# Revenues versus expenditures, how can fiscal decentralization improve infrastructure public spending efficiency?

By

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**Abstract**

Decentralization has been presented as a powerful way to improve governance and the effectiveness of public policies in developing countries. The objective of this research is to analyze the impact of the two aspects of decentralization (expenditure and revenue) on the effectiveness of public expenditure for infrastructure. Using an alternative measure combining revenue (and capital expenditure) with the level of accountability, this article attempts to contribute to the literature on measures of decentralization and analyze its effects. It uses two estimation methods with instrumental variables for a static approach with ethnic tensions as instrumental variable, and GMMs for a dynamic approach. The sample is made up of 40 countries over the period 2002-2016. we find a positive effect for both revenue and expenditure in the static approach, and a positive (negative) impact of decentralizing expenditure (revenue) in a dynamic approach.

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# 1) Introduction

Decentralization, the transfer of power from the central government to local governments with a degree of autonomy, is the most important reform of the last 50 years. The decentralization process has an impact on all components of society, including the quality of governance, the well-being of the population and the effectiveness of public policies, as indicated by the **?**. The current covid-19 crisis has raised the question of the role of the state in both developed and developing countries. Beyond the covid-19 pandemic, the World Bank sees decentralization as a way to promote community-driven development (CDD) and improve the effectiveness of public policies. Several countries have entrusted the maintenance of their infrastructure, particularly roads, to local authorities under the principle of subsidiarity. How effective are such measures? Should certain decisions be taken at a lower level to allow greater involvement of the population in the implementation of public policies? In theory, decentralization was intended to bring the governors and the governed closer together to compensate for the lack of legitimacy or accountability of some central governments. It was also supposed to reduce community tensions and institutional crises in developing countries. Its implementation was expected to foster competition among local jurisdictions and thus allow for a better allocation of resources, greater accountability of local executives and thus increase the effectiveness of public policies. The recent nature of some developing countries and therefore the lack of a sense of nationhood has been an obstacle to political stability and the implementation of effective public policies in these countries. The analysis of the effects of decentralization has been very popular in recent years, but without reaching a consensus on these effects. There are many reasons for this lack of definitive results on the effects of decentralization, including the indicators used to measure the degree of autonomy of local governments, the scarcity of data at the local level, and the models used to estimate these effects. One of the difficulties in analyzing the economic effects of decentralization lies in the way it is understood. If it is viewed in the sense of devolution, that is, a transfer of decision-making power from central to elected local government, how is it measured? The research conducted by Martinez-Vazquez and Mcnab (2003), Altunbas and Thornton (2012) and Thornton (2007) points out that the use of local government revenues or expenditures alone is a limitation of traditional analyses. Indeed, this indicator does not fully capture the capacity of local governments

to implement their own policies or to make decisions independently. The traditional indicator would therefore not fully capture the autonomy of local governments and would not allow for a complete measurement of decentralization. It therefore advocates a multidimensional approach to decentralization in order to best capture the autonomous nature of local government actions. Shair-Rosenfield et al. (2021) also propose a new indicator for measuring political autonomy for regions within countries or indicators of indigenous or metropolitan governance. This work therefore complements this literature, which dates back to Stegarescu (2005), and points out the weaknesses of classic indicators such as those of the IMF's *Governance Finance Statistics*.

In order to contribute to the debate on this topic, this paper analyzes the effect of fiscal decentralization on infrastructure efficiency for a sample of 40 developed and developing countries according to the availability of local government data.

To answer this question, we first estimate the level of efficiency of public spending on infrastructure across countries using the Kum method and then use two estimation methods to assess the effect of revenue and expenditure decentralization on the estimated efficiency score. The first method is a static approach using two stage least squares with an instrumental variable that is the level of ethnic tensions in t-1. The second approach is a dynamic analysis with the Generalized Method of Moments (GMM). In the context of finding new measures to assess the level of autonomy of local governments, we propose a measure that would be a multiplicative combination of local resources (and capital expenditures) with the level of accountability within the country in order to integrate this institutional dimension in the multi-country analysis.

The remainder of the paper is organized as follows. Section 2) makes a review of the literature about the relationship between decentralization and efficiency. Section 3) discusses about the estimation of public spending efficiency using the Kumbhakar et al. (2015) method and deals with the importance of including an institutional context and variables for the measure of fiscal decentralization and control's variables. Section 4) presents the econometric strategy and interprets the empirical results. Section 5) concludes.

## 2) Fiscal decentralization and public spending efficiency, a literature review

There are many studies about the impact of decentralization on the public sector's efficiency. But these papers mainly focus on developed countries or only on the effects that fiscal decentralization could have on education and health outcomes. Melo-Becerraa et al. (2020) in their article show that fiscal decentralization could increase the educational outcome in Colombian municipalities. They use a Stochastic Frontier Analysis method (SFA) with multiple outputs and inputs over the period 2008-2013. They also find that the municipalities located in the periphery get a lower efficiency score than the central municipalities. So, they suggest the establishment of local public policies to deal with the socioeconomic and cultural factors which can reduce the level of educational efficiency in these localities. The main concern with this analysis is the fact that they use local investment and transfers from the national government (both are measured per student). These variables are unable to effectively measure the degree of autonomy and decentralization in Colombia. In the same way, Faguet and Sanchez (2008) results are consistent with the precedents. They find that decentralization allows local governments to switch resources and use them for sanitation, basic services, and education. Fiscal decentralization gives the opportunity to local governments to invest in the needs of their population. In Bolivia for example, where the poorest municipalities were ignored by the central government, decentralization introduced an equalization shock. Indeed, the poorest municipalities got the power to implement their own public policy to match with the local preferences. They measure fiscal decentralization as a ratio between the own resources of a municipality and total expenditure on education by the local government. For the empirical analysis, they use a Two Stage Least Square (2SLS) with lagged per capita taxes as an instrument for the measure of fiscal decentralization. This estimation method, and particularly the choice of the instrument can be criticized. Salinas and Solé-Ollé (2018) explore the effects of fiscal decentralization on education in Spain with a difference-in-difference analysis. Their results suggest that fiscal decentralization is a good way to improve the match between education public policy and preferences of local population over the period 1977-1991. Indeed, the decentralization in Spain reduces the dropout rate in secondary with some peak at 4% in the long run. They compare the regions which have been decentralized in the beginning

of the 1980s' (Cataluna; Galicia; Pais Vasco; ...) with the regions which received more power at the end of 1990s'. They only focus on the local government revenue as a measure of fiscal decentralization, and don't look at the effect of expenditures made by the sub-national government. In the same time, the use of local revenues which includes transfers for education from central government doesn't give the opportunity to appreciate the level of autonomy for Spanish regions and measure his impact on education outcomes in Spain.Cahyaningsih and Fitrady (2019) in a study which cover the period 1994-2016 in Papua Province in Indonesia find that decentralization is ineffective to improve education and health outcomes. They used a Synthetic Control Method which allows the variation of unobserved characteristics over the time and let's expect more accurate results. Their conclusions are in contradiction with the others, but they can explain it by the fact that fiscal decentralization in Papua doesn't lead to a clear share of responsibilities between central and local governments. So, we can observe an overlap of powers and inefficient public policies in health and education due to this lack of clarity in the sharing of attributions. This research shows the importance of a clear share of attribution between the different levels of governments and a regulatory framework to fully get the benefits of fiscal decentralization and avoid Papua's failure. The matter of institutional framework is also significant in the article of Hakim and Sriyana (2010). They show the lack of institution capacity which leads to a misallocation of local government's budget. Fiscal decentralization in Indonesia fails to increase the efficiency of local government. To assess this, they use a Data Envelopment Analysis to identify the most and less efficient regencies. However, the Data Envelopment Analysis is sensitive to extreme values, errors of measure and great heterogeneity inside the observations according to Hjalmarsson et al. (1996). From a political point of view, the goal of their paper is to use the most efficient regencies as a benchmark for the less efficient ones. Another paper of Jacqmin and Lefebvre (2017) shows that a more decentralized higher education system has a positive impact on the ability to attract and retain high top scholars. It positively impacts the quality of high-level education in Europe using a Generalized Method of Moments (GMM) for the estimation. But they don't take account of the role played by the European Research Council which can have a huge impact in the performance of European Research and assess only the impact of decentralized spending but not the effect of local autonomy. Another limit of their study is the using of lagged local public spending as an instrument to tackle the problems of

endogeneity. It's difficult to consider that the past public spending doesn't affect the present quality of higher education. The choice of instrumental variables has always been an important matter in the empirical analysis and can lead to many critics on the findings. Bustamante (2010) realized a comparison between the centralized and decentralized health services in the rural areas of Mexico. They find that centralized health services have better performance for the reduction of the regressive aspect of out-of-pocket health care expenditures. The centralized health care service led to a higher utilization of preventive care from the Mexican people in the rural areas. These results suggest a negative impact of fiscal decentralization on the effectiveness of health services. They use a probit model with the nature of the providers to measure the decentralization. But the fact that the provider is a local company or organization doesn't imply an autonomy of decision. It's difficult to determine if they intercept the effect of decentralization or the impact of an overlap of responsibilities of central and local health service providers. Always in the health sector, Soto et al. (2012) analyzes the effect of fiscal decentralization on the infant mortality rate in Colombia where health expenditure has been decentralizing since 1993. They suggest that fiscal decentralization (measured as the proportion of local health expenditures over the total of health expenditures) reduces the rate of infant mortality rate with a stronger effect for non-poor municipalities over the period 1998-2007 for 1080 local institutions. This result goes in the same way with those of Caldeira et al. (2012) who support the idea that poor people or municipalities are more able to show their preferences and get better results from fiscal decentralization than the poorest. The effect of decentralization depends on the income level. Soto et al. (2012) also tested the effect from central transfers of central government using a Fixed Effect model (FE) using a within municipalities change and a three lagged of health resources to deal with reverse causality issues. The problem of instruments is an important matter to tackle endogeneity, but it's difficult to think that the last expenditure doesn't affect today's health status. The use of lagged variables to deal with reverse causality is common in an empirical point of view, but from a theoretical point of view this way to tackle endogeneity can be a limit and cause some critics about the findings. Maharani and Tampubolon (2014) led an empirical analysis using a multilevel logistic regression to assess the effect of fiscal decentralization on child immunization status in Indonesia. Their results suggest that decentralization doesn't improve the country's immunization coverage. They explain this but the weakness of capacity and ca-

pability of local governments. Adam et al. (2014) studies the effect of fiscal decentralization on health and education efficiency for 21 OECD countries between 1970 and 2000. They find an inverted U-shape relationship between fiscal decentralization and public efficiency in health and education. The efficiency score has been estimated by a Data Envelopment Analysis with the years of schooling multiplied by an education quality index as education output. They also used the inverse of infant mortality rate from OECD Health data of 2007 as output of the health sector. Escaleras and Calcagno (2017) study the impact of decentralization on the infrastructure quality in the United States during the period 1992-2012 and find that fiscal decentralization improves the infrastructure quality. They find it by using a General Linear Model (GLM) and by measuring the decentralization with the revenues and spending of local governments. The use of global spending and revenue can be criticized because they don't fully reflect the autonomy of local government. This measure of decentralization doesn't say anything about the assignment of expenditures and the nature of different revenues from local governments. Otoo and Danquah (2021) analyze the impact of fiscal decentralization (measured by revenues autonomy and vertical imbalance) on the efficiency of public goods delivery for 216 Metropolitan Municipal and District Assemblies in Ghana in 2013. They use a Data Envelopment Analysis for the efficiency measure. They use Tobit model and Stochastic Frontier Analysis for the empirical estimation. Their results suggest that fiscal autonomy has a positive impact on public goods deliveries while vertical imbalance impact negatively the public efficiency. They also find that municipal and metropolitan assemblies are more efficient than district assemblies for health water and waste management functions. The choice of 2013 for the analysis was due to the lack of data, but it doesn't allow a long run analysis and the results could be the consequences of political or social factors in this year.

# 3) Empirical framework

## 3.1) Public spending efficiency score

The estimation of efficiency score has been made by using the methodology of Kumbhakar et al. (2015) which is used by Bamba (2020) and Agasisti (2014). The Kumbhakar et al. (2015) ap-

proach is suitable because it can control the unobserved heterogeneity and separate them from inefficiency. Heterogeneous characteristics of countries regarding their economic development, their political situations, or external shocks can be interpreted as inefficiency.

The use of the Kumbhakar et al. (2015) estimator is suitable in our case because it controls for the unobserved heterogeneity between decisions making units and separate them to the inefficiency. Especially in the panel cross-country analysis, heterogeneous characteristics of countries regarding their economic development, their political situations,etc. may influence the public infrastructure provision without reflecting a bad or good public management.

The prediction of efficiency score have followed the method of Nguyen et al. (2021) which is an implementation of Kumbhakar et al. (2015) with de segmentation of the error term "$\epsilon$" between the pure noise, the short run inefficiency and the long term (or persistent) inefficiency.

We used the short run inefficiency because we are interested in the short-term effects of fiscal decentralization. The population usually doesn't wait for the long-term effect, and their lack of patience could slow down or stop the decentralization process with a centralization of the power with the wish of more effectiveness of public policies. At the same time, the measures which will be necessary to avoid, or correct long run inefficiency needs the agreement of central government. Indeed, the long run spending inefficiency is usually due to structural reasons such as the expenditures chain, demographic structure or corruption as explained by Hauner and Kyobe (2010) and Seifert and Nieswand (2014). Those institutional or regulatory factors can't be handled by local governments and need to be handle by central government to tackle the issues of long run inefficiency. Another explanation is that it's easier for local policymakers to reallocate the investment intentions among the different sectors of economy. This reallocation process is not time consuming and can improve in the short-term a part of efficiency. For the same amount, governments will increase the productivity of global investment and in our case the infrastructure efficiency We test this empirical model:

$$Y_{it} = \alpha + \beta X_{it} + \epsilon_{it} \tag{1}$$

Where $Y_{it}$ is the output variable, $X_{it}$ is the vector of our inputs variables. $i$ refers to the country and $t$ to the year. The error term $\epsilon$ is divided into three components. The new equation

will be:

$$Y_{it} = \alpha + \beta X_{it} + v_{it} - u_{it} - \eta_{it} \tag{2}$$

In this estimation, $\upsilon_i$ represents the pure noise which is independent and identically distributed, $\nu_i$ is the short run technical inefficiency and $\mu_i$ capture the long run (persistent) inefficiency. As in Bamba (2020) we realize the estimation in two steps. We first estimate the next equation to get an estimation of the parameter $\beta$ and the predicted value of $\theta_i$, $\gamma_{it}$, $\widehat{\theta_i}$ and $\widehat{\gamma_{it}}$.

$$y_{it} = \alpha_0^* + \beta X_{it} + \theta_i + \gamma_{it} \tag{3}$$

Where

$$\alpha_0^* = \alpha_0 - E(\eta_{it}) - E(u_{it}) \tag{4}$$

$$\theta_i = \alpha_i - \eta_i + E(\eta_i) \tag{5}$$

$$\gamma_{it} = v_{it} - u_{it} + E(u_{it}) \tag{6}$$

After the first step, we realize a stochastic frontier method to estimate the persistent and transient (or short term) technical inefficiency $\widehat{u_{it}}$. Finally, we compute the time-varying technical efficiency and use it for the empirical analysis.

#### 3.1).1 Inputs and Outputs

We use a two inputs one output approach to evaluate the spending efficiency infrastructures, specially on the road quality. Indeed, in many countries the local governments have the responsibility to maintain the quality of roads. In this way, we use government spending and public investment as inputs and the quality of roads according to Santiago and Ouedraogo (2018). The road got a mark between 1 and 7. In our case the local governments usually don't have in their missions to construct roads. The main purpose of local governments in term of infrastructures is to ensure the maintenance of the national roads in their jurisdiction. This is the reason why we

used the infrastructure quality index used by Santiago and Ouedraogo (2018) and Kuah (2014) and come from the *World Economic Forum, Executive Opinion Survey* of its *Global competitiveness index report* as output for the estimation of our efficiency score. This index has been built by a survey from 13,877 businesses executives across 135 countries in the world. The sample contains all size of company from all the regions within the countries. The sample is regularly updated with new respondents in view to reduce the survey bias. The global score is a simple average of all th responses within the countries, The share of respondents between rural or urban areas could false the mean and the global score of road's quality within the countries. Another issues is the cultural bias which could be false the results is one the limits of the measure. However, if we want to assess the effect of decentralization of infrastructure efficiency, it's difficult to find a better output than roads quality index of the *Global Competitiveness Index*

The choice of the global public expenditures as an output is due to the fact that those global expenditures with education or wages expenditures can indirectly affect the infrastructure efficiency. Indeed, the wages or current expenditures included the expenditures for regulation authority which can help to increase the good management of public money and increase the efficiency of infrastructure spending. The education spending can improve the consciousness of the population and their wish to ensure the good use of public money and sanction the politicians by their vote. These explanations goes in the same way than Afonso et al. (2005)

The inputs and output summary statistics table is available just below

Table 1: Summary statistics of infrastructures inputs and output

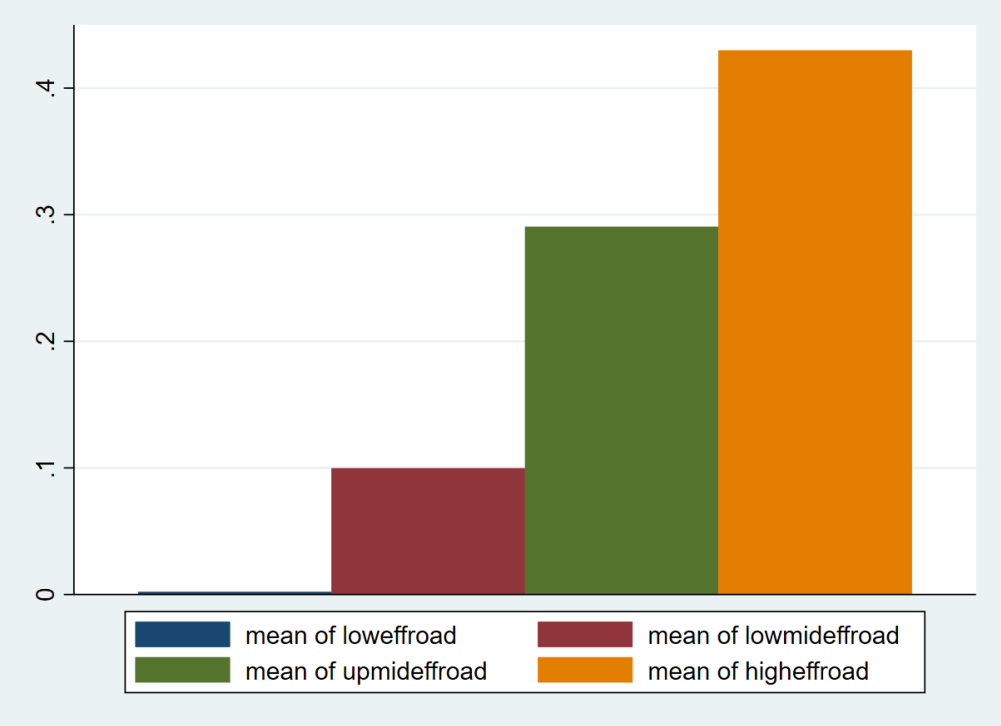
| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| Global Expenditures (% of GDP) | 32.517 | 11.169 | 10.761 | 93.803 | 628 |
| Gross fixed capital formation (% of GDP) | 22.769 | 5.127 | 10.77 | 48.412 | 643 |
| Quality of roads | 4.331 | 1.357 | 1.322 | 6.721 | 507 |

Table 2: Summary statistics of infrastructures efficiency score

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| eff_road | 0.822 | 0.067 | 0.412 | 0.946 | 410 |

In a segmentation of public efficiency by income level, the next graphics show the public

spending efficiency in infrastructures (principally the roads) by country's level income. They clearly show a correlation between income level and public spending efficiency in roads infrastructures.




Efficiency by income level

### 3.2) The measure of fiscal decentralization

The variable of fiscal decentralization comes from the International Monetary Fund (IMF) Fiscal Decentralization database. The principal concern in all the research about decentralization is the choice of the good tool which would be an indicator of fiscal decentralization. The variable which is usually used as an indicator of local government revenues, but this measure didn't say anything about the transfers and the nature of these revenues. The discretionary transfers or other grants which are not included in law could be a means for the central government to put pressure over the local governments and affect the effectiveness of decentralization. In this case, a good measure of fiscal decentralization can be the own local resources such as Caldeira et al. (2012), Caldeira and Rota-Graziosi (2014) and Fjeldstad et al. (2014). The use of own local

resources can be a way to measure the political and economic autonomy of local governments and their ability to implement their own local public policies without being dependent on central power. The own local resources are the revenues that are by and/or for the local government. They can be included in the law, and they are a way to secure the funding of local power. The sub-national governments become accountable only for their electors and not for the central government.

At the same time, the use of local expenditures as indicators of fiscal decentralization has some limits. One of the most important concerns is to know what level of government gave the order. Indeed, it's difficult to make the local government pay for all the expenditures that he realizes. Clearly, an important part of these expenditures has been decided by the central government and executed by the local power. According to UNDP (1999), delegation consists for central government to transfer some decision-making power and administrative skills related to well-defined specific missions to semi-autonomous lower-level entities. Indeed, Boadway and Eyraud (2018) explains that vertical fiscal imbalance can widely affect the supply of public goods and services. The dependence on transfers affects the ability of local governments to design and implement their own public policies. The sub-national expenditures can be a way to measure the other side of decentralization and observe the impact of this way to channeling expenses through local government. It will be a good way to test the argument according to which "local government know what to do for their populations".

Analyzing the effects of fiscal decentralization imply to well understand what we are meaning by these words. The indicator used to measure the degree of decentralization can imply differences in the results, because the meaning of the word "decentralization" varies with the indicator used for the analysis. These can be an explanation of some contradictory results from the literature about the impact of fiscal decentralization. In this paper, we will consider the numerical measure of own local resources and capital's expenditures realized by local governments, but we will add an institutional indicator to fully appreciate the level of decentralization. Our indicators will be a multiplicative combination between institutional and local revenues (or expenditures) variables.

### 3.2).1 The importance of institutional framework

The level of resources or expenditures made by the local level are not enough to fully appreciate the real level of decentralization. As said before, if the own local resources are high, with a poor institutional context we can hardly believe that local governments are independent in the choice and implementation of their local public policies. On the next graphics we can see that Japanese (in pink) and Belorussian (in red) government have the same level of own local resources, but it would be incredible that a Belorussian sub-national government have the same freedom of design and implement their policies than Japanese one.

Own local resources and rule of law

The numerical measure must have a more subjective and institutional aspect to fully appreciate the level of decentralization. In this way, Martinez-Vazquez and Mcnab (2003) and Thornton (2007) show that it's important to also consider the level of democracy, or another institutional variable to measure as well as possible the reality of the decentralization's level. Weingast (1997) in his game-theoretic approach shows that democratic stability depends on the ability to limit the power of politicians. Law allows to reduce this political authority by setting a strict legal framework that applies to everyone. By enhancing democratic stability, law strengthens the accountability of local governments to their constituents. Law also strengthens accountability by giving citizens the possibility to appeal against the decisions of local governments. The importance of law in combination with local governments' own tax revenues seems to be a good indicator of the degree of decentralization and thus autonomy of local governments. The same approach has been used for the local government's expenditures in capital. The *ICRG* measure of accountability is based on the how responsive the government is responsive to its population, according to the kind of regime (dictature, alternating democracy), the judicial independence, and the evidence of free and fair elections

The purpose of this paper is to contribute to the debate on the effects of decentralization, in particular through a measure of decentralization that differs from conventional measures that rely solely on the financial resources or expenditures of local governments. It therefore complements these previous works, as the works of Stegarescu (2005) and Jiménez-Rubio (2011) which high-

light the matters of institutional factors and the weakness of IMF *GFS* to fully appreciate the fiscal autonomy of local governments. The article therefore proposes to measure decentralization as a multiplicative combination of local governments' own resources and sectoral expenditures, with the level of accountability of the governors to their citizens as measured by the *ICRG*. This multiplicative combination will change the hierarchy of data in terms of local own resources and local expenditures, but this modification is intended and assumed. Indeed, the purpose of this new indicator is to give weight to the institutional aspect of decentralization in order to ensure that the accountability assumption that should reveal the people's preference is met. The aim is to avoid situations where local governments have their own local resources, but are not accountable to the local population, which would not allow them to reveal their preferences. The traditional theory of fiscal federalism, which predicts a larger government size in decentralized economies assumes: (i) the presence of a benevolent government that is responsive and accountable for the preferences and needs of local residents and (ii) the mobility of residents reinforcing inter-jurisdictional competition and enhancing local accountability, since residents can vote "with their feet" and arrange themselves into homogeneous communities, where their preferences are maximized. Under these assumptions, it seems unlikely the aforementioned prediction of the traditional theory of fiscal federalism will hold if no democratic institutions exist. Specifically, given a mature democracy, the various monitoring mechanisms, such as elections and press freedom, may function well, which is essential to guarantee the existence of a benevolent government that acts in the interest of residents (Qiao et al. (2019) and Karlström (2015))

The objective is to approach local government autonomy in a broader sense and by integrating the expectations of the population with regard to decentralization. Accountability is a relevant indicator that pushes local governments to take into account the preferences of their populations in the implementation of public policies, thus revealing their preferences. The main advantage of decentralization from a theoretical point of view is that it makes it possible to disclose information (namely the preferences of local populations) that central governments do not have by bringing decision-making centers closer to the governed. One of the assumptions underlying this idea is that local governments are accountable to their populations Using this approach, we are interested in the situation of local investment expenditures, the negative values observed are due to net capital transfers by local governments in these countries according to Lledó et al.

(2020). Due to this negative value, we transform the variable *capital_spending* under logarithmic form. We use the min max transformation which allows us to conserve the variance and save the hierarchy in the data distribution. Du to the low level of negative value, we didn't modify importantly the distribution and get a normalize variable for capital spending which become *logcapital*

### 3.3) The variables

Analyzing the empirical effects of fiscal decentralization on the efficiency of public spending requires the use of controlled variables that could affect both the efficiency of public spending and fiscal decentralization. Apart from the accountability indicators of the *ICRG*, and data on local own resources and infrastructure spending, we used other data to enrich the analysis. To this end, we first use World Bank data (both global governance and global development indicators). These data relate to the rate of urbanization, which can facilitate the provision of public services. At the same time, a high rate of urbanization could lead to a mismatch between the capacity of the local government to provide public services and the need of the population, which could increase substantially. In addition, the rate of urbanization may have an impact on the efficiency of public spending at both the national and subnational levels. For example, in their paper, Jayasuriya and Wodon (2003) show that urbanization has a strong and positive impact on the efficiency of health and education indicators. We also measured the income level of the countries studied with the GDP per capita in constant 2015 US dollars. The use of the constant dollar allows us to avoid the price effect during the period. Similarly, population density is used because of the potential effect on the level of autonomy. The number of inhabitants and the size of the country affect the level of decentralization. Canavire-Bacarreza et al. (2016) shows that geographic issues have a significant impact on the level of decentralization and local autonomy. A higher GDP per capita could help reduce the poverty rate and increase the population's awareness of political efficiency and the use of public funds. All of these elements could have a positive impact on the effectiveness of public policies in these countries. We also used data from UNU-WIDER (2021) on the composition of central government revenues. Indeed, as stated in

their article, government tax reform can increase accountability and improve the efficiency of public spending. They argue that the best way to use tax reforms to improve the efficiency of public policy is to broaden the tax base rather than increase tax rates. External financing is also used in the empirical analysis because of the lack of accountability that such subsidies may entail. The table just below summarize the principal variables used in this study:

Table 3: Summary of Variables

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| accountability | 5.115969 | 1.243584 | 1 | 6 | 752 |
| resources revenues | 1.76 | 5.534 | 0 | 38.415 | 367 |
| non resources revenues | 24.307 | 8.275 | 9.524 | 48.352 | 356 |
| PIT | 4.08 | 3.48 | -3.039 | 15.541 | 616 |
| CIT | 2.842 | 1.764 | 0 | 12.588 | 621 |
| VAT | 6.579 | 2.734 | 0 | 16.389 | 619 |
| Social Contribution | 1.611 | 2.449 | 0 | 10.696 | 615 |
| Urban population | 69.117 | 16.06 | 22.06 | 97.919 | 654 |
| own local resources | 0.121 | 0.107 | 0 | 0.493 | 958 |
| capital_local | 0.639 | 3.012 | -1.654 | 81.822 | 933 |
| GDP per capita constant 2015 USD | 22465.478 | 22188.694 | 368.009 | 105454.733 | 654 |
| log population density | 4.205 | 1.317 | 0.499 | 7.261 | 654 |
| autonomy | 0.614 | 0.554 | 0 | 2.3 | 752 |
| subcap | 6.354 | 2.121 | 1.233 | 26.643 | 730 |

# 4) The econometric model

## 4.1) Baseline Model

The empirical study of decentralization generally raises problems of endogeneity. In particular, the simultaneity bias between the degree of autonomy of communities and efficiency of public spending in roads infrastructures. The level of infrastructure public spending efficiency can af-

fects the trust in the ability of central government to improve the wellness of the population. The local population could put the pressure on central government and ask for a greater decentralization to be close of the policymakers. To avoid these endogeneity problems, we decided to use a two stage least square approach with an instrumental variable which would be the measure of ethnical tensions from the *ICRG*. Indeed, Alesina et al. (2003) explains that an increase of ethnics divisions negatively impacts the supply of public goods and services. The ethnics divisions affect the public policies choices of local government and ethnic conflict are an important determinant of local public finances. In the same way, Tranchant (2011) and Alesina (2003) explain that decentralization is used as a means to reduce ethnic tensions and conflicts in a country. At the same time, ethnic tensions do not directly affect the efficiency of public spending. At the same time, ethnic tensions do not directly affect the efficiency of public spending, especially public spending on infrastructure. Based on this observation, there is a direct effect of ethnic tensions in t-1 on decentralization in t and an indirect effect of these tensions on efficiency. Their effect is mediated by institutional aspects, namely the heterogeneity of preferences, and a demand for rapprochement between the rulers and the governed, to which the response is most often decentralization. Ethnic tensions in t-1 are a good instrument for decentralization in an instrumental variables approach.

The empirical model, inspired by those of Sanogo (2019), Choudhury and Sahu (2022) and Qiao et al. (2019) has the following form:

$$logeffroad_{it} = \alpha logautonomy_{it} + \beta logautonomy2_{it} + \mu X_{it} + \epsilon_{it} \tag{7}$$

$$logeffroad_{it} = \alpha subcap_{it} + \beta logsubcap2_{it} + \mu X_{it} + \epsilon_{it} \tag{8}$$

Where subcap is the combination of local capital expenditure and the accountability level in the country. capital expenditures indicator has been transformed under a logarithmic form in the empirical equation. logeffroad is the logarithmic expression of public spending efficiency on

roads infrastructures. The term $X_{it}$ represents the control variables which can impact the level of decentralization, or the public spending efficiency. Those variables are population density, own local resources, local spending in capital, accountability, GDP per capita, all of them under the logarithmic form. Central government resources and urbanization rate are also included in the empirical model. We sometimes include central government effectiveness under logarithmic for the road's infrastructures efficiency.

The instrumental variable used in this model is the one lagged logarithmic functions of ethnic tensions which is evaluate by the *ICRG* from the available data and observations on racial and languages divisions within the country for the period. In our wish to test the effect of decentralization according to the income level of Countries, we put on the table some interactive variables such as *autonomielow = logautonomy*lowincome* and *autonomiehigh = logautonomy*highincome*. In the same way, we want to test the effect of fiscal decentralization over the electoral cycle such as Jametti and Joanis (2016). So, we create a binary variable (elections) which takes the value 1 the year of a major electoral contest, which could be presidential or legislative according to the nature of the central regime. The variable takes the value 0 otherwise. Otherwise, we don't include the variable elections, but the one lagged value of elections. We did it because the elections can take place at the beginning of the year. Hence the political measures taken by the government to be re-elected and which can affect the efficiency of public sector not during the electoral year, but the year before.

### 4.1).1 Results and interpretation

Table 4: Results of tax autonomy on infrastructures (2SLS)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| VARIABLES | 2SLS | 2SLS | 2SLS | 2SLS | 2SLS |
| log(autonomy) | 14.48* | 10.42** | 10.63** | 11.61** | 10.09** |
| | (7.640) | (4.945) | (5.147) | (5.856) | (4.686) |
| acountability | -3.733* | -2.565* | -2.608* | -2.871* | -2.500* |
| | (2.143) | (1.359) | (1.412) | (1.612) | (1.281) |
| log(own local resources) | -14.40* | -10.33** | -10.42** | -11.65** | -10.08** |
| | (7.629) | (4.928) | (5.141) | (5.941) | (4.737) |
| log(GDP per capita) | 0.484* | 0.283** | 0.295** | 0.386** | 0.245* |
| | (0.290) | (0.136) | (0.134) | (0.164) | (0.141) |
| Urbanization rate | -0.0296 | -0.00953 | -0.0121 | -0.00977 | -0.0189 |
| | (0.0266) | (0.0131) | (0.0132) | (0.0131) | (0.0158) |
| log(grant central government) | -0.145 | -0.0752 | -0.0967 | -0.0275 | -0.0322 |
| | (0.182) | (0.173) | (0.174) | (0.150) | (0.138) |
| value added tax | -0.0317 | -0.0314 | -0.0288 | -0.0244 | -0.0270 |
| | (0.0369) | (0.0385) | (0.0381) | (0.0379) | (0.0352) |
| personal income tax | 0.0102 | 0.0171* | 0.0213* | 0.0254* | 0.0201 |
| | (0.0159) | (0.0104) | (0.0120) | (0.0142) | (0.0147) |
| corporate income tax | -0.0535 | -0.0211** | -0.0132 | -0.0143 | -0.00521 |
| | (0.0364) | (0.00963) | (0.0114) | (0.0117) | (0.0127) |
| log(density) | 0.427 | -0.136 | -0.127 | -0.0786 | -0.285 |
| | (0.763) | (0.394) | (0.402) | (0.456) | (0.437) |
| L.elections | | -0.0501 | -0.0419 | -0.0449 | -0.0377 |
| | | (0.0361) | (0.0323) | (0.0320) | (0.0252) |
| elections t+1 | | 0.0564 | 0.0500 | 0.0513 | 0.0459* |
| | | (0.0359) | (0.0324) | (0.0321) | (0.0266) |
| log(autonomy)*low_income | | | -0.167** | 0.0832 | 0.0330 |
| | | | (0.0749) | (0.137) | (0.106) |
| log(autonomy)*high_income | | | | 0.479* | 0.360* |
| | | | | (0.287) | (0.210) |
| duration | | | | | 0.00929 |
| | | | | | (0.00758) |
| Constant | -7.870* | -4.653** | -4.493** | -6.443** | -3.257 |
| | (4.512) | (1.998) | (2.026) | (2.983) | (2.684) |
| Observations | 319 | 312 | 312 | 312 | 312 |
| Number of Id | 39 | 39 | 39 | 39 | 39 |

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

Table 5: Results of spending autonomy on infrastructures (2SLS)

| VARIABLES | (1) 2SLS | (2) 2SLS | (3) 2SLS | (4) 2SLS |
|---|---|---|---|---|
| expenditures_autonomy | 1.512** | 1.389** | 1.378** | 1.313** |
| | (0.748) | (0.654) | (0.658) | (0.608) |
| accountability | -1.853** | -1.682** | -1.663** | -1.587** |
| | (0.902) | (0.796) | (0.808) | (0.739) |
| log(capital_spending) | -8.720** | -7.176** | -7.116** | -6.762** |
| | (4.338) | (3.563) | (3.589) | (3.311) |
| log(GDP per capita) | -0.0161 | -0.0613 | -0.0599 | -0.0767 |
| | (0.184) | (0.165) | (0.164) | (0.163) |
| Urbanization rate | 0.00481 | -0.00482 | -0.00407 | -0.00473 |
| | (0.00819) | (0.00698) | (0.00699) | (0.00682) |
| log(grant central government) | 0.0640 | 0.0666 | 0.0522 | 0.0715 |
| | (0.0802) | (0.0753) | (0.0778) | (0.0739) |
| value added tax | -0.0863*** | -0.0771*** | -0.0772*** | -0.0728*** |
| | (0.0281) | (0.0235) | (0.0234) | (0.0228) |
| personal income tax | 0.0264** | 0.0221** | 0.0222** | 0.0208** |
| | (0.0115) | (0.0107) | (0.0107) | (0.0105) |
| corporate income tax | 0.0906 | 0.393 | 0.399 | 0.379 |
| | (0.376) | (0.366) | (0.366) | (0.359) |
| excises tax | 0.0467 | 0.0355 | 0.0352 | 0.0309 |
| | (0.0356) | (0.0310) | (0.0311) | (0.0293) |
| corporate income tax | -0.0299* | -0.0248* | -0.0247* | -0.0260* |
| | (0.0172) | (0.0148) | (0.0148) | (0.0148) |
| expenditures_autonomy* high_income | | -1.188*** | -1.188*** | -1.163*** |
| | | (0.404) | (0.400) | (0.384) |
| L.elections | | | | -0.112 |
| | | | | (0.0879) |
| elections | | | | 0.0145 |
| | | | | (0.0183) |
| elections t+1 | | | | 0.116 |
| | | | | (0.0946) |
| expenditures_autonomy*low_income | | | -0.270 | |
| | | | (0.511) | |
| Observations | 303 | 303 | 303 | 303 |
| Number of Id | 39 | 39 | 39 | 39 |

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

The results for the two stage least squares estimation suggest a positive impact of revenue autonomy as measured by our new indicator. This positive effect can be explain by a better matching between local population needs in terms of public infrastructure, and a greater revenue autonomy allows them to implement their own polices. Local governments' control over taxation and greater local own resources, combined with strong accountability to voters, reveals local populations, and gives local governments the ability to know where to allocate funds for greater efficiency, and lower cost. For example,Bardhan and Mookherjee (2006) it is shown that, depending on how local governments are financed, sufficient fiscal autonomy for local govern-

ments could enable them to better deliver public goods (including good quality infrastructure). However, they do not include spillover effects in their analysis. Indeed, local governments may engage in tax competition to attract a larger tax base. Thus, Cai and Treisman (2005) explains that political and fiscal decentralization can lead to competition between local governments. Indeed, the more affluent ones (in terms of human capital, natural resources, etc.) can compete aggressively with the less affluent ones to attract a larger tax base. In our case, this would result in the impoverishment of the less well-endowed local governments, which would no longer be able to carry out their road infrastructure maintenance missions. The disparity in the quality of road infrastructure could lead to a lower overall score in relation to total expenditures, and thus to lower efficiency due to inter-regional inequalities. In the long term, divergence may appear in the trajectory of local governments following a strengthening of their financial autonomy. It therefore seems appropriate to conduct a dynamic analysis of the effects of decentralization on the efficiency of public spending on infrastructure.

## 4.2) Dynamic Model

To deepen the analysis, it was decided to realize a dynamic analysis with the lagged value of estimate efficiency score. So, we use the Generalized Method of Moments (GMM) two-step system such as described by Blundell and Bond (1998) with some panel data, which makes it possible to instrument the degree of autonomy by its previous values or by external instruments. This dynamic panel data approach also allows us to account for the persistence of country risk over time. The two-step system GMM Blundell and Bond (1998) is also appropriate given the structure of our sample (small time dimension relative to the number of countries).However, the results with fixed effect estimates are provided in the appendix As the previous studies which used the GMM with lagged values as instrument, it's difficult to think that those lagged values of autonomy level (measured by revenues or expenditures) doesn't affect the current level of public spending efficiency. So, those instruments are not fully exogenous, and their impact doesn't affect public spending efficiency only through the current level of autonomy. For this reason, we use an external instrument which affects public spending efficiency by its effects on the level of autonomy instead of lagged values of decentralization. According to the literature Alesina

et al. (2003) and Gisselquist (2014), we also choose the level of ethnic tensions in the country measured by the International Country Risk Group. In the same way, Gisselquist (2014) which is an update of Alesina et al. (2003) paper shows an unclear relationship and a mixed effect of ethnic division on public goods provision choices. The ethnics divisions increase the provision of some public goods and reduce the provision of others. Those articles show that ethnics divisions, conflicts and tensions have an impact on the local public finances and the policies choices.

The use of the GMM estimation method allows us to control for unobserved specificities and endogeneity that may exist with the explanatory variable. Moreover, the integration of the variable of interest with a delay in the model necessarily generates an endogeneity and an auto correlation of order 1 which is acceptable. Before using this method, it is necessary to verify the stationary character of the explanatory variables and the variable of interest. The Philip Perron test was used to ensure this stationary character before proceeding with the empirical analysis. The Philip Perron test has the advantage of being non-parametric, it does not prejudge the probability distribution followed by the sample, and it also applies very well to panel data. All these reasons justified the use of this test to verify the stationarity of the variables. The results of the Fisher test made it possible to reject the null hypothesis of non-stationarity. The variables were therefore considered stationary. The two step system GMM estimator proposed by Blundell and Bond (1998) is extensively used in the empirical literature. This estimator is suitable to estimate the dynamic equations 9 and 10 where the one-year lag of the dependent variable is included as a right hand side regressor. We check the validity of the estimator by means of 3 diagnostic tests: the Sargan test of over-identifying restrictions to test the validity of the internal instruments, the Arellano-Bond (AB) tests of first-and second-order serial correlation – denoted respectively AR(1) and AR(2) (in these tests the null hypothesis of absence of second-order serial correlation in the error terms should be not rejected, while the null hypothesis of absence of first-order serial correlation should be rejected). The number of instruments used in the regressions is also reported, because if the number of instruments exceeds the number of countries, the above-mentioned diagnostic tests may lose power.

The estimations equation for assess the impact of revenue decentralization on efficiency have

been inspired by the model of Montes et al. (2018). So, we will test the following model:

$$logeffroad_{it} = \alpha L.logeffroad_{it-1} + \beta logautonomy_{it} + \mu X_{it} + \epsilon_{it} \quad (9)$$

Always to compare the effects of revenue and spending decentralization, we also realize an empirical estimation of the effect of local spending in roads infrastructures on the efficiency of public spending. The new models look like:

$$logeffroad_{it} = \alpha L.logeffroad_{it-1} + \beta subcap_{it} + \mu X_{it} + \epsilon_{it} \quad (10)$$

The results are available in the next tables

### 4.2).1 Results and interpretation

Table 6: Results of autonomy on infrastructures

| VARIABLES | (1) GMM | (2) GMM | (3) GMM | (4) GMM | (5) GMM |
|---|---|---|---|---|---|
| L.log(road_efficiency) | 0.919*** | 0.922*** | 0.920*** | 0.903*** | 0.870*** |
| | (0.0969) | (0.0847) | (0.0789) | (0.0680) | (0.0620) |
| log(autonomy) | -3.761** | -3.876*** | -4.142** | -3.284** | -1.958** |
| | (1.699) | (1.439) | (1.791) | (1.532) | (0.954) |
| accountability | 1.140** | 1.175*** | 1.264** | 1.002** | 0.597** |
| | (0.524) | (0.440) | (0.545) | (0.467) | (0.290) |
| log(own local resources) | 3.785** | 3.900*** | 4.197** | 3.304** | 1.965** |
| | (1.711) | (1.447) | (1.810) | (1.533) | (0.956) |
| Urbanization rate | 3.96e-05 | -4.31e-05 | -0.00102 | -0.000230 | -0.000158 |
| | (0.00220) | (0.00194) | (0.00177) | (0.00145) | (0.00124) |
| log(grant central government) | 0.0534 | 0.0659 | 0.0837 | 0.0395 | -0.0139 |
| | (0.115) | (0.103) | (0.0966) | (0.116) | (0.0731) |
| log(GDP per capita) | -0.236** | -0.247*** | -0.193* | -0.213** | -0.134** |
| | (0.116) | (0.0955) | (0.108) | (0.0893) | (0.0555) |
| value added tax | -0.0141 | -0.0170** | -0.0114 | -0.0106 | -0.00484 |
| | (0.0105) | (0.00803) | (0.0119) | (0.00708) | (0.00634) |
| personal income tax | 0.0124 | 0.0137 | 0.0173 | 0.00806 | 0.00319 |
| | (0.0129) | (0.0105) | (0.0116) | (0.00755) | (0.00535) |
| corporate income tax | -0.0237 | -0.0275 | -0.0369 | -0.0140 | -0.0129 |
| | (0.0253) | (0.0202) | (0.0238) | (0.0139) | (0.00870) |
| log(density) | -0.000145 | -0.000375 | -0.00603 | 0.00162 | -0.00105 |
| | (0.0123) | (0.0115) | (0.0136) | (0.00972) | (0.00975) |
| log(autonomie)*low_income | | | -0.0208 | | |
| | | | (0.0245) | | |
| log(autonomie)*high_income | | | -0.425 | | |
| | | | (0.360) | | |
| L.elections | | 0.0163 | | 0.0168* | -0.355 |
| | | (0.0128) | | (0.00904) | (0.317) |
| elections t+1 | | | | | 0.367 |
| | | | | | (0.323) |
| t | | | | | -0.00231 |
| | | | | | (0.00231) |
| Constant | 2.529** | 2.664*** | 2.406** | 2.235** | 1.443** |
| | (1.157) | (0.952) | (1.103) | (0.868) | (0.608) |
| Observations | 281 | 281 | 280 | 281 | 281 |
| Number of Id | 39 | 39 | 39 | 39 | 39 |
| Instruments | 15 | 19 | 16 | 27 | 30 |
| AR(1) | 0.018 | 0.012 | 0.011 | 0.015 | 0.001 |
| AR(2) | 0.107 | 0.102 | 0.121 | 0.105 | 0.154 |
| Hansen | 0.773 | 0.957 | 0.997 | 0.450 | 0.568 |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Results of local expenditures on infrastructures

| VARIABLES | (1) GMM | (2) GMM | (3) GMM | (4) GMM | (5) GMM |
|---|---|---|---|---|---|
| L.log(road_efficiency) | 0.993*** | 0.873*** | 0.874*** | 0.991*** | 0.975*** |
| | (0.139) | (0.0843) | (0.0750) | (0.147) | (0.136) |
| expenditures_autonomy | 1.131** | 0.964** | 0.810** | 1.132** | 1.034** |
| | (0.524) | (0.457) | (0.375) | (0.492) | (0.474) |
| expenditures_autonomy$\hat{2}$ | -0.0263* | -0.0196 | -0.0183 | -0.0260* | -0.0242** |
| | (0.0139) | (0.0189) | (0.0157) | (0.0135) | (0.0116) |
| accountability | -1.007* | -0.861* | -0.687** | -1.011** | -0.911* |
| | (0.536) | (0.451) | (0.325) | (0.515) | (0.496) |
| log(capital_spending) | -3.892* | -3.739* | -2.912** | -3.956* | -3.572* |
| | (2.229) | (2.015) | (1.379) | (2.149) | (2.107) |
| Urbanization rate | -0.00116 | 0.00171 | 0.00139 | -0.00148 | -0.000908 |
| | (0.0136) | (0.0121) | (0.00903) | (0.0134) | (0.0134) |
| log(grant central government) | -0.0802 | -0.0161 | -0.0363 | -0.0815* | -0.0793 |
| | (0.0512) | (0.0562) | (0.0526) | (0.0493) | (0.0505) |
| log(GDP per capita) | -0.240 | -0.0764 | -0.0789 | -0.238 | -0.218 |
| | (0.157) | (0.160) | (0.127) | (0.152) | (0.150) |
| value added tax | -0.0211 | -0.0169 | -0.0157 | -0.0224 | -0.0201 |
| | (0.0200) | (0.0184) | (0.0150) | (0.0184) | (0.0188) |
| personal income tax | -0.0124 | -0.00756 | -0.0106 | -0.0122 | -0.0123 |
| | (0.0103) | (0.0110) | (0.00866) | (0.0102) | (0.00909) |
| corporate income tax | -0.0264 | -0.0242* | -0.0221 | -0.0260 | -0.0253 |
| | (0.0187) | (0.0144) | (0.0151) | (0.0180) | (0.0184) |
| log(density) | -0.133 | -0.0798 | -0.103 | -0.133 | -0.119 |
| | (0.145) | (0.198) | (0.168) | (0.145) | (0.126) |
| duration | 0.00111 | -0.00234 | -0.00107 | 0.00119 | 0.000737 |
| | (0.00461) | (0.00491) | (0.00346) | (0.00444) | (0.00434) |
| expenditures_autonomy*high_income | | -0.0604 | -0.129 | | |
| | | (0.271) | (0.207) | | |
| expenditures_autonomy*low_income | | -0.117 | -0.212 | | |
| | | (0.347) | (0.267) | | |
| L.elections | | | -0.101 | -0.134** | |
| | | | (0.0672) | (0.0586) | |
| elections t+1 | | | 0.0982 | 0.132** | |
| | | | (0.0631) | (0.0564) | |
| Constant | 7.091** | 5.025 | 4.231* | 7.175** | 6.443** |
| | (3.136) | (3.055) | (2.272) | (2.897) | (2.817) |
| Observations | 274 | 274 | 274 | 274 | 274 |
| Number of Id | 40 | 40 | 40 | 40 | 40 |
| Instruments | 28 | 25 | 30 | 30 | 29 |
| AR(1) | 0.034 | 0.040 | 0.048 | 0.044 | 0.028 |
| AR(2) | 0.427 | 0.575 | 0.575 | 0.390 | 0.412 |
| Hansen | 0.527 | 0.563 | 0.559 | 0.541 | 0.466 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The lack of funding for the poorest local government and the disparity of road's quality within the country can explain the negative effect of autonomy on efficiency score. Revenue decentralization can widens inter-regional heterogeneity, exacerbates regional disparities and produces under-investment inefficiencies as Bellofatto and Besfamille (2021) explain in their paper. In the

same way, Bonet (2006) with a panel data dynamics model explains that fiscal decentralization process increased regional income disparities maybe due to he lack of a redistributive component in the intergovernmental transfers. This dynamic impact on regional disparities explain the negative effect of autonomy on efficiency.

The accountability index has a positive effect on the spending efficiency. Indeed, the rulers are accountable of their choices and policies, and they have interest to make the expenditures the most efficient possible to be re-elected or legitimize their power. The negative effect of GDP per capita is counter-intuitive but, this result depends on the way efficiency is measured (Quality of roads). The idea is that richer countries invest more in infrastructure (in terms of expenditure per capita) than other countries. However, the differential in terms of results (increase of roads quality) is not proportional to the differential in resources as Agasisti (2014) explains. The differential is due to the number of roads and by the already high level of infrastructures quality.

We also find a positive impact of public spending decentralization on infrastructure public spending efficiency. This result can be explained by the fact that an important part of infrastructure expenditures come from central government. The centralization of tax collection avoids the issues of lack of resources for poorest jurisdictions and the disparities in the infrastructure's quality due to an under-investment of those jurisdictions. We do not have information on who is responsible for making decisions about expenditures at the local level or the funds with which they are financed. Expenditures as measured include some funded by transfers. Thus, the central government, through these grants, reduces inequalities and equalizes the means available to local governments to make the investments necessary to maintain the quality of road infrastructure throughout the territory and avoid disparities. The results go in the same way than those of Escaleras and Calcagno (2017) and Barankay (2007). The threshold for capital expenditures decentralization is above 1. This means that we have a positive and linear effect of spending decentralization on their efficiency score. For the column (4) we have a decrease of efficiency score the year before the election and an increase the year after the elections, which means a come back to the trend. The local governments may be influenced by the national electoral cycle through the subventions and intergovernmental transfers.

# 5) Conclusion

By using a new approach to measure the degree of decentralization of local governments through a accountability (for the institutional framework) and local own resources or local spending on infrastructure. This work aims to contribute to the debate on the macroeconomic effects of decentralization on the efficiency of public spending. With a dual approach that examines the effects of local government effects of local government spending and autonomy in terms of local resources. Our empirical analyses show mixed effects of fiscal decentralization on infrastructure efficiency. These effects differ depending on whether the approach is taken in a static or dynamic fashion.

In a static approach, decentralization in all its forms has a positive impact on the efficiency of public spending on infrastructure, notably through a strengthening of the autonomy of local governments as explained by Sow and Razafimahefa (2015). The results vary under a dynamic analysis, as the original disparities between local governments become more visible and lead local governments to compete with each other to attract the largest possible tax base. The richest regions become the most favored, thus the misallocation of resources between richly endowed regions and the poorest (less well endowed) regions that most need its resources are deprived. This misallocation of resources leads to their misuse and thus a negative effect on the efficiency of infrastructure spending. Diseconomies of scale and lack of capacity at the local level could be another explanaitions for the negative effects of revenues decentralization as Taiclet et al. (2015) explains in their report. The transfer of expenditures to the local level, accompanied by intergovernmental transfers, circumvents the problem of resource mobilization at the local level by allocating funds to where they are needed. Local governments can thus use the information they have about the preferences of their populations to better use these funds and improve efficiency. de Mello and Ter-Minassian (2020) in their paper, explain that it is important to build local local capacities if the central government want to fully appreciate the benefits of decentralization. This technical assistance can take place between or within different levels of government to strengthen local capacity in the areas of tax and expenditure policy and administration, service delivery and public financial management, and practices and and regulatory practices and policies.

It can therefore be concluded that the transfer from a dynamic approach to local governments

in a dynamic approach leads to inefficiency due to the disparity in local governments' own resources, the quality of road infrastructure between local governments, their weakness in terms of In the case of local government expenditure, it is important to note that this is not the case for all local governments. With regard to local government expenditure With respect to local government spending, there is a positive and significant result on the efficiency of public spending on infrastructure. Local government spending necessarily contains a transfer component (which may be significant) from central government. This suggests cooperation between the different levels of government. The lack of certainty or data The lack of certainty or data on whether local governments are elected or not makes it difficult to speak clearly of deconcentration or delegation.

Another way to extend this empirical research would be to work on the spillover effects of decentralization on public health spending within a developing country and try to understand the mechanism of complementary or strategic interactions of government and local government. of complementary or strategic interactions of local government.

The main limitations of this research are due to the lack of data on fiscal decentralization in general, but also on the quality of the various roads or other infrastructures (energy, water, etc.) that are under the jurisdiction of local governments. It is also necessary to be able to distinguish between what is relevant to the specific local level on which we are working (in this case the regions).

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# 6) Annexes

**List of Countries**

Afghanistan; Armenia; Australia; Austria; Belarus; Belgium; Bosnia and Herzegovina; Brazil; Bulgaria; Canada; Chile; Costa-Rica; Croatia; Cyprus; Denmark; El Salvador; Estonia; Finland; France; Georgia; Germany; Greece; Honduras; Hungary; Iceland; Iran, Islamic Rep.; Ireland; Israel; Italy; Japan; Latvia; Lithuania; Luxembourg; Malta; Mauritius; Moldova; Mongolia; Netherlands; North Macedonia; Norway; Paraguay; Peru; Poland; Portugal; Russian Federation; Slovenia; South Africa; Spain; Sweden; Switzerland; Thailand; Ukraine; United Kingdom


Countries include in the sample