PAPER

Title: Fiscal Decentralization and the Allocation of Public Spending of Subnational Governments: The Case of Ecuador

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Abstract: *(maximum 300 words)*
This article analyzes the relationship between fiscal decentralization and the growth rate of per capita public spending by subnational governments in Ecuador. A theoretical model is proposed to support the empirical strategy. Data at provincial level over the period 2001–2015 are used. The estimation results for the aggregation of subnational governments show that financial autonomy is positively correlated with the growth rates of per capita public investment and per capita current spending. However, the latter is also negatively correlated with tax autonomy. When using disaggregated data on provincial and local governments, results for financial autonomy hold in most of the cases. However, no evidence is found for tax autonomy. Evidence on a structural break following the passing of the Constitution of 2008 is also found and suggests that the Constitution has had an overall positive impact on public spending. Moreover, considering the structural break sheds light on the results found when it is not taken into account.

Keywords: *Subnational governments; Decentralization; Public spending; Ecuador.*
JEL codes: H53; H77; C23

1. Introduction

In the last three decades, Ecuador, like many other countries around the world, has been involved in a decentralization process whereby the subnational governments have been granted more administrative and fiscal responsibilities.[1] This article analyzes the allocation of public spending by the Ecuadorian subnational governments during the period 2001–2015 with special focus on the role played by fiscal decentralization.

Recently, Aray and Pacheco-Delgado (2020) tested the public investment allocation of Ecuador's central government across provinces. However, this article differs largely from Aray and Pacheco-Delgado (2020) in three ways. First, we focus on subnational governments at both the provincial and the municipal level. Second, we are interested not only in the allocation of public investment but also of current public spending. Public investment aims to increase public capital, while it is assumed that current spending aims to increase human capital (Diamond, 1990; Baldacci, Clements, Gupta and Cui, 2008, among others.). And third, we focus on the relationship between fiscal decentralization and the growth rate of per capita public expenditure of the subnational governments. Two variables are proposed to capture fiscal decentralization: financial autonomy and tax autonomy. The former measures the ratio of the subnational governments' own revenues to the transfers from the general state budget. The latter is measured as the share of the tax collected by the subnational governments on the total taxes collected in the provinces, regardless of the tax collection body.

A very important strand of the literature analyzes the relationship between decentralization and economic performance. In this line, the relationship between fiscal decentralization and economic growth has been the most studied (Martínez-Vázquez and McNab, 2003; Baskaran, Feld and Schnellenbach, 2016; and Martínez-Vázquez, Lago-Peñas and Sacchi, 2017). The relationships between fiscal decentralization and public expenditure composition and efficiency have also been widely addressed in the literature. The composition of public expenditures has been analyzed by authors such as Kappeler and Välilä (2008), Jia, Guo and Zhang (2014), Grisorio and Prota (2015a, 2015b), González-Alegre (2010) and Arze del Granado, Martinez-Vazquez and McNab (2018). As regards efficiency, it is worth mention the works of Balaguer-Coll, Prior and Tortosa-Ausina (2010), Boetti, Piacenza and Turati (2012), Brehm (2013) and Adam, Delis and Kammas (2014).

[1] See Faust and Harbers (2011).

The relationship between fiscal decentralization and public spending allocation has been much less studied as confirmed in the literature review of Martínez-Vázquez *et al*. (2017). Exceptions in this regard include Kappeler, Solé-Ollé and Välilä (2013), who found a positive relationship between revenue decentralization and the provision of public infrastructure at the subnational level in 20 European countries. Similar results have also been found by González-Alegre (2015) and Aray (2019) for the case of Spain.

For the case of Latin American countries, there is scarce evidence on the relationship between fiscal decentralization and public spending. De Mello (2010) provided evidence for a panel of Latin American countries and suggested that fiscal decentralization was negatively correlated with the investment-to-GDP ratio of subnational governments. Regarding single-country studies, Faguet (2004) found that fiscal decentralization is positively correlated with the public investment provision of subnational governments.

Therefore, the contribution of this article is to provide evidence on this little studied topic in Latin America. Precisely, the Inter-American Development Bank (IADB), in a series of articles collected by Fretes and Ter-Minassian (2015), suggested that more local autonomy to generate and manage tax revenues could promote more local development and efficiency. This is especially interesting because Latin American subnational governments rely heavily on transfers from the general state budgets to finance their spending.

The case of Ecuador is particularly interesting as the country has undergone high political instability and fragmentation since returning to democracy in 1979, which has hindered governability and the achievement of stable political agreements, such as administrative and fiscal decentralization. It is worth mentioning that Ecuador has reformed its constitution twice in a span of ten years (1998 and 2008). The Constitution of 2008 is the country's twentieth Magna Carta since Ecuador became an independent nation in 1830, which could be seen as a further symptom of political instability (Negretto, 2009, 2015). In addition, Ecuador is an interesting case because it is an oil exporting country, which might complicate the decentralization process given the important weight the oil industry carries in state revenues.

Although the beginning of the decentralization process in Ecuador dates to the 1970s with the administrative decentralization, it was not until the late 1990s that this process began to emerge. The Constitution of 1998 made progress in the administrative and fiscal decentralization (Tello-Toral and Lucio-Vásquez, 2019).

The Constitution of 2008 is supposed to have given an important boost to the decentralization process, as it provided a model of territorial and administrative division to achieve greater accountability in the allocation of public resources. For example, the decentralized autonomous governments (GAD, in Spanish) were created, which are public institutions that shape the administrative organization of the country's territory.[2]

In addition, Constitution of 2008 promotes fiscal decentralization from both sides: spending and revenues. Therefore, it establishes tax responsibilities by layers of government and clearly defines the main taxes, fees and special contributions assigned to the GAD. Moreover, the GAD are encouraged to take an efficiency-equity trade-off approach in order to meet one of the main objectives of the National Plan for Good Living (*Plan Nacional del Buen Vivir*),[3] that is, to reduce poverty and inequality across the Ecuadorian provinces (Senplades, 2009).

To provide empirical evidence on the relationship between fiscal decentralization and public spending in Ecuador, we propose a theoretical model in which the subnational (regional/local) planner chooses the level of public spending that maximizes a regional collective welfare function subject to the production technology of the regional economy. The model allows to get equations for the growth rates of public investment per capita and current public expenditure per capita. The equations capture the traditional criteria for public spending allocation: the equity-efficiency trade-off, special needs and political factors. Moreover, introducing fiscal variables allows us to test whether the per capita growth rates of public investment and current expenditures are correlated with fiscal decentralization.

In the empirical implementation, panel data of 22 provinces[4] for the period 2001–2015 are used in the analysis. The estimation results for the aggregation of subnational governments (provincial and local) show that financial autonomy is positively correlated with the growth rate of both public investment per capita and current spending per capita. In addition, the growth rate of current public spending per capita is found to be negatively correlated with tax autonomy. When data are disaggregated into layers of subnational governments, the positive relationship found between financial autonomy and growth rate

[2] Appendix A provides an overview of the Ecuadorian administrative system and the financing of subnational governments.
[3] National development plans are scheduled for periods of 4 years. The National Plan for Good Living was implemented in the period 2009–2013.
[4] Although Ecuador has been divided into 24 provinces since 2008, to take advantage of the information available since 2001, we use the previous administrative division, that is, 22 provinces.

of public investment holds for both the provincial and the local governments. In addition, a positive relationship between the growth rate of current public spending per capita and financial autonomy is only found for local governments. Evidence on tax autonomy was not found in any case. Evidence of a structural break caused by the Constitution of 2008 is also shown. Moreover, when the structural break is considered, it incidentally provides, in some cases, explanations for why no evidence on the relationships between the decentralization variables and public spending is found when the structural break is not taken into account. In addition, hypothesis tests show that the relationships between fiscal variables and the per capita current spending (public investment) growth rate are (not) different across layers of government.

This paper is organized as follows. Section 2 presents the theoretical model. The empirical strategy is explained in Section 3 and the estimation results are discussed in Section 4. Robustness checks are performed in section 5, while the main conclusions are presented in section 6.

2. Theoretical model

The collective welfare of the province *j* is expressed by the regional (provincial and local) planner as follows

$$W_{jt} = N_{jt} y_{jt}^{\rho} \Psi_{jt}^{1-\rho} \ , \qquad 0 \leq \rho \leq 1 \qquad (1)$$

Where y_{jt} is the per capita income in the province *j*, Ψ_{jt} denotes the province's economic, social and demographic variables and any other relevant characteristics other than political factors, which are assumed to affect the utility of the individuals. N_{jt} is the population. If $\rho = 1$ ($\rho = 0$), the regional planner only cares about the total income/output (specific characteristics) of the province.

The provincial economy *j* produces an output Y_{jt} in each period *t* according to a Cobb–Douglas production function as follows:

$$Y_{jt} = A_{jt} K_{jt}^{\mu_j} H_{jt}^{\phi_j} G_{jt}^{\theta_j} \qquad 0 < \mu_j, \phi_j, \theta_j < 1 \qquad (2)$$

Where K_{jt} is the non-residential private capital stock, H_{jt} is the human capital input, G_{jt} is the public capital stock and A_{jt} is the total factor productivity. μ_j, ϕ_j, θ_j are the elasticities of the output with respect to the inputs.

Following Hercowitz and Sampson (1991), Kocherlakota and Yi (1997) and Cassou and Lansing (1998), let G_{jt} and H_{jt} accumulate according to the following motion laws:[5]

$$G_{jt} = G_{jt-1}^{1-\left(\sigma_j^G+\vartheta_j^G\right)} CI_{jt}^{\sigma_j^G} RI_{jt}^{\vartheta_j^G} \qquad (3)$$

$$0 < \sigma_j^G, \vartheta_j^G < 1\,; \quad 0 < \sigma_j^G + \vartheta_j^G < 1$$

$$H_{jt} = H_{jt-1}^{1-\left(\sigma_j^H+\vartheta_j^H\right)} CC_{jt}^{\sigma_j^H} RC_{jt}^{\vartheta_j^H} \qquad (4)$$

$$0 < \sigma_j^H, \vartheta_j^H < 1\,; \quad 0 < \sigma_j^H + \vartheta_j^H < 1$$

Where CI_{jt} and RI_{jt} are the public capital investments made by the central and regional (subnational) governments, respectively, in province *j* in period *t*. CC_{jt} and RC_{jt} are the current expenditures made by the central and subnational governments, respectively, in province *j* in period *t*. Following Diamond (1990) and Baldacci *et al*. (2008), we assume that current public spending becomes an input for human capital accumulation since it includes salaries in the public education and health sectors and any other current expenditures that foster more skillful and healthier workers.

The advantages of specifications such as equations (3) and (4) with respect to the standard linear form has already been highlighted by Cassou and Lansing (1998).

The objective of the subnational planner is to choose the levels of RI_{jt} and RC_{jt} that maximize equation (1) subject to equations (2), (3), (4) and the budget constraint

$$RI_{jt} + RC_{jt} \leq \mathrm{RR}_{jt} \qquad (5)$$

Where RR_{jt} is the resource constraint of the subnational planner in province *j*, which is assumed to be fixed for the sake of simplicity and in line with Berhman and Craig (1987) and Castells and Solé-Ollé (2005).

The first order conditions of the maximization problem are:

$$\frac{\partial W_t}{\partial y_{jt}} \cdot \frac{\partial y_{jt}}{\partial G_{jt}} \cdot \frac{\partial G_{jt}}{\partial RI_{jt}} - \lambda_t = 0 \qquad (6)$$

$$\frac{\partial W_t}{\partial y_{jt}} \cdot \frac{\partial y_{jt}}{\partial H_{jt}} \cdot \frac{\partial H_{jt}}{\partial RC_{jt}} - \lambda_t = 0 \qquad (7)$$

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[5] These authors used similar expressions to model the evolution of private capital stock.

Where λ_t is the Lagrange multiplier, which can be interpreted as the marginal cost of public revenues.

Substituting partial derivatives in (6) and (7), the following equations are obtained:

$$\rho\theta_j\vartheta_j^G N_{jt}\Psi_{jt}^{1-\rho}y_{jt}^{\rho-1}\frac{y_{jt}}{RI_{jt}} - \lambda_t = 0 \qquad (8)$$

$$\rho\phi_j\vartheta_j^H N_{jt}\Psi_{jt}^{1-\rho}y_{jt}^{\rho-1}\frac{y_{jt}}{RC_{jt}} - \lambda_t = 0 \qquad (9)$$

The solution of this maximization problem provides the optimal levels of public investment and current expenditure per capita made by the subnational government of province *j* in year *t*:

$$\widehat{ri}_{jt} = \frac{\rho\theta_j\vartheta_j^G}{\lambda_t}\Psi_{jt}^{1-\rho}y_{jt}^{\rho-1}y_{jt} \qquad (10)$$

$$\widehat{rc}_{jt} = \frac{\rho\phi_j\vartheta_j^H}{\lambda_t}\Psi_{jt}^{1-\rho}y_{jt}^{\rho-1}y_{jt} \qquad (11)$$

Where $\widehat{ri}_{jt} = \widehat{RI}_{jt}/N_{jt}$ and $\widehat{rc}_{jt} = \widehat{RC}_{jt}/N_{jt}$.

Following the literature, we also consider political factors that could deviate the allocation of public spending from the optimal rules. Therefore, we consider that the per capita public investment and per capita current expenditure made by the subnational government in province *j* in year *t*, ri_{jt} and rc_{jt}, adjust toward the optimal level according to the following equations:

$$\frac{ri_{jt}}{ri_{jt-1}} = e^{\left(z_{jt}^i+\varepsilon_{jt}^i\right)}\left(\frac{\widehat{ri}_{jt}}{ri_{jt-1}}\right)^{\gamma^i}, \quad 0 \le \gamma^i \le 1 \qquad (12)$$

$$\frac{rc_{jt}}{rc_{jt-1}} = e^{\left(z_{jt}^c+\varepsilon_{jt}^c\right)}\left(\frac{\widehat{rc}_{jt}}{rc_{jt-1}}\right)^{\gamma^c}, \quad 0 \le \gamma^c \le 1 \qquad (13)$$

Where parameters γ^i and γ^c are the adjustment coefficients toward the optimal levels of per capita public investment and per capita current expenditures, respectively. z_{jt}^i and z_{jt}^c are exogenous deterministic shocks caused by political factors, ε_{jt}^i and ε_{jt}^c are random disturbances with expected values equal to zero and *e* is the exponential operator.

By substituting equation (10) in (12) and equation (11) in (13) and taking natural logarithm, we obtain:

$$\Delta Ln(ri_{jt}) = z_{jt}^{i} + \gamma^{i} Ln\left(\frac{\rho\theta_j\vartheta_j^{G}}{\lambda_t}\Psi_{jt}^{1-\rho}y_{jt}^{\rho-1}\frac{y_{jt}}{ri_{jt-1}}\right) + \varepsilon_{jt}^{i} \qquad (14)$$

$$\Delta Ln(rc_{jt}) = z_{jt}^{c} + \gamma^{c} Ln\left(\frac{\rho\phi_j\vartheta_j^{H}}{\lambda_t}\Psi_{jt}^{1-\rho}y_{jt}^{\rho-1}\frac{y_{jt}}{rc_{jt-1}}\right) + \varepsilon_{jt}^{c} \qquad (15)$$

As can be noticed, equations (14) and (15) capture the development indicator (y_{jt}), and indicators for the productivity of the public spending ($\frac{y_{jt}}{ri_{jt-1}}$ and $\frac{y_{jt}}{rc_{jt-1}}$).

3. Empirical strategy

When local governments plan public spending, they rely on the available information. Therefore, let us rewrite equations (14) and (15) considering the lag in the output per capita as follows:

$$\Delta Ln(ri_{jt}) = z_{jt}^{i} + \gamma^{i} Ln\left(\frac{\rho\theta_j\vartheta_j^{G}}{\lambda_t}\Psi_{jt}^{1-\rho}y_{jt-1}^{\rho-1}\frac{y_{jt-1}}{ri_{jt-1}}\right) + \varepsilon_{jt}^{i} \qquad (16)$$

$$\Delta Ln(rc_{jt}) = z_{jt}^{c} + \gamma^{c} Ln\left(\frac{\rho\phi_j\vartheta_j^{H}}{\lambda_t}\Psi_{jt}^{1-\rho}y_{jt-1}^{\rho-1}\frac{y_{jt-1}}{rc_{jt-1}}\right) + \varepsilon_{jt}^{c} \qquad (17)$$

In addition, we need specific forms for Ψ_{jt}, z_{jt}^{i} and z_{jt}^{c} for the empirical implementation. Thus, Ψ_{jt} is specified in a similar way to Aray and Pacheco-Delgado (2020). However, it is extended to capture not only special needs, but also fiscal variables. Again, when local governments plan expenditures related to the special needs of year *t* and have available information for year *t-1* year, the variables capturing special needs are included with one lag. However, fiscal variables are considered in their current values because the subnational governments have available the information on transfers from the general state budget and their own revenues in year *t*. Thus, Ψ_{jt} is specified as follows:

$$\Psi_{jt} = DS_{jt-1}^{\varphi_1}V_{jt-1}^{\varphi_2}TC_{jt-1}^{\varphi_3}EI_{jt-1}^{\varphi_4}HI_{jt-1}^{\varphi_5}SA_{jt-1}^{\varphi_6}ST_{jt-1}^{\varphi_7}tr_{jt}^{\varphi_8}FA_{jt}^{\varphi_9}TA_{jt}^{\varphi_{10}} \qquad (18)$$

Where φ_m, for $m = 1, 2, ..10$, are parameters.

The variables that control for special needs are typically intended to capture the so-called agglomeration and congestion effects. D_{jt} is the population density that captures agglomeration, which often comes along with congestion in both hard and soft infrastructure. To capture congestion in hard infrastructure, the variable V_{jt} denotes the ratio between the number of registered vehicles and kilometers of roads built and the variable TC_{jt} denotes the number of seats available for passengers in public transport (buses) per capita. To capture congestion in soft infrastructure, we include indicators for education and health. Thus, EI_{jt} is the ratio of students enrolled in primary and secondary schools per school and HI_{jt} is the number of beds in hospitals per capita.

We also consider special needs related to the sectors in which subnational governments have more competencies; for example, agriculture and tourism. Thus, the shares of GVA of agriculture, SA_{jt}, and restaurants and hotels, ST_{jt},[6] on the total provincial GVA, are included.

Regarding fiscal variables, we have to control for transfers from the central government to the subnational governments. These transfers make up most of the subnational governments' resources and are therefore expected to affect individuals' welfare and public spending. Hence, tr_{jt} is the per capita transfer from the general state budget to subnational governments. To capture fiscal decentralization, which is the main objective of this study, two variables are included. FA_{jt} is the subnational government's share of own revenues (own taxes, fees and other special contributions) of transfers from the general state budget and is intended to capture financial autonomy. TA_{jt} is the share of tax revenues collected by the subnational government on the total taxes collected by all layers of governments (central, provincial and local taxes) in province *j* and is intended to capture tax autonomy.

Regarding political variables, z^i_{jt} and z^c_{jt} are specified as follows:

$$z^i_{jt} = \alpha^i_1 SR_{jt} + \alpha^i_2 D^{PR}_{jt} + \alpha^i_3 D^{MR}_{jt} \qquad (19)$$

$$z^c_{jt} = \alpha^c_1 SR_{jt} + \alpha^c_2 D^{PR}_{jt} + \alpha^c_3 D^{MR}_{jt} \qquad (20)$$

Where SR_{jt} is the share of right-wing parliaments in province *j* in year *t*, D^{PR}_{jt} is a dummy variable that takes the value of 1 if the prefect of province *j* in year *t* belongs to a right party, and zero otherwise, and D^{MR}_{jt} is a dummy variable that takes the value of 1 if the mayors of province *j* in year *t* are mostly right wing, and zero otherwise.

Substituting equation (18) and (19) in equation (16) and equations (18) and (20) in equation (17), we obtain:

[6] We rely on a proxy for the GVA of the tourism sector due to the lack of data.

$$\Delta Ln(ri_{jt}) = \delta^i + \delta^i_j + \tau^i_t + \gamma^i Ln\left(\frac{y_{jt-1}}{ri_{jt-1}}\right) + \beta^i_1 Ln\left(y_{jt-1}\right) + \beta^i_2 Ln(DS_{jt-1}) + \beta^i_3 Ln(V_{jt-1}) + \beta^i_4 Ln(TC_{jt-1}) + \beta^i_5 Ln(EI_{jt-1}) + \beta^i_6 Ln(HI_{jt-1}) + \beta^i_7 Ln(SA_{jt-1}) + \beta^i_8 Ln(ST_{jt-1}) + \beta^i_9 Ln(tr_{jt}) + \beta^i_{10} Ln(FA_{jt}) + \beta^i_{11} Ln(TA_{jt}) + \alpha^i_1 SR_{jt} + \alpha^i_2 D^{PR}_{jt} + \alpha^i_3 D^{MR}_{jt} + \varepsilon^i_{jt} \quad (21)$$

$$\Delta Ln(rc_{jt}) = \delta^c + \delta^c_j + \tau^c_t + \gamma^c Ln\left(\frac{y_{jt-1}}{rc_{jt-1}}\right) + \beta^c_1 Ln\left(y_{jt-1}\right) + \beta^c_2 Ln(DS_{jt-1}) + \beta^c_3 Ln(V_{jt-1}) + \beta^c_4 Ln(TC_{jt-1}) + \beta^c_5 Ln(EI_{jt-1}) + \beta^c_6 Ln(HI_{jt-1}) + \beta^c_7 Ln(SA_{jt-1}) + \beta^c_8 Ln(ST_{jt-1}) + \beta^c_9 Ln(tr_{jt}) + \beta^c_{10} Ln(FA_{jt}) + \beta^c_{11} Ln(TA_{jt}) + \alpha^c_1 SR_{jt} + \alpha^c_2 D^{PR}_{jt} + \alpha^c_3 D^{MR}_{jt} + \varepsilon^c_{jt} \quad (22)$$

Where $\beta^l_1 = \gamma^l(\rho - 1)$, $\beta^l_h = \gamma^l(1 - \rho)\varphi_h$ and $\delta^l + \delta^l_j + \tau^l_t = \gamma Ln\left(\frac{\rho\theta_j\vartheta^G_j}{\lambda_t}\right)$ for $l = i, c,$ and $h = 2,3,4, \dots, 11$. δ^l, δ^l_j , and τ^l_t are the constant, the individual effect and the time effect, respectively.

According to the theoretical model, it is expected that $0 \leq \gamma^l \leq 1$ and $\beta^l_1 = \gamma^l(\rho - 1) \leq 0$. Subnational governments face a dilemma when allocating public resources, since they should invest in the most productive projects but also invest in alternative projects to compensate for a fall in income per capita to improve social welfare.

Regarding fiscal variables, it is expected that $\beta^l_9 \geq 0$. Moreover, in their seminal works, Tiebout (1961), Musgrave (1969) and Oates (1972) suggested that decentralization brings efficiency in the allocation of resources since regional and local governments know the needs and preferences of their citizens better, which should have a positive effect on the provision of public good and services. Therefore, it is expected that β^l_{10} and $\beta^l_{11} \geq 0$.

4. Estimation results

For the empirical implementation, we have to deal with the constraint that data on subnational governments are only available at provincial level. While this has no implications for the spending allocation of provincial governments, it does have implications for local governments since only aggregated data are available at provincial level. Therefore, we must rely on provincial-level data, regardless of the layer of government.

Data were provided by the Central Bank of Ecuador, the Ministry of Economy and Finance, the National Institute of Statistics, the Internal Revenue Service, the National Secretary of Planning and Development (Senplades) and the GAD, among other official information sources.

Table 1 includes the main descriptive statistics of the variables used in the model and Table 2 shows the correlation coefficients between the variables of the model.

Tables 3 and 4 show the estimation results of equations (21) and (22) using aggregate data of subnational (provincial and local) governments at provincial level.

Let us start with the results for growth rate of public investment per capita in Table 3. The Hausman test (H^{FR}) shows evidence in favor of fixed effects. Control variables lagged one period avoid endogeneity problems of these variables. However, since fiscal variables are included contemporaneously, there may be a problem of endogeneity. Therefore, we perform the Hausman exogeneity test (H^{E}) considering fiscal variables as potentially endogenous. An instrumental variable estimation was run with the fiscal variables lagged two periods as instruments. As can be noticed, exogeneity of the fiscal variables is not rejected. The Sargan test supports the validity of the instrument.

In addition, the Green test rejected the null hypothesis of homoscedasticity and Wooldridge's test rejected the null hypothesis of serial correlation. However, evidence of cross-sectional correlation (Pesaran and Friedman tests) was not found. Therefore, the estimation with fixed effects (within groups) is shown with robust standard errors *à la* Newey and West (1987) and FGLS assuming a first order autocorrelation structure. The model also shows a notable goodness-of-fit, since it explains about 78 percent of the variability of the endogenous variable.

The estimations show the expected results, namely that the growth rate of public investment per capita is positively correlated with the indicator of public investment productivity and negatively correlated with output per capita. Both coefficients are significant at the 1% level. This can be explained by the fact that the subnational governments aim for balanced public investment, so they implement more productive projects along with projects that compensate for the evolution in income.

Recall that coefficient γ^{i} captures the convergence rate to the subnational governments' optimal public investment per capita. Therefore, we can test if there is an immediate convergence, that is, the hypothesis $\gamma^i = 1$. Table 3 shows that, depending on the estimation method, the hypothesis is rejected at the 5% and 1% levels. Also notice that rejection of hypothesis $\beta_1^i = 0$ ($\rho = 1$) suggests that regional planners do not care only about the total income/output of the province. Alternatively, we also tested the joint hypotheses $\gamma^i = 1$ and $\beta_1^i = -1$, which suggest $\rho = 0$. The hypotheses were rejected at the 10% and 1% levels, respectively.

Regarding the special needs criterion, the results suggest that the per capita public investment growth rate is positively (negatively) and weakly correlated with density (GVA of the restaurant and hotel sector).

In relation to the fiscal variables, striking results were obtained. On the one hand, transfers to fund public investments by subnational governments were found to have an important role. The coefficient is positive and significant at the 1% level. On the other hand, strong evidence was also found in favor of a positive relationship between financial autonomy and per capita public investment growth rate. The coefficient is significant at the 1% level. Strikingly, no evidence of a relationship between political variables and the growth rate of public investment of the subnational governments was found.

The estimation results of the equation for the growth rate of current public spending per capita of subnational governments in Table 4 and described below.

Again, the Hausman tests showed evidence of fixed effects and did not reject the hypothesis of exogeneity of the fiscal variables. In addition, the Green test rejected the null hypothesis of homoscedasticity and the Wooldridge test showed evidence of serial correlation. However, no evidence of cross-sectional correlation (Pesaran and Friedman tests) was found. Therefore, estimations with fixed effects with robust standard errors *à la* Newey and West (1987) and FGLS with first order correlation structures are shown. Again, the goodness-of-fit is notable, since the model explains 74% of the variability of the endogenous variable.

Like the growth rate of public investment per capita, the growth rate of current public spending per capita is positively correlated with the indicator of productivity of public current spending and negatively correlated with output per capita. Both coefficients are significant at the 1% level. Again, the fact that hypothesis $\beta_1^c = 0$ was rejected suggests that regional planners do not care only about the total income/output of the province and the joint hypothesis $\beta_1^c = -1$ and $\gamma^c = 1$ ($\rho = 0$) is rejected at the 1% level. Additionally, hypothesis $\gamma^c = 1$ is rejected at any conventional level, suggesting that there is no immediate convergence to the optimal level of current public spending.

In relation to the special needs criterion, weak evidence is found for a negative correlation of the growth rate of current public spending per capita with density.

Regarding fiscal variables, strong evidence was again found. Central transfers are positively correlated with the growth rate of current public spending per capita. The coefficient is significant at the 1% level. Mixed results have been found for the variables that capture fiscal decentralization. A positive and significant relationship at the 1% level is found for financial autonomy and the growth rate of current public spending per capita, while it is negatively correlated with the proxy for tax autonomy, whose coefficient is also significant at the 1% level. As the fiscal decentralization variables are of the same magnitude, we tested the hypothesis $\beta_{10}^c + \beta_{11}^c = 0$ to show evidence that these effects cancel out. Such a hypothesis is rejected at any conventional level, which could be suggesting that the net effect of fiscal variables on the growth rate of current public spending per capita is positive, given that $|\beta_{10}^c| > |\beta_{11}^c|$.

Unlike the per capita public investment growth rate, the growth rate of current public spending per capita is related to political factors. The results show that a larger share of right-wing MPs and the dummy for mostly right-wing mayors are negatively related to the growth rate of current public spending per capita.

The results are in the same line as Faguet (1994) whose findings for Bolivia contradicted the "common claims that local government is too corrupt, institutionally weak, or prone to interest-group capture to improve upon central government's allocation of public resources and concluded that decentralization significantly changed public investment patterns in Bolivia, especially in the poorest regions, which has been beneficial for the development of smaller and lagging municipalities. Moreover, Porto, Pineda Mannheim and Eguino (2018) suggested that granting more autonomy to subnational governments in Latin America, so that they can manage their own resources (taxes) could boost efficiency and development at regional and country level. In addition, this result is also similar to those found by Kappeler *et al*. (2013), González-Alegre (2015) and Aray (2019) for developed countries.

5. Robustness Check

5.1. Seemingly Unrelated Regression Equations (SURE)

In the previous section, equations (21) and (22) were estimated separately. However, it is natural to suspect that both equations are related and therefore form a SURE model.

Table 5 shows the estimations of the SURE model with robust standard errors. As can be noticed, the estimation results are very similar to tables 3 and 4.

The SURE model allows us to test hypotheses across the equations' coefficients. Therefore, we tested the sequential hypotheses $\gamma^i = \gamma^c$ and $\gamma^i = \gamma^c = 1$. The first tests the equality of coefficients across type of spending, while the second tests the joint hypothesis of both coefficients equal to 1, that is, immediate convergence to the optimal level. The hypothesis $\gamma^i = \gamma^c$ is not rejected, suggesting that both public investment and current spending converge similarly to their optimal levels. However, the joint hypothesis of immediate convergence to the optimal level, $\gamma^i = \gamma^c = 1$, is rejected at any conventional level. Moreover, the hypothesis $\beta_1^i = \beta_1^c$ is tested and is not rejected, which leads us to suspect that the development criterion might not differ across types of public spending.

In addition, we test for the equality of coefficients across fiscal variables, specifically the hypotheses $\beta_9^i = \beta_9^c$, $\beta_{10}^i = \beta_{10}^c$ and $\beta_{11}^i = \beta_{11}^c$. The first two hypotheses are not rejected at any conventional level, which might suggest that the growth rates of public investment per capita and current spending per capital are equally correlated with transfers per capita and financial autonomy. However, hypothesis $\beta_{11}^i = \beta_{11}^c$ is rejected at the 5% level.

5.2. Estimations considering provincial governments and local governments separately

In this subsection, equations (21) and (22) are estimated jointly using disaggregated data of the provincial and local governments. To make this compatible with the theoretical framework, let us define

$$RI_{jt} = \left(PI_{jt}^{\omega_j^G} LI_{jt}^{\nu_j^G}\right)^{\frac{1}{\vartheta_j^G}}$$

$$RC_{jt} = \left(PC_{jt}^{\omega_j^H} LC_{jt}^{\nu_j^H}\right)^{\frac{1}{\vartheta_j^H}}$$

Where PI_{jt} (PC_{jt}) and LI_{jt} (LC_{jt}) are the public investments (current expenditures) in province *j* in period *t* made by the provincial and local governments, respectively.

Let us rewrite equations (3) and (4) as follows:

$$G_{jt} = G_{jt-1}^{1-\left(\sigma_j^G+\vartheta_j^G+\nu_j^G\right)} CI_{jt}^{\sigma_j^G} PI_{jt}^{\omega_j^G} LI_{jt}^{\nu_j^G} \qquad (23)$$

$$0 < \sigma_j^G, \vartheta_j^G, \nu_j^G < 1\,; \quad 0 < \sigma_j^G + \omega_j^G + \nu_j^G < 1$$

$$H_{jt} = H_{jt-1}^{1-\left(\sigma_j^H+\vartheta_j^H+\nu_j^H\right)} CC_{jt}^{\sigma_j^H} PC_{jt}^{\omega_j^H} LC_{jt}^{\nu_j^H} \qquad (24)$$

$$0 < \sigma_j^H, \vartheta_j^H, \nu_j^H < 1\,; \quad 0 < \sigma_j^H + \omega_j^H + \nu_j^H < 1$$

Similar to the benchmark model, the provincial planner chooses the levels of PI_{jt} and PC_{jt} that maximize equation (1) subject to equations (2), (23), (24) and the budget constraint, $PI_{jt} + PC_{jt} \leq \mathrm{PR}_{jt}$, where PR_{jt} is the provincial government's resource constraint. However, since data for local governments are only available at the provincial and not at the municipal level, we make a strong assumption. It is assumed that local governments of province *j* choose jointly the aggregate levels of LI_{jt} and LC_{jt} that maximize equation (1) subject to equations (2), (23), (24) and the budget constraint, $LI_{jt} + LC_{jt} \leq \mathrm{LR}_{jt}$, where LR_{jt} is the total resources available to all local governments in province *j*.

The explanatory variables remain the same, except for the fiscal variables. Since we have disaggregated data available at provincial level on own revenues and transfers from the general state budget for provincial and local governments, we are able to construct fiscal variables for both the provincial and local layers of governments separately. Therefore, we jointly estimate equations similar to (21) and (22) for the provincial and local governments, resulting in a SURE model with four equations.

Table 6 shows the estimation results. As can be seen, the previous results obtained for the significance of the variables capturing the equity-efficiency trade-off hold, regardless of the layer of government. In line with Table 5, hypothesis $\gamma^i = \gamma^c$ is not rejected for both layers of government, at the 5% level in the case of provincial governments and at any conventional level for local governments. Again, hypothesis $\gamma^i = \gamma^c = 1$ is rejected at any conventional level. Similarly, the sequential pairs of hypotheses $\gamma_P^i = \gamma_L^i, \gamma_P^i = \gamma_L^i = 1$ and $\gamma_P^c = \gamma_L^c, \gamma_P^c = \gamma_L^c = 1$ are tested. The results for the first pair of hypotheses suggest that the relationship between the efficiency indicator and the growth rate of per capita public investment is equal across layers of government. Furthermore, the growth rates of provincial and local per capita public investment converge immediately to the optimal level. Regarding the second pair of hypotheses, it is found that the relationship between the efficiency indicator and the growth rate of current public spending is equal across layers of government. However, evidence is found against the joint hypothesis of immediate convergence to the optimal level of current public spending.

Again, the hypothesis $\beta_1^i = \beta_1^c$ is not rejected at any conventional level. Moreover, the hypotheses $\beta_{1P}^i = \beta_{1L}^i$ and $\beta_{1P}^c = \beta_{1L}^c$ cannot be rejected at any conventional level either.

Overall, the above results suggest that provincial and local governments do not behave differently with respect to the equity-efficiency trade-off.

It is also noticeable in Table 6 that using disaggregated data does not unveil much more information regarding the significance of the coefficients of the variables that capture special needs. In the case of the per capita public investment growth rate of the provincial governments, the result holds for the GVA of the restaurant and hotel sector. In addition, a weak positive correlation with the education indicator is found. The coefficient is significant at the 10% level. The growth rate of per capita current public spending by the provincial government is found to be negatively correlated with the transport capital indicator. The coefficient is significant at the 5% level. For local governments, only the coefficient of the congestion indicator is significant at the 10% level and for the growth rate of current public spending per capita.

Regarding the fiscal variables, very interesting results arise from using disaggregated data. For the transfer per capita, $Ln(tr_{jt})$, the results hold for both layers of government. The hypotheses $\beta_9^i = \beta_9^c$, $\beta_{9P}^i = \beta_{9L}^i$ and $\beta_{9P}^c = \beta_{9L}^c$ are not rejected at any conventional level, suggesting that public spending by both layers of governments is related equally to transfers from the general state budget. In relation to the fiscal decentralization variables, the above results found for financial autonomy hold for the per capita public investment growth rate of both layers of government and for the per capita current public expenditures of the local governments. However, using disaggregated data unveils that the equal relationship across types of public spending obtained above does not hold since the hypothesis $\beta_{10}^i = \beta_{10}^c$ is rejected at the 5% level for provincial governments and at any conventional levels in the case of local governments. In addition, the hypothesis of an equal relationship between the growth rate of per capita current spending (public investment) and financial autonomy, $\beta_{10P}^c = \beta_{10L}^c$ ($\beta_{10P}^i = \beta_{10L}^i$), across layers of government is (not) rejected. Therefore, these results could be suggesting that the relation between financial autonomy and the growth rate of per capita current spending (public investment) does (not) differ across layers of government. It can be also noticed in Table 6 that no evidence is found for tax autonomy.

Strikingly, evidence of a correlation of the dependent variables with some political variables is only found for local governments.

5.3. Structural break

As mentioned above, the Constitution of 2008 was supposed to have boosted the decentralization process in Ecuador. To capture the structural break, a dummy variable that takes the value of 1 from 2009, and zero otherwise is constructed. Interactions between the dummy variable and the fiscal variables are introduced in equations (21) and (22), which are estimated jointly as in the previous subsection.

The results for the disaggregated data of the subnational governments are shown in Table 7.[7] The joint hypothesis that suggests $\rho = 0$ for provincial governments is not rejected in this case, which is puzzling. Let us now focus on the fiscal variables. For the base variable of transfer per capita, $Ln(tr_{jt})$, the results in Table 6 hold for both layers of government, except for the hypothesis of an equal relationship with per capita current expenditure growth across layers of governments ($\beta_{9P}^{c} = \beta_{9L}^{c}$), which is now not rejected only at the 1% level. For the interacting variable of transfer, we have found that the Constitution of 2008 has changed only the correlation of the transfers with the per capita growth rate of the public spending of local governments and with mixed results, and that the correlation is positive for the public investment and negative for current spending. The coefficients are significant at the 10% and 1% levels, respectively. In line with this, the hypothesis $\beta_{9,09}^{i} = \beta_{9,09}^{c}$ is not rejected for provincial governments, but is rejected at any conventional level for local governments. Moreover, the hypotheses $\beta_{9P,09}^{i} = \beta_{9L,09}^{i}$ and $\beta_{9P,09}^{c} = \beta_{9L,09}^{c}$ are rejected at the 5% and 1% levels, respectively. This supports the evidence that the relationship between transfers and the growth rates of per capita public expenditures have been affected differently across government layers since the new constitution came in force.

In relation to the decentralization variables, we have found that the coefficient is positive and significant for the base variable of financial autonomy in all cases except for the growth rate of per capita current public spending for the provincial governments, which is negative at the 5% level. The hypothesis $\beta_{10}^{i} = \beta_{10}^{c}$ is now more strongly rejected for both layers of governments, while similar results with respect to Table 6 are found for hypotheses $\beta_{10P}^{i} = \beta_{10L}^{i}$ and $\beta_{10P}^{c} = \beta_{10L}^{c}$. Therefore, these results confirm that the

[7] Results for aggregated data of subnational governments are available upon request.

relationship between financial autonomy and the growth rate of per capita current spending (public investment) did (not) differ across layers of government before the Constitution of 2008.

For the interacting variable of financial autonomy, we have found that the Constitution of 2008 only changed the correlations of financial autonomy with the per capita current public spending growth rate for both layers of government and, strikingly, the signs of these correlation coefficients are opposite to those of the previous period. Thus, from 2009, a significant positive coefficient at the 1% level is found in the case of provincial governments, while it is negative in the case of local governments and significant at the 5% level. Notice that, for the case of the provincial governments, the similar magnitudes, but with opposite signs, of the coefficient of financial autonomy across the two periods could explain the non-significant result shown in Table 6. To state this more clearly, the hypothesis $\beta_{10P}^{c} + \beta_{10P,09}^{c} = 0$ is tested and not rejected at any conventional level. However, this is not the case of per capita current spending of the local governments. In this case, the magnitudes of the coefficients of the variables for financial autonomy are very different and much larger in absolute values for the positive correlation before 2009 than the negative correlation from 2009, thus suggesting that the opposite effects do not cancel out, which is in line with the results of Table 6. The fact that hypothesis $\beta_{10L}^{c} + \beta_{10L,09}^{c} = 0$ is rejected confirms our suspicions. Hypotheses $\beta_{10P}^{i} + \beta_{10P,09}^{i} = 0$ and $\beta_{10L}^{i} + \beta_{10L,09}^{i} = 0$ were also tested and rejected in line with Table 6.

Moreover, the hypothesis $\beta_{10,09}^{i} = \beta_{10,09}^{c}$ is rejected for provincial governments at the 5% level, while it is not rejected for local governments. Results for the tests of hypotheses $\beta_{10P,09}^{i} = \beta_{10L,09}^{i}$ and $\beta_{10P,09}^{c} = \beta_{10L,09}^{c}$ are similar to those found in the previous period, thus confirming that the relationship between financial autonomy and the growth rate of per capita current spending (public investment) has (not) differed across layers of government after the Constitution of 2008.

Regarding tax autonomy, the negative relationship between the growth rate of per capita current public spending shown in Tables 4 and for the aggregation of subnational governments emerges now only for local governments. The coefficient is significant at the 1% level. Table 7 also shows that after the Constitution of 2008 the correlation became positive, while the magnitudes remained similar. Therefore, this explains why no evidence for such a correlation coefficient was found in Table 6. To unveil this, the hypothesis $\beta_{11L}^{c} + \beta_{11L,09}^{c} = 0$ is tested and not rejected at any conventional level. Similarly, notice that for the per capita public investment growth rate of the provinces a significant positive coefficient is obtained for tax autonomy from 2009, in contrast to the negative sign in the previous period. Therefore, the hypothesis $\beta_{11P}^{i} + \beta_{11P,09}^{i} = 0$ is tested. However, it is not rejected at any conventional level, which is not in line with the results in Table 6. Hypotheses $\beta_{11P}^{c} + \beta_{11P,09}^{c} = 0$ and $\beta_{11L}^{i} + \beta_{11L,09}^{i} = 0$ were not rejected, which is in line with Table 6. Finally, notice that for the rest of the hypotheses, the results are similar to those found for financial autonomy. Therefore, the relationship between tax autonomy and the growth rate of per capita current spending (public investment) is (not) different across layers of government before and after the Constitution of 2008.

6. Conclusions

This article analyzed the allocation criteria of financial resources of the subnational governments of Ecuador. A theoretical model of public resource allocation was proposed to capture the traditional criteria established by the literature: efficiency, equity or redistribution, special infrastructure needs and political factors. In addition, fiscal variables were introduced in the model. Panel data for provinces of Ecuador over the period 2001–2015 were used.

The results suggest that the country’s subnational governments were able to deal with the efficiency-equity trade-off in allocating public spending.

Regarding the fiscal variables, although transfers from the general state budget play a key role in the subnational budgets, we found, overall, evidence of positive correlations between the fiscal decentralization variables and the subnational governments’ public expenditures for both the provincial and the local governments. In addition, evidence of a structural break caused by the Constitution of 2008 was found and was stronger for current spending. In accounting for the structural break, we were able to unveil striking mixed results that could provide an explanation for the absence, in some cases, of evidence on fiscal variables when a structural break is not considered. Finally, we can conclude that the correlations between the fiscal variables and growth rate of per capita current spending (public investment) are (not) different across layers of government before and after the Constitution of 2008.

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Table 1. Basic statistics

Variable	Mean	Standard Deviation
$\Delta Ln(ri_{jt})$	0.0918	0.3248
$\Delta Ln(rc_{jt})$	0.0126	0.2643
$Ln\left(\frac{y_{jt-1}}{ri_{jt-1}}\right)$	3.2216	0.8042
$Ln\left(\frac{y_{jt-1}}{rc_{jt-1}}\right)$	4.0362	0.7011
$Ln(y_{jt-1})$	8.0242	0.6249
$Ln(DS_{jt-1})$	3.5315	1.3508
$Ln(V_{jt-1})$	2.6528	1.0806
$Ln(TC_{jt-1})$	-2.0065	0.8112
$Ln(EI_{jt-1})$	4.6670	0.4391
$Ln(HI_{jt-1})$	-6.7166	0.3383
$Ln(SA_{jt-1})$	-2.2969	0.7932
$Ln(ST_{jt-1})$	-4.2473	0.9030
$Ln(tr_{jt})$	5.0837	0.6206
$Ln(FA_{jt})$	-1.7554	0.5002
$Ln(TA_{jt})$	-0.5823	0.4692
SR_{jt}	0.4080	0.3402
D_{jt}^{PR}	0.3424	0.4752
D_{jt}^{MR}	0.3697	0.4835

Notes: Number of observations: 308. Number of groups: 22. All variables in logs except for political variables.

Table 2. Correlation coefficients

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. $\Delta Ln(ri_{jt})$	1.000																	
2. $\Delta Ln(rc_{jt})$	-0.216	1.000																
3. $Ln\left(\frac{y_{jt-1}}{ri_{jt-1}}\right)$	0.265	-0.060	1.000															
4. $Ln\left(\frac{y_{jt-1}}{rc_{jt-1}}\right)$	-0.032	0.195	0.636	1.000														
5. $Ln(y_{jt-1})$	-0.029	-0.031	0.468	0.703	1.000													
6. $Ln(DS_{jt-1})$	0.016	0.046	0.492	0.404	-0.203	1.000												
7. $Ln(V_{jt-1})$	0.012	0.016	0.461	0.538	0.162	0.736	1.000											
8. $Ln(TC_{jt-1})$	-0.020	0.038	0.214	0.463	0.071	0.645	0.750	1.000										
9. $Ln(EI_{jt-1})$	-0.036	0.053	0.368	0.457	0.235	0.596	0.682	0.560	1.000									
10. $Ln(HI_{jt-1})$	0.035	-0.008	0.143	0.132	-0.057	0.399	0.419	0.442	0.401	1.000								
11. $Ln(SA_{jt-1})$	0.025	0.027	-0.254	-0.427	-0.770	0.285	-0.109	-0.139	-0.073	-0.118	1.000							
12. $Ln(ST_{jt-1})$	0.049	-0.049	-0.270	-0.446	-0.325	-0.050	0.051	0.084	0.230	0.387	0.036	1.000						
13. $Ln(tr_{jt})$	0.005	-0.010	-0.601	-0.257	0.282	-0.852	-0.522	-0.355	-0.405	-0.295	-0.035	0.044	1.000					
14. $Ln(FA_{jt})$	0.021	0.016	0.440	0.288	0.251	0.421	0.620	0.399	0.592	0.406	-0.278	0.302	-0.400	1.000				
15. $Ln(TA_{jt})$	0.060	-0.026	-0.305	-0.293	-0.041	-0.486	-0.472	-0.411	-0.492	-0.374	0.112	-0.202	0.403	-0.307	1.000			
16. SR_{jt}	0.068	-0.033	0.331	0.048	0.004	0.087	-0.039	-0.198	-0.128	0.159	-0.025	-0.005	-0.260	0.054	-0.049	1.000		
17. D_{jt}^{PR}	0.090	-0.066	0.136	0.107	0.050	-0.060	-0.130	-0.261	-0.142	-0.008	-0.022	-0.017	0.011	0.010	0.073	0.343	1.000	
18. D_{jt}^{MR}	0.028	-0.043	-0.009	-0.072	0.046	-0.077	-0.066	-0.207	0.080	0.051	0.027	0.143	0.063	0.111	-0.015	0.233	0.357	1.000

Table 3. Panel data regression of equation (21): Per capita public investment growth rate of subnational governments

	Newey and West		GLS	
	Coefficient	**SE**	**Coefficient**	**SE**
$Ln\left(\frac{y_{jt-1}}{ri_{jt-1}}\right)$	0.8709	0.0605***	0.8336	0.0465***
$Ln(y_{jt-1})$	-0.8257	0.0983***	-0.8092	0.0766***
$Ln(DS_{jt-1})$	0.3669	0.4419	0.4767	0.2891*
$Ln(V_{jt-1})$	-0.0196	0.0310	-0.0067	0.0300
$Ln(TC_{jt-1})$	0.0128	0.0405	0.0329	0.0327
$Ln(EI_{jt-1})$	0.0303	0.1047	0.0176	0.0821
$Ln(HI_{jt-1})$	0.0553	0.0838	0.0514	0.0557
$Ln(SA_{jt-1})$	0.0938	0.0575	0.0584	0.0463
$Ln(ST_{jt-1})$	-0.0848	0.0468*	-0.0610	0.0346*
$Ln(tr_{jt})$	0.6576	0.0967***	0.6220	0.0607***
$Ln(FA_{jt})$	0.1755	0.0556***	0.1648	0.0389***
$Ln(TA_{jt})$	0.0211	0.0506	0.0378	0.0341
SR_{jt}	0.0477	0.0448	0.0279	0.0362
D_{jt}^{PR}	-0.0252	0.0286	-0.0196	0.0212
D_{jt}^{MR}	0.0179	0.0250	0.0047	0.0207
R^2	0.7772			
H^{FR}	32.06 (0.0063)			
H^{E}	13.91 (0.5327)			
Sargan test	5.520 (0.1374)			
Green test	276.67 (0.0000)			
Wooldridge SC test	42.29 (0.0000)			
Pesaran CD test	-1.85 (1.9356)			
Friedman CD test	5.65 (0.9996)			
$\gamma^i = 1$	4.55 (0.0338)		12.75 (0.0004)	
$\rho = 0\ (\gamma^i = 1, \beta_1^i = -1)$	2.61 (0.0756)		13.26 (0.0013)	

Notes: Number of observations: 308. Number of groups: 22. All variables in logs except for political variables. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 4. Panel data regression of equation (22): Per capita current public spending of subnational governments

	Newey and West		GLS	
	Coefficient	SE	Coefficient	SE
$Ln\left(\frac{y_{jt-1}}{rc_{jt-1}}\right)$	0.7717	0.0636***	0.8161	0.0483***
$Ln(y_{jt-1})$	-0.8046	0.1031***	-0.8405	0.0770***
$Ln(DS_{jt-1})$	-0.3731	0.4173	-0.5309	0.2796*
$Ln(V_{jt-1})$	-0.0140	0.0266	-0.0032	0.0296
$Ln(TC_{jt-1})$	0.0231	0.0345	0.0310	0.0297
$Ln(EI_{jt-1})$	-0.1375	0.1036	-0.1153	0.0818
$Ln(HI_{jt-1})$	-0.0465	0.0500	-0.0672	0.0435
$Ln(SA_{jt-1})$	-0.0260	0.0492	-0.0194	0.0406
$Ln(ST_{jt-1})$	-0.0110	0.0413	-0.0186	0.0343
$Ln(tr_{jt})$	0.5205	0.1118***	0.5629	0.0581***
$Ln(FA_{jt})$	0.2597	0.0617***	0.2858	0.0402***
$Ln(TA_{jt})$	-0.1026	0.0318***	-0.1119	0.0259***
SR_{jt}	-0.1408	0.0605**	-0.1095	0.0396***
D_{jt}^{PR}	0.0339	0.0295	0.0328	0.0229
D_{jt}^{MR}	-0.0730	0.0273***	-0.0386	0.0231*
R^2	0.7421			
H^{FR}	45.33 (0.0000)			
H^{E}	18.69 (0.2283)			
Sargan test	2.01 (0.5711)			
Green test	1354.92 (0.0000)			
Wooldridge SC test	100.09 (0.0000)			
Pesaran CD test	-2.44 (1.9852)			
Friedman CD test	2.57 (1.0000)			
$\gamma^c = 1$	12.90 (0.0004)		14.52 (0.0001)	
$\rho = 0\ (\gamma^c = 1, \beta_1^c = -1)$	6.63 (0.0016)		14.52 (0.0007)	
$\beta_{10}^c + \beta_{11}^c = 0$	6.04 (0.0146)		15.97 (0.0000)	

Notes: Number of observations: 308. Number of groups: 22. All variables in logs except for political variables. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 5. Seemingly unrelated regression equations (SURE): Growth rates of per capita public investment and current spending of subnational governments

	Public Investment		Current Spending	
	Coefficients	SE	Coefficients	SE
$Ln\left(\frac{y_{jt-1}}{ri_{jt-1}}\right)$	0.8828	0.0617***		
$Ln\left(\frac{y_{jt-1}}{rc_{jt-1}}\right)$			0.7831	0.0583***
$Ln(y_{jt-1})$	-0.8347	0.0943***	-0.8154	0.0902***
$Ln(DS_{jt-1})$	0.3544	0.4118	-0.3889	0.3586
$Ln(V_{jt-1})$	-0.0188	0.0307	-0.0133	0.0238
$Ln(TC_{jt-1})$	0.0122	0.0393	0.0226	0.0319
$Ln(EI_{jt-1})$	0.0337	0.0983	-0.1392	0.0912
$Ln(HI_{jt-1})$	0.0548	0.0722	-0.0467	0.0448
$Ln(SA_{jt-1})$	0.0956	0.0588	-0.0261	0.0438
$Ln(ST_{jt-1})$	-0.0858	0.0444*	-0.0108	0.0371
$Ln(tr_{jt})$	0.6568	0.0889***	0.5202	0.0942***
$Ln(FA_{jt})$	0.1767	0.0493***	0.2603	0.0534***
$Ln(TA_{jt})$	0.0204	0.0472	-0.1035	0.0278***
SR_{jt}	0.0493	0.0448	-0.1419	0.0531***
D_{jt}^{PR}	-0.0259	0.0280	0.0350	0.0259
D_{jt}^{MR}	0.0186	0.0238	-0.0737	0.0243***
R^2	0.7791		0.7437	
Log pseudolikelihood	2974.4307			
Breusch-Pagan test	8.85 (0.0029)			
$\gamma^i = \gamma^c$ / $\gamma^i = \gamma^c = 1$	1.49 (0.2221) / 16.49 (0.0003)			
$\rho = 0 \begin{pmatrix}\gamma^i = 1, \beta_1^i = -1, \\ \gamma^c = 1, \beta_1^c = -1\end{pmatrix}$	17.38 (0.0016)			
$\beta_1^i = \beta_1^c$	0.02 (0.8797)			
$\beta_9^i = \beta_9^c$	0.93 (0.3340)			
$\beta_{10}^i = \beta_{10}^c$	1.03 (0.3091)			
$\beta_{11}^i = \beta_{11}^c$	5.37 (0.0205)			
$\beta_{10}^l + \beta_{11}^l = 0$	8.99 (0.0027)		8.26 (0.0040)	

Notes: Number of observations: 308. Number of groups: 22. All variables in logs except for political variables. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 6. Seemingly unrelated regression equations (SURE): Growth rates of per capital public investment and current spending of provincial and local governments

	Provincial Governments				Local Governments			
	Public Investment		Current Spending		Public Investment		Current Spending	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
$Ln\left(\frac{y_{jt-1}}{ri_{jt-1}}\right)$	0.9113	0.0707***			0.9274	0.0985***		
$Ln\left(\frac{y_{jt-1}}{rc_{jt-1}}\right)$			0.7322	0.0819***			0.7787	0.0665***
$Ln(y_{jt-1})$	-0.9507	0.1593***	-0.7744	0.1991***	-0.8766	0.1208***	-0.8361	0.1064***
$Ln(DS_{jt-1})$	-0.0102	0.7350	0.9567	0.7590	0.0127	0.4743	-0.0437	0.3833
$Ln(V_{jt-1})$	0.0207	0.0650	-0.0307	0.0590	-0.0270	0.0431	0.0517	0.0313*
$Ln(TC_{jt-1})$	-0.0507	0.0731	-0.1401	0.0705**	0.0337	0.0440	0.0279	0.0348
$Ln(EI_{jt-1})$	0.3011	0.1666*	-0.0639	0.2170	0.1038	0.1150	-0.1556	0.1031
$Ln(HI_{jt-1})$	0.1795	0.1165	-0.1279	0.1234	-0.0467	0.0627	0.0087	0.0517
$Ln(SA_{jt-1})$	0.0528	0.0967	0.0494	0.1013	0.0185	0.0611	-0.0274	0.0483
$Ln(ST_{jt-1})$	-0.1464	0.0768*	-0.0056	0.1026	-0.0802	0.0556	-0.0329	0.0392
$Ln(tr_{jt})$	0.5213	0.1082***	0.4264	0.1266***	0.7374	0.0911***	0.6307	0.0847***
$Ln(FA_{jt})$	0.1205	0.0428***	-0.0110	0.0294	0.1796	0.0495***	0.3672	0.0454***
$Ln(TA_{jt})$	0.0176	0.0188	-0.0091	0.0155	0.1376	0.0846	-0.0776	0.0602
SR_{jt}	0.0179	0.0820	-0.0437	0.1074	-0.0202	0.0480	-0.0911	0.0547*
D_{jt}^{PR}	-0.0279	0.0598	-0.0033	0.0491	-0.0681	0.0313**	0.0109	0.0256
D_{jt}^{MR}	-0.0419	0.0468	-0.0239	0.0537	-0.0070	0.0310	-0.0258	0.0312
R^2	0.7432		0.6293		0.7994		0.7626	
Log pseudolikelihood	2614.9538							
Breusch-Pagan test	22.10 (0.0018)							
Hypotheses								
$\gamma^i = \gamma^c$ / $\gamma^i = \gamma^c = 1$	3.10 (0.0785) / 11.46 (0.0032)				1.65 (0.1995) / 11.40 (0.0033)			
$\gamma_P^i = \gamma_L^i$ / $\gamma_P^i = \gamma_L^i = 1$					0.02 (0.8893) / 1.96 (0.3757)			
$\gamma_P^c = \gamma_L^c$ / $\gamma_P^c = \gamma_L^c = 1$					0.20 (0.6543) / 21.06 (0.0000)			
ρ = 0 $\begin{pmatrix}\gamma^i = 1, \beta_1^i = -1, \\ \gamma^c = 1, \beta_1^c = -1\end{pmatrix}$	11.80 (0.0189)				13.62 (0.0086)			
$\beta_1^i = \beta_1^c$	0.41 (0.5231)				0.07 (0.7954)			
$\beta_{1P}^i = \beta_{1L}^i$					0.17 (0.6771)			
$\beta_{1P}^c = \beta_{1L}^c$					0.08 (0.7775)			
$\beta_9^i = \beta_9^c$	0.30 (0.5825)				0.83 (0.3615)			
$\beta_{9P}^i = \beta_{9L}^i$					2.63 (0.1049)			
$\beta_{9P}^c = \beta_{9L}^c$					1.81 (0.1786)			
$\beta_{10}^i = \beta_{10}^c$	6.52 (0.0107)				7.59 (0.0059)			
$\beta_{10P}^i = \beta_{10L}^i$					0.84 (0.3589)			
$\beta_{10P}^c = \beta_{10L}^c$					49.73 (0.0000)			
$\beta_{11}^i = \beta_{11}^c$	1.09 (0.2963)				5.03 (0.0250)			
$\beta_{11P}^i = \beta_{11L}^i$					2.07 (0.1499)			
$\beta_{11P}^c = \beta_{11L}^c$					1.23 (0.2673)			
$\beta_{10}^l + \beta_{11}^l = 0$	12.24 (0.0005)		0.43 (0.5137)		9.94 (0.0016)		16.86 (0.0000)	

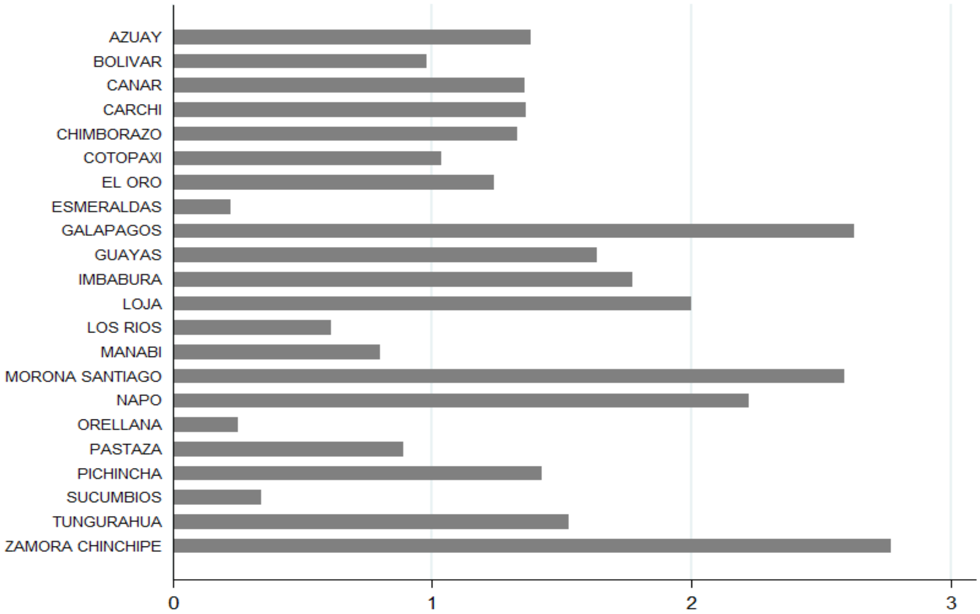
Notes: Number of observations: 252. Number of groups: 22. All variables in logs except for political variables. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 7. Seemingly unrelated regression equations (SURE) with structural change due to the Constitution of 2008: Capital and current expenditures of provincial and local governments

	Fixed Effects (within)							
	Provincial Governments				Local Governments			
	Public Investment Growth Rate		Current public Spending Growth Rate		Public Investment Growth Rate		Current public Spending Growth Rate	
	Coeff.	White SE	Coeff.	White SE	Coeff.	White SE	Coeff.	White SE
$Ln\left(\frac{y_{jt-1}}{ri_{jt-1}}\right)$	0.9402	0.0685***			0.9332	0.1001***		
$Ln\left(\frac{y_{jt-1}}{rc_{jt-1}}\right)$			0.7874	0.0844***			0.8185	0.0589***
$Ln(y_{jt-1})$	-0.9988	0.1573***	-0.8449	0.1988***	-0.8808	0.1225***	-0.8800	0.0974***
$Ln(DS_{jt-1})$	0.6157	0.8565	1.5136	0.8443*	-0.3531	0.4904	-0.0347	0.3929
$Ln(V_{jt-1})$	0.0222	0.0641	0.0078	0.0667	-0.0253	0.0408	0.0281	0.0313
$Ln(TC_{jt-1})$	-0.0371	0.0716	-0.1543	0.0716**	0.0246	0.0408	0.0015	0.0339
$Ln(EI_{jt-1})$	0.2654	0.1629	-0.1893	0.2279	0.0567	0.1258	0.0225	0.1077
$Ln(HI_{jt-1})$	0.1766	0.1158	-0.0990	0.1221	-0.0335	0.0625	-0.0463	0.0510
$Ln(SA_{jt-1})$	0.0300	0.0849	0.0590	0.1027	0.0313	0.0622	-0.0403	0.0575
$Ln(ST_{jt-1})$	-0.1585	0.0803**	-0.0246	0.1015	-0.0868	0.0529	-0.0546	0.0373
$Ln(tr_{jt})$	0.5263	0.1025***	0.4081	0.1284***	0.7103	0.0950***	0.7312	0.0837***
$Ln(tr_{jt})$_2009	-0.1024	0.0659	-0.0105	0.0681	0.0938	0.0549*	-0.2404	0.0601***
$Ln(FA_{jt})$	0.1110	0.0496**	-0.0948	0.0443**	0.1773	0.0578***	0.3947	0.0470***
$Ln(FA_{jt})$_2009	-0.0080	0.0425	0.1329	0.0408***	0.0104	0.0549	-0.1175	0.0556**
$Ln(TA_{jt})$	-0.0257	0.0201	-0.0070	0.0198	0.1357	0.0836	-0.1637	0.0583***
$Ln(TA_{jt})$_2009	0.0984	0.0228***	-0.0023	0.0205	0.0327	0.0825	0.1955	0.0624***
SR_{jt}	-0.0029	0.0801	-0.0527	0.1071	-0.0216	0.0468	-0.0828	0.0516
D_{jt}^{PR}	-0.0411	0.0610	0.0188	0.0503	-0.0781	0.0312**	0.0335	0.0274
D_{jt}^{MR}	-0.0299	0.0473	-0.0642	0.0552	-0.0001	0.0308	-0.0012	0.0312
R^2	0.7570		0.6418		0.8015		0.7841	
Log pseudolikelihood		2962.0079						
Breusch-Pagan test		25.38 (0.0003)						
$\gamma^i = \gamma^c$ / $\gamma^i = \gamma^c = 1$	2.19 (0.1386) / 6.72 (0.0347)				1.05 (0.3048) / 9.65 (0.0080)			
$\gamma_P^i = \gamma_L^i$ / $\gamma_P^i = \gamma_L^i = 1$					0.00 (0.9511) / 1.09 (0.5809)			
$\gamma_P^c = \gamma_L^c$ / $\gamma_P^c = \gamma_L^c = 1$					0.10 (0.7551) / 14.90 (0.0006)			
$\rho = 0 \begin{pmatrix}\gamma^i = 1, \beta_1^i = -1, \\ \gamma^c = 1, \beta_1^c = -1\end{pmatrix}$	7.15 (0.1280)				11.42 (0.0222)			
$\beta_1^i = \beta_1^c$	0.31 (0.5775)				0.00 (0.9960)			
$\beta_{1P}^i = \beta_{1L}^i$					0.44 (0.5072)			
$\beta_{1P}^c = \beta_{1L}^c$					0.03 (0.8665)			
$\beta_9^i = \beta_9^c$ / $\beta_{9,09}^i = \beta_{9,09}^c$	0.46 (0.4972) / 0.92(0.3369)				0.03 (0.8640) / 15.01 (0.0001)			
$\beta_{9P}^i = \beta_{9L}^i$ / $\beta_{9P,09}^i = \beta_{9L,09}^i$					2.04 (0.1529) / 5.84 (0.0157)			
$\beta_{9P}^c = \beta_{9L}^c$ / $\beta_{9P,09}^c = \beta_{9L,09}^c$					4.61 (0.0319) / 7.90 (0.0049)			
$\beta_{10}^i = \beta_{10}^c$ / $\beta_{10,09}^i = \beta_{10,09}^c$	9.14 (0.0025) / 5.14 (0.0234)				8.59 (0.0034) / 2.55 (0.1103)			
$\beta_{10P}^i = \beta_{10L}^i$ / $\beta_{10P,09}^i = \beta_{10L,09}^i$					0.82 (0.3656) / 0.08 (0.7752)			
$\beta_{10P}^c = \beta_{10L}^c$ / $\beta_{10P,09}^c = \beta_{10L,09}^c$					60.47 (0.0000) / 15.95 (0.0001)			
$\beta_{11}^i = \beta_{11}^c$ / $\beta_{11,09}^i = \beta_{11,09}^c$	0.34 (0.5599) / 10.07 (0.0015)				10.08 (0.0015) / 2.55 (0.1103)			
$\beta_{11P}^i = \beta_{11L}^i$ / $\beta_{11P,09}^i = \beta_{11L,09}^i$					3.64 (0.0565) / 0.58 (0.4470)			
$\beta_{11P}^c = \beta_{11L}^c$ / $\beta_{11P,09}^c = \beta_{11L,09}^c$					6.82 (0.0090) / 9.07 (0.0026)			
$\beta_{10S}^l + \beta_{10S,09}^l = 0$ ($l = i, c$ and $S = P, L$)	5.01 (0.0252)		1.62 (0.2032)		13.42 (0.0002)		29.37 (0.0000)	
$\beta_{11S}^l + \beta_{11S,09}^l = 0$ ($l = i, c$ and $S = P, L$)	10.34 (0.0013)		0.29 (0.5928)		2.29 (0.1299)		0.16 (0.6876)	

Notes: Number of observations: 252. Number of groups: 22. All variables in logs except for political variables. *** significant at the 1% level; ** significant at the 5% level; * significant at the10% level.

Figure 1. *Own revenues as % of GAV for the provinces of Ecuador, 2001–2015*



Source: Central Bank of Ecuador and Ministry of Economy and Finance.