# 8. TERRITORIAL GROWTH IN ECUADOR: THE ROLE OF ECONOMIC SECTORS

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## Abstract

*Ecuador is a developing country characterized by severe territorial disparities reflected in a heterogeneous economic and social geography that risk to undermine a future balanced development. The paper analyses for the first time the impact of main economic sectors on sub-national growth process in the context of the "Changing Productive Matrix" policy objective, which aims to achieve productive diversification based on adding value through de-concentration of production from the existing poles to the whole territory. The estimation is performed using new data provided by Central Bank of Ecuador for the period 2007-2014 through a panel econometric technique. The results prove that, despite the strategy aimed at changing the productive matrix pushed by the government, this process is far to be completed. In particular, the country is too much focused on low productive sectors which depress economic growth and the manufacture and financial services sectors are too much concentrated in few areas, preventing their possible positive effect into the whole economy.*

**Keywords:** sub-national growth, Ecuador, panel spatial econometrics, economic sectors

**JEL Classification**: R11, R12, R58

## 1. Introduction

Ecuador, a country whose growth has been mainly favored by the high level of oil prices in recent years,[3] has been characterized by persisting severe cantonal disparities, reflected in a heterogeneous economic and social geography, which account for cantons[4] with

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[3] *Based on information from Central Bank of Ecuador, during the period 2000-2014 the average price of Ecuadorian crude oil grew by 3.45 times compared to the initial period, from 24.9 USD in 2000 to 85.81 USD in 2014. In June 2008, Ecuador enjoyed the highest price has reached a barrel of Ecuadorian oil in its history: 123 USD. In 2008, the contribution of oil revenues to GDP, reached a record high of 20.5%.*
[4] *The Republic of Ecuador, located in the northwest of South America, between Colombia (north) and Peru (south), is divided into 24 provinces, 221 municipalities or cantons and 1,228 parishes, in an area of 283,500 square kilometers, with around 16 million inhabitants (see map in Appendix A).*

asymmetric characteristics in terms of productivity and competitiveness, as well as in terms of differentiated population and social dynamics (Mendieta, 2015a; Ramón-Mendieta *et al*., 2013; Alvarado, 2011). CEPAL (2010) admits that these asymmetries between sub-national areas can inhibit the growth of domestic production and contribute to its instability, becoming a problem of circular causation that can undermine the future development of the whole country.

In spite of the compensatory territorial policies that started in the 1990s, together with policies and reforms whose aim was to increase the decentralization and the autonomy of the institutions that manage development, the benefits in terms of reduction of asymmetries have been very limited (Barrera, 2007).

Since 2008, with the new constitution, the process of territorial compensation in Ecuador made another push, with a stronger role of the National Secretariat of Planning and Development (SENPLADES), which coordinates the processes of autonomy, promotes decentralization of institutions, and seeks to expand local development capacities. In this context, the Central Government has started the project called "Changing Productive Matrix" which aims to achieve "productive diversification based on adding value; promotion of the exports and their expansion in terms of products and destinations: substitution of imports, including the different actors; de-concentration of production from the existing poles to the territories, and the continuous improvement of productivity and competitiveness across all sectors of the economy" (National Plan of Good Life, PNBV, 2013-2017: 73).

This study, using a new dataset provided by the Central Bank of Ecuador, assesses the role of main economic sectors in the economic growth of the 221 Ecuadorian cantons.

To our knowledge, no studies on the sectoral impact on growth have been done for Ecuador. The few empirical evidences which analyze economic growth in this country refer mainly to absolute convergence using standard econometric framework. In this respect, we can recall Ramón-Mendieta (2009), Valdiviezo-Ramón (2013) and Mendieta, (2015a), who use cross-section models to evaluate absolute provincial convergence of GVA per capita. Ramón-Mendieta *et al*. (2013) use a provincial panel and Mendieta (2015b) a cantonal cross-section estimation. More sophisticated techniques are adopted by Mendieta and Pontarollo (2016), who identify club-convergence patterns using spatial econometrics techniques and by Mendieta and Szeles-Raileanu (2016), who find, through parametric and non-parametric analysis that the regional GVA distribution remains polarized and it seems that the group of rich provinces advances faster than the majority of provinces.

The paper is organized as follows. In the second section, a brief overview of the economic structure of Ecuador is given. The third section describes the empirical model and the estimation technique, while in the fourth section we illustrate the results of our analysis. Finally, in the last part we discuss the conclusions and policy implications.

## 2. The Sub-national Ecuadorian Economic Structure

The PNBV, in force from 2008, implemented various strategies in order to smooth territorial gaps. The first one relies on an unprecedented level of public investment deployed throughout the country, especially on roads, hydroelectric projects and in various areas, such as health, education and safety, which was made possible from the significant government

revenues derived mainly from high oil prices and a more efficient tax collection.[5] The second strategy consists in reshaping the productive structure of the country through the individuation of geografical macroareas that, according to the central government, might specialise into some specific sectors. This strategy of sectoral relocation is part of the changeover process that aims to go beyond the productive specialization that actually characterizes the country. According with the PNBV, it would be obtained through the evaluation of the endogenous capabilities and the physical characteristics of each territory. This would lead to know the specific functional economic specialization of each area, building Zonal Agendas, which would permit to define a territorial governance model that aims to push the transformation of each "local" productive matrix. The total number of Zonal Agendas is nine and in each one various functional economic specialization were identified. According to Article 238 of the Constitution, one of the responsabilities of the Autonomous Decentralized Governments[6] (GADs), which have political, administrative and financial autonomy, is to promote the productive activities in the framework of the "Changing Productive Matrix" strategy.

According to Martín (2012), the results of these policies have been quite positive in terms of economic growth, but also of poverty reduction (Mideros, 2012). World Bank data confirm this trend between 2006 and 2011, with a 16.9 per cent reduction in the rate of extreme poverty.

But were these apparent positive results distributed equally within the country? Is it possible to speak of balanced effects? Are these performances accompanied by a process of homogeneous territorial growth? These questions implicitly imply to evaluate how the national and local productive matrix has evolved, in order to determine whether the process of improvement in well-being is sustainable over time.

Ecuador, in fact, is characterized by a relatively strong share of non-financial services and agriculture, while it is widely differentiated in terms of manufacturing, with some cantons and provinces in which the latter is rather concentrated. This is shown in Appendix B, where the average sectoral share by province grouped into ten sectors in 2007 and 2014 is reported.[7] The data on GVA show that minimal changes in provincial production structure are observed.

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*[5] Since the seventies, the oil extraction is the most important activity for the Ecuadorian economy. In 1974, oil represented 42.51 per cent of public sector revenues, 62.01 per cent of exports and 13.15 per cent of national value added. By 2014, these proportions were 18.47 per cent, 51.70 per cent and 10.41 per cent, respectively (Central Bank of Ecuador, 2015).*

*[6] Autonomous Decentralized Government are composed by different levels of government, such as 1228 rural parish boards, 221 municipal councils, and 24 provincial councils.*

*[7] Following the indications of the Central Bank of Ecuador, in this paper we excluded the gross value added related to oil production because it does not create wealth in the cantons where it is produced (Mendieta, 2015a; Ramón-Mendieta et al., 2013). The data on GVA provided by the Central Bank of Ecuador and expressed in USD is constant prices with base year 2007 Central Bank of Ecuador does not produce annual cantonal data on Gross Domestic Product. Anyway, GVA per head is one of the headline indicators used, for example, in the UK regional policy (Dunnell, 2009). According to BIS (2010: 3), in fact, "Gross Value Added per head is typically used for considering performance levels within a country. Although there are some criticisms of this metric it has the advantage that it provides a full picture of performance implicitly including both productivity and employment effects". In addition, GVA, which measures the contribution to the economy of each individual producer, industry or sector, is used in the estimation of Gross Domestic Product (GDP) when using the production or income approaches. In this extent, GVA can be used as a proxy of GDP.*

The manufacturing sector, which accounts for around 16 per cent of domestic value added, is very concentrated into a few areas. These belong to Guayaquil and Quito, in provinces of Pichincha and Guayas, respectively, that create around 60 per cent of the manufacturing value added. The share of the agricultural sector is important in some provinces with low levels of development, such as Los Rios, Esmeraldas, Cotopaxi, Carchi y Bolivar. According to the last public spending policy, the public administration sector, plus the education and health services, are important for creation of economic value especially in poor provinces such as Morona Santiago, Napo, Bolivar, Pastaza, Zamora Chinchipe and Orellana. In connection with this, as a result of public investment in infrastructure and housing, the construction sector shows an increasing share between 2007 and 2014 in all the provinces.

These results may be seen more clearly in Table 1, where the Gini index based on the sectoral GVA share for each sector is reported.[8] The Gini index varies between 0 and 1, where zero expresses perfect equality, while a coefficient of one corresponds to the maximal inequality among values. The table confirms that the productive structure has changed only slighlty and that some sectors are characterized by very high concentration. These sectors are, as conceivable, mining and hydroelectric power, because they depend on the availability of natural resources, but also manufacturing and financial sector, which are concentrated in the provincial capitals and whose concentration had only slowly diminished between 2007 and 2014. Other important sectors for the Ecuatorian economy that tend to be more concentrated in 2014 are agriculture, basic services and construction. Sectors more related to public intervention, such as education and health, are more stable over time, while public administration is 7% less concentrated in 2014 than in 2007, probably because of the NPBV policies.

**Table 1**

**The Gini Index**

| Year | GVA/pop growth | GVA/pop | Agricult. | Mines | Manuf. | Hydro-electric | Const. | Basic serv. | Fin. serv | Pub. adm. | Teaching | Health |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | | 0.333 | 0.359 | 0.977 | 0.743 | 0.943 | 0.292 | 0.209 | 0.611 | 0.409 | 0.250 | 0.600 |
| 2008 | 0.720 | 0.355 | 0.392 | 0.975 | 0.748 | 0.949 | 0.336 | 0.233 | 0.599 | 0.380 | 0.288 | 0.607 |
| 2009 | 0.494 | 0.326 | 0.370 | 0.965 | 0.755 | 0.954 | 0.374 | 0.234 | 0.610 | 0.374 | 0.278 | 0.615 |
| 2010 | 0.579 | 0.318 | 0.394 | 0.960 | 0.745 | 0.939 | 0.382 | 0.239 | 0.573 | 0.353 | 0.281 | 0.615 |
| 2011 | 0.739 | 0.307 | 0.402 | 0.958 | 0.436 | 0.436 | 0.381 | 0.255 | 0.564 | 0.357 | 0.279 | 0.599 |
| 2012 | 0.703 | 0.311 | 0.417 | 0.965 | 0.700 | 0.429 | 0.389 | 0.260 | 0.556 | 0.334 | 0.273 | 0.602 |
| 2013 | 0.729 | 0.321 | 0.422 | 0.961 | 0.706 | 0.444 | 0.386 | 0.272 | 0.571 | 0.335 | 0.270 | 0.605 |
| 2014 | 0.729 | 0.331 | 0.415 | 0.969 | 0.705 | 0.446 | 0.399 | 0.281 | 0.584 | 0.340 | 0.269 | 0.603 |

*Note: GVA/pop growth is intended between two consecutive years. The first cell means between 2007 and 2008, the second between 2008 and 2009, and so on. The Gini index for GVA/pop growth, as there are various negative values, is based on Raffinetti et al. (2015)*

The results reported in Table 1 do not tell anything about the spatial patterns. In the perspective of this study, the last point is quite important, because if a high Gini coefficient goes together with spatial concentration, this guarantees quite homogeneous territorial context that might facilitate spatial diffusion. This position contrasts with various studies, especially on European regional development (see Ertur *et al.*, 2006) because we start from a different departure point. In Europe, in which the territorial context is more homogeneous in terms of infrastructure, education and socio-economic conditions, spatial inhomogeneities

[8] *The Gini index has been calculated for each economic sector individually and measures the distribution of GVA between cantons.*

are traslated into a core-periphery pattern in which regions phisically located in the pheriphery of each country and/or of the continent are tipically the poorest. In Ecuador, the situation is completely different: there is not a well-defined territorial context, and the richest cantons, typically the main cities, i.e. the provincial capitals, create the vast majority of wealth and the highest percentage of value added. In this respect, a clear territorial pattern in presence of such a high territorial inequality would mean that the richest cantons are not "isolated islands" surrounded by poorest cantons, but tend to form well-defined clusters.

In order to check this point, the Moran's I is used. This statistic provides a single summary measure that describes the degree of clustering in spatial data, and it is defined as:

$$MI = \frac{n}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{i,j}} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{i,j}(y_i-\bar{y}_i)(y_j-\bar{y}_j)}{\sum_{i=1}^{n}(y_i-\bar{y}_i)} \quad (1)$$

where: *i* and *j* refer to different spatial units of which there are *n*, *y* is the data value in each and $w_{i,j}$ the element of the line *i* and row *j* of the row standardized spatial weights matrix **W** of *n*×*n* size. The calculated Moran's I varies between minus one and one. A positive coefficient corresponds to a value of Moran's I that is larger than its theoretical mean of –1/*n*-1, or, equivalently, a positive z-value, and points to positive spatial autocorrelation, that is similar values cluster together in a map. The reverse represents regimes of negative association, that is, dissimilar values cluster together in a map.

Following Dall'Erba and Le Gallo (2007 and 2008) and Ertur *et al.* (2006), we constructed the spatial weights matrix **W** considering the shortest distance by car in kilometers of road between the capital of canton *i* and *j*.[9] Precisely, only the cantons belonging to the lower quintile of the kilometers of road distance are accounted, and they are weighted by the inverse of the squared distance, in order to reflect a gravity function. Cantons whose distance is greater than the first quintile distance have value zero. This choice guarantees every single canton is connected to at least another canton. The matrix, then, as customary, is standardized by row.

The estimated results are presented in Table 2. In the majority of sectors, despite the significant Moran's I, its value is very low, while in mining, hydroelectric power and health sectors it is not significant. This is due to the fact that mining and hydroelectric power sectors are located in very few and specific cantons, while the health sector is widespread in space. The other sectors need to be analyzed into a bit more detail. In fact, by comparing the results of Tables 1 and 2 we can get some interesting insights regarding the concentration and the spatial patterns of the variables. Manufacturing and financial services sectors are strongly polarised in few areas (see Appendix A an Table 1), and have a low Moran's I. This means that they do not form clusters within the provinces in which they are located, and neither among areas belonging to different provinces, showig what it is called spatial heterogeneity, i.e. a clumpy distribution of processes across a space. Agriculture and construction sectors, on the reverse, are not so strongly concentrated as according to the Gini index, and their Moran's Is, although higher than the two previous sectors, are pretty low. This points to a patchy territorial pattern with small groups of quite homogeneous cantons. Another interesting case is public administration, which has the highest relative Moran's I and quite low Gini index, highlighting that this sector, in comparson with the others, is much more homogeneous within each cluster. Finally, the level of GVA per capita is randomly distributed, and the GVA growth per capita has a Gini index between 0.5 and 0.7, but not a

[9] *The distance has been computed using the command R function mapdist of the library ggmap Kahle and Wickham (2013).*

significant Moran's I, showing that the growth of cantons does not depend on the growth of the neighbour ones.

**Table 2**

**Moran's I of Sectoral GVA Share**

| Year | GVA/ pop growth | GVA/ pop | Agricult. | Mines | Manuf. | Hydro-electric | Const. | Basic serv. | Fin. serv | Pub. adm. | Teaching | Health |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | | 0.122*** | -0.019 | -0.016 | 0.141*** | -0.013 | 0.144*** | -0.049 | 0.053 | 0.169*** | 0.177*** | 0.005 |
| 2008 | -0.088 | 0.034 | 0.051 | -0.013 | 0.168*** | -0.012 | 0.087*** | -0.035 | 0.061* | 0.161*** | 0.243*** | -0.007 |
| 2009 | 0.034 | 0.082** | 0.050 | -0.021 | 0.107*** | -0.016 | 0.048*** | -0.02 | 0.076** | 0.219*** | 0.238*** | -0.011 |
| 2010 | -0.045 | 0.095** | 0.094** | -0.012 | 0.121*** | -0.018 | 0.073*** | -0.007 | 0.114*** | 0.210*** | 0.217*** | -0.010 |
| 2011 | 0.012 | 0.065* | 0.113*** | -0.012 | 0.144*** | -0.012 | 0.107*** | 0.054 | 0.108*** | 0.229*** | 0.196*** | -0.024 |
| 2012 | 0.053 | 0.053 | 0.152*** | 0.016 | 0.082*** | 0.004 | 0.149*** | 0.067* | 0.104** | 0.219*** | 0.188*** | -0.029 |
| 2013 | -0.095 | 0.048 | 0.157*** | 0.032 | 0.102*** | 0.012 | 0.197*** | 0.098** | 0.150*** | 0.172*** | 0.162*** | -0.017 |
| 2014 | 0.055 | 0.037 | 0.155*** | 0.030 | 0.150*** | 0.013 | 0.187*** | 0.127*** | 0.203*** | 0.134*** | 0.141*** | -0.017 |

*Note: *Significant at 1 per cent, ** significant at 5 per cent, *** significant at 10 per cent. GVA/pop growth is intended between two consecutive years. The first cell means between 2007 and 2008, the second between 2008 and 2009, and so on.*

These findings address the problem that, in principle, the widespread differences among neighbor locations might be an obstacle to the application of general policies because their effects may be confined to a very limited spatial dimension.

Furthermore, in accordance with the rising central government spending, sectors such as public administration, education and health have increased their relative share in the recent years, but were not able to foster a more productive and balanced productive structure. On the contrary, in particular in provinces with the lowest GVA per head, they were responsible for a large part of gross value added both in 2007 and 2014. This eventuality risks to undermine the long-run development perspectives and the balanced territorial development. Thus, if from one hand the effects of public sector and of connected activities can be hampered by unfavorable socio-economic conditions, on the other hand the potential positive impact is connected to the capacity of local policy makers, namely the GADs, to tailor policies related to the specificity of each territory (Barca *et al*., 2012).

On the bases of this first analysis, in the next section we delve over the Ecuadorian sub-national growth and the roles of sectoral structure.

## 3. The Empirical Model

The sectoral pattern described above may have, inevitably, an impact on growth. In particular, the concentration of more productive sectors in few areas may be an obstacle to a balanced territorial development and may amplify, or at least maintain unchanged, the territorial inequality levels. In addition, as shown in Table 1, the effectiveness of "Changing Productive Matrix" policy objective is put under question. In particular, the de-concentration of production from the existing poles to the territories is not reached. In order to analyze the

sectoral effects on growth, following Mallik and Carayannis (1994), we specify the following equation:

$$gr_{i,t} = \alpha + \beta log(y_{i,t-1}) + \delta \boldsymbol{sectors}_{i,t-1} + \mu_i + \eta_t + \varepsilon_{it} \quad (2)$$

where: the dependent variable $gr_{i,t}$ represents the cantonal annual growth rate of per capita gross value added between *t-1* and *t*; $\alpha$ is a constant term; $\mu_i$ and $\eta_t$ are, respectively, dummies specific to canton *i* which control for unvarying factors determining differences in the steady states across cantons and time dummies that account for yearly specific effects; $y_{i,t-1}$ is the per capita GVA in canton *i*, of which there are 221, over period 2007-2014;[10] $\beta$, if significantly different from zero and negative, is the coefficient related to the annual rate at which an economy converges to the long-run steady state. The vector of additional variables $\boldsymbol{sectors}_{t-1}$ represent the relative weight of the GVA produced by the different economic sectors, which assume an important role in light of the "Changing of Productive Matrix" plan. The considered sectors are: agriculture, mining, manufacturing, hydroelectric power, construction, basic services, financial services, public administration, education and health.

When dealing with territorial data, as in this case, equation (2) can be expanded to include spatial effects. These can be modelled in different ways and are related to the possibility that in the empirical estimation the presence of significant spatial autocorrelation in the explanatory and/or dependent variables might lead to biased and/or inconsistent results using classical OLS estimation techniques (Anselin, 1988; Lesage and Pace, 2009). The simplest spatial models can include the spatial lag as autoregressive term (SAR), as an error term (SEM), or as additional regressors (spatial lag of x model, SLX). Further specification, as a mix of previous ones, are possible: spatial Durbin, with both the spatial autoregressive and spatial lag of independent variables (SDM), and spatial error model with spatial error term and the spatial lag of the regressors (SDEM). The choice of the model has direct consequences on the interpretation of the partial derivatives: while in the case of spatial error there are no differences from OLS, in the other cases we have implications in terms of spatial effects and spatial spillovers. According to Elhorst (2014) and Le Sage and Pace (2014), spillovers may be of two types: local for SLX and SDEM and global for SAR model and SDM. Among the firsts, McMillen (2003) and, more recently, Gibbons and Overman (2012) and Corrado and Fingleton (2012), argued that the use of a spatial autoregressive term may reflect some identification problems that, using standard spatial econometric approaches, could not be correctly accounted for. These authors, as well as Halleck Vega and Elhorst (2015), suggest giving more attention to SLX, taking it as the baseline model, because it is more flexible and computationally simpler.

In this study, we consider these issues testing the mentioned spatial models and comparing them with the standard OLS.

## 4. Estimation Results

Following the logic of the previous section, the estimation in Table 3 was performed with both standard and spatial panel techniques, following Elhorst (2009 and 2014). The comparison of the models based on the AIC leads to excluding the spatial models. The spatial lag of the dependent variable and the autoregressive error term are not significant and their introduction does not substantially increase the explanatory power of the model.

[10] *In literature, Henley (2005) uses GVA per head to measure growth of UK regions.*

The signs related to the significant sectors are negative and robust irrespective the specification. Spatial effects accounted by the spatial lag of the independent variables are very weak, both in SLX, Durbin and error Durbin models. In the last two cases, furthermore, the autoregressive terms continue to be not significant. These results, combined with the spatial exploratory analysis of the previous paragraph, confirm a certain degree of permeability of Ecuatorian territories with regard to spatial spillovers. The permeability is basically related to the heterogeneity of Ecuadorian reality, which is an obstacle for the spatial diffusion of the effects of economic growth. This is, at least partially, due to an historical heritage in which the development of the country has been focussed almost exclusively to the two main cities, Quito and Guayaquil, that took a reciprocal benefit that pushed their growth trajectories with the construction of the railways that connected them in 1908, and that excluded various territories and provincial capital cities (Deler *et al*. 1983). This generated an axis between the capital and the main port that reinforced these cities reciprocally, at the price of leaving aside the other areas of the country. The mentioned heterogeneity, although it was originated more than a century ago, nowaday is still an obstacle for a balanced territorial development. This is because there are deep differences not only in terms of territorial distribution of sectors, but also regarding infrastructure, physical and human capital endowments and public amenities. Furthermore, more densely populated cantons, which generally correspond to the provincial capitals, benefit from a cohesive business tissue, able to better exploit the competitive advantages and mechanisms that promote production (Guevara *et al*., 2015; Mendieta, 2015a). According to the theory of urban systems (Eaton and Eckstein, 1997 and Black and Henderson, 1999) larger urban areas are related to an industrial variety which leads to better local conditions and, hence, to an increase in productivity. In this Respect, Guevara *et al*. (2015) find that only 63 cantons out of 221 in Ecuador have more than 50% of urbanization. The territorial dishomogeneity makes that spillovers, and in particular Schumpeterian ones, do not find fertile ground to generate a spatial multiplier effects. The problem of Ecuador, in fact, is that, as it has isolated production systems, they are not, by definition, structured and integrated enough to be able to fully exploit their potentials, with the result of a limited or negative effects with respect to economic growth. This is shown by agriculture, construction, basic services and administration sectors, which are typically characterized by low productivity. Unfortunately there are no data on employment at cantonal level but, at national level, only around 11% of employment is in the manufacturing sector, while around 25% is in agriculture. This means that, despite manufacturing being more important than agriculture in producing GVA (see tables in the Appendix), a large part of the population is not directly involved in this process. In this respect, the negative impact on economic growth might be explained by the fact that the less productive sectors are the ones that have the highest share of employment and this structure has not changed over the years (Guzmán-Espinoza, 2011). The results in Table 3, beside giving information regarding the (lack of) spatial spillovers, allow us to examine the effects of each single sector. Water procurement, together with construction, has a negative effect on growth, which is probably related to the fact that these sectors are well-developed only in some cantons, which are located mainly in the province of Zamora and in cantons where mining and large public infrastructures, such as hydroelectric plants, were built. The financial sector, as well as manufacturing, which could make the difference as regards fostering growth, is too much clustered in few central locations, and the result is that their impact on cantonal growth is null. The outcomes go together with the lack of sectoral de-concentration and the unchanged productive matrix. This process is too slow and unable to generate a real change that may have an impact on growth. The reason might be found in the lack of empowerment of GADs that, often, are not enough efficient to permit an effective

disarticulation of central governmant policies at local level. Additionally, the distribution of state agencies, as well as public services and productive infrastructures was traditionally unequal in the territory, and it did not change during the considered time span, which might have led to deepening territorial inequalities.

A further motivation of our findings could be due to the fact that less productive sectors, such as agriculture, which employes the higher share of employment, are typically subsistence, and manufacturing and services are only complementary activities in the majority of cantons. A further cause of the results could be that the policy of the central government is based on a wrong geographic scale. Zonal Areas are based on regions defined according to criteria of territorial contiguity, interregional balance, political-administrative divisions and management of watersheds, but without accounting for the productive structure and functionality of the territories (Tandazo and Gasca, 2014). Thus, this "regionalization" does not account for aspects such as geographic market integration, organizational and geographic fragmentation of production, and distribution and spatial relationship of economic activities in the territory.

Finally, as a robustness check, we computed the same estimates of Table 3 using the approach described in paragraph 2, but with different thresholds. In particular, to account for the possible existence of small clusters, we considered as cut-off the percentiles from the fifth to the fifteenth. The results do not vary and the spatial models are excluded to be the best choice for our data. The still negligible spatial dependence leads us to confirm that the standard OLS is still the best choice.

## 5. Conclusions

The paper explores the spatial disributions of seven economic sectors in Ecuador and their impact on cantonal growth using a panel approach.

The results support the importance of considering (lack of) spatial relationships in analyzing sub-national development in Ecuador, which appears asymmetrically distributed in space, with some circumscribed areas in which the majority of productive sectors are concentrated. Despite the Central Government's project to change productive matrix and to de-concentrate development, the share of non-financial and agricultural sector is still too large and accounts for almost 40 per cent of gross value added. Recent government's investment policies boosted construction and public sectors, but failed to generate a positive impact in most productive sectors such as manufacturing and high level services. This might be due to various reasons, among which we mention the mentioned territorial heterogeneity, the lack of urban agglomerations, but also the lack of efficiency of the public sector and of coordination between public actors and local stakeholders.

The outcomes of the analysis have some important policy implications and open up various problems for the future of the PNBV. The first is that sectoral government policies need to be reshaped accounting for territorial specificities because these are conceived as fundamental sources of growth if properly valued (Barca *et al.*, 2012). These policies must have multiple directions. The first one is decentralizing the manufacturing sector and/or creating incentives related to the creation of collateral services. This requires an in-depth analysis of the actual situation with the involvement of institutional actors and territorial stakeholders. The second point is to reinforce the local networks investing in both 'harder' (for example roads) and 'softer' infrastructure (human capital and research capacity). The third point is to add an explicit spatial

dimension to the actual policy objectives. In addition to the reduction of existing disparities, the aim has to be avoiding territorial imbalances making both the sectoral policies that have a spatial impact and the sub-national policy more coherent, through an improved territorial integration and cooperation.

With the actual economic deceleration due to the low oil price and the cut in the government spending, new forms of partnerships between the public and private sectors have to be found. This means a new strategic planning based on real and concrete needs, and a more efficient public sector, able to quickly and effectively involve the local stakeholders. Due to the fragmented economic and territorial tissue of Ecuador, new sectoral policies need to be anchored into territorial realities, and policy makers cannot leave aside the local factor that can make the difference in the long-run development of the country.

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**Table 3**

## Estimation Results (q1)

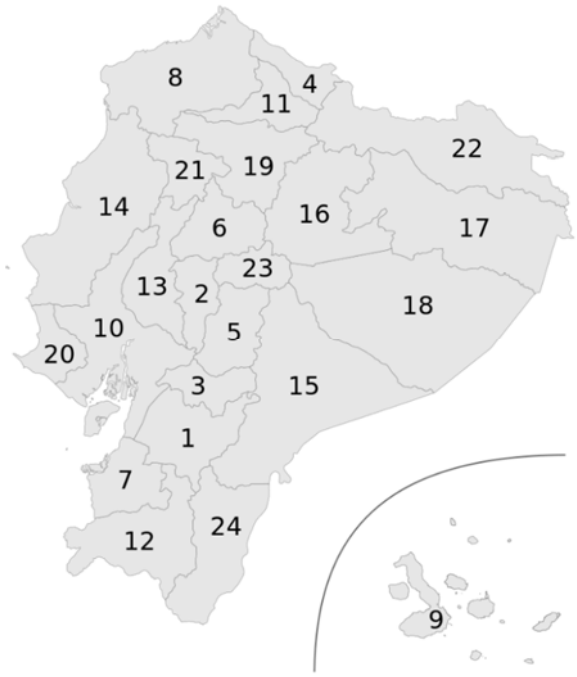
| | OLS | | Sp. Lag | | Sp. Error | | SLX | | Sp. Durbin | | Sp. Durbin Error | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GVA/pop | -0.3939 | *** | -0.3941 | *** | -0.3946 | *** | -0.3946 | *** | -0.395 | *** | -0.3952 | *** |
| | (-15.6931) | | (-14.557) | | (-14.6417) | | (-15.4009) | | (-14.3573) | | (-14.3666) | |
| Agricult. | -0.4386 | *** | -0.4412 | *** | -0.44 | *** | -0.4382 | *** | -0.4405 | *** | -0.4413 | *** |
| | (-3.824) | | (-3.5676) | | (-3.5745) | | (-3.7749) | | (-3.5327) | | (-3.5384) | |
| Mines | -0.1011 | | -0.1042 | | -0.1002 | | -0.0467 | | -0.0472 | | -0.0494 | |
| | (-0.6242) | | (-0.5967) | | (-0.5754) | | (-0.2837) | | (-0.2668) | | (-0.2799) | |
| Manuf | -0.0237 | | -0.0258 | | -0.0265 | | -0.0188 | | -0.0204 | | -0.0198 | |
| | (-0.3342) | | (-0.3375) | | (-0.349) | | (-0.2639) | | (-0.267) | | (-0.2585) | |
| Hydroelectr. | -0.396 | ** | -0.4005 | * | -0.4027 | * | -0.3948 | ** | -0.398 | * | -0.3957 | * |
| | (-2.051) | | (-1.9237) | | (-1.9416) | | (-2.0341) | | (-1.9093) | | (-1.8998) | |
| Construct | -0.3846 | *** | -0.3903 | *** | -0.3964 | *** | -0.325 | ** | -0.329 | ** | -0.3238 | ** |
| | (-2.8426) | | (-2.6749) | | (-2.7365) | | (-2.3469) | | (-2.2116) | | (-2.1724) | |
| Basic serv. | -0.2525 | ** | -0.2566 | ** | -0.2563 | ** | -0.2372 | ** | -0.2393 | ** | -0.2377 | ** |
| | (-2.274) | | (-2.1432) | | (-2.1536) | | (-2.1047) | | (-1.9768) | | (-1.9624) | |
| Fin. serv | 0.0027 | | -0.0017 | | -0.045 | | 0.2421 | | 0.224 | | 0.2451 | |
| | (0.0044) | | (-0.0026) | | (-0.068) | | (0.3789) | | (0.3263) | | (0.3566) | |
| Pub. adm. | -0.394 | ** | -0.3985 | ** | -0.3913 | ** | -0.3511 | ** | -0.3512 | * | -0.3531 | * |
| | (-2.3551) | | (-2.2084) | | (-2.178) | | (-2.0703) | | (-1.9277) | | (-1.9395) | |
| Teaching | -0.3055 | | -0.3066 | | -0.3069 | | -0.3567 | * | -0.3626 | * | -0.368 | * |
| | (-1.5887) | | (-1.4784) | | (-1.4894) | | (-1.8148) | | (-1.718) | | (-1.741) | |
| Health | -0.4938 | * | -0.497 | | -0.4987 | * | -0.3785 | | -0.3817 | | -0.3816 | |
| | (-1.7619) | | (-1.6447) | | (-1.654) | | (-1.3307) | | (-1.2497) | | (-1.2527) | |
| **W**×GVA/pop | | | | | | | -0.0138 | | -0.0275 | | -0.0132 | |
| | | | | | | | (-0.3312) | | (-0.5884) | | (-0.2993) | |
| **W**×Agricult. | | | | | | | 0.1178 | | 0.0809 | | 0.0839 | |
| | | | | | | | (0.4581) | | (0.2922) | | (0.3075) | |
| **W**×Mines | | | | | | | 0.2017 | | 0.197 | | 0.2377 | |
| | | | | | | | (0.4198) | | (0.3817) | | (0.4704) | |
| **W**×Manuf | | | | | | | -0.257 | * | -0.2824 | * | -0.2658 | * |
| | | | | | | | (-0.339) | | (-0.3394) | | (-0.3441) | |
| **W**×Hydroelectr. | | | | | | | -0.257 | | -0.2824 | | -0.2658 | |
| | | | | | | | (-0.5294) | | (-0.5412) | | (-0.5158) | |
| **W**×Construct | | | | | | | -0.2755 | | -0.3053 | | -0.3019 | |
| | | | | | | | (-1.0031) | | (-1.0338) | | (-1.0383) | |
| **W**×Basic serv. | | | | | | | -0.0234 | | -0.0575 | | -0.0631 | |
| | | | | | | | (-0.0913) | | (-0.2091) | | (-0.2328) | |
| **W**×Fin. serv | | | | | | | -1.836 | | -1.8771 | | -1.8997 | |
| | | | | | | | (-1.4599) | | (-1.3897) | | (-1.4273) | |
| **W**×Pub. adm. | | | | | | | 0.3575 | | 0.3236 | | 0.3215 | |
| | | | | | | | (1.0833) | | (0.9124) | | (0.9188) | |
| **W**×Teaching | | | | | | | 0.1907 | | 0.183 | | 0.206 | |
| | | | | | | | (0.5327) | | (0.4758) | | (0.5419) | |
| **W**×Health | | | | | | | 0.2734 | | 0.2344 | | 0.2476 | |
| | | | | | | | (0.3817) | | (0.3046) | | (0.3261) | |
| ρ | | | -0.0258 | | | | | | -0.0367 | | | |
| | | | (-0.7861) | | | | | | (-1.0527) | | | |
| λ | | | | | -0.044 | | | | | | -0.047 | |
| | | | | | (-1.2565) | | | | | | (-1.3423) | |
| Time dummies | yes | | yes | | yes | | yes | | yes | | yes | |
| Cantonal dummies | yes | | yes | | yes | | yes | | yes | | yes | |

| | OLS | | Sp. Lag | | Sp. Error | | SLX | | Sp. Durbin | | Sp. Durbin Error | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Observations | 1547 | | 1547 | | 1547 | | 1547 | | 1547 | | 1547 | |
| R-sq. | 0.322 | | 0.4456 | | 0.4452 | | 0.2179 | | 0.4504 | | 0.4495 | |
| Rbar-sq. | 0.2174 | | 0.2223 | | 0.2224 | | 0.0139 | | 0.2284 | | 0.2285 | |
| sigma | 0.0139 | | 0.0161 | | 0.016 | | 0.0139 | | 0.016 | | 0.0159 | |
| logliksfe | 1119.9 | | 1120.481 | | 1120.78 | | 1126 | | 1126.953 | | 1127.121 | |

*Significant at 1 per cent, ** significant at 5 per cent, *** significant at 10 per cent. t-stat in brackets.

## Appendix A: Map of Ecuador

**Figure A1: Provinces of Ecuador**




| ID | Province | Area ($km^2$) |
|---|---|---|
| 1 | Azuay | 8 639 |
| 2 | Bolívar | 3 254 |
| 3 | Cañar | 3 908 |
| 4 | Carchi | 3 699 |
| 5 | Chimborazo | 6 479 |
| 6 | Cotopaxi | 6 569 |
| 7 | El Oro | 5 988 |
| 8 | Esmeraldas | 14 893 |
| 9 | Galápagos | 8 010 |
| 10 | Guayas | 17 139 |
| 11 | Imbabura | 4 599 |
| 12 | Loja | 11 027 |
| 13 | Los Ríos | 6 254 |
| 14 | Manabí | 18 400 |
| 15 | Morona | 25 690 |
| 16 | Napo | 13 271 |
| 17 | Orellana | 20 773 |
| 18 | Pastaza | 29 520 |
| 19 | Pichincha | 9 494 |
| 20 | Santa Elena | 3 763 |
| 21 | Santo Domingo | 4 180 |
| 22 | Sucumbíos | 18 612 |
| 23 | Tungurahua | 3 334 |
| 24 | Zamora | 10 556 |

Source: Authors' elaboration on the basis of INEC.

**Appendix B: Sectoral Composition by Province**

Tables B1 and B2 show, for years 2007 and 2014, respectively, the relative sectoral share in the production of value added for each province. The sum by row is one and the number in bold highlights the sector with the highest relative share.

**Table B1**

**Percentage of Contribution by Sector to Total Provincial Value Added in 2007**

| Province | Agricult. | Mines | Manufac. | Hydroe-lectric | Construct. | Basic serv. | Fin. serv | Pub. adm. | Teach-ing | Health | GVA/pop |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Azuay | 5.50 | 0.90 | 14.80 | 11.70 | 10.40 | **34.60** | 4.80 | 7.00 | 5.50 | 3.50 | 3635.24 |
| Bolivar | **34.00** | 0.00 | 1.70 | 0.00 | 10.30 | 21.50 | 1.40 | 13.90 | 12.20 | 3.40 | 1568.13 |
| Cañar | 20.70 | 0.30 | 8.50 | 0.00 | 15.60 | **31.70** | 2.90 | 7.10 | 9.00 | 3.40 | 2232.58 |
| Carchi | 21.00 | 0.10 | 5.10 | 0.50 | 11.10 | **35.50** | 1.70 | 13.70 | 7.90 | 2.80 | 2070.46 |
| Cotopaxi | 26.90 | 0.00 | 7.00 | 0.90 | 13.40 | **29.90** | 1.50 | 7.10 | 8.90 | 3.20 | 2130.33 |
| Chimborazo | 13.40 | 0.10 | 8.20 | 0.70 | 15.90 | **33.70** | 2.40 | 10.70 | 10.00 | 3.80 | 1852.56 |
| El Oro | 25.40 | 2.30 | 4.30 | 0.20 | 11.00 | **34.20** | 1.70 | 7.50 | 7.40 | 3.40 | 2662.38 |
| Esmeraldas | 20.30 | 0.00 | **39.20** | 0.00 | 7.60 | 17.10 | 0.50 | 6.20 | 6.50 | 1.80 | 3236.06 |
| Guayas | 7.80 | 0.40 | 19.30 | 0.80 | 8.50 | **45.60** | 2.30 | 4.40 | 5.60 | 2.70 | 3528.43 |
| Imbabura | 9.60 | 0.10 | 7.20 | 0.20 | 16.60 | **41.70** | 3.10 | 8.70 | 9.10 | 2.60 | 2218.04 |
| Loja | 16.00 | 0.10 | 4.00 | 0.10 | 16.70 | **33.50** | 3.80 | 14.20 | 6.70 | 4.50 | 2051.10 |
| Los Rios | **38.60** | 0.00 | 3.60 | 0.30 | 7.20 | 26.80 | 0.90 | 6.60 | 9.50 | 5.20 | 2113.85 |
| Manabi | 21.10 | 0.10 | 15.60 | 0.10 | 11.30 | **29.70** | 1.40 | 7.80 | 9.00 | 3.00 | 2056.03 |
| Morona Santiago | 17.70 | 0.00 | 1.70 | 5.90 | 11.30 | **23.80** | 1.70 | 21.70 | 10.90 | 4.00 | 1401.64 |
| Napo | 13.80 | 0.00 | 1.50 | 1.40 | 16.10 | **27.80** | 0.90 | 21.80 | 10.30 | 5.30 | 1558.22 |
| Pastaza | 7.50 | 0.00 | 4.80 | 0.00 | 14.40 | **37.80** | 2.00 | 19.80 | 8.40 | 4.40 | 2124.3 |
| Pichincha | 5.10 | 0.20 | 18.70 | 0.40 | 7.70 | **45.50** | 4.90 | 5.60 | 4.40 | 2.80 | 4585.38 |
| Tungurahua | 6.80 | 0.10 | 11.80 | 7.90 | 12.60 | **38.50** | 3.30 | 6.30 | 6.60 | 4.80 | 2821.25 |
| Zamora Chinchipe | 15.50 | 3.40 | 1.70 | 0.70 | 12.20 | **24.10** | 1.20 | 24.10 | 11.90 | 4.80 | 1558.29 |
| Galapagos | 17.90 | 0.00 | 0.80 | 0.00 | 9.30 | **50.20** | 0.90 | 15.50 | 1.50 | 0.90 | 7115.92 |
| Sucumbios | 12.50 | 0.00 | **33.40** | 0.00 | 8.00 | 23.30 | 0.90 | 10.30 | 8.40 | 2.20 | 2385.67 |
| Orellana | 19.30 | 0.00 | 18.80 | 0.00 | 5.40 | **22.30** | 1.10 | 19.50 | 10.10 | 2.40 | 1881.13 |
| Santo Domingo | | | | | | | | | | | |
| Santa Elena | | | | | | | | | | | |
| Total | 11.18 | 0.37 | 16.41 | 1.37 | 9.41 | 39.81 | 3.05 | 6.52 | 6.16 | 3.05 | 3138.64 |

*Note: In bold the main sector. Provinces of Santa Elena and Santo Domingo were created after 2007 from the provinces of Guayas and Pichincha respectively and then they were included only in 2013.*

**Table B2**

**Percentage of Contribution by Sector to Total Provincial Value Added in 2014**

| Province | Agricult. | Mines | Manufac. | Hydroe-lectric | Construct. | Basic serv. | Fin. serv | Pub. adm. | Teac-hing | Health | GVA/pop |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Azuay | 3.55 | 1.40 | 18.82 | 4.24 | 18.05 | **32.84** | 5.44 | 5.75 | 5.79 | 4.35 | 3917.58 |
| Bolivar | 21.15 | 0.00 | 2.26 | 1.08 | 12.61 | **26.32** | 3.01 | 14.30 | 12.95 | 4.41 | 1759.50 |
| Cañar | 12.05 | 0.26 | 5.35 | 1.23 | 20.66 | **33.98** | 4.29 | 8.34 | 8.31 | 5.16 | 2613.70 |
| Carchi | 24.10 | 0.05 | 3.08 | 1.20 | 12.08 | **32.19** | 2.47 | 10.40 | 8.48 | 4.64 | 2349.77 |
| Cotopaxi | 24.94 | 0.07 | 5.22 | 1.26 | 13.02 | **32.81** | 2.17 | 7.50 | 8.45 | 3.56 | 2421.52 |
| Chimborazo | 12.35 | 0.05 | 11.12 | 1.58 | 18.39 | **28.98** | 2.71 | 9.01 | 9.65 | 5.20 | 2304.04 |
| El Oro | 28.23 | 5.82 | 4.96 | 1.14 | 12.98 | **31.21** | 2.12 | 6.72 | 6.17 | 4.23 | 3488.08 |
| Esmeraldas | **33.09** | 0.03 | 14.93 | 1.24 | 10.13 | 22.02 | 0.54 | 5.84 | 8.50 | 2.78 | 2741.14 |
| Guayas | 8.65 | 0.46 | 23.07 | 1.35 | 12.04 | **37.01** | 2.75 | 4.14 | 5.14 | 3.51 | 4233.00 |
| Imbabura | 6.88 | 0.13 | 10.88 | 1.72 | 18.43 | **39.77** | 2.63 | 6.66 | 7.62 | 4.26 | 2969.43 |
| Loja | 9.48 | 0.05 | 3.21 | 1.43 | 18.21 | **38.20** | 3.78 | 10.57 | 8.62 | 5.67 | 2456.46 |
| Los Rios | **38.50** | 0.00 | 3.46 | 0.97 | 10.29 | 26.70 | 0.81 | 6.86 | 7.79 | 3.55 | 2682.95 |
| Manabi | 12.39 | 0.11 | 16.30 | 1.29 | 16.04 | **31.85** | 1.36 | 7.49 | 8.09 | 4.13 | 2666.13 |
| Morona Santiago | 6.99 | 0.01 | 2.76 | 2.46 | 14.17 | **30.32** | 2.53 | 15.04 | 15.98 | 8.65 | 1682.29 |
| Napo | 10.40 | 0.00 | 1.64 | 1.39 | 13.51 | **32.39** | 1.33 | 16.43 | 14.24 | 7.44 | 2039.19 |
| Pastaza | 7.67 | 0.00 | 5.01 | 1.52 | 15.22 | **32.57** | 3.22 | 15.41 | 11.94 | 6.20 | 2378.39 |
| Pichincha | 3.67 | 0.46 | 17.86 | 1.01 | 11.80 | **40.67** | 4.73 | 10.31 | 3.43 | 2.58 | 5964.16 |
| Tungurahua | 5.96 | 0.05 | 15.91 | 2.19 | 12.19 | **42.69** | 4.90 | 4.37 | 6.28 | 4.27 | 3194.24 |
| Zamora Chinchipe | 6.28 | 2.35 | 1.69 | 1.79 | 16.38 | **31.06** | 0.99 | 21.05 | 14.16 | 6.09 | 1738.28 |
| Galapagos | 7.56 | 0.00 | 1.16 | 0.90 | 9.29 | **58.61** | 0.83 | 12.57 | 4.09 | 1.88 | 5095.08 |
| Sucumbios | 12.20 | 0.00 | 12.62 | 0.74 | 13.91 | **35.65** | 0.95 | 8.21 | 10.43 | 3.69 | 2460.50 |
| Orellana | 16.76 | 0.00 | 2.60 | 2.79 | 6.71 | **31.22** | 1.40 | 17.78 | 14.74 | 4.25 | 1861.69 |
| Santo Domingo | 10.46 | 0.02 | 11.75 | 1.33 | 13.91 | **36.80** | 1.66 | 8.49 | 8.51 | 6.11 | 2658.36 |
| Santa Elena | 7.52 | 13.75 | 14.86 | 1.14 | 23.69 | **33.50** | 0.68 | 6.17 | 9.58 | 1.90 | 2259.49 |
| Total | 10.34 | 0.78 | 16.40 | 1.41 | 13.19 | 36.25 | 3.22 | 7.42 | 5.87 | 3.57 | 3704.86 |

*Note: In bold the main sector.*