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Fiscal Decentralization and the Efficiency of Public Service Delivery

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Abstract

This paper explores the impact of fiscal decentralization on the efficiency of public service delivery. It uses a stochastic frontier method to estimate time-varying efficiency coefficients and analyzes the impact of fiscal decentralization on those efficiency coefficients. The findings indicate that fiscal decentralization can improve the efficiency of public service delivery but only under specific conditions. First, the decentralization process requires adequate political and institutional environments. Second, a sufficient degree of expenditure decentralization seems necessary to obtain favorable outcomes. Third, decentralization of expenditure needs to be accompanied by sufficient decentralization of revenue. Absent those conditions, fiscal decentralization can worsen the efficiency of public service delivery.

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I. INTRODUCTION

This paper analyzes the impacts of fiscal decentralization on the efficiency of public service delivery. It contributes to existing studies by focusing explicitly on the efficiency of public service delivery instead of the policy outcome. The policy outcome can be improved by augmenting policy inputs (for instance, spending allocation); in contrast, efficiency is measured as the difference in policy outcomes—across countries and over time—under a similar set of policy inputs. This paper also covers a large sample of countries, including developed, emerging, and developing economies.² Last, it uses recent empirical techniques to reach the findings and ascertain their robustness.

The paper’s findings suggest that fiscal decentralization can serve as a policy tool to improve performance, but only under specific conditions. Our findings focus on the efficiency of spending on education and health and indicate that an adequate institutional environment is needed for decentralization to improve public service delivery. Such conditions include effective autonomy of local governments, strong accountability at various levels of institutions, good governance, and strong capacity at the local level. Moreover, a sufficient degree of expenditure decentralization seems necessary to obtain a positive outcome. And finally, decentralization of expenditure needs to be accompanied by sufficient decentralization of revenue to obtain favorable outcomes. Absent those conditions, fiscal decentralization can worsen the efficiency of public service delivery. The paper is structured as follows. Section II reviews the existing literature and summarizes the merits and risks of fiscal decentralization. Section III presents the empirical analysis. Section IV concludes with the main policy recommendations.

II. LITERATURE REVIEW AND THEORETICAL BACKGROUND

Fiscal decentralization can improve the efficiency of public service delivery through preference matching and allocative efficiency. Local governments possess better access to local preferences and, consequently, have an informational advantage over the central government in deciding which provision of goods and services would best satisfy citizens’ needs (Hayek, 1945; Tiebout, 1956; Musgrave, 1969). When provided by the jurisdiction that has the control over the minimum geographic area, costs and benefits of public services are fully internalized, which is expected to improve allocative efficiency (Oates, 1972).

Fiscal decentralization can also ameliorate efficiencies by fostering stronger accountability. Geographical closeness of public institutions to the local population (final beneficiaries) fosters accountability and can improve public service outcomes, particularly in social sectors such as education and health (Ahmad, Brosio, and Tanzi, 2008; Cantarero and

² Previous studies focused solely on a specific country or a specific group of countries.

Pacual Sanchez, 2006). Local accountability is expected to put pressure on local authorities to continuously search for ways to produce and deliver better public service under limited resources, leading to “productive efficiency.” Accountability can foster larger spending in public investment and in growth-enhancing sectors, such as education and health (Keen and Marchand, 1997; Arze del Granado and others, 2005; Bénassy-Quéré and others, 2007; Kappeler and Valila, 2008; Fredriksen, 2013). Local accountability can be strengthened through a direct election of local authorities by the local population.

Furthermore, fiscal decentralization can improve efficiency through the “voting with one’s feet” hypothesis. Decentralization gives voters more electoral control over the authorities (Seabright, 1996; Persson and Tabellini, 2000; Hindriks and Lockwood, 2005). It encourages competition across local governments to improve public services; voters can use the performance of neighboring governments to make inferences about the competence or benevolence of their own local politicians (Bordignon and others, 2004). Fiscal decentralization may lead to a decrease in lobbying by interest groups, distorting policy choices and increasing waste of public funds.

However, fiscal decentralization can worsen public service delivery if scale economy is important. Devolution of public service delivery to a small-scale local government can decrease efficiency and increase costs if economies of scale are important in the process of production and provision of some specific public goods. For instance, shifting the production and provision of public services to a municipality with a small size of government officials (producers and providers) and a small population (beneficiaries) can reduce efficiency.

Fiscal decentralization can also obstruct the redistribution role of the central government. To guarantee a minimum level of public service and basic needs (or standard of living) for the entire population (regardless of their geographical location), the central government often carries out equalization transfers, which would be disrupted in cases of insufficient leverage on resources (Ter-Minassian, 1997). When a large share of revenue and expenditure is shifted to local governments, the central government does not possess sufficient resources to ensure a minimum equity across the entire territory.

Fiscal decentralization can also hinder public service delivery if accountability is loose. If accountability is not broadly anchored in a local democratic process, but instead is based on rent-seeking political behavior, local governments would be tempted to allocate higher decentralized expenditure to non-productive expenditure items (such as wages and goods and services instead of capital expenditure). This can hinder efficiency, economic growth, and overall macroeconomic performance (Davoodi and Zou, 1998; Woller and Phillips, 1998; Zhang and Zou, 1998; Rodriguez-Pose and others, 2009; Gonzalez Alegre, 2010; Grisorio and Prota, 2011).

III. EMPIRICAL ANALYSIS

A. Methodology

This paper investigates the efficiency, rather than just the outcome, of public service delivery in health and education. Policy outcome is the directly measurable impact of public service delivery; outcome indicators can include infant mortality rate and school enrollment rate. Policy outcomes can be improved by augmenting policy inputs, such as expenditure allocation for health and education. However, the efficiency analysis focuses on the improvement in outcome while keeping inputs unchanged.³ This approach allows analyzing the impact of policies other than inputs in improving the provision of public goods and services; such policies can include fiscal decentralization.

The methodology is based on a two-step approach, estimating efficiency coefficients and analyzing the impact of fiscal decentralization on the latter. In a first step, the efficiency of public service delivery is estimated using stochastic frontier techniques. These techniques provide time-varying coefficients that measure the distance of the public services in a specific country at a specific year to the best public services provided using similar inputs in the sample of countries considered in this analysis. In a second step, this paper estimates the effects of fiscal decentralization on the estimated efficiencies. Instrumental variable methods are used to obtain bias-corrected coefficients. These methods address concerns about endogeneity associated with the decentralization process; they can also tackle reverse causality that could plague the estimated parameters.

In a first step, efficiency coefficients are estimated from stochastic frontier techniques. Methodologies on efficiency estimates can be grouped in two main approaches: (i) a parametric approach (Battese and Coelli, 1988; Jayasuriya and Wodon, 2003; Grigoli and Kapsoli, 2013) and (ii) a non-parametric approach (Gupta and Verhoeven, 2001; Herrera and Pang, 2005; Gupta and others, 2007). This paper uses the parametric approach-based stochastic frontier analysis (SFA). The SFA allows estimating models with multiple inputs, as opposed to non-parametric models that do not take into account the effect of exogenous factors on the outcome variable because of the restriction on the number of variables. As the outcome variables in this paper, that is, infant mortality and enrollment ratio, are plausibly affected by structural factors other than public expenditure, such as socioeconomic characteristics of the country, a multivariable model is better suited for the analysis. Moreover, the SFA allows estimating country-specific and time-varying coefficients.

The SFA techniques assume that no economic agent (i.e., country) can exceed the ideal “frontier.” The frontier refers to the optimum output—infant mortality rate or enrollment rate—produced with limited inputs, such as public expenditure. The deviation of the output in a

³ Alternatively, the efficiency analysis can also aim at reducing inputs while keeping the outcome unchanged.

specific country at a specific time from this frontier represents the individual measure of efficiency of that country. Efficient governments are those operating at, or very close to, the frontier as they try to reduce the infant mortality rate or improve the enrollment rate, given a limited amount of public expenditure.

The first-step model is specified as follows:

$$Y_{it} = \alpha + \gamma PE_{it-1} + \sum_{k=1}^K \varphi_k Z_{k,it-1} + \varepsilon_{it} \quad (1)$$

$$\begin{cases} \varepsilon_{it} = \omega_{it} \pm \eta_{it} \\ \eta_{it} = g(t) \square \eta_i \quad \text{and} \quad g(t) = \exp[-\lambda(t - T_i)] \end{cases} \quad (2)$$

The dependent variable Y_{it} in equation (1) represents public expenditure outcomes on health and education, namely the infant mortality rate and the secondary school enrollment rate, with subscripts i and t denoting respectively country and time dimensions. The interest variable PE_{it-1} corresponds to public expenditure on health and education as a percent of GDP. A set of control variables $Z_{k,it}$ are added and are likely to influence the infant mortality rate or the enrollment rate. The error term ε_{it} in equation (1) has two components as shown in equation (2); ω_{it} represents an idiosyncratic disturbance, capturing measurement error or any other classical noise, and the remaining part η_{it} is a one-sided disturbance capturing the country-specific and time-varying efficiencies of public expenditure.⁴ Equations (1) and (2) allow obtaining the country-specific and time-varying efficiencies of public expenditure, following the formula provided by Battese and Coelli (1988) and Jondrow and others (1988).

The second step consists of measuring the extent to which fiscal decentralization affects the estimated efficiencies. The impact of fiscal decentralization is analyzed through a direct channel, a non-linear relationship, and interactions with political and institutional variables. The baseline model is the following:

$$\hat{\eta}_{it} = \alpha + \delta fd_{it-1} + \varphi GDP_{it-1} + \psi_{it} \quad (3)$$

The dependent variable $\hat{\eta}_{it}$ is the country-specific and time-varying efficiencies estimated from equations (1) and (2), α is a common constant term, and fd_{it-1} measures fiscal decentralization.

⁴ A stream of existing literature assumes time-invariant efficiency. However, the assumption of invariant efficiency might be questionable, especially in the presence of long panel data. We relax the assumption of time-invariant efficiency and allow for time-varying individual-specific efficiencies (Cornwell and others, 1990).

To explore non-linearities in the relationship between fiscal decentralization and public expenditure efficiency, a quadratic specification is added—i.e., squared fiscal decentralization $(fd_{it-1})^2$ —as shown in equation (4). Non-linearities, if any, are detected by computing the derivatives:

$$\hat{\eta}_{it} = \alpha + \delta_1 fd_{it-1} + \delta_2 (fd_{it-1})^2 + \varphi GDP_{it-1} + \psi_{it} \quad (4)$$

Furthermore, the impact of the political and institutional environment on the relationship between decentralization and the efficiency of public service delivery is investigated. Political and institutional variables are introduced additively (I_{it-1}) but also in interaction with fiscal decentralization ($fd_{it-1} \times I_{it-1}$), as shown in equation (5).

$$\hat{\eta}_{it} = \alpha + \delta fd_{it-1} + \tau (fd_{it-1} \times I_{it-1}) + \rho I_{it-1} + \varphi GDP_{it-1} + \psi_{it} \quad (5)$$

Parameter ρ corresponds to the direct effect of political and institutional variables on efficiency. Parameters δ and τ correspond respectively to the effect of fiscal decentralization on the efficiency and the influence of the political and institutional environments on the causal link between fiscal decentralization and public service efficiency. ψ_{it} in equations (3)–(5) is a composite error term, taking into account country-specific characteristics.

Fiscal decentralization is measured as the share of subnational fiscal variables over general government fiscal variables.⁵ The main estimates in this paper are based on the expenditure side of fiscal decentralization, using the share of subnational expenditure to general government expenditure.⁶ The main focus is on expenditure as it is directly linked to health and education outcomes and efficiency (as opposed to revenue). However, to ensure a comprehensive study, the paper also analyzes the impacts of revenue decentralization on the efficiency of public service delivery, using the share of local government revenue to general government revenue.⁷ The political and institutional variables focus on the level of corruption, the degree of autonomy of the regions, the strength of the democracy, and the constitutional regime (presidential or parliamentary). Control variables in the stochastic frontier analysis comprise the real GDP per capita as a measure of the level of development, the density and population size, and the average years of primary and secondary schooling. All these variables

⁵ Local governments can include states, regions, districts, municipalities, and other level(s) of government, depending on the institutional arrangement in the country.

⁶ Owing to difficulties in obtaining data from local and regional governments, our fiscal decentralization index is obtained as the residual after deducting the ratio of central government share of expenditure over total general government expenditure. This approach can have some caveats, but it allows large country and period coverages.

⁷ The vertical fiscal imbalance, i.e., the share of local government expenditure financed with its own revenue, can also provide important insights; however, this indicator is not available for the full sample in this study.

are considered to influence the infant mortality rate and the secondary school enrollment rate.⁸ It would be insightful to use the share of subnational expenditure on health and education to general government expenditure in each of the two sectors; however, such data are not available for many of the countries in the sample. Furthermore, the efficiency is influenced by factors beyond expenditure, and an analysis using aggregate expenditure ratio allows clearer comparison with the analysis using aggregate revenue ratio.

Endogeneity and causality concerns are addressed through lag and instrument techniques that motivate the introduction of additional variables. An initial attempt at reducing any bias consists of introducing all explanatory variables, including fiscal decentralization, with a one-period lag. Furthermore, two-stage least squares techniques are applied for the fiscal decentralization variable, using three instrumental variables. First, the population size is considered a significant variable affecting the decentralization process because larger countries generally tend to be more decentralized despite some counter examples (Dziobek et al., 2011; Jiménez-Rubio, 2011; Escolano et al., 2012). The rationale is that in countries with large populations, it is more difficult for central authorities to have sufficient information to target citizens' needs, which leads to decentralization. Second, the existence of natural resources can act as an obstacle to decentralization, because of possible rent-seeking behaviors of fiscal authorities that benefit directly from the resource windfalls. Under such circumstances, embarking on a fiscal decentralization process would imply a subsequent private loss for incumbent authorities. On the other hand, residents of resource-rich regions can claim larger shares of resources through accelerated decentralization. Moreover, natural resources might be seen as a blessing, triggering the decentralization process because windfalls may constitute an additional source of revenue to share with the subnational governments. Third, government fractionalization and fractionalization in the legislative system can affect the decentralization process. Fractionalization is measured as the probability that two deputies randomly picked either from the government or the legislature will be from different parties. Higher fractionalization may either act against the decentralization process, owing to political motives, or accelerate decentralization. The expected signs of these two last instrumental variables on the decentralization process cannot be determined *a priori*.

B. Data

The sample covers an unbalanced panel of 64 countries, including advanced, emerging, and developing economies, during 1990–2012. Data are taken from various sources, including the IMF's Governments Financial Statistics, the World Bank's World Development Indicators, Eurostat, and OCED databases, among others. Annexes I and II present the full sample, variable definitions, and sources.

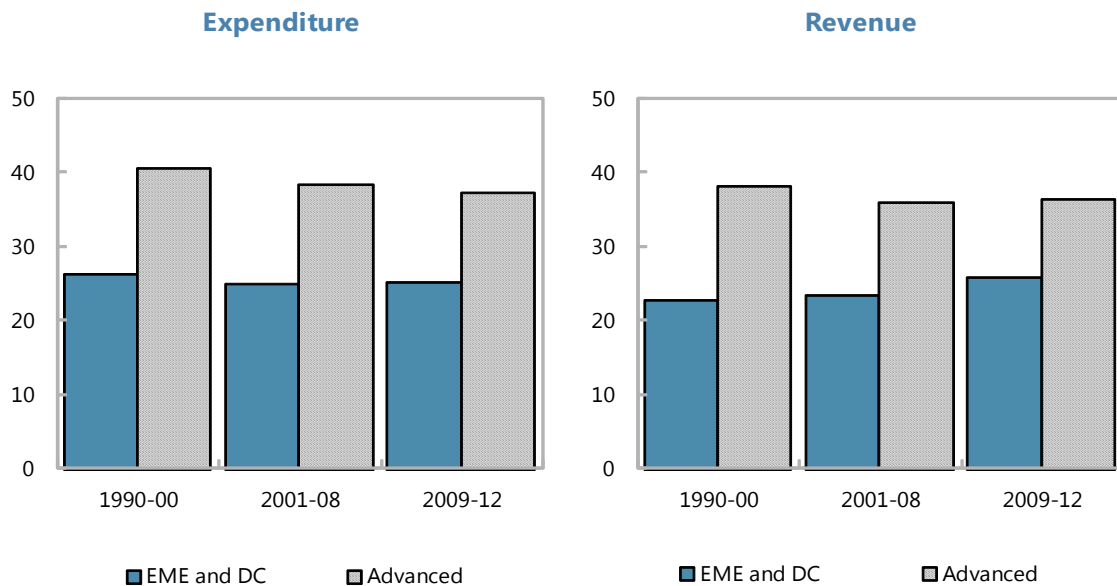
⁸ To avoid perfect collinearity, we exclude the variable average year of schooling while estimating the effect of public education expenditure on the secondary school enrollment rate. GDP per capita is used as a control variable when estimating the effect of fiscal decentralization on public expenditure efficiency.

Fiscal decentralization is larger in advanced economies than in emerging economies and developing countries, but it has accelerated in the latter two groups in recent decades.

Table 1 and Figure 1 provide descriptive statistics of the main variables used in this analysis. On average, about 30 percent of public expenditure is implemented by subnational governments. This share is about 40 percent for advanced economies compared to about 25 percent for emerging economies and developing countries. On the revenue side, the share of subnational governments is about 27 percent; 37 percent in advanced economies; and 23 percent in emerging economies and developing countries. The legislative system appears to be much more fractionalized than the government. The probability that two deputies come from two different parties is 65 percent, whereas it is only 29 percent for members of governments. A higher corruption index indicates a more corrupt system; corruption seems more pervasive in emerging economies and developing countries. The political system index is a binary variable, taking a value of one for parliamentary regimes and zero for presidential regimes; advanced economies appear more parliamentary based than emerging economies and developing economies. A higher democracy score indicates a higher degree of democracy. The “autonomy” indicator is a dummy variable taking the value of one when constitutionally autonomous regions exist in the country.

Figure 1. Share of Subnational Government Expenditure/Revenue

(Percent of general government expenditure/revenue)



Source: Authors' calculations.

Table 1. Descriptive Statistics

Variables	Number of observations	Mean			Std. Dev.	Min	Max
		All	Advanced	EME and DC			
FD expenditure (%)	1086	29.6	39.0	25.4	21.3	0.0	98.4
FD revenue (%)	1129	27.4	36.8	23.5	20.0	0.0	73.6
Real GDP pc (in thousands)	1467	22.7	34.7	17.6	15.7	1.3	97.4
Natural res. (% GDP)	1467	4.5	1.9	5.7	8.1	0.0	64.0
Government frac.	1381	0.3	0.3	0.3	0.3	0.0	1.0
Fractionalization	1361	0.7	0.7	0.6	0.2	0.0	1.0
Population size (in millions)	1472	48.6	43.3	50.9	138.7	0.1	1236.7
Corruption	1280	-2.7	-3.5	-2.3	1.3	-5.0	0.7
Parliamentary	1433	0.6	0.9	0.4	0.5	0.0	1.0
Democracy	1425	30.1	51.0	20.9	26.4	1.0	82.0
Autonomy	1427	0.2	0.3	0.2	0.4	0.0	1.0

Source: Authors' calculations.

C. Efficiency Estimates

The average efficiency of the countries in the sample is at about 85 percent of the production frontier. The predicted efficiencies from the stochastic frontier analysis are about 82.2 percent on average for health and 87.8 percent for education (Table 2). An efficiency score of x percent implies that the country delivers x percent of the possible objective (*reducing infant mortality rate or increasing school enrollment rate*) as compared to a fully efficient country using similar input values (such as public expenditure). The benchmark efficiency estimates—columns (1) and (4) in Table 2—are based on the approach proposed by Battese and Coelli (1988). To check the robustness of the findings, two other methodologies are applied. Efficiency estimates based on Jondrow and others (1982) are presented in columns (2) and (4); and the estimates that take into account heterogeneity and heteroskedasticity are shown in columns (3) and (6). The estimates from those various approaches are highly correlated.

Table 2. Stochastic Frontier Estimates of Public Service Efficiency

Statistics	Estimated efficiencies					
	Health			Education		
	Battese and Coelli (1988)	Jondrow et al. (1982)	Heterog.	Battese and Coelli (1988)	Jondrow et al. (1982)	Heterog.
	(1)	(2)	(3)	(4)	(5)	(6)
Mean of efficiencies	0.82	0.81	0.84	0.88	0.88	0.88
Standard deviation	0.09	0.10	0.11	0.10	0.10	0.13
Minimum	0.30	0.29	0.31	0.33	0.33	0.27
Maximum	0.94	0.94	0.98	0.98	0.98	0.99

Note: Columns 1 and 4 use the Battese and Coelli (1988) method to estimate the efficiency score, while columns 2 and 5 draw upon the alternative Jondrow et al. (1982) methodology. We allow for heterogeneity and heteroscedasticity while estimating the efficiency scores in columns 3 and 6.

Source: Authors' calculations.

D. Direct Channel and Non-Linear Relationship

Through a direct channel, expenditure decentralization seems to improve the efficiency of public service delivery in advanced economies but has a negative impact in emerging economies and developing countries. Estimating equation (3), the first step of the two-stage least squares points to the appropriateness of the instrument variables. The latter are significantly correlated with the endogenous regressor in almost all cases (the associated p-values are < 0.05). Besides, using the Kleibergen-Paap's p values, the null hypothesis that "the equations are underidentified" can be rejected at the 5 percent level. The results of the second step are presented in Table 3. Pooling the advanced economies, emerging markets, and developing economies, it appears that fiscal decentralization has no significant effect on the efficiency of public expenditure (columns 1 and 6). Considering that the various countries exhibit dissimilar levels of decentralization (as shown in the previous section), the sample is divided in two groups: (i) advanced economies, and (ii) emerging markets and developing economies.⁹ For advanced economies, fiscal decentralization shows positive impacts on the efficiency of public expenditure on health (column 2). To quantify this effect, one could say that a 5 percent increase in fiscal decentralization would lead to 2.9 percentage points of efficiency gains in public service delivery. The coefficient is statistically insignificant for education (column 7). In contrast, for emerging markets and developing economies, the impacts are negative (columns 3 and 8). These positive and negative effects of decentralization, respectively for the first and second group of countries, are robust to the inclusion of time dummies, albeit with a slight reduction in the magnitude of the parameters (columns 4,5,9, and 10). This seems to confirm that the results are not driven by common shocks hitting all countries at the same time, nor by a time-trend evolution of the efficiency scores.

A non-linearity analysis seems to indicate that a sufficient degree of expenditure decentralization is required to bring about positive impacts. The non-linearity is investigated through equation (4), and the results are presented in Table 4. For the entire sample, the fiscal decentralization variable and its squared term affect significantly the efficiency of public services (columns 1 and 4). Interestingly, the coefficient of the former is negative whereas that of the latter is positive. This seems to suggest that the relationship between fiscal decentralization and the efficiency of public service delivery is not linear, but U-shaped. A low level of fiscal decentralization seems to be harmful; it needs to exceed about 35.7 percent for health and 35.4 percent for education to bring about improvements in the

⁹ The country grouping follows the classification in the World Economic Outlook (2014). It would be insightful to divide the second group in Emerging Market Economies and Low-Income Countries (LICs); however, the variables in this analysis are available only for a limited number of LICs, impeding a thorough empirical analysis for this group separately.

efficiency of public services.¹⁰ At least, about one third of public expenditure would need to be shifted to the local authorities to obtain positive outcomes from fiscal decentralization. This non-linear relationship might imply the importance of the scale economy in the production and delivery of public services. As many public services require substantial initial fixed costs, if the scale of public services shifted to the local level is too small, the local authorities might have to reduce the provision of services to reduce the variable costs to cover the large initial fixed costs. Note, however, that the sufficient level of fiscal decentralization likely differs across countries, depending on country-specific considerations.

Table 3. Fiscal Decentralization and Public Expenditure Efficiency

Variables	Dependent variable: estimated efficiencies									
	Health					Education				
	All	Advanced	EME and DC	Time dummies		All	Advanced	EME and DC	Time dummies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FD _(t-1)	0.109 (0.925)	0.599*** (7.956)	-0.322*** (-2.919)	0.433*** (5.211)	-0.187*** (-2.737)	0.0373 (0.126)	-0.0453 (-0.339)	-0.872** (-2.545)	0.800*** (3.674)	-0.616** (-2.305)
Real GDP pc _(t-1)	0.035*** (5.402)	0.008 (0.778)	0.023*** (2.730)	-0.061*** (-3.286)	-0.093*** (-6.865)	-0.020** (-2.200)	-0.077*** (-4.339)	-0.007 (-0.386)	0.044 (1.284)	-0.070** (-2.564)
<i>Time dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	875	269	606	269	606	690	213	477	213	477
Countries	55	14	41	14	41	53	14	39	14	39
Fisher (<i>p-value</i>)	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.041	0.000	0.249
Hansen OID (<i>p-value</i>)	0.000	0.008	0.000	0.000	0.007	0.000	0.000	0.004	0.042	0.000
KP-under	0.000	0.000	0.000	0.000	0.000	0.057	0.002	0.048	0.013	0.034
FD _(t-1) instrumentation (<i>p-value</i>)	0.000	0.000	0.000	0.000	0.000	0.052	0.000	0.029	0.019	0.029

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics are shown in parentheses. Fisher statistic presents a test of joint significance of estimated coefficients. Hansen OID and Kleibergen-Paap (KP) test respectively the over-identification restriction and the hypothesis that equations are underidentified. FD instrumentation test, with a lower p-value indicates that endogenous regressors (fiscal decentralization) are significantly correlated with the instrumental variables proposed (political and government fractionalization, and natural resource Source: Authors' calculations.

¹⁰ Based on the estimated parameters in Table 4, the decentralization indicative threshold for the health sector is computed as $\frac{\partial \hat{\eta}_t}{\partial fd_{t-1}} = \delta_1 + 2 \times \delta_2 fd \Rightarrow fd^* = -\frac{\delta_1}{2\delta_2}$ or $fd^* = \left(-\frac{(-2.247)}{(2 \times 3.149)}\right) \times 100 = 35.7$ percent. The threshold for the education sector was derived similarly.

Table 4. Fiscal Decentralization and Public Expenditure Efficiency (Non-linearity)

Variables	Dependent variable: estimated efficiencies					
	Health			Education		
	All	FD < fd^*	FD $\geq fd^*$	All	FD < fd^*	FD $\geq fd^*$
	(1)	(2)	(3)	(4)	(5)	(6)
FD _(t-1)	-2.247*** (-3.518)	-0.797*** (-3.487)	0.210** (2.415)	-1.307** (-1.963)	0.717 (0.980)	-0.061 (-0.395)
FD ² _(t-1)	3.149*** (3.622)			1.847** (2.259)		
Real GDP pc _(t-1)	-0.003 (-0.226)	0.032*** (2.699)	-0.006 (-1.056)	-0.035** (-2.537)	0.049 (1.513)	-0.047*** (-4.222)
Number of observations	875	481	390	690	365	321
Countries	55	37	29	53	35	27
Fisher (<i>p-value</i>)	0.000	0.000	0.049	0.036	0.311	0.000
Hansen OID (<i>p-value</i>)	0.010	0.000	0.188	0.011	0.051	0.176
KP-under	0.001	0.004	0.000	0.077	0.019	0.000
FD _(t-1) instrumentation (<i>p-value</i>)	0.000	0.011	0.000	0.052	0.053	0.000
(FD _(t-1)) ² instrumentation (<i>p-value</i>)	0.000	0.000		0.006		

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust T-statistics are shown in parentheses.

Source: Authors' calculations.

The U-shaped relationship is confirmed when the sample observations are split below and above the indicative threshold. For health, when the fiscal decentralization ratio is below the estimated indicative threshold of 35.7 percent, a 1 percent increase in fiscal decentralization ratio reduces the efficiency by about 0.8 percentage point (column 2 of Table 4). In contrast, when the decentralization ratio reaches or exceeds the indicative threshold, decentralization improves the efficiency of public service delivery. A 1 percent increase in the decentralization ratio increases the efficiency by 0.2 percentage point (column 3 of Table 4). For education, the coefficients of the fiscal decentralization are not statistically significant when the sample observations are divided.

The findings on the U-shape relationship are supported by the dissimilar impacts of fiscal decentralization in advanced economies and in emerging markets and developing countries. As shown in Table 3, fiscal decentralization positively affects the efficiency of public services in advanced economies and negatively affects efficiency in emerging markets and developing countries. Interestingly, the level of expenditure decentralization is on average about 40 percent in advanced economies, which is above the mentioned indicative threshold of about 35 percent. In contrast, the average level of expenditure decentralization is only about 25 percent in emerging markets and developing countries, far below the indicative threshold of 35 percent.

E. Political and Institutional Conditions

To support public expenditure efficiency, fiscal decentralization requires an adequate political and institutional environment. Table 5 presents the results of the estimation from model (5). It appears that the interactions of the decentralization and political and institutional

variables are significantly associated with the efficiency of public service delivery. Corruption negatively affects the impacts of fiscal decentralization on the efficiency of public services. When taking into account the corruption variable, a 5 percent increase in the fiscal decentralization ratio is associated on average with a 2.5 percent decrease in the efficiency of public expenditure relative to the mean efficiency.¹¹ This might be due to stronger power of interests groups at the local level. Local authorities may also have more discretion and fewer controls, giving room for leakage of public resources, as argued by Gauthier and Wane (2008).¹² In contrast, the positive and statistically significant sign of the interaction between fiscal decentralization and the political system variables ($FD \times Parliamentary_{(t-1)}$) indicates that the combination of a parliamentary system and fiscal decentralization may boost public expenditure efficiency. Parliamentary regimes, as opposed to presidential regimes, have stronger institutional frameworks to limit the executive's discretionary powers. Also, implementing decentralization in a more democratic environment can improve the efficiency of public service delivery. Furthermore, the existence of constitutionally autonomous regions also has positive and statistically significant impacts. Autonomous regions may be free of any vertical constraint that could come from the top level and influence the way public expenditure is implemented locally. The nonsignificance of real GDP per capita used as a control variable in most cases might be because the methodology already controlled for this variable in the first step, when estimating the efficiency.

The role of the political and institutional environment is also confirmed when separately analyzing advanced economies and emerging markets and developing countries. Table 6 displays the results of the estimations of equation (5) using two subsamples: (i) advanced economies and (ii) emerging markets and developing economies. First, looking at the coefficients of the fiscal decentralization variable itself, the results support the above findings that decentralization broadly improves the efficiency of public service delivery in advanced economies but worsens the efficiency in emerging markets and developing countries. Second, advanced economies and emerging economies and developing countries seem to broadly confirm that an adequate political and institutional environment improves the impact of fiscal decentralization on the efficiency of public service delivery. For both subgroups and for both health and education, corruption has negative impacts and the autonomy of regions has positive effects on the relationship between decentralization and public service efficiency. This is the expected result because weak governance at the local level might lead to misuse of decentralized resources and expenditure and worsen the efficiency of public service delivery. Sufficient autonomy of local authorities vis-à-vis the central government is needed to allow the preference matching and allocation efficiency to fully operate.

¹¹ The marginal effect of corruption is obtained as in Ebeke (2012) as follows: $(-0.488 \times 0.05) \times 100 = -2.4$.

¹² In this line, Treisman (1999, 2000a) argues that federal states may be perceived as more corrupt, because of their larger size compared to unitary states.

Table 5. Fiscal Decentralization and Political/Institutional Environments

Variables	Dependent variable: estimated efficiencies							
	Health				Education			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD _(t-1)	-0.523 (-1.540)	-0.809 (-1.137)	-1.307*** (-2.703)	-0.727*** (-3.159)	-1.079* (-1.780)	-0.171 (-0.217)	-0.764* (-1.889)	-0.696 (-1.275)
FD × Corruption _(t-1)	-0.488*** (-3.291)				-0.608*** (-2.738)			
FD × Parliamentary _(t-1)	4.373** (2.206)				1.160 (0.836)			
FD × Regime _(t-1)	0.033*** (2.967)				0.0125 (1.477)			
FD × Autonomy _(t-1)	2.057*** (5.457)				1.952*** (2.931)			
Real GDP pc _(t-1)	-0.040 (-1.535)	-0.122 (-1.598)	-0.117*** (-2.803)	0.013 (1.154)	-0.130** (-2.371)	-0.044 (-0.920)	-0.0717** (-2.257)	-0.020 (-1.120)
Number of observations	810	875	874	875	639	690	689	690
Countries	51	55	55	55	49	53	53	53
Fisher (<i>p-value</i>)	0.006	0.097	0.001	0.000	0.029	0.700	0.241	0.061
Hansen OID (<i>p-value</i>)	0.408	0.868	0.422	0.139	0.900	0.012	0.004	0.141
KP-under	0.040	0.175	0.013	0.001	0.076	0.134	0.067	0.092
FD _(t-1) instrumentation (<i>p-value</i>)	0.000	0.000	0.000	0.000	0.038	0.229	0.014	0.047
FD × I _(t-1) instrument. (<i>p-value</i>)	0.058	0.226	0.000	0.000	0.161	0.115	0.000	0.000

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses.

Source: Authors' calculations.

Table 6. Fiscal Decentralization and Political/Institutional Environments (sub-groups)

Variables	Dependent variable: estimated efficiencies							
	Health				Education			
	Advanced		EME and DC		Advanced		EME and DC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
FD _(t-1)	0.106	0.874*	-0.734***	-0.489***	0.17	-1.255***	-1.455***	-0.975***
FD × Corruption _(t-1)	-0.264 (-1.254)	-1.692	(-4.688) (-3.894)		-0.392 (-0.448)	(-2.614) (-3.294)		(-4.384) (-2.864)
FD × Autonomy _(t-1)	-0.264 (-0.509)		1.344*** (-3.908)		1.754** (-2.54)		1.835*** (-2.942)	
Real GDP pc _(t-1)	-0.108 (-1.146)	0.013 (-0.802)	0.002 (-0.147)	0.017* (-1.698)	-0.154 (-1.115)	-0.064** (-2.077)	-0.056* (-1.694)	-0.010 (-0.560)
Number of observations	266	269	544	606	211	213	428	477
Countries	14	14	37	41	14	14	35	39
Fisher (<i>p-value</i>)	0.003	0.000	0.000	0.000	0.002	0.006	0.000	0.005
Hansen OID (<i>p-value</i>)	0.472	0.036	0.400	0.002	0.228	0.404	0.922	0.101
KP-under	0.521	0.036	0.004	0.000	0.642	0.049	0.064	0.007
FD _(t-1) instrumentation (<i>p-value</i>)	0.000	0.000	0.000	0.000	0.000	0.000	0.027	0.018
FD × I _(t-1) instrument. (<i>p-value</i>)	0.171	0.000	0.002	0.000	0.538	0.002	0.050	0.000

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses.

Source: Authors' calculations.

F. Robustness

A range of sensitivity analysis is performed to assess the robustness of the findings.

Outliers are excluded from the baseline estimates. Then, the baseline model is reestimated using a dependent variable—efficiency of public service delivery—that is derived through alternative methodologies. Finally, the political and institutional variables are replaced with alternative indicators.

The results are robust to the exclusion of countries with extreme ratios of fiscal decentralization. The analysis is conducted using a narrowed sample. Countries totally or almost totally centralized, i.e., with decentralization ratios close to zero, are excluded. Also, countries that have extremely high degrees of decentralization, i.e., decentralization ratios exceeding 90 percent, are dropped. A comparison of the results displayed in Table 7 with those in Table 3 shows that the results are not driven by outliers. Regarding health, the impact of decentralization remains positive for advanced economies, and negative for emerging markets and developing economies, corroborating the baseline findings. The thrust of the results also remains unchanged for education despite a slight difference in the magnitude of the coefficients.

Table 7. Fiscal Decentralization and Public Expenditure Efficiency: Excluding Outliers

Variables	Dependent variable: estimated efficiencies							
	Health				Education			
	Excluding outliers		0%<fd<90%		Excluding outliers		0%<fd<90%	
	Advanced	EME and DC	Advanced	EME and DC	Advanced	EME and DC	Advanced	EME and DC
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
FD _(t-1)	0.599*** -7.956	-0.338*** (-3.023)	0.599*** -7.956	-0.388*** (-3.315)	-0.0453 (-0.339)	-0.884** (-2.560)	-0.0453 (-0.339)	-0.931** (-2.410)
Real GDP pc _(t-1)	0.00763 (0.778)	0.0224*** (2.627)	0.00763 (0.778)	0.0134 (1.426)	-0.0767*** (-4.339)	-0.00773 (-0.437)	-0.0767*** (-4.339)	-0.00673 (-0.341)
Number of observations	269	593	269	531	213	467	213	426
Countries	14	40	14	37	14	38	14	35
Fisher (<i>p-value</i>)	0.000	0.000	0.000	0.000	0.000	0.039	0.000	0.056
Hansen OID (<i>p-value</i>)	0.008	0.000	0.008	0.000	0.000	0.005	0.000	0.037
KP-under	0.000	0.000	0.000	0.000	0.002	0.056	0.002	0.061
FD _(t-1) instrumentation (<i>p-value</i>)	0.000	0.000	0.000	0.000	0.000	0.033	0.000	0.035

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses. Source: Authors' calculations.

The findings are robust to alternative methodologies of efficiency estimates. Two methodologies are employed to compute alternative estimates of the efficiency of public service delivery: a variante of stochastic frontier analysis based on Jondrow and others (1982) and a methodology that takes into account the sample heterogeneity and heteroskedasticity. The results shown in Table 8 focus on the role of political and institutional variables, and confirm

the findings from the baseline analysis.¹³ Under both alternative efficiency estimates, and for both health and education, corruption hinders—with high statistical significance—the impacts of fiscal decentralization on public service efficiency. The favorable role of parliamentary regimes and more democratic institutions in combination with fiscal decentralization is also confirmed, despite weak statistical significance in some cases. The positive impact of the autonomy of regions on the relationship between fiscal decentralization and efficiency of public service delivery is ascertained with high statistical significance in all cases (alternative efficiency estimates and health and education).

The thrusts of the results remain unchanged under an approach that absorbs short-term fluctuations. Fiscal decentralization changes slowly over time and plausibly affects the efficiency of public services with time lags. Thus, it would be useful to check the robustness of the results using averages of the variables over a few-year period. Accordingly, all variables are averaged over a four-year period. In the efficiency of public service delivery and the fiscal decentralization variables, the latter is introduced with a one-period lag. The results, displayed in Table 9, support the baseline findings. Decentralization improves the efficiency of public expenditure in advanced economies (columns 2 and 8). The impact seems negative for emerging markets and developing countries, but it is not statistically significant. In terms of interactive variables, the negative impact of corruption is confirmed (columns 4 and 10). The favorable contribution of parliamentary regimes is also ascertained (columns 5 and 11). As for the autonomy of regions, the impact is positive but not statistically significant.

Furthermore, the results are broadly robust to alternative political and institutional variables. The following alternative variables are employed: bureaucracy, political stability, and checks and balances.¹⁴ All those alternative variables lead to broadly similar inferences as under the baseline analysis; the signs of the coefficients are mostly as expected, although statistical significance is low in many cases (Table 10).

¹³ The pattern of nonlinearity is also broadly confirmed under the alternative efficiency estimates, but with lower statistical significance.

¹⁴ The checks and balances variable measures the existence of effective control over the executive and legislative branches in a presidential system. In parliamentary systems, checks and balances measure whether there is a one, two, or three or more party coalition controlling the government.

Table 8. Fiscal Decentralization and public expenditure efficiency: Alternative Efficiency Estimates

Variables	Dependent variables: Estimated efficiencies															
	Health								Education							
	The Jondrow et al. (1982) approach				Heterogeneous efficiencies				The Jondrow et al. (1982) approach				Heterogeneous efficiencies			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
FD _(t-1)	-0.560 (-1.556)	-0.866 (-1.142)	-1.392*** (-2.711)	-0.781*** (-3.181)	-0.488*** (-2.962)	-0.389 (-1.424)	-0.552*** (-2.770)	-0.546*** (-2.665)	-1.087* (-1.780)	-0.174 (-0.220)	-0.774* (-1.897)	-0.702 (-1.277)	-1.726** (-2.319)	-0.694 (-0.632)	-1.254** (-2.074)	-1.327* (-1.798)
FD × Corruption _(t-1)	-0.518*** (-3.284)				-0.110** (-2.543)				-0.612*** (-2.738)				-0.778*** (-2.873)			
FD × Parliamentary _(t-1)		4.663** (2.208)				0.979 (1.508)				1.161 (0.833)				1.777 (0.872)		
FD × Regime _(t-1)			0.0355*** (2.970)				0.009** (2.052)				0.0126 (1.477)				0.0184 (1.451)	
FD × Autonomy _(t-1)				2.199*** (5.504)				1.069*** (2.732)				1.965*** (2.939)				3.121*** (3.243)
Real GDP pC _(t-1)	-0.0415 (-1.516)	-0.13 (-1.596)	-0.125*** (-2.825)	0.0144 (1.182)	-0.099*** (-11.046)	-0.112*** (-4.312)	-0.132*** (-5.617)	-0.084*** (-7.668)	-0.131** (-2.377)	-0.044 (-0.922)	-0.072** (-2.256)	-0.020 (-1.136)	-0.089 (-1.306)	0.023 (0.322)	-0.036 (-0.732)	0.053** (2.185)
Number of observations	810	875	874	875	719	778	777	778	639	690	689	690	639	690	689	690
Countries	51	55	55	55	51	55	55	55	49	53	53	53	49	53	53	53
Fisher (<i>p-value</i>)	0.006	0.095	0.001	0.000	0.000	0.000	0.000	0.000	0.029	0.695	0.239	0.060	0.001	0.011	0.001	0.000
Hansen OID (<i>p-value</i>)	0.398	0.871	0.437	0.136	0.009	0.154	0.085	0.246	0.901	0.012	0.004	0.141	0.722	0.028	0.033	0.425
KP-under	0.040	0.175	0.013	0.001	0.000	0.013	0.000	0.000	0.076	0.134	0.067	0.092	0.076	0.134	0.067	0.092
FD _(t-1) instrumentation (<i>p-value</i>)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.229	0.014	0.047	0.038	0.229	0.014	0.047
FD × I _(t-1) instrument. (<i>p-value</i>)	0.058	0.226	0.000	0.000	0.000	0.039	0.000	0.000	0.161	0.116	0.000	0.000	0.161	0.116	0.000	0.000

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses.

Source: Authors' calculations.

Table 9: Fiscal Decentralization and Public Expenditure Efficiency: Absorbing Short-term Fluctuations

Variables	Dependent variables: 4-year average of estimated efficiencies											
	Health						Education					
	All	Advanced	EME and DC	Political interactions			All	Advanced	EME and DC	Political interactions		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FD _(t-1)	-0.092 (-0.362)	0.294*** (3.091)	-0.759 (-1.514)	-0.350 (-1.198)	-0.313 (-0.512)	-1.637 (-1.506)	-0.001 (-0.001)	0.482*** (3.636)	-0.460 (-0.642)	-0.550 (-1.179)	-3.718 (-1.139)	0.180 (0.136)
FD × Corruption _(t-1)				-0.136 (-1.539)						-0.343*** (-2.654)		
FD × Parliamentary _(t-1)					1.977* (1.689)						4.912 (1.148)	
FD × Autonomy _(t-1)						1.455 (1.607)						0.0738 (0.068)
Real GDP pc _(t-1)	0.033*** (3.484)	0.013 (0.698)	0.028 (1.400)	0.003 (0.109)	-0.049 (-0.868)	0.020 (0.832)	-0.012 (-0.414)	-0.124*** (-3.991)	0.007 (0.217)	-0.047 (-1.187)	-0.155 (-0.969)	-0.011 (-0.268)
Number of observations	221	63	158	203	221	221	199	61	138	184	199	199
Countries	55	14	41	51	55	55	52	14	38	48	52	52
Fisher (<i>p-value</i>)	0.002	0.002	0.016	0.011	0.231	0.218	0.909	0.001	0.815	0.078	0.83	0.996
Hansen OID (<i>p-value</i>)	0.012	0.219	0.318	0.422	0.674	0.691	0.065	0.059	0.045	0.267	0.899	0.087
KP-under	0.522	0.107	0.698	0.361	0.569	0.717	0.507	0.134	0.667	0.255	0.646	0.704

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses.
Source: Authors' calculations.

Table 10: Fiscal Decentralization and Public Expenditure Efficiency: alternative political and institutional variables.

Variables	Dependent variable: estimated efficiencies											
	Health						Education					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FD _(t-1)	-0.486* (-1.838)	0.953*** (3.609)	-0.597*** (-3.131)	-1.408 (-1.513)	-0.480*** (-2.741)	-0.022 (-0.061)	-0.007 (-0.003)	0.786** (2.143)	-0.409 (-1.382)	-0.811 (-1.310)	0.565 (1.519)	-0.014 (-0.008)
FD × Assembly elec. _(t-1)							5.499 (0.525)					
FD × Presidential _(t-1)		-1.737*** (-4.999)						-1.410*** (-2.583)				
FD × All house _(t-1)			0.541*** (3.846)						0.13 (1.452)			
FD × Bureaucracy _(t-1)				0.379 (0.953)						0.16 (0.644)		
FD × Political stab. _(t-1)					0.102 (0.781)						0.459 (1.394)	
FD × Checks and balances _(t-1)						0.141 (0.924)						-1.032 (-1.216)
Real GDP pc _(t-1)	0.054*** (5.817)	0.002 (0.169)	0.004 (0.394)	-0.008 (-0.282)	0.006 (0.412)	0.009 (0.540)	0.023 (0.786)	-0.034** (-2.319)	-0.027*** (-2.715)	-0.032 (-1.541)	-0.022 (-1.065)	0.080 (0.910)
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	875	875	844	807	602	868	690	690	664	639	482	684
Countries	55	55	54	51	55	55	53	53	51	49	51	53
Fisher (<i>p-value</i>)	0.000	0.000	0.000	0.000	0.000	0.596	0.533	0.016	0.003	0.074	0.039	0.812
Hansen OID (<i>p-value</i>)	0.009	0.631	0.001	0.003	0.000	0.012	0.598	0.011	0.000	0.002	0.094	0.483
KP-under	0.013	0.000	0.000	0.135	0.024	0.426	0.872	0.109	0.062	0.262	0.007	0.858
FD _(t-1) instrumentation (<i>p-value</i>)	0.000	0.000	0.000	0.000	0.004	0.000	0.302	0.024	0.034	0.057	0.045	0.075
FD × I _(t-1) instrument. (<i>p-value</i>)	0.042	0.000	0.000	0.002	0.141	0.622	0.263	0.228	0.000	0.385	0.059	0.938

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses.
Source: Authors' calculations.

G. Revenue Decentralization

Decentralization of revenue can contribute to public service efficiency. Revenue decentralization shows positive and statistically significant impacts on public service delivery for advanced economies and emerging economies and developing countries (Table 11). The findings are robust to alternative estimates of the efficiency variable, based on Jondrow (Table 12) or adjusting for heterogeneity (Table 12). The robustness is further ascertained by excluding outliers or by restricting the sample to only the countries that have revenue decentralization between zero and ninety percent (Table 13). For health and education, and for advanced economies and emerging economies and developing countries, revenue decentralization positively affects the efficiency of public service delivery. These findings might imply the need to accompany expenditure decentralization with sufficient revenue decentralization to ensure improvement of performance.¹⁵

Table 11. Revenue Descentralization: Baseline and Country Specific Estimates

Variables	Dependent variable: estimated efficiencies					
	Health			Education		
	All	Advanced	EME and DC	All	Advanced	EME and DC
	(1)	(2)	(3)	(4)	(5)	(6)
FD Revenue _(t-1)	0.57*** (4.334)	0.561*** (6.168)	0.0487 (0.416)	1.275** (2.524)	0.666*** (4.297)	0.673* (1.771)
Real GDP pc _(t-1)	0.0485*** (5.778)	-0.0424** (-1.963)	-0.0551*** (-3.061)	0.0381 (1.640)	0.0271 (0.874)	-0.0104 (-0.242)
Time dummies	No	Yes	Yes	No	Yes	Yes
Number of observations	904	269	635	714	213	501
Countries	55	14	41	53	14	39
Fisher-p (<i>p-value</i>)	0.000	0.000	0.000	0.042	0.000	0.174
Hansen OID (<i>p-value</i>)	0.000	0.000	0.008	0.033	0.003	0.001
KP-under	0.000	0.001	0.000	0.011	0.020	0.001

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses.

Source: Authors' calculations.

¹⁵ This analysis could be complemented with a direct investigation of the impact of vertical fiscal imbalance; however, the latter variable is not available for most countries in the sample.

Table 12: Revenue Decentralization: Alternative Efficiency Estimates

Variables	Dependent variable: estimated efficiencies					
	Health			Education		
	Jondrow et			Jondrow et		
	All	al. (1982)	Heterog.	All	al. (1982)	Heterog.
(1)	(2)	(3)	(4)	(5)	(6)	
FD Revenue _(t-1)	0.57*** (4.334)	0.616*** (4.429)	-0.098 (-0.997)	1.275** (2.524)	1.286** (2.532)	1.653*** (2.799)
Real GDP pc _(t-1)	0.048*** (5.778)	0.053*** (5.842)	-0.078*** (-12.645)	0.038 (1.640)	0.038 (1.627)	0.125*** (4.503)
Time dummies	No	No	No	No	No	No
Number of observations	904	904	805	714	714	714
Countries	55	55	55	53	53	53
Fisher-p (<i>p-value</i>)	0.000	0.000	0.000	0.042	0.041	0.000
Hansen OID (<i>p-value</i>)	0.000	0.000	0.001	0.033	0.034	0.029
KP-under	0.000	0.000	0.000	0.011	0.011	0.011

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses.

Source: Authors' calculations.

Table 13: Revenue Decentralization: Excluding Outliers

Variables	Dependent variable: estimated efficiencies							
	Health				Education			
	Excluding outliers		0%<fd<90%		Excluding outliers		0%<fd<90%	
	Advanced	EME and DC	Advanced	EME and DC	Advanced	EME and DC	Advanced	EME and DC
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
FD _(t-1)	0.670*** (8.023)	0.463*** (3.308)	0.670*** (8.023)	0.366** (2.455)	0.094 (0.680)	1.051* (1.892)	0.094 (0.680)	1.036** (2.324)
Real GDP pc _(t-1)	0.041*** (3.057)	0.046*** (4.983)	0.041*** (3.057)	0.036*** (3.35)	-0.082*** (-5.654)	0.054** (-2.028)	-0.082*** (-5.654)	0.039 (-1.595)
Number of observations	269	622	269	528	213	491	213	423
Countries	14	41	14	37	14	39	14	35
Fisher (<i>p-value</i>)	0.000	0.000	0.000	0.004	0.000	0.081	0.000	0.063
Hansen OID (<i>p-value</i>)	0.040	0.000	0.040	0.000	0.000	0.003	0.000	0.007
KP-under	0.000	0.000	0.000	0.000	0.004	0.012	0.004	0.003
FD _(t-1) instrumentation (<i>p-value</i>)	10.445	11.122	10.445	8.222	6.387	3.573	6.387	4.399

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses. Source: Authors' calculations.

The importance of a favorable institutional environment is also confirmed by the analysis of revenue decentralization (Table 14). Corruption decreases the positive impact of revenue decentralization on the efficiency of public service delivery. Despite the negative influence of the regime variable, which accounts for the strength of the democracy, the overall effect of revenue decentralization remains positive. The checks and balances variable, which is incrementally coded with the existence of effective control over the executive and legislature in a presidential system, enhances the contribution of revenue decentralization.

Table 14. Revenue Decentralization: Political/Institutional Interactions

Variables	Dependent variable: estimated efficiencies							
	Health				Education			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD Revenue _(t-1)	0.116 (0.598)	0.944*** (3.050)	1.443** (2.379)	-0.26 (-0.513)	-0.613 (-0.896)	3.436** (2.266)	2.052** (2.019)	0.593 (0.707)
FDR × Corruption _(t-1)	-0.170*** (-3.787)				-0.458*** (-3.853)			
FDR × Regime _(t-1)	-0.018** (-2.456)				-0.040* (-1.951)			
FDR × Parliamentary _(t-1)	-2.297 (-1.406)				-0.997 (-0.836)			
FDR × Checks _(t-1)	0.264** (2.110)				0.12 (0.739)			
Real GDP pc _(t-1)	0.039*** (3.690)	0.053* (1.729)	0.108** (2.488)	0.026 (1.287)	0.005 (0.212)	0.244** (2.002)	0.073 (1.547)	0.016 (0.481)
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	836	903	904	895	660	713	714	706
Countries	51	55	55	55	49	53	53	53
Fisher (<i>p-value</i>)	0.000	0.000	0.000	0.022	0.000	0.221	0.279	0.209
Hansen OID (<i>p-value</i>)	0.007	0.022	0.066	0.677	0.975	0.674	0.150	0.042
KP-under	0.000	0.000	0.532	0.059	0.085	0.086	0.114	0.216

Note: (*), (**) and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses. Source: Authors' calculations.

IV. CONCLUSIONS AND POLICY IMPLICATIONS

Fiscal decentralization can serve as a policy tool to improve the efficiency of public service delivery, but only under some conditions. Expenditure decentralization seems to have improved service delivery in advanced economies, but its impacts in emerging economies and developing countries seems rather mixed. The empirical findings in this paper indicate that expenditure decentralization needs to exceed an indicative threshold of about 35 percent to improve service delivery. However, revenue decentralization seems to have positive impacts across all country groups. This seems to indicate the need to accompany the decentralization of responsibilities with sufficient decentralization of resources.

Findings under expenditure decentralization and under revenue decentralization point to the need for a favorable institutional and political environment. Effective autonomy of local governments is required to allow preference matching and the allocative efficiency hypothesis to operate. Strong accountability of local authorities vis-à-vis the local population is necessary to allow the productive efficiency hypothesis to operate. Corruption needs to be tackled to prevent misuse of public resources. And capacity needs to be strengthened at the local level. Absent those conditions, fiscal decentralization can worsen public service delivery.

An extension of this paper could include an analysis of an alternative indicator of policy outcome and an investigation of the impact of decentralization on other macroeconomic performance. Alternative outcome indicators, such as life expectancy at birth and adjusted primary education net enrollment rate, are presented in the paper to confirm the robustness of the results (Annex III). However, it would be insightful to conduct the analysis using life expectancy, school drop-out rates, or PISA scores as these variables might exhibit larger variance across countries and across time. Moreover, it would be important to analyze the impact of decentralization on key macroeconomic performance, such as fiscal outcome and GDP growth as improvements in public expenditure efficiency can be a channel through which decentralization ultimately influences those variables.

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Annex I. Countries, Data Coverage, and Sources

Countries	Coverage	Sources	Countries	Coverage	Sources
Argentina	1993–2004	GFS, WEO	Korea	2000–2012	OECD database
Australia	1990–2011	OECD database	Latvia	1995–2012	Eurostat
Austria	1990–2012	Eurostat	Lesotho	1990–2008	GFS, WEO
BahrainT	1990–2004	GFS, WEO	Lithuania	1995–2012	Eurostat
Belarus	2001–2010	GFS, WEO	Luxembourg	1990–2012	Eurostat
Belgium	1990–2012	Eurostat	Maldives	1990–2011	GFS, WEO
Bhutan	1990–2009	GFS, WEO	Malta	1995–2012	Eurostat
Bolivia	1990–2007	GFS, WEO	Mauritius	2000–2011	GFS, WEO
Brazil	1997–2012	GFS, WEO	Mexico	1990–2012	GFS, WEO
Bulgaria	1995–2012	Eurostat	Mongolia	1992–2012	GFS, WEO
Canada	1990–2010	OECD database	Netherlands	1990–2012	Eurostat
Chile	1990–2012	GFS, WEO	New Zealand	1990–2012	OECD database
Croatia	2002–2012	Eurostat	Norway	1990–2012	Eurostat
Cyprus	1995–2012	Eurostat	Pakistan	1990–2007	GFS, WEO
Czech Republic	1995–2012	Eurostat	Peru	1995–2012	GFS, WEO
Denmark	1990–2012	Eurostat	Poland	1995–2012	Eurostat
Egypt	2002–2012	GFS, WEO	Portugal	1990–2012	Eurostat
Estonia	1995–2012	Eurostat	Romania	1995–2012	Eurostat
Finland	1990–2012	Eurostat	Seychelles	1993–2012	GFS, WEO
France	1990–2012	Eurostat	Singapore	1990–2012	GFS, WEO
Georgia	1997–2012	GFS, WEO	Slovak Republic	1995–2012	Eurostat
Germany	1990–2012	Eurostat	Slovenia	1995–2012	Eurostat
Greece	1995–2012	Eurostat	South Africa	1990–2012	GFS, WEO
Hungary	1995–2012	Eurostat	Spain	1995–2012	Eurostat
Iceland	1995–2012	Eurostat	Sweden	1993–2012	Eurostat
India	1990–2012	GFS, WEO	Switzerland	1990–2012	Eurostat
Indonesia	1990–2004	GFS, WEO	Tunisia	1990–2012	GFS, WEO
Iran	1990–2009	GFS, WEO	Turkey	1990–2012	OECD database
Ireland	1990–2012	Eurostat	United Kingdom	1990–2012	Eurostat
Israel	1995–2012	OECD database	United States	1990–2012	OECD database
Italy	1990–2012	Eurostat	Uruguay	1999–2012	GFS, WEO
Japan	1990–2012	OECD database	Venezuela	1990–2005	GFS, WEO

Annex II. Variables, Definitions and Data Sources

Variables	Description	Sources
<i>Fiscal variables</i>		
Expenditure decentralization	Fiscal decentralization - Expenditures side	Eurostat, GFS, OECD and WEO
Revenue decentralization	Fiscal decentralization - Revenue side	
<i>Demographic and macro variables</i>		
Imr	Mortality rate, infant (per 1,000 live births)	World Bank, World Development Indicators 2014
Umr	Mortality rate, under-5 (per 1,000 live births)	
Primary education	Primary education, duration (years)	
Secondary education	Secondary education, duration (years)	
Average year of schooling	Average year of primary and secondary schooling	
Total population	Measures the size of the population	
Density	Population density (people per sq. km of land area)	
Real GDP pc	GDP per capita, PPP (constant 2011 international)	
Natural resources (% GDP)	Natural resource rents	
<i>Health and education variables</i>		
Health expenditure	Health expenditure, public (% of GDP)	OECD and UNESCO databases
Primary enrollment	Gross enrollment ratio, primary, both sexes (%)	
Secondary enrollment	Gross enrollment ratio, secondary, both sexes (%)	
Education exp.	Government expenditure on education as % of GDP (%)	
<i>Political and institutional variables</i>		
Polstab	Political stability measures the likelihood that the government will be destabilized by unconstitutional or violent means.	The WGI, 2013 Update
Government fractionalization	Probability that two deputies randomly picked from the government parties will be of different parties.	
Fractionalization	The probability that two deputies picked from the legislature will be of different parties.	DPI2012 Database of Political Institutions:
Parliamentary	Dummy variable that takes value 1 if the political system is parliamentary	
Democracy	Variable recording the strenght of the democracy	
Autonomy	Dummy variable taking value 1 with the existence of autonomous region	
Corruption	Assessment of corruption within the political system.	

Note: *Expenditure* and *Revenue decentralization* for European and OECD countries are taken respectively from Eurostat and OECD databases. For emerging economies and developing countries, data are from GFS and WEO.

Annex III. Alternative Policy Outcome Variables
(Life expectancy at birth and adjusted primary education net enrollment rate)

Table A3.1: Fiscal Decentralization and Public Expenditure Efficiency

	Dependent variable: estimated efficiencies									
	Health					Education				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FD _(t-1)	-0.775***	-0.279***	-0.530**	-0.248	0.367***	-1.474***	0.931	-1.649***	-0.162	0.547**
	(-4.072)	(-2.833)	(-2.515)	(-0.799)	(4.924)	(-3.182)	(1.049)	(-3.104)	(-0.787)	(2.115)
(FD _(t-1)) ²	1.069***	0.441***	0.868**			2.719***	-1.069	3.106***		
	(3.975)	(3.134)	(2.470)			(3.613)	(-0.976)	(3.230)		
Real GDP pc _(t-1)	-0.0027	0.0150***	0.000	0.006	0.002	0.045***	-0.006	0.052***	0.067***	0.013
	(-0.600)	(3.588)	(-0.019)	(0.532)	(0.520)	(3.542)	(-0.626)	(3.149)	(6.468)	(0.972)
Number of observations	926	303	623	528	394	569	188	381	321	246
Countries	58	16	42	40	30	50	14	36	32	24
Fisher (<i>p-value</i>)	0.000	0.000	0.003	0.119	0.000	0.000	0.748	0.000	0.000	0.066
Hansen OID (<i>p-value</i>)	0.014	0.000	0.002	0.148	0.253	0.020	0.198	0.011	0.001	0.129
KP-under	0.000	0.000	0.000	0.419	0.000	0.000	0.061	0.004	0.048	0.001

Note: (*), (**), and (***) denote statistical significance level of 10 percent, 5 percent and 1 percent respectively. Robust t-statistics in Source: Authors' calculations.

Table A3.2: Fiscal Decentralization and Political/Institutional Environment

	Dependent variable: estimated efficiencies							
	Health				Education			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD _(t-1)	-0.065	-0.087***	-0.245***	-0.146***	-0.419	0.003	-0.111	-0.373*
	(-1.261)	(-2.969)	(-3.783)	(-3.492)	(-1.378)	(0.015)	(-0.763)	(-1.955)
FD × Corruption _(t-1)	-0.026				-0.426***			
	(-0.604)				(-2.830)			
FD × Parliamentary _(t-1)		-0.064				-3.643		
		(-0.355)				(-1.585)		
FD × Regime _(t-1)			0.008***				-0.002	
			(3.961)				(-0.493)	
FD × Autonomy _(t-1)				0.530***				1.561***
				(5.022)				(3.259)
Real GDP pc _(t-1)	0.008	0.0118*	-0.027***	0.006	-0.038	0.148***	0.057**	0.038**
	(1.449)	(1.722)	(-3.383)	(1.642)	(-1.066)	(3.376)	(2.407)	(2.220)
Number of observations	861	926	925	926	529	569	568	569
Countries	54	58	58	58	46	50	50	50
Fisher (<i>p-value</i>)	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen OID (<i>p-value</i>)	0.001	0.002	0.471	0.113	0.194	0.206	0.000	0.024
KP-under	0.264	0.122	0.000	0.000	0.026	0.445	0.000	0.001

Note: (*), (**), and (***) denote statistical significance level of 10%, 5% and 1% percent respectively. Robust t-statistics in parentheses.

Source: Authors' calculations.