The Spatial Structure of Ecuador: Analysis Using Market Potentials

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Abstract

The goal of this chapter is to analyze the spatial structure of Ecuador, that is, to find out if the economic activity in this country is clustered in or around several provinces and/or regions. In other words, we want to establish from a geographical economics perspective which provinces are considered belonging to the so-called core and which ones to the periphery. We will carry out the analysis by computing each region’s market potentials. The methodological approach of this study is based on the well-known Harris, 1954, market potential concept of the regional economics literature. For each province and using as the time frame the period 2007–2014, we have computed its Harris, 1954, market potential, which takes into account the economic activity in the surrounding locations weighting them by the inverse of the distance. With regard to the weighting scheme, we will use two different proxies: on the one hand, the distance measured in kilometers between the capital of each province, and on the other hand, the distance measured in terms of the time needed to travel from the capital of one province to the other.

Keywords: market potential, regional development, center-periphery pattern, Ecuador, economic activity

1. Introduction

Without any doubt, one of the key concerns of the economics science is the study of the levels of wellbeing of the citizens and the process of income distribution which affects the wellbeing levels. From this perspective, it is very difficult that a country is able to fully accomplish the needs of its citizens. It is a very well-known feature that the economic activity is concentrated in few locations in the space and therefore this fact makes difficult to achieve a balanced
development of the different territories within a country and therefore to achieve good levels of citizens welfare. For instance, in the case of Ecuador according to the figures provided by its National Statistical Institute, only 1.9% of the population belongs to the upper class, 11.2% are upper-middle class, 22.8% are middle class, 49.3% are middle-low class and 14.8% are low class. Moreover, around 8% of the population lives with less than 1 dollar a day. On the other hand, it is well known that economic activity is concentrated in space and the identification of core-periphery patterns which are common to many countries are also present in the case of Ecuador. Without any doubt, there are two provinces that are acting as “core” from a geographical economics point of view, whereas the remaining ones would be acting as “periphery.” Our main goal is to analyze whether the spatial distribution of the economic activity in Ecuador follows a core-periphery pattern which is clearly observed in other geographical settings in the world, such as in the European Union, Spain, Portugal, Romania, etc. In order to deal with this issue, we will resort to the computation of the Harris [1] market potentials for the Ecuador provinces. The results of the computations will be shown in a map which will provide us with a macroscopic picture of the spatial distribution of economic activity within Ecuador and will also be informative about the potential existence of a core-periphery structure in terms of spatial distribution. The remaining part of the chapter is structured as follows: in the next section, the theoretical background of the Harris [1] market potential concept is presented. Section III looks at the analysis of the spatial structure of Ecuador based on the market potential computations over the period 2007–2014. Section IV looks at the analysis of the distribution of economic activity in Ecuador by means of Lorenz curves and associated Gini indexes. The last section of the chapter contains the main conclusions.

2. Theoretical background

Following Harris [1], the market potential of a geographical observation (region \(i\)) is defined as the summation of markets (\(M\)) accessible to \(i\) divided by their “distances” (\(d_{ij}\)) to that point \(i\). When the calculation is done on areal units, a correction for the size of the internal market of each area (self-potential) is necessary in order to measure the accessibility of its firms to the markets. Therefore, considering the \(R - 1\) possible markets of other \(j\) regions, the Harris’ s Market Potential of region \(i\) can be decomposed into its Internal Market Potential (IMP) and External Market Potential (EMP) components:

\[
HM P_i = \sum_{j=1}^{R} \frac{M_j}{d_{ij}} = \frac{M_i}{d_{ii}} + \sum_{j=1}^{R-1} \frac{M_j}{d_{ij}} = IMP_i + EMP_i
\]

where the distance to the own regional market (\(d_{ii}\)) is measured by within region distances, as discussed below. Part of the focus of this chapter is on the construction and interpretation of External Market Potential. Versions of this last variable have been called “non-local” Head and Mayer [2], “surrounding” Blonigen et al. [3] or “foreign” Brakman et al. [4] market potential.

The distance between the locations \(i\) and \(j\) (\(d_{ij}\)) is going to be measured as follows:
a. In first place, we will proxy this distance by considering the distance between the capitals of the provinces measured in kilometers. The use of physical distances allow to capture not only the trade costs but also the “relative” trade costs Yotov [5] and the barriers which are not related to trade and other sort of interactions Linders et al. [6].

b. On the other hand, we will consider also the distance measured in travel time between the capitals of the provinces. This weighting scheme allows to control the quality of the infrastructure. It might well happen in case that comparing vis-à-vis two locations that are in terms of physical distance of equal distance but in terms of travel times are quite different on account of the quality of the infrastructure, physical geography of the region, etc., and therefore the centrality levels of the locations could be biased in case we only take into account a measure of physical distance based on kilometers.

As we see from the expression the market potential of a location can be broken down into a domestic or internal component and a foreign or external one (market potential generated by the surrounding locations excluding the location for which the computations is being made).

When facing the computation of the domestic market potential, the definition of the internal distance within each location ($d_{ii}$) is critical issue. The standard methodology assumes that the spatial units (in our case the Ecuadorian provinces) are circular and the internal distance is proxied as proportional to the square root of each province area. We follow Keeble et al. [7] and use our measure of internal distance as

$$d_{ii} = 1/3 \cdot r_i = 1/3 \sqrt{\text{area}_i / \pi}$$  \hspace{1cm} (2)

This measure allows the potential concentration of economic activity in and around the center. This way of computing internal distances increases the role of the internal market in comparison with other proxies, such as 2/3 of the radius used by other authors. Finally, as the proxy for the volume of economic activity $M$, we have chosen on the one hand the provincial population and on the other the real per capital GDP. In both cases, we have a time series that goes from 2007 to 2014.

According to the theoretical background, the market potential indicators we have defined are the following:

(A) Indicators of market potential using a distance matrix based on kilometers:

1. pmp represents the Harris [1] market potential computed from data on population of each province. The internal distance is computed as 1/3 of the radius. Sources: Own elaboration based on provincial population data, area of each province, distance expressed in kilometers.

2. pmvyar represents the Harris [1] market potential computed from data on real gross value added of each province. The internal distance is computed as 1/3 of the radius. Sources: Own elaboration based on provincial population data, area of each province, distance expressed in kilometers.
Indicators of market potential using a distance matrix based on travel times:

1. pmpt represents the Harris [1] market potential computed from data on population of each province. The internal distance is computed as 1/3 of the radius. Sources: Own elaboration based on provincial population data, area of each province, distance expressed in minutes of travel time between locations. For the computation of the internal distance, we consider a cruise speed of 60 km/h.

2. pmyyar represents the Harris [1] market potential computed from data on real gross value added of each province. The internal distance is computed as 1/3 of the radius. Sources: Own elaboration based on provincial population data, area of each province, distance expressed in minutes of travel time between locations. For the computation of the internal distance, we consider a cruise speed of 60 km/h.

The datasets for our computations have been obtained from different sources: Central bank of Ecuador, National Statistical Institute [8], Service of internal rents. In order to represent the indexes of market potential, we will use a geographic information system (ESRI from Arcmap).

Harris’s approach has been widely used in Regional Economics. One reason is that it offers a way of capturing Tobler’s [9] first law of Geography, which would be much quoted later by the Spatial Econometrics literature: “Everything is related to everything else, but near things are more related than distant things.” In the 1990s, Krugman’s general equilibrium setting provides microeconomic foundations to the physical analogies of Harris’s indicator Krugman [10]. The NEG’s “wage equation” predicts that regional wages are a function of the size of the markets available to each region. Here, the final basic equation is presented following Head and Mayer [2] and Combes et al. [11].

3. Spatial structure of Ecuador: 2007–2014

3.1. A short descriptive view of Ecuador

Ecuador with an area of 283,561 km² and a population of 16,298,217 inhabitants [8] is located on the northwestern part of South America. Its borders are in the North Colombia, in the South Peru and in the East and West the Pacific Ocean. The political capital is Quito whereas the economic and most populated city is Guayaquil. The official language of Ecuador is Spanish and its population is mostly catholic. Ecuador is considered one of the countries endowed with more biodiversity in the world Jaramillo [12]. From a geographical point of view, Ecuador is divided into three regions: coast, valley and East and the insular region. These three regions group the 24 provinces in which the country is divided for administrative purposes.

Historically, Ecuador is characterized by being a primary sector-export-oriented economy where the agricultural goods have been the main resource both in production and employment with the handicap that the economy relies on only one export product, cacao. At the
beginning of the twentieth century, the cacao was the main national product for foreign markets. The fall in the international prices of cacao and several diseases which affected this commodity were at the hearth of the shrink of this industry in Ecuador. At the end of 1940s, the cacao production was substitute by the banana production to convert Ecuador the first supplier of this fruit worldwide. However, from 1970s onwards, the oil production took the lead and from that moment onwards it was the more important trading commodity in the Ecuador economy. Currently, exports of oil account for 40% of total Ecuador exports and it represents a similar share in the Ecuador government budget. At the end of 1990s and influenced by a series of political and military circumstances jointly with the implementation of bad economic policies, Ecuador suffered the worst economic crisis of its history. The economy was dollarized in order to readjust the economic situation and since then Ecuador was able to keep the stability allowing the people to improve their standards of leaving.

3.2. Spatial structure of Ecuador: a provincial level analysis, 2007–2014

The next section contains the analysis of the main results. Ecuador is divided into 24 provinces. This analysis does not take into account the insular province of Galapagos, so the analysis is carried out for the remaining 23 provinces. The first set of tables shown (Tables 1 and 2) contains the results of the computations of the market potentials using population as a proxy for the economic activity and as a distance matrix, one based on kilometers (Table 1) and another based on travel times (Table 2). The time period of this study is 2007–2014.

Our results show that there are two provinces with top ranking in terms of market potential: Guayas and Pichincha. In this sense, if we measure the demand accessibility using as our distance matrix the one based in travel times the top provinces in terms of market potential are the same. From a more general perspective, it can be appreciated that the provinces located along the coast Guayas, Manabi, Los Rios and El Oro and those located in the central valley Pichincha, Bolivar, Cotopaxi, Tungurahua, Chimborauso, Santo Domingo have average values which are higher than for those provinces located in the Eastern (Morona Santiago, Napo, Pastaza, Sucumbios, Orellana, Zamora Chinchipe) and Northern parts of the country (Carchi, Esmeraldas).

Tables 3 and 4 analyze the growth of the market potential based on population and distance matrix based on both kilometers and travel times over the period 2007–2014. The average growth rate of the period has been normalized to 100 and therefore the values presented in the table are deviations from it.

It can be seen that all provinces have experienced positive growth rates in terms of market potentials. The national average growth rate over this period was 20.6% and if we look at the average growth rates of the different regions the figures are pretty similar: coast 21.56%, valley 19.33% and east 21.98%. However, it is worth mentioning that the market potential growth experience by the provinces of Pichincha and Guayas is slightly above the remaining regions (with the exception of Santo Domingo and Santa Elena which in the past belonged to the
Therefore, the results of this analysis show that besides the fact that Pichincha and Guayas are the provinces with the highest market potential values they are also the provinces which grow more. This is in line with a process of

| Province             | Average       | Maximum       | Minimum       |
|----------------------|---------------|---------------|---------------|
| Azuay                | 92652.5705    | 100791.5361   | 83470.1759    |
| Bolívar              | 102640.904    | 234778.2186   | 76385.8753    |
| Cañar                | 84303.3891    | 92911.6269    | 75910.5037    |
| Carchi               | 50203.8387    | 54774.9113    | 45791.5643    |
| Cotopaxi             | 110749.6981   | 123452.41     | 101855.5623   |
| Chimborazo           | 103211.5082   | 132311.1641   | 89189.6738    |
| El Oro               | 92977.9622    | 99164.8545    | 86016.7238    |
| Esmeraldas           | 56438.9936    | 61845.8743    | 50175.0441    |
| Guayas               | 201438.9578   | 220138.0792   | 177975.4394   |
| Imbabura             | 83668.7818    | 90205.3727    | 76674.9822    |
| Loja                 | 55531.8701    | 60488.3873    | 50222.1887    |
| Los Ríos             | 131864.6442   | 149285.0045   | 117676.4483   |
| Manabí               | 99230.4968    | 107262.4807   | 89197.9657    |
| Morona Santiago      | 44158.7542    | 50886.0203    | 38882.5417    |
| Napo                 | 53332.5414    | 61321.4244    | 47078.2933    |
| Pastaza              | 63813.2107    | 74588.4253    | 56635.5377    |
| Pichincha            | 185364.005    | 204115.2439   | 163019.6668   |
| Tungurahua           | 124468.8505   | 130730.6259   | 113257.9825   |
| Zamora Chinchipe     | 37087.2701    | 41173.9809    | 33073.5494    |
| Sucumbíos            | 40942.0633    | 45593.5881    | 36212.6012    |
| Orellana             | 37632.1285    | 42857.0325    | 33034.4732    |
| Santo Domingo        | 95227.0321    | 104779.1647   | 83177.5547    |
| Santa Elena          | 76081.575     | 84762.8119    | 65266.7887    |

Source: Own elaboration.

Table 1. Market potential based on population and distance matrix based on Kms (pmp): 2007–2014.
increasing concentration of economic activity in the Ecuadorian space in the aforementioned provinces. In short, we are facing with a core-periphery spatial type of structure in terms of economic development in Ecuador.

| Province            | Average | Maximum | Minimum  |
|---------------------|---------|---------|----------|
| Azuay               | 92592.5568 | 100731.3599 | 83412.5499 |
| Bolívar             | 102535.049 | 234672.077  | 76284.2360 |
| Cañar               | 84192.9403 | 92800.8791  | 75804.4493 |
| Carchi              | 50222.8078 | 54793.9317  | 45809.7787 |
| Cotopaxi            | 108774.2513 | 121471.615  | 99958.7109 |
| Chimborazo          | 101570.0002 | 130665.2119 | 87613.4751 |
| El Oro              | 93046.4709 | 99233.5486  | 86082.5068 |
| Esmeraldas          | 56624.9354 | 62032.3196  | 50353.5881 |
| Guayas              | 201426.2849 | 220124.8887 | 177963.2707 |
| Imbabura            | 83938.1960 | 90274.9748  | 76374.6347 |
| Loja                | 55535.9395 | 60492.4677  | 50226.0962 |
| Los Ríos            | 131932.0897 | 149352.6326 | 117741.2104 |
| Manabí              | 99146.3469 | 107178.103  | 89107.1638 |
| Morona Santiago     | 44148.7933 | 50876.0324  | 38872.9772 |
| Napo                | 53051.8262 | 61039.9491  | 46808.7466 |
| Pastaza             | 62876.0065 | 73648.6837  | 55735.6212 |
| Pichincha           | 185307.6088 | 204056.5448 | 162965.5144 |
| Tungurahua          | 121159.0108 | 127283.9717 | 110173.8251 |
| Zamora Chinchipe    | 37246.9290 | 41334.0713  | 33226.8560 |
| Sucumbios           | 41281.7371 | 45934.1816  | 36538.7607 |
| Orellana            | 37619.5657 | 42844.4356  | 33022.4102 |
| Santo Domingo       | 95318.2998 | 104874.1591 | 83265.1912 |
| Santa Elena         | 76293.5317 | 84975.3425  | 65470.3125 |

Source: Own elaboration.

Table 2. Market potential based on population and distance matrix based on travel times (pmpt): 2007–2014.
Tables 5 and 6 show the market potential computations (along with the maximum and minimum values) based on the data on real gross value added and a weighting scheme based on kilometers (Table 5) and travel times (Table 6) over the period 2007–2014.

| Province           | Provincial indices (2007) | Provincial indices (2014) | Growth rate (2007–2014) |
|--------------------|--------------------------|--------------------------|-------------------------|
| Azuay              | 90.0894                  | 107.6601                 | 19.5036                 |
| Bolívar            | 74.4205                  | 88.7624                  | 19.2714                 |
| Cañar              | 90.0444                  | 107.2954                 | 19.1583                 |
| Carchi             | 91.2112                  | 106.3728                 | 16.6225                 |
| Cotopaxi           | 91.9691                  | 105.6850                 | 14.9135                 |
| Chimborazo         | 86.4144                  | 104.9252                 | 21.4209                 |
| El Oro             | 92.5130                  | 105.8198                 | 14.3873                 |
| Esmeraldas         | 88.9013                  | 108.5106                 | 22.0573                 |
| Guayas             | 88.3520                  | 109.2827                 | 23.6901                 |
| Imbabura           | 91.4225                  | 106.7099                 | 16.7217                 |
| Loja               | 90.4384                  | 107.1129                 | 18.4373                 |
| Los Ríos           | 89.2403                  | 107.0655                 | 19.9743                 |
| Manabí             | 89.8795                  | 107.5099                 | 19.6155                 |
| Morona Santiago    | 88.0517                  | 107.8498                 | 22.4846                 |
| Napo               | 88.2731                  | 107.6785                 | 21.9834                 |
| Pastaza            | 88.7520                  | 106.6445                 | 20.1600                 |
| Pichincha          | 87.9456                  | 110.1159                 | 25.2089                 |
| Tungurahua         | 90.9930                  | 105.0307                 | 15.4272                 |
| Zamora Chinchipe   | 89.1776                  | 107.9099                 | 21.0056                 |
| Sucumbíos          | 88.4484                  | 108.6017                 | 22.7854                 |
| Orellana           | 87.7826                  | 108.4066                 | 23.4944                 |
| Santo Domingo      | 87.3465                  | 110.0309                 | 25.9704                 |
| Santa Elena        | 85.7852                  | 111.1875                 | 29.6115                 |

Source: Own elaboration.

Table 3. pmp Market potential growth: (2007–2014, Ecuador = 100).
These results are also in line with the previous ones. The provinces of Guayas and Pichincha have the highest values in terms of the average values and also in terms of the maximum values. In the context of the Ecuadorian economy, the “center” of the economic activity is

| Province            | Provincial indices (2007) | Provincial indices (2014) | Growth rate (2007–2014) |
|---------------------|--------------------------|--------------------------|-------------------------|
| Azuay               | 90.0855                  | 107.6624                 | 19.5112                 |
| Bolívar             | 74.3980                  | 88.7466                  | 19.2859                 |
| Cañar               | 90.0365                  | 107.2997                 | 19.1734                 |
| Carchi              | 91.2130                  | 106.3720                 | 16.6192                 |
| Cotopaxi            | 91.8955                  | 105.7141                 | 15.0372                 |
| Chimborazo          | 86.2592                  | 104.9388                 | 21.6552                 |
| El Oro              | 92.5156                  | 105.8185                 | 14.3791                 |
| Esmeraldas          | 88.9247                  | 108.4961                 | 22.0089                 |
| Guayas              | 88.3515                  | 109.2831                 | 23.6911                 |
| Imbabura            | 91.4263                  | 106.7078                 | 16.7145                 |
| Loja                | 90.4389                  | 107.1127                 | 18.4365                 |
| Los Rios            | 89.2438                  | 107.0640                 | 19.9680                 |
| Manabí              | 89.8743                  | 107.5128                 | 19.6257                 |
| Morona Santiago     | 88.0499                  | 107.8507                 | 22.4881                 |
| Napo                | 88.2321                  | 107.6976                 | 22.0616                 |
| Pastaza             | 88.6437                  | 106.6826                 | 20.3499                 |
| Pichincha           | 87.9432                  | 110.1177                 | 25.2145                 |
| Tungurahua          | 90.9332                  | 105.0553                 | 15.5301                 |
| Zamora Chinchipe    | 89.2069                  | 107.8935                 | 20.9474                 |
| Sucumbíos           | 88.5107                  | 108.5464                 | 22.6569                 |
| Orellana            | 87.7798                  | 108.4081                 | 23.4999                 |
| Santo Domingo       | 87.3548                  | 110.0252                 | 25.9519                 |
| Santa Elena         | 85.8137                  | 111.1678                 | 29.5455                 |

Source: Own elaboration.

Table 4. pmpt Market potential growth: (2007–2014, Ecuador = 100).
directed toward these two provinces and once again to those located in the central valley and the Ecuadorian coast. These results also show that the so-called “economic periphery“ is located in the Eastern and Northern provinces of the country. Finally, Tables 7 and 8 show the results of the market potential growth based on data on real gross value added and the

| Province         | Average     | Maximum     | Minimum    |
|------------------|-------------|-------------|------------|
| Azuay            | 330790.0639 | 383810.751  | 288514.5   |
| Bolívar          | 273622.048  | 318956.125  | 240500     |
| Cañar            | 286376.6592 | 332880.842  | 250222.1   |
| Carchi           | 187513.0012 | 218350.91   | 163299.4   |
| Cotopaxi         | 389992.9367 | 455835.274  | 340354.1   |
| Chimborazo       | 324140.4994 | 380217.919  | 282906.2   |
| El Oro           | 307187.3137 | 372297.719  | 258022.4   |
| Esmeraldas       | 196345.2721 | 219066.09   | 179702.8   |
| Guayas           | 764554.4936 | 894921.42   | 680397.1   |
| Imbabura         | 306003.2275 | 363380.632  | 262102.1   |
| Loja             | 171716.7066 | 197779.8    | 147479.6   |
| Los Ríos         | 425388.5919 | 497077.361  | 371446.8   |
| Manabí           | 301730.1684 | 354520.917  | 260227.1   |
| Morona Santiago  | 160526.4038 | 185596.329  | 138712.1   |
| Napo             | 223371.077  | 257049.974  | 197712.7   |
| Pastaza          | 239690.2167 | 273774.265  | 207511.4   |
| Pichincha        | 918315.932  | 1103744.33  | 810267.4   |
| Tungurahua       | 413451.5802 | 481996.649  | 359893.1   |
| Zamora Chinchipe | 122847.6793 | 141977.57   | 106111.3   |
| Sucumbíos        | 268916.6845 | 291250.95   | 219804.3   |
| Orellana         | 300660.5064 | 368926.973  | 218269     |
| Santo Domingo    | 339282.25   | 397740.056  | 299168     |
| Santa Elena      | 267274.6315 | 295592.854  | 251272.2   |

Source: Own elaboration.

Table 5. Market potential based on real gross value added and a distance matrix based on kilometers (pmvyr): 2007–2014.
We have normalized the average growth rate of the country to 100 and the figures for each province represent deviations from the average.

| Province            | Average | Maximum | Minimum |
|---------------------|---------|---------|---------|
| Azuay               | 330618.2731 | 383612.472 | 288366.2 |
| Bolivar             | 273319.0349 | 318606.39 | 240238.4 |
| Cañar               | 286060.4965 | 332515.93 | 249949.2 |
| Carchi              | 187567.3008 | 218413.582 | 163346.3 |
| Cotopaxi            | 384338.1643 | 449308.582 | 335472.6 |
| Chimborazo          | 319441.6361 | 374794.53 | 278849.9 |
| El Oro              | 307383.4219 | 372524.066 | 258191.7 |
| Esmeraldas          | 196877.536 | 219680.425 | 180162.3 |
| Guayas              | 764518.2169 | 894879.55 | 680365.8 |
| Imbabura            | 306201.9275 | 363609.97 | 262273.6 |
| Loja                | 171728.3554 | 197793.245 | 147479.6 |
| Los Ríos            | 425581.6565 | 497300.194 | 371613.5 |
| Manabí              | 301489.287 | 354242.894 | 260019.1 |
| Morona Santiago     | 160497.8905 | 185563.42 | 138867.5 |
| Napo                | 222567.5215 | 256122.516 | 197019 |
| Pastaza             | 237007.443 | 270677.83 | 205195.6 |
| Pichincha           | 918154.4962 | 1103558 | 810127.9 |
| Tungurahua          | 406200.8457 | 473343.502 | 354129.3 |
| Zamora Chinchipe    | 123304.7073 | 142505.068 | 106505.8 |
| Sucumbíos           | 269889.0104 | 292373.2 | 220725.2 |
| Orellana            | 300624.5449 | 368887.902 | 218234.9 |
| Santo Domingo       | 339543.5064 | 398041.596 | 299393.5 |
| Santa Elena         | 267881.3637 | 296293.139 | 251795.9 |

Source: Own elaboration.

Table 6. Market potential based on real gross value added and a distance matrix based on travel times (pmvyar): 2007–2014 (pmvyart): 2007–2014.

two weighting schemes (kilometers and travel times) over the period 2007–2014. Once again we have normalized the average growth rate of the country to 100 and the figures for each province represent deviations from the average.
The results show a positive market potential growth for all provinces being the average around 32.64%. The Oro province stands out as the leading province in this period.

Overall, our results show a clear core-periphery structure in the spatial distribution of economic activity across the Ecuadorian territory. The provinces of Pichincha and Guayas are the

| Province         | Provincial indices (2007) | Provincial indices (2014) | Growth rate (2007–2014) |
|------------------|--------------------------|---------------------------|-------------------------|
| Azuay            | 87.2198194               | 116.028501                | 33.02997119            |
| Bolívar          | 87.8949485               | 116.568137                | 32.62211257            |
| Cañar            | 87.375178                | 116.238818                | 33.03414102            |
| Carchi           | 87.0869815               | 116.445744                | 33.71199958            |
| Cotopaxi         | 87.2718546               | 116.882956                | 33.92972661            |
| Chimborazo       | 87.2788727               | 117.300344                | 34.39717997            |
| El Oro           | 83.9951413               | 121.195669                | 44.28890396            |
| Esmeraldas       | 91.5238707               | 111.571869                | 21.90466624            |
| Guayas           | 90.1252275               | 117.051358                | 29.8763528             |
| Imbabura         | 85.6533821               | 118.750588                | 38.64086286            |
| Loja             | 85.879565                | 115.17796                 | 34.11567701            |
| Los Ríos         | 87.3194179               | 116.852537                | 33.82193743            |
| Manabí           | 86.2449577               | 117.496013                | 36.23522562            |
| Morona Santiago  | 86.4107578               | 115.617322                | 33.7996855             |
| Napo             | 88.5130982               | 115.077555                | 30.01189339            |
| Pastaza          | 86.5748493               | 114.220042                | 31.93212884            |
| Pichincha        | 88.5659937               | 120.192222                | 35.70922363            |
| Tungurahua       | 87.0460036               | 116.578742                | 33.92773567            |
| Zamora Chinchipe | 86.3763184               | 115.572041                | 33.80061028            |
| Sucumbíos        | 90.7023646               | 108.305273                | 19.40733141            |
| Orellana         | 82.4137243               | 117.040982                | 42.01637301            |
| Santo Domingo    | 88.1767193               | 117.229845                | 32.94874843            |
| Santa Elena      | 94.0127261               | 110.595178                | 17.63851794            |

Source: Own elaboration.

Table 7. pmvyar Market potential growth: (2003–2014, Ecuador = 100).

The results show a positive market potential growth for all provinces being the average around 32.64%. The Oro province stands out as the leading province in this period.

Overall, our results show a clear core-periphery structure in the spatial distribution of economic activity across the Ecuadorian territory. The provinces of Pichincha and Guayas are the
leading regions. These regions are followed by those located in the coast and some of the ones located in the central Valley. The economic periphery is made up of the provinces located in the Northern and Eastern parts of the country.

| Province            | Provincial indices (2007) | Provincial indices (2014) | Growth rate (2007–2014) |
|---------------------|--------------------------|--------------------------|-------------------------|
| Azuay               | 87.2202                  | 116.0288                 | 33.0296                 |
| Bolívar             | 87.8966                  | 116.5694                 | 32.6209                 |
| Cañar               | 87.3763                  | 116.2397                 | 33.0334                 |
| Carchi              | 87.0867                  | 116.4454                 | 33.7119                 |
| Cotopaxi            | 87.2857                  | 116.9044                 | 33.9330                 |
| Chimborazo          | 87.2929                  | 117.3280                 | 34.4072                 |
| El Oro              | 83.9966                  | 121.1919                 | 44.2819                 |
| Esmeraldas          | 91.5098                  | 111.5822                 | 21.9347                 |
| Guayas              | 90.1254                  | 117.0514                 | 29.8761                 |
| Imbabura            | 85.6538                  | 118.7484                 | 38.6376                 |
| Loja                | 85.8795                  | 115.1779                 | 34.1156                 |
| Los Ríos            | 87.3189                  | 116.8518                 | 33.8218                 |
| Manabí              | 86.2448                  | 117.4976                 | 36.2372                 |
| Morona Santiago     | 86.4107                  | 115.6173                 | 33.7997                 |
| Napo                | 88.5210                  | 115.0763                 | 29.9988                 |
| Pastaza             | 86.5776                  | 114.2064                 | 31.9121                 |
| Pichincha           | 88.5663                  | 120.1930                 | 35.7095                 |
| Tungurahua          | 87.1808                  | 116.5294                 | 33.6640                 |
| Zamora Chinchipe    | 86.3761                  | 115.5714                 | 33.8002                 |
| Sucumbios           | 90.6865                  | 108.3309                 | 19.4563                 |
| Orellana            | 82.4132                  | 117.0411                 | 42.0174                 |
| Santo Domingo       | 88.1752                  | 117.2284                 | 32.9493                 |
| Santa Elena         | 93.9953                  | 110.6061                 | 17.6719                 |

Source: Own elaboration.

Table 8. pmvyart Market potential growth: (2003–2014, Ecuador = 100).
4. Lorenz curves and Gini index: an alternative analysis of concentration of the economic activity in Ecuador

To complement the analysis carried out in the previous section and with the goal of getting a more complete picture of the distribution of the economic activity in Ecuador, this section presents the results of the spatial concentration of population and GDP in space by computing the Gini index and plotting the associated Lorenz curves for 2007 and 2014.

The results of Table 9 are quite remarkable. Of the total population, 41.5% in Ecuador is concentrated in the two provinces in which the highest market potentials values are reached, Guayas and Pichincha. However, in terms of space, these two provinces only represent a 10.1% of the total area of the country. Additionally, 66.2% of the total Ecuadorian population is concentrated in six provinces; four in the coast regions and two in the valley regions. These regions represent 25.3% of the total area. The Eastern provinces represent around 46.8% of the national territory but only the 4.7% of the total population.

As Figure 1 shows, the Lorenz curve for 2007 is far from the equal distribution line. The value of the Gini coefficient for this year was 0.54. Comparing these results with those of 2014 (Table 10) gives the same image. Guayas and Pichincha keep concentrating a big share of the total Ecuadorian population. The figure for 2014 is 43.3% which means an increase in terms of concentration of population in these two provinces close to 2% over the course of these 7 years. Of the population, 66.69% is concentrated in the six provinces mentioned for 2007 (four in the coast and two in the valley). So, these data speak out clearly about a gradual process of increasing the concentration of population in Ecuador over the course of these 7 years of our analysis.

The 45% of the total Ecuadorian population is concentrated in six provinces; four in the coast regions and two in the valley regions (Figure 2).

In order to finish the analysis of the concentration of the economic activity in Ecuador, we replicate the computation but instead of working with population data we work with gross value added data. Tables 11 and 12 show the results of the computations. In the year 2007, around 51.4% of the total national GDP was concentrated in Guayas and Pichincha. Therefore, the remaining 48.6% of the total Ecuadorian gross value added is distributed over the 21 provinces left with the reinforcing effect that five provinces of the Eastern part of Ecuador generate 2.5% of the gross value added (GVA) but represent 32.3% of the total area of the country. Moreover, these data also show that production is more concentrated than population in the space.

The fact that more than 50% of the Ecuadorian GVA is concentrated in less than 10% of the territory reflects quite clearly the center-periphery pattern of the spatial distribution of economic activity in Ecuador. Again, the Lorenz curve (Figure 3) associated with these data shows the lack of an equal distribution of GVA in space.

The results for the year 2014 are repeated (Table 12 and Figure 4). Over the course of these 7 years, the concentration of GVA in space was quite stable: Guayas and Pichincha still concentrate
a share of GVA similar to that of 2007. Amazonia provinces continue to have a marginal share in the national aggregate.

The associated Lorenz curve for 2014 shows again the lack of an equal distribution in terms of GVA in space.

| Province      | POP 2007 | POP index | Area         | Area index |
|---------------|----------|-----------|--------------|------------|
| Ecuador       | 13180564 | 100       | 247576.91    | 100        |
| Guayas        | 3216811  | 24.4057   | 15430.4      | 6.2325     |
| Pichincha     | 2260935  | 17.1535   | 9535.91      | 3.8516     |
| Manabí        | 1264524  | 9.5938    | 18939.6      | 7.6499     |
| Los Ríos      | 736363   | 5.5867    | 7205.27      | 2.9103     |
| Azuay         | 668715   | 5.0734    | 8309.58      | 3.3563     |
| El Oro        | 619616   | 4.7009    | 5766.68      | 2.3292     |
| Tungurahua    | 508166   | 3.8554    | 3386.25      | 1.3677     |
| Esmeraldas    | 481426   | 3.6525    | 16132.23     | 6.5160     |
| Cotopaxi      | 456378   | 3.4625    | 6108.23      | 2.4672     |
| Loja          | 423997   | 3.2168    | 11062.73     | 4.4684     |
| Imbabura      | 405041   | 3.0730    | 4587.51      | 1.8529     |
| Chimborazo    | 387216   | 2.9377    | 6499.72      | 2.6253     |
| Santo Domingo | 302931   | 2.2983    | 3446.65      | 1.3921     |
| Santa Elena   | 238158   | 1.8068    | 3690.17      | 1.4905     |
| Cañar         | 223151   | 1.6930    | 3146.08      | 1.2707     |
| Carchi        | 166646   | 1.2643    | 3780.45      | 1.5269     |
| Sucumbíos     | 163631   | 1.2414    | 18084.42     | 7.3045     |
| Morona Santiago| 123012 | 0.9332    | 24059.4      | 9.7179     |
| Orellana      | 107167   | 0.8130    | 21692.1      | 8.7617     |
| Napo          | 94720    | 0.7186    | 12542.5      | 5.0661     |
| Zamora Chinchipe| 81418 | 0.6177    | 10584.28     | 4.2751     |
| Pastaza       | 73652    | 0.5587    | 29641.37     | 11.9725    |
| Bolivar       | 176880   | 1.3419    | 3945.38      | 1.5935     |

Source: Own elaboration.

Table 9. Concentration of population in space: provincial analysis for 2007.
Figure 1. Concentration of population in the space: Lorenz curve (2007).

| Province | POP 2014 | POP index | Area  | Area index |
|----------|----------|-----------|-------|------------|
| Ecuador  | 15990499 | 100       | 247576.91 | 100        |
| Guayas   | 4024929  | 25.2160   | 15430.4   | 6.2325     |
| Pichincha| 2891472  | 18.1149   | 9535.91   | 3.8516     |
| Manabi   | 1481940  | 9.2843    | 18939.6   | 7.6499     |
| Los Ríos | 853622   | 5.3479    | 7205.27   | 2.9103     |
| Azuay    | 796169   | 4.9879    | 8309.58   | 3.3563     |
| El Oro   | 662671   | 4.1516    | 5766.68   | 2.3292     |
| Esmeraldas| 590483 | 3.6993    | 16132.23  | 6.5160     |
| Tungurahua| 550832 | 3.4509    | 3386.25   | 1.3677     |
| Chimborazo| 496735 | 3.1120    | 6499.72   | 2.6253     |
| Loja     | 490039   | 3.0700    | 11062.73  | 4.4684     |
| Cotopaxi | 450921   | 2.8250    | 6108.23   | 2.4672     |
| Imbabura | 438868   | 2.7494    | 4587.51   | 1.8529     |
Table 10. Concentration of population in the space: provincial analysis for 2014.

| Province          | POP 2014 | POP index | Area   | Area index |
|-------------------|----------|-----------|--------|------------|
| Santo Domingo     | 411009   | 2.5749    | 3446.65| 1.3921     |
| Santa Elena       | 350624   | 2.1966    | 3690.17| 1.4905     |
| Cañar             | 253863   | 1.5904    | 3146.08| 1.2707     |
| Sucumbíos         | 200656   | 1.2571    | 18084.42| 7.3045     |
| Bolivar           | 199646   | 1.2507    | 3945.38| 1.5935     |
| Carchi            | 178228   | 1.1165    | 3780.45| 1.5269     |
| Morona Santiago   | 170722   | 1.0695    | 24059.4| 9.7179     |
| Orellana          | 148573   | 0.9308    | 21692.1| 8.7617     |
| Napo              | 117465   | 0.7359    | 12542.5| 5.0661     |
| Zamora Chinchipe  | 105213   | 0.6591    | 10584.28| 4.2751     |
| Pastaza           | 97093    | 0.6082    | 29641.37| 11.9725    |

Source: Own elaboration.

Figure 2. Concentration of population in the space: Lorenz curve (2014).
| Province          | Gross value added 2007 | 2007 GVA index | Area         | Area index |
|-------------------|------------------------|----------------|--------------|------------|
| Ecuador           | 50190086.88            | 100            | 247576.91    | 100        |
| Guayas            | 13214750.89            | 26.3294        | 15430.4      | 6.2325     |
| Pichincha         | 12611133.3             | 25.1267        | 9535.91      | 3.8516     |
| Orellana          | 3358202.066            | 6.6909         | 21692.1      | 8.7617     |
| Manabí            | 2688008.696            | 5.3556         | 18939.6      | 7.6499     |
| Sucumbíos         | 2634997.387            | 5.2500         | 18084.42     | 7.3045     |
| Azuay             | 2372847.61             | 4.7277         | 8309.58      | 3.3563     |
| Esmeraldas        | 1535676.76             | 3.0597         | 16132.23     | 6.5160     |
| El Oro            | 1485376.498            | 2.9595         | 5766.68      | 2.3292     |
| Los Ríos          | 1610362.868            | 3.2085         | 7205.27      | 2.9103     |
| Tungurahua        | 1307735.864            | 2.6055         | 3386.25      | 1.3677     |
| Santa Elena       | 967550.6039            | 1.9277         | 3690.17      | 1.4905     |
| Loja              | 886069.4937            | 1.7654         | 11062.73     | 4.4684     |
| Santo Domingo     | 873247.841             | 1.7398         | 3446.65      | 1.3921     |
| Imbabura          | 847935.3511            | 1.6894         | 4587.51      | 1.8529     |
| Cotopaxi          | 813526.0521            | 1.6208         | 6108.23      | 2.4672     |
| Chimborazo        | 805359.6217            | 1.6046         | 6499.72      | 2.6253     |
| Cañar             | 492437.3047            | 0.9811         | 3146.08      | 1.2707     |
| Pastaza           | 453855.0913            | 0.9042         | 29641.37     | 11.9725    |
| Carchi            | 329638.4857            | 0.6567         | 3780.45      | 1.5269     |
| Napo              | 308168.7469            | 0.6140         | 12542.5      | 5.0661     |
| Bolívar           | 279234.4877            | 0.5563         | 3945.38      | 1.5935     |
| Morona Santiago   | 180071.2014            | 0.3587         | 24059.4      | 9.7179     |
| Zamora Chinchipe  | 133900.6612            | 0.2667         | 10584.28     | 4.2751     |

Source: Own elaboration.

Table 11. Concentration of GDP in the space: provincial analysis for 2007.
| Province         | GVA 2014    | GVA index 2014 | Area        | Area index 2014 |
|------------------|-------------|----------------|-------------|-----------------|
| Ecuador          | 96149947.22 | 100            | 247576.91   | 100             |
| Pichincha        | 24891270.92 | 25.8879        | 9535.91     | 3.8516          |
| Guayas           | 24521159.48 | 25.5030        | 15430.4     | 6.2325          |
| Orellana         | 7777765.855 | 8.0892         | 21692.1     | 8.7617          |
| Manabi           | 5613352.904 | 5.8381         | 18939.6     | 7.6499          |
| Azuay            | 4544320.808 | 4.7262         | 8309.58     | 3.3563          |
| Sucumbios        | 3555555.515 | 3.6979         | 18084.42    | 7.3045          |
| El Oro           | 3514434.05  | 3.6551         | 5766.68     | 2.3292          |
| Los Ríos         | 3290664.887 | 3.4224         | 7205.27     | 2.9103          |
| Tungurahua       | 2529219.117 | 2.6304         | 3386.25     | 1.3677          |
| Esmeraldas       | 2226630.386 | 2.3157         | 16132.23    | 6.5160          |
| Imbabura         | 1874820.421 | 1.9498         | 4587.51     | 1.8529          |
| Loja             | 1730412.907 | 1.7997         | 11062.73    | 4.4684          |
| Santo Domingo    | 1669825.878 | 1.7366         | 3446.65     | 1.3921          |
| Chimborazo       | 1645283.493 | 1.7111         | 6499.72     | 2.6253          |
| Cotopaxi         | 1569886.543 | 1.6327         | 6108.23     | 2.4672          |
| Santa Elena      | 1294825.234 | 1.3466         | 3690.17     | 1.4905          |
| Cañar            | 955807.2926 | 0.9940         | 3146.08     | 1.2707          |
| Pastaza          | 755638.0963 | 0.7858         | 29641.37    | 11.9725         |
| Carchi           | 658539.5995 | 0.6849         | 3780.45     | 1.5269          |
| Bolívar          | 504711.7462 | 0.5249         | 3945.38     | 1.5935          |
| Morona Santiago  | 412703.5292 | 0.4292         | 24059.4     | 9.7179          |
| Napo             | 344159.0745 | 0.3579         | 12542.5     | 5.0661          |
| Zamora Chinchipe | 268959.4799 | 0.2797         | 10584.28    | 4.2751          |

Source: Own elaboration.

**Table 12.** Concentration of GVA in the space: provincial analysis for 2014.
5. Conclusions

This chapter carries out an analysis of the spatial distribution of Economic activity in Ecuador over the period 2007–2014. The methodology followed was the computation of the so-called...
Harris [1] market potential values as well as the analysis by means of the Lorenz curves and associated Gini indexes.

Our results are very conclusive about the so-called core-periphery spatial distribution of activity in space. Guayas and Pichincha provinces characterized by being the economic and political capitals of Ecuador concentrate the biggest shares of population and GDP in a fairly small amount of space. Moreover, from and geographical perspective, the so-called economic center of Ecuador is made up of the provinces located in the center and the coast.

From this perspective, the Guayas province, the main Ecuadorian port, with a steady growth in terms of agriculture, industry and services, is endowed at the same time with a very good airport and road infrastructures. It has been the economic policy in the last 10 years in Ecuador to improve the infrastructure quality of this part of the country. The potential growth of this region can be seen by taking into account that in the year 2015 the DP World company was assigned the building and administration of the Posorja port which is located in the province of Guayas with an amount of 1200 millions of dollars.

Pichincha, the province of the Ecuadorian capital, keeps its development based on the agricultural activities (growing flowers) services and industrial activities. Similarly, to the Guayas province, it has also an international airport and very good infrastructures. Both provinces are also important touristic destinations.

In the other hand, the “economic periphery” is located in the Eastern and Northern parts of Ecuador. These areas are characterized by a low economic development with very low qualification levels of its population (most of this population is made up of indigenous). The provinces in the Eastern parts of Ecuador although they are very well-endowed with minerals, especially oil, they were not fully exploited due to various political and economic reasons which limited the private investment.

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