal policy. In line with our research objective, a measure of fiscal decentralization was added as a variable of interest in our FRF model, which leads to the following FRF specification:

$$pb_{it} = \alpha + \rho pb_{it-1} + \beta f d_{it} + \gamma_1 d_{it-1} + \gamma_2 og_{it} + X_{it}\delta + u_{i,t}. \tag{2}$$

Following the empirical studies on FRF estimation and impact of fiscal decentralization of fiscal balance (for instance, Baskaran, 2009; Thornton, 2009; Abiad and Ostry, 2005, Gosh *et al.*, 2011, Medeiros, 2012; Everaert and Jansen, 2017), but also the economic intuition, we considered large number of macroeconomic, demographic, political and institutional variables to optimize choice of control variables. We started with opting for macroeconomic variables to come up with the next set of proposed macroeconomic controls: GDP per capita in PPP (*gdp_ppp*), HICP (*hicp*), trade openness (*tr_op*), 10-year interest rate (*ir_10*), and business investments (*bi*). The business investments[2] are not the variable typically found among controls in existing literature, but intuition implies that it may be useful addition to output gap in capturing effects of economic cyclicality. We included two demographic controls, population size (*pop*) (Baskaran, 2009) and age-dependency ratio (*adr*) (Everaert and Jansen, 2017). Regarding political and institutional factors, we included parliamentary election cycle (*par_e*) (Afonso, 2008; Afonso and Hauptmaier, 2009; Turini, 2008), fiscal rule index (*fri*) (EC, 2011; Medeiros, 2012), dummy if country was in financial crisis (*fin_cr*) (Thornton, 2009), dummy if country was a part of EMU (*emu*) (Everaert and Jansen, 2017), and Government Effectiveness Index (*gov_ef*). The GFI is also not typical control in FRF estimation, but we consider it important to capture impact of institutional aspects on discretionary fiscal policy.

Celasun, *et al.* (2006) point that FRF specification as in equation (1) brings about three sources of potential endogeneity. First, if capacity to generate primary balance is time-in-

variant and differs across countries, lagged debt will be correlated to random error. Second, if policy shocks are autocorrelated, lagged debt will be still correlated to random error even when individual country effects are removed. Third, output gap may be endogenous to the contemporaneous fiscal policy shocks. Thus, the pooled OLS estimator is likely to produce the inconsistent estimations of the FRF. The situation is getting even more complicated when fiscal decentralization enters the FRF specification. Regarding the way in which expenditure and tax decentralization are measured, economic intuition tells that fiscal decentralization may be simultaneously affected by the primary balance; subnational expenditures and taxes are components of the total government expenditures and taxes, and government expenditures and taxes appear as denominators of the respective subnational items in computation of fiscal decentralization measures. In addition, the possible presence of the heterogeneity, autocorrelation and panel correlation in model errors should be kept in mind as additional concerns for econometric estimation.

4.2. Instrumentalization of the fiscal decentralization measures

As we saw, running pooled OLS panel regression to quantify impact of fiscal decentralization on fiscal stance would probably lead to unreliable estimates and inference due to endogeneity issues. Endogeneity enters into the pooled regression through at least unobserved heterogeneity and perhaps revers causality. While unobserved heterogeneity gets easy to solve (with no other explanatory variables in the model) by using estimators that threat individual effects, reverse causality is much harder to handle as it requires instrumentalization of the endogenous variable.

Assuming that instruments are available, proper way to address revers causality would be used in two-step estimation approach

$$fd_{it} = \alpha_0 + \sum_{j=1}^{L} \alpha_j z_{it,j} + \epsilon_{it}; \tag{3}$$

$$pb_t = \beta_0 + \beta_1 \widehat{fd_{it}} + \varepsilon_{it}. \tag{4}$$

where fd_{it} is a measure of fiscal decentralization, pb_t is a measure of primary balance, and $z_{it,j}$ is a vector of fiscal decentralization determinants used as instruments.

The major issue in any kind of modeling based on IV approach is how to find good instruments. As theory implies, good instrument should have two properties: to be correlated with endogenous variable and not-correlated to the model error. Considering that main source of endogeneity in this case is reverse causality, good instruments should be those which are arguably not affected by the variations in fiscal balance, but have significant impact on fiscal decentralization. It further implies that fiscal variables should not be considered as instruments. Instead, good instruments would be those determined by political, institutional, geographic, or socio-economic, demographic factors or other macroeconomic variables not primarily driven by fiscal factors.

Following the discussion about fiscal decentralization endogeneity and a review of the empirical literature, we selected a couple of variables considered to significantly affect fiscal decentralization. First, the variables measuring size of the country are considered significant because larger countries generally tend to be more decentralized. Country size is typically instrumented by the land area (Canavire-Bacarreza *et al.*, 2019) or population size (Sow and Razafimahefa, 2015; 2017). Land area and population in EU countries are expectedly positively correlated (pooled correlation coefficient is 0.74), so we decided to use only land area as an instrument. We also produced variable municipality size calculated as a ratio between population and number of municipalities. Use of municipality size as an instrument has its advantage; it is not correlated to country size (pooled coefficient is -0.02) and contains information on both population size and territorial organization of the country. Regarding other fiscal decentralization determinants that combine information on geographic and population, some authors propose Geographic Fragmentation Index (Canavire-Bacarreza *et al.*, 2019) or Ethnic Fractionalization Index (Pickard, 2020). Since data on those variables are beyond our reach, we chose urban population, which appears as a significant determinant of FD (Bojanic, 2020), but arguably not affected by primary balance.

Finding an adequate macroeconomic instrument is especially challenging, since conjecture that fiscal balance does not affect certain macroeconomic variable could barely support theoretical or empirical validation. Therefore, we chose only trade openness found by Bojanic (2020) to have significant impact on fiscal decentralization. While association between fiscal and current account is well-known in economics (twin deficits) and confirmed in many studies, we are not aware of any research that suggests significant impact of fiscal balance on trade openness. However, openness is negatively related to country size, as large countries benefit from sizable markets which reduces their needs for international trade (Alesina and Wacziarg, 1997). Indeed, pooled correlation between openness and country size in our sample is -0.82. Therefore, we used first difference of the openness as an instrument.

The next set of instruments is chosen amongst political determinants of fiscal decentralization. Sow and Razafimahefa (2015, 2017) point out that higher government or legislative fractionalization may either accelerate or act against the decentralization process, depending on political motives. We used variables index of legislative fractionalization (Rae, 1968) and type of government, both from the CPDS database. The former measures concentration of seats by parties in the parliament (0 - minimal, 1 maximal fractionalization). Type of government is categorical variable indicating strength of the political support to the government, going from 1 (single-party majority government) to 7 (technocratic government).

Beside the type of government, two more variables were also included which depicts government characteristics. The first one is categorical variable degree of federalism in political system (0 = no federalism, 1 = weak federalism, 2 = strong federalism), also retrieved from the CPDS database. This variable is considered important to control countries that have federal states and subsequently two tiers of subnational expenditures and revenues (Austria, Belgium, Germany and Spain). Eventually, we add Government Effectiveness Index of the World Bank (ranging from -2.5 to 2.5), following the idea that government effectiveness is positively associated with decentralization.

5. Results and discussion

We start analysis by what we called the type I of FRF estimation, meaning that primary balance is used as a measure of fiscal stance, and the issue of fiscal decentralization endogeneity is utterly neglected. Three estimation methods are applied to estimate equation (2): Fixed Effects OLS, Panel-corrected standard errors LSDV, and 2-step IV-GMM. The FE is considered as the benchmark estimation, being consistent even if individual effects are correlated to model errors. The Panel-Corrected SE LSDV[3] estimator is used to correct covariance matrix of standard errors for very probable cross-sectional dependency and autocorrelation. In IV estimation, lagged debt and output gap are instrumentalized by the third leg of debt, second leg of output gap, growth rate of GDP pc in PPP, and first difference of 10-year interest rates.[4] Instead of standard 2SLS IV approach, we used 2-step HAC[5] consistent IV-GMM estimator following the suggestion of Baum *et al.* (2007), that the resulting GMM estimates will be more efficient than those produced by IV. We included the first lag of primary balance in all model specifications, which rises the Nickell bias. Regarding our sample and estimation results, Nickell bias is likely around 7% (approximately $-(1 + \rho)/(T - 1)$). However, we are not particularly interested in precise estimation of the ρ coefficient, thus, dynamic panel estimators were not used. We considered time dimension of the sample too short to run unit root tests. Instead, it was assumed that all macroeconomic and demographic control variables are non-stationary, therefore they were transformed into growth rates or the first differences.[6] Regression results are displayed in Table 3.

Table 3
FRF TYPE I - FULL ESTIMATION RESULTS

	Expenditure decentralization			Tax decentralization		
	FE OLS	PCSE LSDV	FE IV-GMM	FE OLS	PCSE LSDV	FE IV-GMM
Primary balance, first lag (L.pb)	0.5099*** (0.0510)	0.4674*** (0.1188)	0.5080*** (0.0679)	0.4801*** (0.0452)	0.4339*** (0.1295)	0.4617*** (0.0631)
Expenditure decentralization (sng_exp_dec)	0.1300** (0.0511)	0.1708 (0.1224)	0.2078*** (0.0493)			
Tax decentralization (sng_tax_dec)				-0.2276*** (0.0681)	-0.2626*** (0.0620)	-0.2589*** (0.0520)
Government debt, first lag (L.gg_d)	0.0622*** (0.0106)	0.0703*** (0.0193)	0.0956*** (0.0139)	0.0552*** (0.0104)	0.0603*** (0.0197)	0.0851*** (0.0127)
Output gap (og)	0.1127* (0.0602)	0.1352 (0.0973)	0.1760*** (0.0584)	0.0773 (0.0717)	0.0958 (0.1071)	0.1495** (0.0616)
GDP per capita, first diff. (D.l_gdp_ppp)	0.0735* (0.0417)	0.0641 (0.0798)		0.0798* (0.0402)	0.0805 (0.0834)	
HICP, firt diff. (D.l_hicp)	0.0226 (0.1286)	0.0453 (0.1068)	0.1032 (0.0974)	0.0985 (0.1635)	0.0804 (0.1146)	0.1891 (0.1161)
Trade openness, first diff. (D.tr_op)	0.0124 (0.0274)	0.0091 (0.0235)	-0.0049 (0.0218)	0.0031 (0.0327)	-0.0037 (0.0265)	-0.0147 (0.0233)
Interest rate, first diff. (D.ir_10)	0.0805 (0.0959)	0.1086 (0.1304)		0.0699 (0.0981)	0.1169 (0.1333)	

(Continued)

	Expenditure decentralization			Tax decentralization		
	FE OLS	PCSE LSDV	FE IV-GMM	FE OLS	PCSE LSDV	FE IV-GMM
Business investments, first diff (D.BI)	0.2628***	0.2673	0.3483***	0.2434***	0.2540	0.3383***
	(0.0528)	(0.1945)	(0.1000)	(0.0544)	(0.2028)	(0.0979)
Population, first diff. (D.l_pop)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Age dependency ratio, first diff. (D.adr)1	-0.3692	-0.4281	-0.5241***	-0.3403	-0.5647	-0.4871**
	(0.2953)	(0.3958)	(0.2013)	(0.3388)	(0.4301)	(0.2239)
Parliamentary elections (par_e)	-0.0019	-0.0019	-0.0007	-0.0017	-0.0018	-0.0003
	(0.0023)	(0.0022)	(0.0018)	(0.0024)	(0.0023)	(0.0018)
Fiscal rule index (fri)	0.0010	0.0019	-0.0005	0.0017	0.0024	0.0005
	(0.0017)	(0.0025)	(0.0013)	(0.0019)	(0.0025)	(0.0014)
Government Effectiveness (gov_ef)	0.0150*	0.0166	0.0197***	0.0131**	0.0104	0.0169***
	(0.0078)	(0.0106)	(0.0067)	(0.0053)	(0.0096)	(0.0060)
Financial crises (fin_cr)	-0.0078**	-0.0095**	-0.0101***	-0.0106***	-0.0110***	-0.0133***
	(0.0032)	(0.0041)	(0.0024)	(0.0036)	(0.0041)	(0.0028)
Countries members of EMU (emu)	-0.0040	-0.0069	-0.0066	-0.0021	-0.0005	-0.0043
	(0.0033)	(0.0044)	(0.0042)	(0.0038)	(0.0052)	(0.0044)
St. err. robust to	HS	HS, AC and panel CSD	HS and AC	HS	HS, AC and panel CSD	HS and AC
Underid.			63.427***			62.115***
Weak id.			32.166*			33.723*
Overid.			6.897**			8.602***
Orthog.			5.028**			8.150***
Endog.			9.416***			8.244**
No. of Obs.	463	463	463	463	463	463
R-Squared	0.60	0.70	0.57	0.60	0.68	0.58

Notes: FRF type I: Dependent variable –non-adjusted primary balance, fiscal decentralization is not instrumented.

Standard errors in parenthesis.

* if $p<0.1$, ** if $p<0.05$, *** if $p<0.01$, except for weak id. test.

Estimated coefficients for country dummies in PCSE LSDV omitted.

HS - heteroskedasticity, AC - autocorrelation, CSD - cross-sectional dependency.

IV-GMM estimation:

Underid- Kleibergen-Paap rk LM underidentification test (H0: instruments are not relevant); Weak id. - Stock-Yogo weak ID test (* if 5% maximal bias to OLS is not rejected according to Kleibergen-Paap rk Wald F statistic); Overid. - Hansen J overidentification test of all instruments (H0: overidentifying restrictions are valid); Orthog. - C test of fiscal decentralization indicator exogeneity (H0: suspect variables are orthogonal); Endog. - Endogeneity test of lagged debt and output gap (H0: suspect variables are not endogeneous).

Excluded instruments: third leg of debt, second leg of output gap, growth rate of GDP pc in PPP, and first difference of 10-year interest rates.

Subsequently, the same set of regression equations was re-estimated using cyclically-adjusted balance as a measure of fiscal stance, but ignoring the potential endogeneity of fiscal

decentralization. Results of this estimation, denoted as FRF type II, are shown in Table 4. When results in both tables are compared, estimation results are remarkably similar. Expenditure decentralization is found to be positively associated with improvement in primary result of government operations, regardless of what is measured (non-adjusted or adjusted primary balance). This association remains robust across estimation methods, although PCSE estimates do not indicate significance of association. Opposite to expenditure decentralization, estimated association between tax decentralization and primary balance is inverse.

For the moment, we will put aside discussion of this puzzling result to further scrutinize reliability of the model specification and estimated results. Since large number of control variables appears in the model and individual effects are removed in all estimations, omitted variable can be disregarded as a potential issue of estimation bias. The FE and PCSE estimates do not provide useful information on validity of model specification, except that estimates are robust to heteroskedsticity, autocorrelation and panel correlations. On the other hand, post estimation tests of IV-GMM estimates give some additional insights on the endogeneity issues. First, lagged debt and output gap are properly treated as endogenous. This is in line with expectation since primary balance and output gap are simultaneously determined by the cyclical fluctuations of output, thus indicating that test of endogeneity works well. Second, selected instruments are relevant but validity of overidentifyng restriction are questioned in FRF regressions type I. Third, fiscal decentralization measures do not pass orthogonality test in FRF type I, but appears exogenous in FRF type II, most likely because simultaneous impact of economic cyclicality on fiscal stance and fiscal decentralization declines when structural measure of fiscal stance is used. Overall, FRF type II seems to be properly specified and estimated using IV-GMM estimator, for both measures of fiscal decentralization.

Table 4
FRF TYPE II - FULL ESTIMATION RESULTS

	Expenditure decentralization			Tax decentralization		
	FE OLS	PCSE LSDV	FE IV-GMM	FE OLS	PCSE LSDV	FE IV-GMM
Primary balance, first lag (L.pb)	0.5269*** (0.0512)	0.5116*** (0.1213)	0.5181*** (0.0653)	0.5014*** (0.0465)	0.4894*** (0.1327)	0.4898*** (0.0625)
Expenditure decentralization (sng_exp_dec)	0.1023** (0.0464)	0.1316 (0.1197)	0.1283** (0.0498)			
Tax decentralization (sng_tax_dec)				-0.2186*** (0.0600)	-0.2361*** (0.0598)	-0.2452*** (0.0527)
Government debt, first lag (L.gg_d)	0.0517*** (0.0101)	0.0590*** (0.0196)	0.0684*** (0.0139)	0.0469*** (0.0095)	0.0515** (0.0204)	0.0648*** (0.0119)
Output gap (og)	-0.1765*** (0.0595)	-0.1759** (0.0741)	-0.2007*** (0.0475)	-0.2170*** (0.0669)	-0.2215*** (0.0821)	-0.2388*** (0.0503)
GDP per capita, first diff. (D.l_gdp_ppp)	-0.0034 (0.0410)	-0.0112 (0.0789)		0.0052 (0.0382)	0.0068 (0.0813)	
HICP, firt diff. (D.l_hicp)	0.1230 (0.1263)	0.1396 (0.1033)	0.1922** (0.0904)	0.1858 (0.1557)	0.1730 (0.1117)	0.2763** (0.1088)
Trade openness, first diff. (D.tr_op)	-0.0148 (0.0286)	-0.0167 (0.0213)	-0.0272 (0.0200)	-0.0213 (0.0325)	-0.0258 (0.0241)	-0.0373* (0.0217)

(Continued)

	Expenditure decentralization			Tax decentralization		
	FE OLS	PCSE LSDV	FE IV-GMM	FE OLS	PCSE LSDV	FE IV-GMM
Interest rate, first diff. (D.ir_10)	0.1060 (0.1014)	0.1393 (0.1213)		0.0967 (0.1022)	0.1432 (0.1238)	
Business investments, first diff (D.BI)	0.2853*** (0.0598)	0.2933 (0.1971)	0.2848*** (0.0951)	0.2679*** (0.0597)	0.2780 (0.2038)	0.2820*** (0.0908)
Population, first diff. (D.l_pop)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000* (0.0000)
Age dependency ratio, first diff. (D.adr)	-0.4019 (0.2764)	-0.3996 (0.3626)	-0.4834** (0.1902)	-0.3600 (0.3162)	-0.4977 (0.4020)	-0.4566** (0.2072)
Parliamentary elections (par_e)	-0.0024 (0.0022)	-0.0024 (0.0021)	-0.0020 (0.0017)	-0.0022 (0.0023)	-0.0023 (0.0022)	-0.0017 (0.0017)
Fiscal rule index (fri)	0.0013 (0.0017)	0.0017 (0.0024)	0.0004 (0.0012)	0.0019 (0.0018)	0.0022 (0.0025)	0.0011 (0.0013)
Government Effectiveness (gov_ef)	0.0136* (0.0071)	0.0150 (0.0096)	0.0149** (0.0065)	0.0120** (0.0050)	0.0097 (0.0087)	0.0137** (0.0057)
Financial crises (fin_cr)	-0.0074** (0.0032)	-0.0092** (0.0038)	-0.0096*** (0.0022)	-0.0098*** (0.0034)	-0.0105*** (0.0038)	-0.0127*** (0.0026)
Countries members of EMU (emu)	-0.0026 (0.0032)	-0.0054 (0.0042)	-0.0018 (0.0043)	-0.0011 (0.0035)	-0.0004 (0.0050)	-0.0002 (0.0044)
St. err. robust to	HS	HS, AC and panel CSD	HS and AC	HS	HS, AC and panel CSD	HS and AC
Underid.			63.248***			62.653***
Weak id.			36.234*			37.378*
Overid.			1.394			1.400
Orthog.			0.000			0.702
Endog.			8.724**			8.756**
No. of Obs.	463	463	463	463	463	463
R-Squared	0.54	0.69	0.53	0.55	0.67	0.54

Notes: FRF type I: Dependent variable –cyclically-adjusted primary balance, fiscal decentralization is not instrumented.

Standard errors in parenthesis.

* if p<0.1, ** if p<0.05, *** if p<0.01, except for weak id. test.

Estimated coefficients for country dummies in PCSE LSDV omitted.

HS - heteroskedasticity, AC - autocorrelation, CSD - cross-sectional dependency.

IV-GMM estimation:

Underid- Kleibergen-Paap rk LM underidentification test (H0: instruments are not relevant); Weak id. - Stock-Yogo weak ID test (* if 5% maximal bias to OLS is not rejected according to Kleibergen-Paap rk Wald F statistic); Overid. - Hansen J overidentification test of all instruments (H0: overidentifying restrictions are valid); Orthog. - C test of fiscal decentralization indicator exogeneity (H0: suspect variables are orthogonal); Endog. - Endogeneity test of lagged debt and output gap (H0: suspect variables are not endogeneous);

Excluded instruments: third leg of debt, second leg of output gap, growth rate of GDP pc in PPP, and first difference of 10-year interest rates.

Statistical evidence is shown that upholds exogeneity of the fiscal decentralization measures in FRF type II specification. Is fiscal decentralization really exogenous or it is only statistical illusion? The exogeneity assumption in the FRF model imposes that fiscal decentralization is determined by the variables arguably beyond the impact of discretionary fiscal policy. We have previously chosen set of variables as the potential instruments to run the first-step regression. Before econometric estimation of the first-step regression, we checked correlation between instruments looking for potential high co-linearity. As common knowledge suggests, high co-linearity between regressors does not disrupt overall explanatory power of the model, but may distort the precision and significance of the estimated individual regression coefficients. The former implies that high co-linearity is not a matter of concern to get unbiased prediction of the dependent variable. However, getting precise estimation of the regression coefficients is important to do the logical check of the model validity, i.e. to see if the estimation yields coefficients that are consistent with prior expectations. While correlation matrix is not a perfect substitute to the rigorous co-linearity tests, it gives the hint if the problems with high co-linearity can be expected. Correlation matrix of potential instruments, displayed in Table 5 in the Appendix, does not indicate that any pair of the variables is highly correlated, therefore high co-linearity does not appear as a matter of concern prior to running regression.

Table 5
CORRELATION MATRIX OF FISCAL DECENTRALIZATION INSTRUMENTS

	l_area	l_mun_size	urb_pop	D.tr_op	gov_type	rae_leg	fed	gov_ef
l_area	1							
l_mun_size	0.1063	1						
urb_pop	-0.0151	0.2608	1					
D. tr_op	-0.1248	-0.0102	-0.0086	1				
gov_type	0.0985	0.1572	0.1026	0.0453	1			
rae_leg	-0.3329	0.1084	0.2363	0.0424	0.297	1		
fed	0.1894	-0.1316	0.3029	-0.0308	-0.0164	0.1102	1	
gov_ef	-0.1113	0.1601	0.5914	-0.005	0.0066	0.2372	0.2365	1

Source: Author's calculations based on Eurostat data.

Note: l_area‑logged land area in sq. km; l_mun_size‑logged municipality size; urb_pop‑urban population; D. tr_op‑first difference of openness; gov_type‑government type; rae_leg‑index of legislative fractionalization; fed‑degree of federalism; gov_ef‑Government Effectiveness Index.

We estimated the first-step regression using pooled OLS and FE OLS estimator. For instance, Canavire-Bacarreza *et al*. (2019) proposed the use of pooled OLS to address endogeneity issue of fiscal decentralization regarding low time variance of geographic determinants. However, we consider that ignoring individual effects may lead to the rise of the omitted variable bias. To simply illustrate this point, it is assumed that fiscal decentralization is determined by two variables, one that varies over time, and other that is unobserved and time invariant. As the time invariant determinant of fiscal decentralization is possibly correlated to individual effects in second-step equation, unobserved heterogeneity will make fiscal de-

centralization endogenous when regression is estimated using pooled estimator even if time variations are properly instrumented in the first step.

Table 6 shows result of the first-step estimation. When results of the pooled regression are considered, everything seems to be all right. Proposed instruments seem to impressively explain 69% of variations in expenditure decentralization and 54% of the tax decentralization. Estimated coefficients are in line with expectations: larger land area, higher share of urban population, more fractionalized and efficient governments, more fractionalized legislation, and higher federalism are positively associated with fiscal decentralization. The only exemption is negative association between municipality size and tax decentralization, which may be the consequence of some sort of asymmetric allocation of local non-tax revenues in favor of larger municipalities discouraging their tax efforts. Negative relation of trade openness to fiscal decentralization may look counterintuitive, but it has already been mentioned that smaller countries, usually less decentralized, tend to be more open.

Table 6
FIRST-STEP REGRESSION RESULTS

	Expenditure decentralization		Tax decentralization	
	Pooled OLS	FE OLS	Pooled OLS	FE OLS
l_area	0.0348***	-0.8137*	0.0519***	0.2927
	(0.0022)	(0.3982)	(0.0029)	(0.3137)
l_mun_size	0.0112***	-0.1495	-0.0207***	0.0892
	(0.0037)	(0.1728)	(0.0030)	(0.0618)
urb_pop	0.1349***	-0.3642*	0.1182**	-0.1120
	(0.0369)	(0.2013)	(0.0466)	(0.1558)
D.tr_op	-0.0806*	-0.0399	0.0004	-0.0198
	(0.0420)	(0.0330)	(0.0500)	(0.0149)
gov_type	0.0284***	0.0025	0.0112***	0.0005
	(0.0033)	(0.0015)	(0.0032)	(0.0009)
rae_leg	0.2393***	-0.0095	0.2537***	0.0180
	(0.0340)	(0.0425)	(0.0437)	(0.0371)
fed	0.0754***	0.0000	0.0519***	0.0000
	(0.0051)	(.)	(0.0082)	(.)
gov_ef	0.0598***	-0.0139	0.0451***	0.0036
	(0.0079)	(0.0238)	(0.0081)	(0.0189)
No. of Obs.	532.00	532.00	513.00	513.00
R-Squared	0.69	0.11	0.54	0.05

Note: l_area - logged land area in sq. km; l_mun_size - logged municipality size; urb_pop - urban population; D. tr_op - first difference of openness; gov_type - government type; rae_leg - index of legislative fractionalization; fed - degree of federalism; gov_ef - Government Effectiveness Index.

land area in sq. km slightly varies over time due to updated or revised data rather than to change in area.

When the first-step regression is estimated using the FE estimator, the results have completely changed. The associations between potential instruments and fiscal decentralization

appear mostly insignificant and frequently have a "wrong" sign. The FE estimation proves a very important thing - proposed instruments have low time variations and fail to explain within variations of the fiscal decentralization. Thus, explanatory power of instruments in explaining within variations in expenditure and tax decentralization drops dramatically to 11% and 5%, respectively. The important implication of this finding is that proposed instruments are highly correlated only to time-invariant unobserved individual effects (for instance socio-political background of the country), and therefore get useless in estimating the second-step regression using some of FE estimators.

Econometric theory stipulates that when the instruments are invalid, it produces inconsistent estimates and may result in higher bias than OLS estimation. Moreover, invalid instruments will make overidentifying restrictions invalid. To see if instrumentalization of fiscal decentralization measures by instruments that have low time variations really increases bias of IV estimates and makes GMM restrictions invalid, we again re-estimate the FRF model (FRF estimation type III). First, we did FE estimation of the second-step regression using predicted values of fiscal decentralization measures from the first-step estimation as in Table 6. Then the second-step IV-GMM estimation was done as in previous FRF estimation, but this time it was assumed that lagged debt and output gap are exogenous, while fiscal decentralization is endogenous and instrumented by the same set of instruments as in Table 7.

Table 7
FRF TYPE III - FULL ESTIMATION RESULTS

	Expenditure decentralization		Tax decentralization	
	second-step FE	FE IV-GMM	second-step FE	FE IV-GMM
Cyclically-adjusted primary balance (L.ca_pb)	0.5360*** (0.0458)	0.5957*** (0.0699)	0.5368*** (0.0457)	0.6118*** (0.0744)
Predicted expenditure decentralization (sng_exp_dec_hat)	-0.0117 (0.0218)			
Expenditure decentralization (sng_exp_dec)		0.1134 (0.0992)		
Predicted tax decentralization (sng_tax_dec_hat)			-0.0334 (0.0494)	
Tax decentralization (sng_tax_dec)				0.0551 (0.2543)
Government debt, first lag (L.gg_d)	0.0448*** (0.0088)	0.0447*** (0.0110)	0.0453*** (0.0089)	0.0371*** (0.0081)
Output gap (og)	-0.1952*** (0.0671)	-0.1710*** (0.0362)	-0.1945*** (0.0678)	-0.1782*** (0.0412)
GDP per capita, first diff. (D.l_gdp_ppp)	0.0030 (0.0423)		0.0025 (0.0423)	
HICP, firt diff. (D.l_hicp)		0.0052 (0.0070)		0.0067 (0.0070)
Trade openness, first diff. (D.tr_op)	0.1580 (0.1495)	0.0848 (0.0769)	0.1599 (0.1481)	0.0953 (0.0782)

(Continued)

	Expenditure decentralization		Tax decentralization	
	second-step FE	FE IV-GMM	second-step FE	FE IV-GMM
Interest rate, first diff. (D.ir_10)	-0.0203 (0.0328)		-0.0196 (0.0334)	
Business investments, first diff. (D.BI)	0.0990 (0.1064)	0.0414 (0.0908)	0.0989 (0.1061)	0.0400 (0.0948)
Population, first diff. (D.l_pop)	0.2771*** (0.0600)	0.1625** (0.0657)	0.2777*** (0.0602)	0.1645** (0.0654)
Age dependency ratio, first diff. (D.adr)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Parliamentary elections (par_e)	-0.4111 (0.2811)	-0.4741** (0.2221)	-0.4096 (0.2803)	-0.5015* (0.2575)
Fiscal rule index (fri)	-0.0021 (0.0023)	-0.0031** (0.0015)	-0.0021 (0.0023)	-0.0030* (0.0015)
Government Effectiveness (gov_ef)	0.0016 (0.0017)	0.0001 (0.0014)	0.0016 (0.0017)	-0.0002 (0.0014)
Financial crises (fin_cr)	0.0118** (0.0057)		0.0122** (0.0054)	
Countries members of EMU (emu)	-0.0086** (0.0035)	-0.0068*** (0.0020)	-0.0086** (0.0035)	-0.0070*** (0.0021)
Government debt, first lag (L.gg_d)	-0.0014 (0.0031)	0.0027 (0.0039)	-0.0015 (0.0031)	0.0039 (0.0038)
St. err. robust to	HS	HS and AC	HS	HS and AC
Underid.		22.743***		10.403
Weak id.		2.847		2.249
Overid.		15.250***		15.943**
Orthog.		11.889***		12.721***
Endog.		0.254		0.552
No. of Obs.	463.00	463.00	463.00	463.00
R-Squared	0.52	0.53	0.52	0.51

Notes: FRF type I: Dependent variable –cyclically-adjusted primary balance, fiscal decentralization is instrumented.

sng_exp_dec_hat and sng_tax_dec_hat denotes predicted values from the first step regression.

Standard errors in parenthesis.

* if p<0.1, ** if p<0.05, *** if p<0.01, except for weak id. test.

HS - heteroskedasticity, AC - autocorrelation, CSD - cross-sectional dependence.

IV-GMM estimation:

Underid - Kleibergen-Paap rk LM underidentification test (H0: instruments are not relevant); Weak id. - Stock-Yogo weak ID test (* if 5% maximal bias to OLS is not rejected according to Kleibergen-Paap rk Wald F statistic); Overid. - Hansen J overidentification test of all instruments (H0: overidentifying restrictions are valid); Orthog. - C test of lagged debt and output gap exogeneity (H0: suspect instruments are orthogonal); Endog. - Endogeneity test of expenditure or tax decentralization (H0: suspect variables are not endogeneous).

Excluded instruments: logged land area in sq. km, logged municipality size, urban population, first difference of openness, government type, index of legislative fractionalization, degree of federalism, and Government Effectiveness Index.

Our predictions turn to be correct that using fiscal decentralization instruments that varies low over time, as suggested by the existing literature, actually weakens reliability of estimation results. Estimated response of the CAPB to the expenditure and tax decentralization became insignificant, and signs got unstable. IV-GMM post-estimation tests show that proposed instruments are weak, and Stock-Yogo test does not reject hypothesis that maximal bias of IV estimator is lower than 30%. In case of FRF specification for tax decentralization, instruments appear as utterly invalid, which is in line with FE estimation results in Table 6. Hansen J tests for both specification reject validity of moment conditions. The rest of the estimation results seems consistent with previous estimations of FRF, although probably a bit biased as endogeneity test indicates that lagged debt and output gap are indeed endogenous in the FRF specification.

With the reference to the estimation results, findings suggest that expenditure decentralization had positive, while tax decentralization had negative impact over the sample period. The former result implies that delegating the expenditure responsibilities to subnational governments seems to increase primary surpluses or reduce primary deficits. It is consistent with findings from the strand of the existing literature which argues that fiscal decentralization promotes accountability and fiscal discipline, and leads to a more efficient spending allocation. The negative response of primary balance to tax decentralization is a puzzling and intriguing finding. Not only that empirical findings on the benefits of revenue decentralization are contradictory, but opinions on the association between the tax autonomy and fiscal balance are also divergent. Firstly, it can be assumed that larger own revenue sources should encourage fiscal discipline (Governatori and Yim, 2012; Thornton, 2009), while on the other hand (De Mello, 2000; Fornasari et al., 2000) it is claimed that higher tax autonomy might amplify misuse of soft budget constraints and intergovernmental coordination failures.

Our findings on associations between spending and revenue decentralization and primary balance fully correspond to those from the benchmark study of Governatori and Yim (2012). Their thorough analysis of interactions between expenditure and revenue decentralization demonstrates that net effects of spending decentralization depends on the dependency on transfers, tax autonomy and structure of subnational expenditures. However, they also were not able to explain negative association between own revenues decentralization and primary balance, recognizing a limited suitability of this indicator to capture all aspects of revenue decentralization "does not yet explain the fact that it has an adverse effect on the budget balance, though, rather than being simply insignificant." (Governatori and Yim, 2012).

Does tax decentralization really discourage fiscal discipline, or is it some sort of statistical illusion? If the former is true, then there has to be some transmission channel in which tax decentralization reduces primary balance. Bearing in mind that primary balance is calculated as difference between revenues and primary expenditures, the basic economic reasoning is that expenditure decentralization works through expenditure channel, i.e. helps in reducing government expenditures. The same should hold for tax decentralization; higher level of tax decentralization should promote fiscal discipline in tax collection and subsequently helps to increase government revenues. We examined this reasoning by running additional set of regressions to test validity of expected transmission channels. Results are displayed in Table 8.

Table 8
IMPACT TRANSMISSION OF FISCAL DECENTRALIZATION TO GOVERNMENT FINANCE

	Government expenditures		Government revenues	
	FE OLS	FE IV-GMM	FE OLS	FE IV-GMM
Government expenditures, first lag (L.gg_exp)	0.5681***	0.5877***		
	(0.0616)	(0.0759)		
Expenditure decentralization (sng_exp_dec)	-0.0875**	-0.2130***		
	(0.0340)	(0.0559)		
Government revenues, first lag L.gg_rev			0.7470***	0.7435***
			(0.0799)	(0.0527)
Tax decentralization (sng_tax_dec)			-0.0587*	-0.0736**
			(0.0312)	(0.0344)
Government debt, first lag (L.gg_d)	-0.0288***	-0.0802***	0.0165**	0.0040
	(0.0098)	(0.0157)	(0.0073)	(0.0078)
Output gap (og)	-0.1125	-0.3405***	-0.0152	-0.1673***
	(0.0808)	(0.0648)	(0.0298)	(0.0598)
GDP per capita, first diff. (D.l_gdp_ppp)	-0.1610***		-0.0783***	
	(0.0492)		(0.0223)	
HICP, firt diff. (D.l_hicp)	0.0257	-0.0190	0.0673*	0.1476**
	(0.1296)	(0.1004)	(0.0348)	(0.0613)
Trade openness, first diff. (D.tr_op)	-0.0175	-0.0114	-0.0028	-0.0143
	(0.0281)	(0.0220)	(0.0111)	(0.0103)
Interest rate, first diff. (D.ir_10)	-0.1092		-0.0352	
	(0.0694)		(0.0367)	
Business investments, first diff. (D.BI)	-0.2682***	-0.3895***	0.0026	0.0182
	(0.0896)	(0.1206)	(0.0485)	(0.0577)
Population, first diff. (D.l_pop)	-0.0000	-0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Age dependency ratio, first diff. (D.adr)	0.1941	0.3824*	-0.0263	0.1178
	(0.2627)	(0.2154)	(0.1197)	(0.1474)
Parliamentary elections (par_e)	0.0005	-0.0009	-0.0013	-0.0009
	(0.0021)	(0.0018)	(0.0013)	(0.0012)
Fiscal rule index (fri)	-0.0024	0.0007	-0.0005	0.0008
	(0.0017)	(0.0014)	(0.0008)	(0.0010)
Government Effectiveness (gov_ef)	-0.0145**	-0.0217***	-0.0056	-0.0037
	(0.0058)	(0.0068)	(0.0037)	(0.0040)
Financial crises (fin_cr)	0.0093***	0.0088***	-0.0010	-0.0032*
	(0.0032)	(0.0025)	(0.0011)	(0.0019)
Countries members of EMU (emu)	0.0089**	0.0143***	0.0025	0.0036
	(0.0033)	(0.0042)	(0.0040)	(0.0036)

(Continued)

	Government expenditures		Government revenues	
	FE OLS	**FE IV-GMM**	**FE OLS**	**FE IV-GMM**
Underid.		56.790***		61.083***
Weak id.		31.772*		38.816*
Overid.		10.565***		0.8685
Orthog.		9.197***		0.196
Endog.		15.465***		6.074**
No. of Obs.	463	463	463	463
R-Squared	0.67	0.62	0.66	0.64

Notes: Dependent variables - government expenditures and government revenues.

Standard errors in parenthesis.

* if $p < 0.1$, ** if $p < 0.05$, *** if $p < 0.01$, except for weak id. test.

IV-GMM estimation:

Underid- Kleibergen-Paap rk LM underidentification test (H0: instruments are not relevant); Weak id. - Stock-Yogo weak ID test (* if 5% maximal bias to OLS is not rejected according to Kleibergen-Paap rk Wald F statistic); Overid. - Hansen J overidentification test of all instruments (H0: overidentifying restrictions are valid); Orthog. - C test of fiscal decentralization indicator exogeneity (H0: suspect variables are orthogonal); Endog. - Endogeneity test of lagged debt and output gap (H0: suspect variables are not endogeneous);

Excluded instruments: third leg of debt, second leg of output gap, growth rate of GDP pc in PPP, and first difference of 10-year interest rates.

Our conjecture that expenditure decentralization positively impact primary balance through government expenditure looks correct, although IV-GMM post-estimation test expectedly suggest that expenditure decentralization in this model specification is endogenous. On the other hand, tax decentralization does not seem to improve collection of government revenues. On the contrary, estimation results suggest that higher tax decentralization imposes deterioration of the government revenues. Statistical evidence of this finding is particularly strong in case of IV-GMM estimation, where post-estimation tests suggest that tax decentralization is exogenous and overidentifying conditions are valid.

Nevertheless, could it be that the negative response of primary balance to tax decentralization is only an econometric illusion? If we assume this is true, then high co-linearity between tax decentralization and some control variable is the most likely to be blamed. To check this possibility, we estimated a bunch of alternative model specifications keeping tax decentralization and varying other regressors on the RHS of the equation. Nevertheless, the negative response of primary balance to tax decentralization was never questioned, regardless of the model specification. Moreover, we estimated alternative FRF specifications in which both expenditure and tax decentralization are regressors at the same time. Even then, estimation results remained robust and did not challenge the findings of our analysis; values of estimated coefficients (0.14 for expenditure and -0.28 for tax decentralization, both significant at 1% level) do not show signs of distortion despite high correlation between those two variables (around 70%). Finally, no statistical evidence was found that our finding of

the negative response of primary balance to tax decentralization is an econometric illusion, although this option can never be disregarded with absolute certainty.

6. Conclusions

In this paper it was analyzed how fiscal stance in the EU countries responded to the expenditure and tax decentralization over the period 1999-2019, using the fiscal reaction function (FRF) modeling framework. Our findings show that fiscal stance positively responded to expenditure decentralization and negatively responded to tax decentralization, regardless whether fiscal stance is proxied by non-adjusted or cyclically-adjusted primary balance. Positive association between expenditure decentralization and primary balance corresponds to the view of the first generation theory that spending decentralization results in a more efficient expenditure allocation because provision of the public goods at the subnational level is better tailored to subnational preferences. On the other hand, negative response of primary balance to tax decentralization is not so easy to explain, as the second generation theory suggests that higher reliance of subnational governments on transfers and bailouts aggravates soft budget constraints, discouraging fiscal discipline and tax efforts.

However, the question is imposed whether the later result is only some sort of statistical illusion, caused by model misspecification or ignorance of potential endogeneity of fiscal decentralization. We provided solid evidence that fiscal decentralization indeed affects fiscal stance. Nevertheless our findings on the exogeneity of the fiscal decentralization and claims on causality of the impact are limited only to fiscal reaction function modelling framework applied in this study. The set of variables arguably not affected by the current fiscal performance or discretionary policymaking, such as size of the country, urban population or political fragmentation, seems to fairly explain variations in fiscal decentralization. Subsequently, fiscal decentralization indicators appear robustly exogenous within the fiscal reaction function with cyclically-adjusted balance as a proxy for fiscal stance. Nevertheless, we demonstrated that usual instruments of the fiscal decentralization that slowly varies over time are strongly correlated with country individual effects, leading to the poor performance of IV estimation in panel data analysis whereby individual effects are usually removed.

Our research has an important limitation. We relied on basic quantitative fiscal decentralization measures, therefore we could not disregard possibility that the use of some advanced indicator would challenge our findings, especially about negative response of fiscal stance to tax decentralization. Nevertheless, our results are still fully corresponding to those of Governatori and Yim (2012), who used more advanced indicators and their interactions to assess associations between fiscal decentralization and primary balance. We hypothesized that negative impact of tax decentralization on the primary balance is transmitted through the government revenues, but further research is recommended to resolve this puzzle.

Appendix

Table A1
VARIABLE DESCRIPTIONS

Label	Operationalization	Data Source
pb	Primary balance	AMECO database
ca_pb	Cyclically-adjusted primary balance	AMECO database
gg_d	Government consolidated gross debt	Eurostat
og	Output gap	AMECO database
gg_exp	Total general government expenditure (as percent of GDP)	Eurostat
sng_exp	Subnational local government expenditure (as percent of GDP)	Eurostat
sng_exp_dec	Expenditure decentralization=Subnational local government expenditure (as percent of GDP) / Total general government expenditure (as percent of GDP)	Author's calculation
gg_rev	Total general government revenue (as percent of GDP)	Eurostat
sng_rev	Subnational local government revenue (as percent of GDP)	Eurostat
sng_rev_dec	Revenue decentralization=Subnational local government revenue (as percent of GDP)/Total general government revenue (as percent of GDP)	Author's calculation
gg_tax	Total general government tax revenue (as percent of GDP)	Eurostat
sng_tax	Subnational local government tax revenue (as percent of GDP)	Eurostat
sng_tax_dec	Tax decentralization=Subnational local government tax revenue (as percent of GDP)/Total general government tax revenue (as percent of GDP)	Author's calculation
hicp	Harmonized Index of Consumer Prices (HICP) annual average index	World Bank
tr_op	Trade openness. Sum of exports and imports of goods and services measured as a share of gross domestic product (as percent of GDP)	World Bank
Ir_10	Interest rate on long-term maturity bond - government bond yields, 10 years' maturity	Eurostat
BI	Business investments (as percent of GDP)	Eurostat
adr	Age dependency ratio is the ratio of dependents - people younger than 15 or older than 64 - to the working-age population - those ages 15-64. Data are shown as the proportion of dependents per 100 working-age population	World Bank

(Continued)

Label	Operationalization	Data Source
par_e	Parliamentary elections	European Election Database
fri	Fiscal rule index	European Commission
gov_ef	Government Effectiveness. Perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	World Bank
fin_cr	Financial crises	ESRB database
emu	Countries members of European Monetary Union.	European Central Bank
l_area	Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes.	World Bank
gdp_ppp	GDP per capita, PPP (current international $).	World Bank
urb_pop	Urban population refers to people living in urban areas as defined by national statistical offices (% of total population).	World Bank
mun_size	Municipality size (Population/Number of municipalities).	EU sub-national governments, 2010 Edition, CEMR Dexia and Eurostat
gov_type	Government type	CPDS database
rae_leg	Index of legislative fractionalization	CPDS database
fed	Degree of federalism	CPDS database

Notes

1. Permanent component of output, as a tax basis, determines permanent level of revenue.

2. Due to the lack of data on business investments, Malta was excluded from the sample in FRF estimation.

3. Dummies for country individual effects.

4. The endogenous variables are lagged two periods when used as instruments to assure lower correlation with contemporaneous errors. Growth rate of GDP pc in PPP is considered instrument for output gap and long-term interest rate for debt. LT interest rate is differenced, being probably non-stationary.

5. Heteroskedasticity and autocorrelation consistent.

6. GDP pc in PPP, population and HICP are transformed into growth rates; trade openness, LT interest rate, business investments and age dependency ratio are transformed into first differences.

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Resumen

El objetivo de este trabajo es examinar la respuesta del saldo primario ajustado en función del ciclo (SPAC) de los países de la UE a la descentralización fiscal y del gasto. Aportamos a la literatura tres conclusiones importantes. En primer lugar, los resultados de las estimaciones indican que el SPAC respondió positivamente a la descentralización del gasto y negativamente a la descentralización fiscal. En segundo lugar, la descentralización fiscal parece estar impulsada por determinantes exógenos al saldo primario. En tercer lugar, las variables consideradas como "buenos" instrumentos en la literatura existente no explican las variaciones de los indicadores de descentralización fiscal. Nuestra hipótesis es que el impacto negativo de la descentralización fiscal sobre el saldo primario se transmite a través de los ingresos públicos, pero es necesario seguir investigando para resolver este enigma.

Palabras clave: descentralización fiscal, función de reacción fiscal, orientación fiscal, UE.

Clasificación JEL: H60, H71, H72.