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Fiscal decentralization and economic growth in Ecuador: Panel data on provincial council and municipalities since a heterodox vision

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Abstract

The objective of the present investigation tries to determine the nature of relationship between fiscal decentralization and economic growth for Ecuadorian case from heterodox perspective. A panel data model is used, where the dependent variable being GDP pc (proxy for economic growth), and variables of interest and control (proxies of fiscal decentralization) are public investment, public consumption, the export ratio, poverty and inflation. The results indicate that greater fiscal decentralization affects economic growth, in which the public investment of the Decentralized Autonomous Governments (GADs) from the application of Organic Code of Territorial Organization, Autonomy and Decentralization (COOTAD) since 2010 has allowed its impact on the provincial GDP per capita to be stronger.

1. Introduction

The relationship between fiscal decentralization and economic growth has always been manifested from the neoclassical perspective, where, representative agent and the stimulus of taxes on economic activity have been the ruler to determine this relationship. In addition, private income has been considered as a fundamental variable in relation to economic growth. From Tiebout (1956), Musgrave (1959) and Oates (1972), was presented the relationship between fiscal decentralization and economic growth as the conditionality of the inverse relationship, and how the level of economic growth is affected for fiscal decentralization.

In the present study, we analize this relationship between economic growth and fiscal decentralization by a heterodox vision of measurement from public spending, the field of public investment and consumption, as determinants of economic growth. This different approach should review the actions of the state through public policy, to promote the conditions of economic growth, based on a decentralization process that allows the state (from the GAD's) to generate through investment and public consumption, the conditions necessary for the relationship between economic growth and fiscal decentralization to have an influence on investment and public consumption.

This alternative approach seeks to present the role of the state as the dynamizer of the economy, hence the importance of measuring the relationship of economic growth and fiscal decentralization from the definition of investment and public consumption, as determining variables in a process of fiscal decentralization. Defining for this also the existence of fiscal decentralization or not, a dummy variable, in a dynamic of change of economic growth measured from investment and public consumption, before and after decentralization.

Furthermore, this approach aims to capture the role of the state, not only as an engine of the economy in a process of fiscal decentralization, but as a determinant of social improvements. Considering since 1980, Latin

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America becomes one of the geographical areas with the greatest inequality in the world, a situation that has made it increasingly necessary to apply public policies that pursue a sustained improvement in income redistribution and income as their objective wealth. In this sense, fiscal policy plays a fundamental role, considering fiscal policy as the set of public income and expenditure policies applied in order to guarantee the economy and social conditions of the population, in distributional settings (Varela, 2011).

When referring to the Ecuadorian case, the Constitution of Ecuador in force (Asamblea Nacional, 2008) refers to decentralization in Art. 238, Art. 262, Art. 270. Everything indicated in Art. 262 and 270 refer to the importance of local governments against public consumption and investment as a component of improvement in the economy and social conditions of Ecuador.

In the international arena, the theoretical interest in the relationship between economic growth and fiscal decentralization dates from the 1950s of the previous century. All the aforementioned have focused on the main agent and the incentive for private investment and consumption, as mechanisms of relationship between decentralization and economic growth. In this study, we will no longer focus on the main agent and the private sector as the engine in the relationship between decentralization and economic growth, but we will refer to the public sector as the engine of this relationship, a situation that frames us in a different approach than traditionally has analyzed the relationship between decentralization and economic growth.

However, we must emphasize that all studies have focused on analysis at the level of countries, or federations, but in developed countries. In developing countries such as Ecuador there are no studies in this regard, but studies have been carried out in Colombia at the regional level, but considering the restriction of the representative agent in a production function of constant returns with standard preferences of a representative household based on the Ramsey-Cass-Koopmans model.

- ✓ This work is organized as follows: The second section addresses the literature review, the process from centralization to decentralization in Ecuador, and theoretical and empirical evidence. The third section addresses the methodology based on the use of panel data. The fourth section deals with the results at the level of Provincial Council and Municipalities of Ecuador. The fifth section are conclusions.

2. Literature review

2.1. Ecuador: Since Centralization to Decentralization

Centralization from 1830 to 2009: From the beginning of the Republic, Ecuador was characterized by maintaining a state operation based on the centralization of functions and powers in the central government. However, political events in the country, with continuous overthrowings mainly in the 1920s, 40s, and mainly in the 1990s, which exposed the corrupt and manipulative practices of the economic and financial oligarchies to the governments of the day ended with the financial crisis of 1999 and the adoption of the dollarization system, events that allowed a broad debate on the importance of carrying out decentralization processes in Ecuador.

Thus, faced with the exhaustion, discredit and ineffectiveness of the central government, decentralization appeared in the Ecuadorian debate as a way to strengthen public action at all territorial levels, with wide spaces for citizen participation that allow the transfer of responsibilities, functions and mechanisms for provide public services effectively and equitably, from the different local governments.

Decentralizing reforms: The first reforms occurred with the National Participation Fund (FONAPAR) in 1971, which created unified taxes to carry out transfers from the central government to subnational governments. Subsequently, the National Development Council appeared in 1984 as part of the fiscal capacity of subnational governments, and shows the existing deficiencies in FONAPAR, which led to its disappearance, due to the ad hoc distribution that was made from the central government to the other levels of government. In 1990, with Law 72, the National Sectional Development Fund (FODESEC) appeared to manage allocations to the Provincial Council.

The Decentralization debate between the years 1990-2006: It realizes mainly from the academy, as well as from political organizations and governments of the moment, circumscribed in an almost ideological confrontation on how to apply Decentralization in Ecuador.

Neoliberal approach: Directed from the Social Christian Party, oligarchic groups and the mainstream media have tried to focus the Decentralization process since the 1990s, in order to define that any decentralization policy must be aimed at privatization of public services and public companies, to achieve greater productive efficiency and effectiveness in the decentralization process of the Ecuadorian state; However, this the carte

decentralization could not be carried out, due to the massive mobilizations by the indigenous movement and the various social groups in Ecuador, which have always faced the oligarchic and regional interests of the country.

Neocontractual approach: Later, as a consequence of the financial crisis of 1999 and the adoption of the dollar as currency, a confrontation was generated between the Post Consensus of Washington that looked for in the governments of Jamil Mahuad (1998-2000), Lucio Gutiérrez (2003- 2004) and Alfredo Palacio (2004-2006) continue with the neoliberal measures that had been left halfway, and the social demands led by the Confederation of Indigenous Nationalities of Ecuador (CONAIE), specifying the pressure for an inclusive political system, the Neo contractual approach, which seeks to recover the role of the state as a mechanism for improvements in the strengthening of the state at any level of government, from the ethnic and regional diversity of the country.

Social - Participative Approach: Distinguishes as part of the debate, the difference between decentralization and autonomy, as well as the difference between decentralization and deconcentration, to direct decentralization towards the definition of public policies as part of citizen participation. In this social - participatory approach, the constituent process of Montecristi of 2008 brought together all the organizations of the Coast, Sierra, Amazon and Galapagos, as well as the Association of Municipalities of Ecuador (AME) and the Council of Provincial Governments (CONGOPE), with whom the Constitution regarding Decentralization was drafted, but also on citizen participation as part of the decentralization process. This is how part of this conjunction between decentralization and citizen participation, the empty chair or participatory budgets were incorporated into Ecuadorian legislation, in which citizenship is part of the decisions made by local or sub-national governments.

Organic Code of Territorial Organization, Autonomy and Decentralization (COOTAD), 2010: Created from the Constitution of 2008, and its approval in 2009, which underwent improvements in 2014. It should be considered that COOTAD reallocated resources to the autonomous governments as follows:

- ✓ 15% of permanent income and 5% of non-permanent income of the general state budget correspond to Metropolitan Districts.
- ✓ 21% of permanent income and 10% of non-permanent income from the general state budget for Decentralized Autonomous Governments (GAD's), with a distribution of 27% for provincial councils, 67% for municipalities and 6% for parish councils according to two components:

1) “Starting in 2010, the amount corresponding to the autonomous governments is distributed,

2) The difference between the total to be distributed and the amounts assigned by the first component distributed based on seven criteria; population, population density, unsatisfied basic needs, improvement in living standards, fiscal effort, administrative effort, fulfillment of goals of the national and regional development plan”.

In addition, the generation of surcharges on existing taxes to finance infrastructure works, where the criterion is decided by the National Competencies Council (CNC) in conjunction with the Planning and Development Secretariat (SENPLADES) and the Ministry of Finance. Regarding the decentralization of spending, COOTAD defined certain conditions: 30% of resources to permanent expenses and 70% to non-permanent or capital expenses, with art reviews by the CNC, SENPLADES and the Ministry of Finance, every 4 years.

2.2. Theoretical and empirical evidence

From the neoclassical perspective, fiscal decentralization is based on Tiebout's Theory of Voting with Feet and Oates's Theory of Decentralization, in which the link between fiscal decentralization and economic growth is centered on the principle of economic efficiency given by the supply of public goods and services, according to the entrepreneurial and individual capacity to choose where to live, given the heterogeneous preferences that exist between the different localities. In this heterogeneity, localities compete with each other to stimulate choice and efficiency as a positive effect on the economy, with which the relationship between fiscal decentralization and economic growth is established. Thus, fiscal decentralization increases economic efficiency and thus economic growth.

In the first-generation theories, efficiency in the allocation of resources manifests itself as beneficial in decentralization, this is reflected in the works of Musgrave (1959), Oates (1972) and Tiebout (1956). The assumptions of decentralization based on efficient allocation of resources are based on the ease of effective governance, such as is carried out in developed or advanced countries that have facilitated the decentralization process based on the existence of relatively transparent and effective subnational governments. However, this first-generation theory has focused on the representative agent, on income, consumption and private investment through a production function with a budget restriction based on incentives to the entrepreneur, where the state must generate the best conditions for the economy through public policy. market to the detriment of society.

In second-generation theories, expressed in the work of Weingast (2006, 2009), the traditional assumptions of Musgrave, Oates and Tibout are questioned. Also, authors said its applicability to middle-income countries is not feasible due to the limitations imposed by low income, precarious housing and citizen mobility tied to strong ethnic-regional ties. In addition, it is mentioned that economic elites dominate public institutions, preventing broad citizen participation.

From the traditional view, Hatfield and Prado (2012) reviewed the classic problem of fiscal competition in the context of federal nations and derive a positive theory of partial decentralization. This theory explains that using redistributive taxes on capital to provide public goods leads to high taxes setting what supposedly results in a small stock of capital that lowers the returns from redistribution. Therefore, all this leads to the implementation of a lower level of taxes on capital, and this must be done by establishing in the Constitution, a partial degree of decentralization. On the other hand, fiscal decentralization is very important in economic growth because it generates a higher level of fiscal competition in Local Governments that would supposedly bring efficiency gains in the productive apparatus.

Fiscal studies of decentralization of the OECD (2015, 2016) said the rules and practices that govern fiscal relations between the different levels of government administration, and their respective responsibilities in taxes, expenses and debt management, all of them influence economic efficiency and growth.

From the neoclassical perspective, a decentralized system must necessarily be more receptive to the demands of society in order to increase well-being, that is, to increase consumer efficiency, while meeting the well-being and demand of society from decentralization. However, although the evidence may show a positive impact with a greater fiscal decentralization of expenditures, “there are other factors - such as physical capital, human capital, fiscal pressure, inflation rate, unemployment rate and the instrumental variable - that explain the growth of per capita income to a greater extent ”(Pérez González and Cantarero, 2001, pp. 24-25).

The proposition that horizontal equalization between locations improves both equity and efficiency, referred as early as the 1950s by Buchanan's seminal papers (1950), generated important later papers including Flatters et at (1974), Boadway (2001, 2004), Kim and Dougherty (2018). A key idea of these studies on horizontal equalization between localities indicates that the choice of a household's location is affected not only by labor productivity but also by the fiscal capacity of subnational governments. In case, when households choose their locations taking into account not only wages and productivity, but also the fiscal capacity of subnational governments, migration between localities will not be efficient in the sense that the total productivity of the economy is not maximizes. Therefore, if a household faces differences in the local tax burden or in the benefits of public services between localities, migration leads to an inefficient allocation of resources. Therefore, fiscal equalization that guarantees equal treatment among equals, also eliminates the differential network of tax benefits to improve both efficiency and equity (Kim and Dougherty, 2018).

In the field of fiscal equalization as a determinant of fiscal decentralization and inclusive growth. Kim and Dougherty (2018) define that the theoretical argument related to the differential and fiscal net tax benefits in equalization is interesting and important because it implies the perspective of achieving both efficiency and inclusion (equity), and for this, there is a solid theoretical basis for redistribution between localities. However, the extent to which tax incentives lead to mobility amongst localities is an empirical question. The tax equalization system of the Nordic countries is a good example (Kim and Lotz, 2008). Viewed from these perspectives, there is a strong inclusive growth rationale for the fiscal equalization role. However, the implementation of intergovernmental transfers, in the practice faces many challenges due to incentive problems. For example, intergovernmental transfers create an incentive for recipient local governments to manipulate local tax bases and spending needs to increase the amount of transfers they receive.

From the empirical evidence, Zou in 1996 considered two levels of government, one local and the other federal, both levels of government with their own income based on consumption taxes, transfers between levels of governments and budget balances. With this, based on the accumulation of local public capital, he sketches a regional economic growth model to examine “how variations in taxes and transfers affect the long-term equilibrium values of consumption and the stock of private capital, as well as the consumption and local public capital stock” (Zou, 1996, p. 12). Starting from a dynamic system, he establishes four differential equations and four endogenous variables: public consumption and private consumption, and public capital and local private capital. This dynamic system is obtained starting from a utility function of the family (producer) from private consumption (c) and local public consumption (E). Under these conditions, the total income of the local government will be determined by what it receives from the central government, that is, taxes and transfers, and its spending determined by consumption and local investment from the public sector. Assumes again a balanced budget with a budget constraint from the local and central governments.

Xie et al. (1999), like Zou, determined a framework of understanding from a CES production function: with a substitution parameter, the constant elasticity of substitution. Following the same procedure like Zou, the authors

arrive in the long term to determine the growth rate of per capita income, and in contrast to the previous work "they determine the tax rate that maximizes economic growth (τ *)", that is, the tax rate that influences economic growth (Xie et al., 1999, p. 8).

Zhang and Zou (2001) studied the effect of the composition of public spending on growth based on Devarajan (1996) proposed, that is, from a nested Cobb-Douglas production function, they identify contributions at each level of government to starting from different types of public spending. To do this, these authors work with an invariable tax rate with a budget restriction that maximizes utility, achieving in the long term a higher per capita income from the allocation of the public budget between different levels of government and different types of capital within each of these levels.

Agúndez and Chaparro (2002, p.23) based on the works of Zou (1996) and Xie et al. (1999) proposed a model of decentralization of income and economic growth to recognize that "given a certain degree of decentralization of public spending, the dependence of sub-central governments on their own resources up to a certain level, would have positive effects on economic growth". In this sense, according to the allocation of spending and considering the various sources of financing of local governments, there is a different degree of efficiency in these governments, and according to that degree of efficiency of public spending, economic growth is maximized, reaching "an optimal composition of the total resources of the representative local government from the point of view of economic growth" (p.34). Also, Rodríguez and Ezcurra (2009) in a study for 17 autonomous communities of Spain with a common financing scheme analyzed the regional difference in the growth rate of the Gross Domestic Product per capita as a function of the difference in the level of regional public spending per capita. While, Feld et al (2004) in a study for 26 Swiss cantons analyzed the cantonal growth rate per capita in relation to the cantonal decentralization of spending, cantonal decentralization of income, leveling transfers received by the canton, indicator of fiscal competence and canton fragmentation indicator.

In recent decades, a large number of countries have sought decentralization as a means of seeking a more efficient and effective public sector. Other countries were disenchanted with the performance of previous planning and centralized policies. In fact, fiscal decentralization addresses how the public sector is organized and how to create opportunities for greater growth and well-being. Kim and Dougherty (2018) perform an analysis for member countries with panel data in an OECD study, where they define the logarithm of gross domestic product (GDP) per capita to depend linearly on the logarithm of the stock of human capital and the logarithm of the investment rate (Mankiw et al (1992). In the long run the relationship is embedded in a convergence growth equation, where the potential growth of the GDP per capita rate depends on the past potential of the GDP per capita, factor production and a set of structural variables that influence growth.

For the Latin American region, Lozano and Julio (2016) establish a panel data analysis to measure the relationship between fiscal decentralization and economic growth at the department level in Colombia. The applied model "takes as an initial reference a simple version of the endogenous growth model of Barro, according to which the government acquires a fraction of the product from the private sector to provide free public services to private producers (infrastructure services, right ideologys property, among others)" (Lozano and Julio, 2016, p.3).

3. Methodology

To carry out the analysis of the relationship between fiscal decentralization and economic growth, we will use as dependent variable per capita Gross Domestic Product (pibppl) and as independent variables the following: consumption per capita (cgpl), investment per capita (lnppi), income poverty (ppil), inflation (inf), national foreign trade ratio (rcel), and population (pobl). The collection information was realized from Central Bank of Ecuador (BCE) and Ministry of Economy and Finance (MEF) at 2000-2018 period. The period 2000-2009 is considered as dummy with value 0, an period 2010-2018 is considered as dummy with value 1. The statistical packages or software used for making research analysis was Stata. The econometric model used is panel data with N and T larges, an longitudinal model.

Generally, the starting point in longitudinal models is the grouped Ordinary Least Squares (OLS) model. According to Cameron and Trivedi (2009, p. 248), this estimate uses the variations within (in time for an individual) and between (for individuals at the same time) simultaneously. The resulting estimators are consistent if the appropriate model is the random effects model and inconsistent otherwise. Furthermore, it assumes that the regressors are not related to the error. It has the following form in equation (1), where a common intercept is included and the individual effects (αi- α) are centered on zero:

$$y_{it} = \alpha + \beta_k X'_{it} + (\alpha_i - \alpha + \varepsilon_{it}) \quad (1)$$

This type of model has a variation, when considering the structure of the errors, giving rise to a grouped model FGLS or estimator of the averaged population. It is possible to specify if the model presents, as an example, an Autoregressive process of order one with the following error specification in equation (2), where the model error presents a significant lag:

$$\mu_{it} = \rho_1 \mu_{it-1} + \varepsilon_{it} \quad (2)$$

The random effects estimator is consistent if this model is appropriate. This model assumes that the time-invariant component of the error can be treated as random and also is not related to the regressors. It captures both individual effects over time and those between individuals. Presents the following specification containing a weight and unobserved heterogeneity (3):

$$(y_{it} - \widehat{\theta_i}\bar{y}_i) = (1 - \widehat{\theta_i})\alpha + (X_{it} - \widehat{\theta_i}\bar{X}_i)'\beta_k + \{(1 - \widehat{\theta_i})\alpha_i + (\varepsilon_{it} - \widehat{\theta_i}\overline{\varepsilon_{it}})\} \quad (3)$$

According to Cameron and Trivedi (2009, p. 256), the component (θ_i)ˆ, is consistently estimated as shown in equation (4). It should be mentioned that if (θ_i)ˆ = 0, then it is a case of grouped regression OLS. Whereas if (θ_i)ˆ = 1, the model implies fixed effects.

$$\theta_i = 1 - \sqrt{\frac{\sigma_\varepsilon^2}{(T_i\,\sigma_\alpha^2 + \sigma_\varepsilon^2)}} \quad (4)$$

The fixed effects model (within) eliminates the unobserved individual effects through the calculation of means. So, αi is removed from the equation. The model is consistent when it is appropriate, and inconsistent if the random effects model is ideal. Efficient estimators are achieved despite the fact that there may be endogeneity with the time-invariant component of the error. The specification of the model is as follows in equation (5), the STATA program includes an estimated intercept that expresses the average of the individual effects of αi, and the large means of: $\bar{y}$, $\bar{X}$, $\bar{\varepsilon}$ (6).

$$(y_{it} - \bar{y}_i) = (X_{it} - \bar{X}_i)'\beta_k + (\varepsilon_{it} - \overline{\varepsilon_{it}}) \quad (5)$$

$$(y_{it} - \bar{y}_i + \bar{\bar{y}}) = \alpha + \left(X_{it} - \bar{X}_i + \bar{\bar{X}}\right)'\beta_k + (\varepsilon_{it} - \overline{\varepsilon_{it}} + \bar{\bar{\varepsilon}}) \quad (6)$$

Finally,according Cameron and Trivedi (2009), if the fixed effects model is appropriate, one way to deal with endogeneity caused by omitted variables that do not change over time is to calculate the estimator of the first differences. It provides better estimators than those of fixed effects if the regressors show lags in the first order. Features the following specification (7):

$$(y_{it} - y_{it-1}) = (X_{it} - X_{it-1})'\beta_k + (\varepsilon_{it} - \varepsilon_{it-1}) \quad (7)$$

In this way, the model is defined as presented in equation [8]. The variable of interest in the model is the Investment of the GADs, to show the change in the slopes of the variable caused by the application of COOTAD, two dummys have been created and dummy variables have been constructed, described in equation [9].

$$pibppl_{il} = \propto + \beta_1 cgpl_{il} + \beta_2 igpl_{il} + \beta_5\, ppil_{il} + \beta_6 inf_{il} + \beta_7 rcel_{il} + \beta_8 pobl_{ij} + \mu_{il} \quad (8)$$

$$pibppl_{il} = \propto + \beta_1 cgpl_{il} + \beta_3 igpld1_{il} D1 + \beta_4 igpld2_{il} + \beta_5\, ppil_{il} + \beta_6 inf_{il} + \beta_7 rcel_{il} + \beta_8 pobl_{ij} + \mu_{il} \quad (9)$$

Donde:

pibppl = First difference of the natural logarithm of the GDP per capita GAD´s.

∝ = Time trend effect in the model ∝_t-∝_ (t-1) = ∝.

cgpl = First difference of the natural logarithm of the consumption of GAD´s per capita.

lnppi = First difference of the natural logarithm of the Investment of GAD´s per capita.

lnppid1 = First difference of the natural log of GAD´s Investment per capita 2010-2018

lnppid2 = First difference of the natural log of GAD´s Investment per capita 2000-2009

ppil = First difference of the natural log of income poverty.

inf = First difference of national inflation.

rcel = First difference of the National Foreign Trade ratio.

pobl = First difference of the natural logarithm of the GAD´s population.

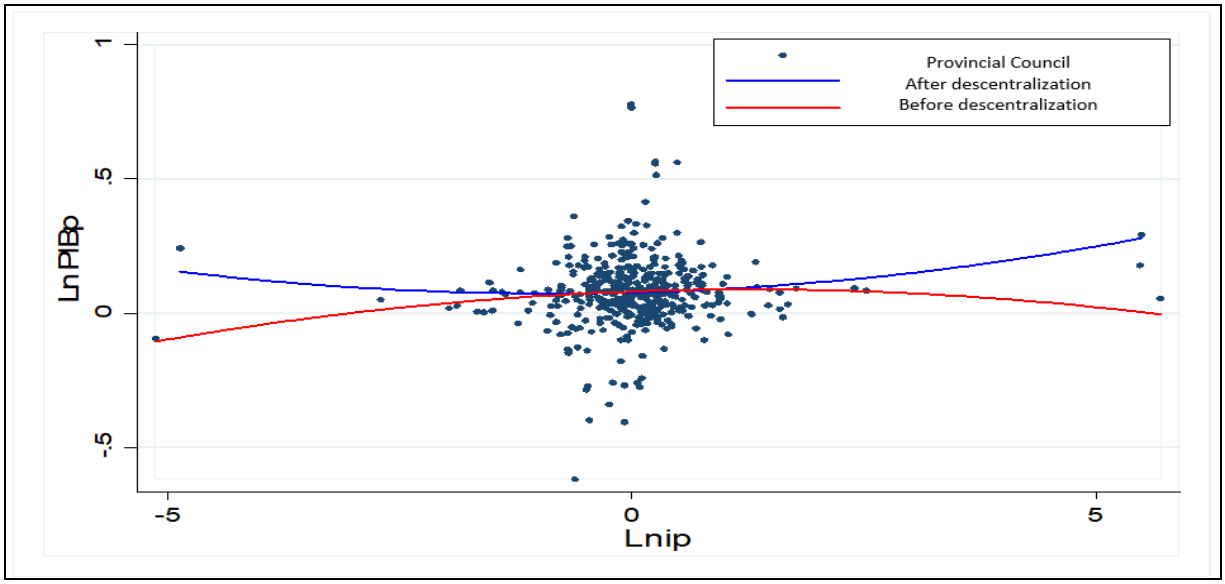
4. Results

4.1. At the level of Provincial Council of Ecuador

4.1.1. Descriptive analysis Provincial Council of Ecuador

Graph 1 shows in aggregate the relationship between GDP pc and public investment pc in the Provincial Council. Concentration continues to occur both in decentralization and without fiscal decentralization, between a GDP pc and a low investment pc, however, in the process of decentralization, both GDP pc and investment pc increase considerably, especially in provinces with natural resources such as oil or mining. The per capita Gross Domestic Product (GDPpc) variable is directly related to public investment, that is, when GDP per capita increases in the same way, does the Investment per capita of the GAD's. In general, the Eastern region is the one that concentrates the highest levels of public investment, on average in the study period, it is $ 97.96, followed by the Sierra region $ 34.98 and finally the Coast region $ 30.23. Meanwhile, when relating the GDP per capita by province with respect to the consumption per capita of the GAD's, a positive but little accentuated relationship between the variables can be observed in Graph 1.

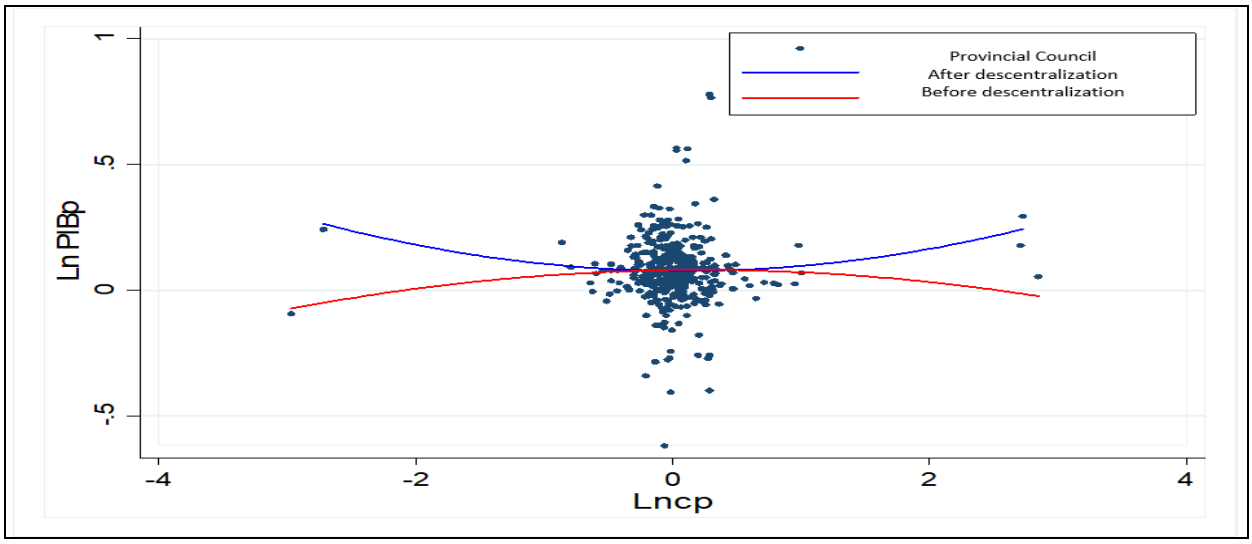
Furthermore, eastern provinces (Orellana and Sucumbíos) are in the upper right ideology; that is to say, they are those with the highest levels of public consumption and GDPpc with respect to the other provinces of the country. While in a contrary scenario, provinces such as Morona Santiago and Zamora Chinchipe have the lowest levels at the national level. On the other hand, provinces of the Coast (Guayas and Esmeraldas) and Sierra (Pichincha and Azuay) have higher levels of GDPpc and public consumption in these regions. Being the Coastal region the one with the lowest average CGP ($ 35,385), where the Guayas province is the one with the lowest public consumption on average, $ 24.20 given the inverse relationship between GAD's Consumption with respect to the total population.



Graph 1: Relationship between GDP per capita and Investment, Provincial Council 2000-2018.

Source: Central Bank of Ecuador, Ministry of Economy and Finance. Elaboration: Authors.

Graph 2 shows a low GDP pc with a constant higher public consumption, in almost all the country's provinces. However, in the process of decentralization, this relationship between GDP pc and public consumption pc varies much more, especially with increases in public consumption pc, more than in GDP pc. This condition indicates that, although in the process of decentralization, public consumption is growing, not necessarily this higher consumption affects the growth of GDP. This condition is possibly due to the fact that there is a greater destination for public consumption, but it is not intended to stimulate production, unlike public investment, which is mainly aimed at improving the conditions of the productive sector, such as the infrastructure carried out to a greater extent from fiscal decentralization.



Graph 2. Relationship between GDP Per Capita and Consumption, Provincial Council 2000-2018.

Source: Central Bank of Ecuador, Ministry of Economy and Finance. Elaboration: Authors.

In graph 1 and 2, it can be observed that the effect of fiscal decentralization on economic growth is greater after the fiscal decentralization applied in Ecuador since 2010, and the period 2000-2009, the effect of fiscal decentralization on economic growth is lower. In the same way, this decentralization process is affected to a greater extent in the period 2010-2018 due to a greater investment made by the provincial governments.

4.1.2. Empirical evidence Provincial Council of Ecuador

The results obtained from the econometric model applied to the first differences of the series of the 24 provinces of Ecuador are presented in Table 1. It is evident that, in all the models, there is a positive and significant impact towards the GDP per capita, generated by the investment of the GADs, which acquires a greater slope after the application of COOTAD (see coefficient lnipsd and lnipcd), demonstrating the positive benefits of decentralization. In addition, it should be emphasized that the R2 is low because the model is not predictive but rather an autocorrelation model (table 2), also, it should be emphasized that, due to lack of data at the provincial level on poverty, inflation and foreign trade, the national index is considered, possibly making the R2 low, however all tests and results of the 8 models presented show the existence of model fit.

Table 1. Econometric model results, Ecuador Provincial Council 2000-2018.

Variable	MCO (1)	EA (2)	EF (3)	AR1 (4)	FGLSH (5)	FGLSC (6)	FGLSHA (7)	FGLSCA (8)
lnipsd	.01384468	.01384468	.01403177	.01286867	.0033229	.01310621***	.00326281	.01306052***
lnipcd	.0254912***	.0254912***	.02584129***	.02797552***	.02128365***	.02375446***	.02137383***	.02384971***
lncpsd	-.01299263	-.01299263	-.00924595	-.01669052	-.00501073	-.01158243***	-.00495319	-.0117307***
lncpcd	-.02633301*	-.02633301*	-.02680185*	-.02837399*	-.01744429	-.02468052***	-.01756331	-.02475433***
lnce	-.14710782*	-.14710782*	-.14760453*	-.13453802*	-.15653511**	-.1272718***	-.15649721**	-.12676109***
inf	-.0015579***	-.0015579***	-.00155302***	-.00161033***	-.00174743***	-.00162906***	-.00175138***	-.00163183***
lnppi	-.50018791***	-.50018791***	-.50125811***	-.51128758***	-.39056783***	-.50659402***	-.39184557***	-.50706874***
lnea	.01905313	.01905313	.01877182	.02819514	-.02108786	.02470783	-.02123376	.02506136
_cons	.04005696***	.04005696***	.03999018***	.03912415***	.05139156***	.04023189***	.05130316***	.04018031***
N	432	432	432	432	432	432	432	432
r2	.14444826		.14754685					
re_o								
r2_b		.08642805	.12737734					
r2_w		.14747463	.14754685					
sigma_u		0	.01770543					
sigma_e		.12366913	.12366913					
rho		0	.02008531					

Note: ****significant 10%, **5% and *1% respectively.* **Source:** *Authors.*

Table 2 describes the tests applied to select the most appropriate estimators. The null hypothesis that the model does not present omitted variables with the Ramsey test is accepted. The model presents heteroskedasticity problems; to have a correct inference, cluster or robust errors are used. The model does not present first-order autocorrelation, the Wooldridge test is accepted. With the Breusch and Pagan test, the OLS estimators prevail before EF or EA. This is corroborated with the acceptance of the null hypothesis of the Hausman test.

Table 2. Test applied to the model in first differences Ecuador Provincial Council 2000-2018.

Test	**Null Hypothesis (Ho)**	**Prob> "Statistical"**	**Result**
Ramsey	Model does not have omitted variables	0.2944	Ho with significance greater than 10% is accepted
Wald	Sigma (i) ^ 2 = Sigma ^ 2 for all i	0.0000	Ho of constant variance is rejected and we accept Ha of heteroscedasticity
Wooldridge	No first order autocorrelation	0.5764	Ho with significance greater than 10% is accepted
Breusch and Pagan	Unobservable component that generates heteroscedasticity. Var(u)=0	1.000	Ho is accepted. MCO model prevails before EA or EF.
Hausman	Non-systematic difference in coefficients	0.9996	Ho is accepted Prevail EA model over EF.

Source*:* Authors.

Table 3 shows the interpretation of the betas for the grouped OLS model. To summarize, the investment of the GADs from the application of COOTAD since 2010 has allowed its impact on the provincial GDP per capita to be stronger, going from 1.4% to 2.5%. Additionally, it is observed that the control variables used in the model

have a negative impact on GDP, that is, both national poverty, national inflation, population growth, and foreign trade ratio, decrease the provincial GDP per capita.

Table 3. Interpretation of grouped OLS model betas

Variable	Nomenclature B	Significant	Valor B	Interpretation
Lnipsd	β_1	1%	0.0138447	Faced with an increase of 1% in the differences in lnipsd, it is expected that on average the differences in lnpibp will increase by 1.3%.
Lnipcd	β_2	12%	0.0254912	Faced with a 1% increase in the differences in lnipcd, it is expected that on average the differences in lnpibp will increase by 2.5%.
Lncpsd	β_3	1%	-0. 0129926	Faced with a 1% increase in the differences in lncpsd, the differences in lnpibp are expected to decrease by 1.3% on average.
Lncpcd	β_4	1%	-0. 026333	Faced with a 1% increase in the differences in lncpcd, it is expected that on average the differences in lnpibp will decrease by 2.6%.
Lnce	β_5	10%	-0. 1471078	Faced with a 1% increase in lnce differences, it is expected that on average the lnpibp differences will decrease by 14%.
Inf	β_6	1%	-0. 0015579	Faced with a unit increase in inf differences, it is expected that on average the differences in GDP will decrease by 0.1%
Lnppi	β_7	20%	-0. 5001879	Faced with an increase of 1% in the differences in lnppi, it is expected that on average the differences in lnpibp will decrease by 50%.
Lnea	β_8	12%	0. 0190531	Faced with a 1% increase in line differences, it is expected that on average the differences in lnpibp will increase by 1.9%.
Lnpob	β_9	1%	0.0138447	Faced with an increase of 1% in the differences in lnipsd, the differences in lnpibp are expected to increase by 1.3% on average.

Source: Authors.

Compared to the previous model, the income poverty variable is significant and negatively affects GDP per capita. The variable that considers suitable employment is not significant. It is observed in this case, the investment of the autonomous governments has a positive impact on the growth of the GDP per capita, only in the decentralization processes. The opposite is the case with government consumption.

4.1.2.1. Structural change test

To verify if the results presented in the three models correspond to a structural change in the slopes of Investment and Consumption per capita of governments.

$$Fexp = \frac{\frac{6{,}121966 - 6{,}1163311}{1}}{\frac{6{,}1163311}{432 - 8}}$$

Fexp = 0,3906

Prob (Fexp) = 0,5322

Therefore, the null hypothesis that there is no structural change in the model slopes in the variable lnppi is accepted. So, it is not necessary to create dummy variables to capture the change in the coefficient of lnppi. However, the structural change implies a strong variation, while the use of the dummy variables showed that

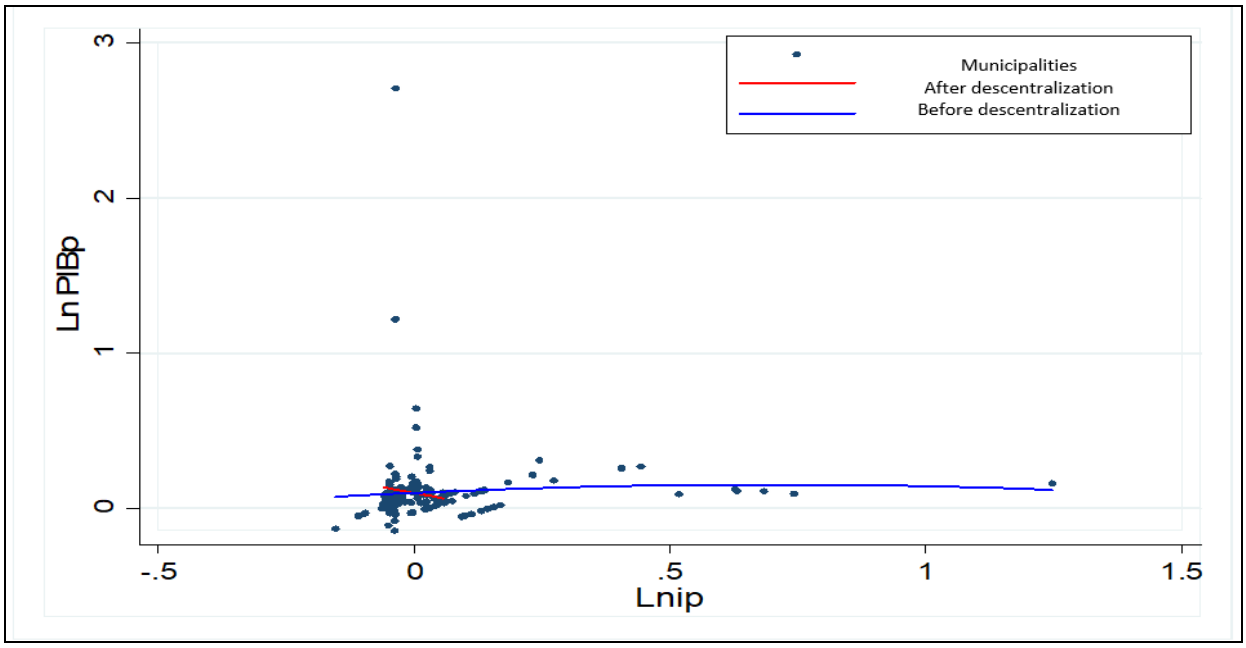
after the application of COOTAD, the investment of the provincial governments generates a greater impact on the provincial GDP, despite not being excessively high.

4.2 At the municipal level of Ecuador

4.2.1. Descriptive analysis Municipalities of Ecuador

Graph 3 presents an almost directly proportional relationship between GDP pc and public investment pc. Throughout the analysis period, the evolutionary process denotes greater growth accompanied by greater public investment, although it is from 2010 that public investment pc grows considerably in accompaniment with GDP pc, especially in cities known as the development poles of the Ecuador: Quito, Guayaquil and Cuenca. Also, between 2000-2009 period (before fiscal decentralization) there is practically no change in public investment pc, although there is a variation in GDP pc, while between 2010-2018 period, the relationship is directly proportional and to a greater extent, that is, greater fiscal decentralization shows greater public investment. Therefore, greater fiscal decentralization, greater economic growth. This situation can be made visible by seeing this change, for example, in the city of Quito, where the year prior to decentralization, 2009, the GDP pc is 6,563.13 dollars, and public investment pc is 3,868.82 Dollars. While in 2018, 8 years after fiscal decentralization, the GDP pc is $ 9,207.13, with a public investment pc of $ 9,116.44. It is evident that greater fiscal decentralization produces greater economic growth, in conditions where public investment is greater. In other words, when analyzing Quito for example, we can see that the pc GDP grows from 1,936.31 current dollars in 2000 to 9,207.13 current dollars in 2018. This growth has been accompanied by a higher PC public investment, which grows from $ 4,827.98 in 2000 to $ 9,116.43 in 2018. The same happens with Cuenca or Guayaquil. Although the dynamics in the relationship between GDP pc and public investment pc of the municipalities, before and after fiscal decentralization is different, as analyzed below.

In the relationship between GDP pc and public consumption pc with fiscal decentralization, the GDP pc is higher than without decentralization, and public consumption pc has the same trend. The relationship between GDP pc and public consumption pc, before fiscal decentralization shows a condition of low public consumption under conditions where GDP pc is lower than in the period of fiscal decentralization. While in decentralization it is evident that not only is public consumption pc higher compared to periods of no fiscal decentralization, but GDP pc is much higher in all cities compared to the process of no fiscal decentralization.

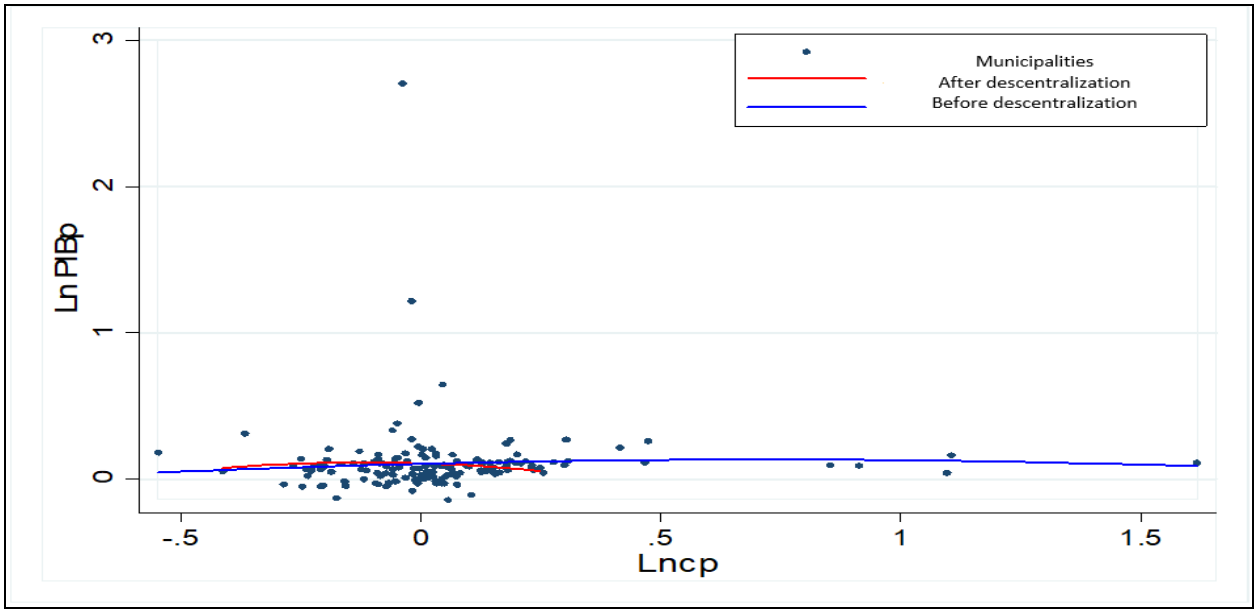


Graph 3. Relationship between GDP per capita and Public Investment, Municipalities 2000-2018.

Source*:* Central Bank of Ecuador, Ministry of Economy and Finance. Elaboration: Authors.

Also, graph 4 shows that GDP pc grows in conditions where public consumption pc does not very much. However, the largest cities such as Quito, Guayaquil or Cuenca, have higher public consumption rates than the rest of the country. Thus, for example, while in 2018, Santo Domingo had a pc GDP of $ 4,000,51 dollars with a public consumption pc of $ 79.91, the capital of the country, Quito, presented a GDP pc of 9,207,13 dollars in 2018, with a public consumption pc of 432.41 dollars. The same happens with cities like Loja and Ambato, with

great differences in GDP pc and public consumption pc, with respect to large cities such as Quito, Guayaquil or Cuenca.



Graph 4. Relationship between GDP per capita and Public Consumption, Municipalities 2000-2018

Source: *Central Bank of Ecuador, Ministry of Economy and Finance. Elaboration: Authors.*

4.2.2. Empirical evidence Municipalities of Ecuador

The results obtained from the panel data econometric model are presented in Table 4 applied to the first differences of the series of 9 municipalities of Ecuador. The model applies the considerations described in the Provincial Council section. It is evident that, in decentralization processes, per capita investment by municipalities positively affects GDP per capita, while in the process without decentralization the effect was negative. Similarly, the negative effect of government per capita consumption is reduced. In addition, it is evident that, in all the models, there is a positive and significant impact on the GDP per capita, generated by the investment of the GADs, which acquires a greater slope after the application of COOTAD (see coefficients lnipsd and lnipcd), demonstrating the positive benefits of decentralization. In addition, it must once again be emphasized that the R2 is low because the model is not predictive but rather an autocorrelation model, also, it must be emphasized that, due to lack of data at the municipalities level on poverty, inflation and foreign trade, the index is considered national, possibly making the R2 low, however, all tests and results of the 8 models presented show the existence of model fit.

Table 4. Econometric model results in first differences, Ecuador municipalities 2010-2018

Variable	MCO (1)	EA (2)	EF (3)	AR1 (4)	FGLSH (5)	FGLSC (6)	FGLSHA (7)	FGLSCA (8)
lnipsd	-.26954167	-.26954167	-.67771696*	-.69192234	-.14796651	-.42858951	-.1762679	-.39018202
lnipcd	.22702521**	.22702521***	.23576315**	.25484937***	.23918373**	.29235718***	.23213962***	.31690461***
lncpsd	-.14997664*	-.14997664*	-.18113367*	-.20412505*	-.0502993	-.05012846	-.05393525	-.04874743
lncpcd	-.05295445*	-.05295445*	-.03580831	-.03635167*	-.04067108	-.05151704***	-.02906964	-.03348511***
lncesd	-.86743884	-.86743884*	-.88759955	-.86012732*	-.21613285**	-.58070784***	-.22517014***	-.56287414***
lncecd	-.45513868***	-.45513868***	-.47486571**	-.43432402***	-.43073775*	-.5383558*	-.39864236**	-.5203327**
infsd	-.03011966	-.03011966	.01822503	.01866221	-.02645879	-.03077249**	-.00020877	.01382318
infcd	.00962205	.00962205	.00718557	.00596855	.00425903	.00524138	.00278995	.00566436**
lnppisd	-.55101516*	-.55101516*	-.87796417**	-.46974845**	-.46146375**	-.31488126***	-.36101505*	-.2920997***
lnppicd	.05550311*	.05550311*	.05967635*	.04418183*	.0451559	.01949*	.03314954	.0307454***
lneasd	13.500.024	13.500.024	.75566171	.8180795	.75325177	.85815758***	.55603658	.48246101***
lneacd	.10861886*	.10861886*	.21281816**	.08026717*	.0967699	.02403105	.0488064	.06832572***
_cons	.07893266**	.07893266***	.08039566***	.08626041***	.05728907***	.05998425***	.06256429***	.07544033***
N	162	162	162	162	162	162	162	162
r2	.14847612		.18902016					
re_o								
r2_b		.03180469	.35485796					
r2_w		.1782561	.18902016					
sigma_u		0	.09585074					
sigma_e		.22377583	.22377583					
rho		0	.15502703					

, ** and * significant 15%, 5% and 1% respectively.* **Source:** *Authors.*

Table 5 describes the tests applied to select the most appropriate estimators. The null hypothesis that the model does not present omitted variables with the Ramsey test is not accepted. The model presents heteroskedasticity problems; to have a correct inference, cluster or robust errors are used. The model presents first-order autocorrelation, the Wooldridge test is accepted. With the Breusch and Pagan test, the OLS estimators prevail before EF or EA. This is corroborated with the acceptance of the null hypothesis of the Hausman test.

Table 5. Test applied to the model in first differences, Ecuador Municipalities 2000-2018

Test	Null Hypothesis (Ho)	Prob> "Statistical"	Result
Ramsey	Model does not have omitted variables	0.0002	Ho is rejected
Wald	Sigma (i) ^ 2 = Sigma ^ 2 for all i	0.000	Ho of constant variance is rejected and we accept Ha of heteroscedasticity
Wooldridge	No first order autocorrelation	0.000	Ho is rejected
Breusch y Pagan	Unobservable component that generates heteroscedasticity. Var(u)=0	1.000	Ho is accepted. MCO model prevails before EA or EF.
Hausman	Non-systematic difference in coefficients	0.000	Ho is accepted EF model prevails over EA.

Source: *Authors.*

Table 6 presents the interpretation of the coefficients of the regressors for the grouped OLS model. The minimum significance of the independent variables is determined by the population. It is observed how the decentralization process improved the relationship between investment and consumption per capita of the municipalities with the GDP per capita.

Table 6. Interpretation of grouped OLS model betas.

Variable	Nomenclature B	Significant	Valor B	Interpretation
Lnipsd	β_1	12%	-0. 6919223	Faced with a 1% increase in lnipsd differences, the average lnpibp differences are expected to decrease by 69%.
Lnipcd	β_2	2.5%	0. 2548494	Faced with a 1% increase in lnipcd differences, the average lnpibp differences are expected to increase by 25%.
Lncpsd	β_3	3%	-0.20 41251	Faced with an increase of 1% in the differences in lncpsd, it is expected that on average the differences in lnpibp will decrease by 20%
Lncpcd	β_4	9%	-0. 363517	Faced with a 1% increase in the differences in lncpcd, it is expected that on average the differences in lnpibp will decrease by 36%.
Lnce	β_5	13%	-0. 8601273	Frente a un incremento del 1% de las diferencias del lnce se espera que en promedio las diferencias de lnpibp disminuyan en 86%.
Inf	β_6	17%	0. 0059686	Frente a un incremento del unitario de las diferencias de inf se espera que en promedio las diferencias de pibpl aumenten en 0.05%.
Lnppi	β_7	13%	0. 0441818	Frente a un incremento del 1% de las diferencias del lnppi se espera que en promedio las diferencias de lnpibp aumenten en 0.4%.
Lnea	β_8	8%	0. 8180795	Frente a un incremento del 1% de las diferencias del lnea se espera que en promedio las diferencias de lnpibp aumenten en 81%.
Lnpob	β_9	12%	-0. 6919223	Frente a un incremento del 1% de las diferencias del lnipsd se espera que en promedio las diferencias de lnpibp disminuyan en 69%

Source: Authors

4.2.2.1. Structural change test:

To verify if the results presented in the three models correspond to a structural change in the slopes of Investment and Per capita Consumption of governments.

$$Fexp = \frac{\frac{8.4714801 - 8.40801562}{2}}{\frac{8.40801562}{162 - 11}}$$

Fexp=0.569

Prob = 0.450

Therefore, for the municipalities model, there is insufficient evidence of partial rupture in the model. However, the structural change implies a strong variation, while the use of the dummy variables showed that after the application of COOTAD, investment and public consumption generate a greater impact on GDP per capita.

5. Conclusions

Fiscal decentralization in the public sector must be understood from two perspectives: revenues and expenditures to include the transfer of authority and management mechanisms from the central level to local governments. In Ecuador, decentralization is defined through the Organic Code of Territorial Ordering of Decentralized Autonomous Administrations (COOTAD, 2017), which defines four levels of government: a metropolitan level and three levels of local government: Provincial Council, Municipalities and Boards Parochial. In this study, we have focused on Provincial Council and Municipalities.

The theoretical discussion in economics on fiscal decentralization and growth focuses on the efficiency aspects of a decentralized arrangement and the financing of public services. While the empirical discussion analyzes fiscal decentralization tied to spending on public investment, governance, taxes, health, inequality and even economic policy. In addition, it should be mentioned that there are theoretical studies of the relationship between fiscal decentralization and economic growth at the country level. There are also studies at the regional level in countries. Therefore, the quantification of the impact of fiscal decentralization on macroeconomic behavior, be it economic growth, the size of the public sector, budget stability or inflation, has considered the use of the expenditure (or income) ratio indicator of subnational governments or the self-sufficiency ratio of subnational governments - their own resources over their total resources -.

Therefore, the relationship between fiscal decentralization and economic growth are defined by public policies that promote a more effective local policy than that carried out by the central government, because local officials can control the situations of policy promotion from the side of supply and demand. Empirically, the relationship between fiscal decentralization and economic growth will be analyzed in the context of the Ecuadorian economy from a time series. For this, the decentralization indicators and explanatory variables proposed by various authors were used.

This work follows the methodology proposed by Cameron and Trivedi (2009) among other authors, to select the most appropriate estimators. Thus, the Breusch and Pagan test is carried out, where it is identified if there is a component that generates heteroscedasticity in the model. Next, the Hausman test is calculated to select between fixed and random effects. Finally, several tests are carried out to validate the classic assumptions in the model.

The tests applied for the selection of the most appropriate estimators determine that the null hypothesis that the model does not present omitted variables, for this reason, the Ramsey test is accepted. The model does not show first order autocorrelation and the Wooldridge test is accepted. With the Breusch and Pagan test, the OLS estimators prevail before EF or EA. This is corroborated with the acceptance of the null hypothesis of the Hausman test.

In the interpretation of the betas for the grouped OLS model. In summary, the investment of the GADs from the application of COOTAD since 2010 has allowed its impact on the provincial GDP per capita to be stronger, going from 1.3% to 2.5% in provincial council, and decreases from -69% a 25% in Municipalities. Additionally, it is observed that the control variables used in the model have a negative impact on GDP pc, that is, both national poverty, national inflation, population growth, and foreign trade ratio, decrease the provincial GDP per capita.

Finally, the null hypothesis is accepted because there is no structural change in the model slopes in the variable lnppi. So, it is not necessary to create dummy variables to capture the change in the coefficient of lnppi. However, the structural change implies a strong variation, while the use of the dummy variables showed that after the application of COOTAD, the investment generates a greater impact on the provincial GDP, despite not being excessively high.

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