

“Urbanization in Ecuador: An overview using the FUA definition”

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This paper presents an overview of the urbanization in Ecuador during the period 1950 – 2010. First, it is shown that Ecuador does not follow a suitable definition of urban areas, then the idea of Functional Urban Areas (FUAs) definition is introduced. In this line, 28 FUAs in Ecuador are analyzed. When Ecuadorian FUAs population evolution over time is explored, it is possible to observe that the urbanization of Ecuador had its peak between 1960 and 1980. Moreover, the highest increase of population in recent decades is mostly driven by the urban growth of small FUAs. In addition, the analysis suggests that the FUAs in Ecuador are in line with the size and structure of the FUAs of a similar developing country, Colombia, and the whole OECD sample of FUAs. Finally, it is pointed that the population of Ecuador is concentrated in the FUAs of metropolitan size (1.5 million of inhabitants or more), which are below the average of the metropolitan areas of the OECD.

JEL Classification: R12, R23.

Keywords: Developing economies, Ecuador, FUAs, OECD, Urbanization.

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1. Introduction

Cities are the engines of a country's economic activity. The global urbanization trend over the last decade shows, without doubting, that the world is more urban than rural (Pesaresi et al., 2016). However, how to define "urban" has been an important concern to the different international organizations and researchers. In fact, one of the most ambitious goal of the Organization for Economic Co-operation and Development (OECD) and European Commission is to identify and standardize the international comparability of urban areas around the world on the denomination of Functional Urban Areas-FUAs (OECD, 2013; Brezzi, et al., 2012).

The FUAs has opened the international comparison of the urbanization to more than 30 OECD and non-OECD countries, and therefore, they allow to analyze the urban spatial structure and its trend across countries under a standardized definition of urban areas (Veneri, 2017). The importance of building the FUAs relies on having a new point of view of the urbanization which becomes important for developing economies because it is considered remarkable differences in the urbanization between developed and developing economies. The urbanization in developing countries is characterized by extreme poverty and bad quality of their institutions (Glaeser and Henderson, 2017). Thus, the FUAs have allowed to international organizations and governments to consider public policies for a better urban planning.

As for the FUAs construction, the FUAs require population and commuting data. However, the lack of necessary data, especially in the developing countries, has become a barrier in their identification process. In those cases, several approaches have been used to identify them where there is not the standard data available. For example, the OECD applies an alternative method to identify the FUAs in China (OECD, 2015). Although, the Chinese FUAs identification does not have the standard methodological approach, they allowed to understand the urbanization system and economic performance of the Chinese functional urban areas. The result shows that the Chinese FUAs are growing more concentrated with 15 urban areas with more than 10 million of inhabitants.

Recently, Obaco et al. (2017) also propose an alternative approach to identify FUAs. This methodology is applied in Ecuador. However, FUAs that were identified in Ecuador have not been compared with the international FUAs of OECD database as it has been done for the majority of cases. The underlying reason is given by the fact that Ecuador is not member of the OECD. Thus, this paper contributes to analyze the evolution of urbanization in Ecuador under the FUAs definition and compare the FUAs in Ecuador with the international context

of the OECD. Additionally, the contribution of this work to the literature of the FUAs is twofold. First, the comparison of the FUAs of Ecuador in the international context will show if the Ecuadorian FUAs, based on a different methodological approach, have a similar urban structure of the FUAs of the OECD based on its standard approach. Indeed, comparing FUAs allows to go further when anomalies in the patterns of countries with similar characteristics are found. Second, this paper will also check the evolution of the Ecuadorian urbanization applying a different concept of urbanization.

Results suggest that FUAs in Ecuador are in line with the size and structure of the FUAs of a similar developing country such as Colombia, and the whole OECD sample of FUAs. We also show that the share of the population concentrated in the FUAs of metropolitan size (1.5 million or more) in Ecuador are below the average of urbanization of the OECD sample. When the evolution over time of the FUAs population is explored, we can observe that the urbanization of Ecuador has faced the highest increase of population between 1960 and 1980. Moreover, another interesting finding is that the highest increase in the population in the recent decades is mostly driven by the urban growth of small FUAs.

The rest of this work is structured as follows. Section two presents the related literature. Section three shows the introduction to the urbanization in Ecuador, while section four introduces the FUA identification in Ecuador. Section five presents the data, while the Ecuadorian urbanization through the FUAs definition is presented in section six. Section seven shows the Ecuadorian FUAs in the international context. Finally, section eight presents the conclusions of the paper.

2. Related literature

Several approaches have been used to define urban areas. The delimitation of an urban area can be driven by a morphology, demography, or socio-economic point of view (Ferreira et al., 2010). In particular, this work focuses on the economic definition of cities which implies a functional delimitation of urban areas from a socio-economic perspective. In that sense, a city is a dense area that can be considered an independent market in which supply and demand for goods and production factors are traded and an equilibrium price exists.

Commuting flows between cities is, by far, the most popular means of functional cities labelled as Local Labor Markets (LLMs), which was developed in the US at the beginning of the 90s. Commuting flows are also used for the identification of Metropolitan Areas (Duranton, 2015; Puderer, 2008; Adams et al., 1999). The use of commuting flows has been widely used in this literature.

That is the case of Fox and Kumar (1965) who propose a method to create local areas based on commuting data, merging spatial areas hierarchically according to workers' daily travels. Similarly, Coombes et al. (1986), among others, systematize this procedure by developing algorithms that are widely used in many countries and regions in which the idea is to have a minimum of self-containment of commuting flow within the LLMs (Casado-Díaz and Coombes, 2011).

However, the international comparability and the collection of statistical data are general problems as most countries use different conceptions to define their metropolitan areas. One of the most ambitious efforts of the Organization for Economic Cooperation and Development (OECD), jointly with the European Commission, is the identification and standardization of the economic urban areas labelled as Functional Urban Areas (FUAs). This methodology identifies 1,251 FUAs of different sizes in more than 31 countries, which gave as a further result of the OECD metropolitan dataset, which considers close to 300 cities with populations of 500,000 inhabitants or more. Nowadays, many researchers prefer the use of FUAs to perform economic analyses (OECD, 2013, OECD, 2016; Schmidheiny and Suedekum, 2015; Veneri, 2016, 2017) instead of simply geographical delimitations.¹ For example, Veneri (2016) finds a better fitting model for the zip's law using FUAs rather than the administrative boundaries given by the countries, and Veneri (2017) analyzes the urban spatial structure of the FUAs across the world and find that there is an increasing trend in the decentralization of the urban areas. Moreover, Ahrend et al. (2017) and Matano et al. (2018) analyze agglomeration effects on labor productivity using FUAs as units of analysis.

In detail, FUAs involve three identification steps (OECD, 2013). First, it is explored the population density of the country, looking for grid cells of high population density (grid cells with a minimum of 1,000 or 1,500 inhabitants –set by the researcher- per km²). Next, it is identified clusters of grid cells of high population density. Then, those clusters should contain a minimum of 50,000 or 100,000 inhabitants to be considered as an urban core, depending on the country. These urban cores allow to identify the municipality of reference (head of the FUAs). However, a minimum of 50% of the population must be contained in the urban core. In the second step, those urban centers are connected as part of one FUAs if two urban cores share at least a minimum of commuting flow (15%).² In

¹ For more information and list of countries, see <http://www.oecd.org/cfe/regional-policy/functionalurbanareasbycountry.htm>

² Polycentric FUAs is where there are two or more urban cores within the FUA. In many European countries the minimum commuting flows applied might reach up to 50% (OECD, 2012).

a third step, it is identified the hinterland, which includes all the surrounded areas that are not urban areas, but they are connected to the urban cores through a minimum of commuting flows as well. The minimum is the same that has been applied in the second step.

The OECD concept of FUAs has also been extended to those countries that are not OECD members because generally they do not account for an own economic definition of urban areas. In this case, the FUAs allow to compare, to evaluate and to elaborate recommendations of public policies and urbanization around the world. However, the lack of adequate data to elaborate the FUAs is a main barrier in these countries. For example, in China (OECD, 2015), the very same OECD modifies the FUAs methodology to take advantage of the available information or characteristics of the country. In this case, a different minimum threshold to identify urban cores is applied (550 inhabitants per km²) as this country is not densely populated across the territory. To connect urban cores and determine the hinterland, it is applied a decay function of the expected commuting zone.

Similarly, Obaco et al. (2017) present a different methodology to identify FUAs where there is not commuting data. The approach is based on a varying travel time to connect urban cores and determine the hinterland of each FUA. The final coverage of the travel time will depend on the geographical extension of the urban cores because it is shown that larger urban cores have on average more influence zones. However, this model needs a calibration of the parameters to apply the varying travel time model. The model is based on the estimated parameters from Colombia.³ Then, the model is applied in Ecuador. Following this work, and the simplicity of the model to identify FUAs, the OECD has used the same travel time approach to identify FUAs in other developing countries such as Morocco and Viet Nam (OECD, 2018). However, the FUAs identified in Ecuador have not been explored and have not been compared with the international OECD database. In this work, we cover this gap.

3. Urban definition in Ecuador

Ecuador is a small developing open economy. It lies on northwest coast of South America. It limits with Colombia at the north, Peru at the east and south, and the Pacific Ocean at the west (see panel A of figure 1). Ecuador has an area of 283,561 km² and it is formed by four natural regions: The Coast, the Highlands, the Amazon and the Galapagos Islands. Administrative division of Ecuador is based on three levels. From higher to lower: provinces (25), cantons

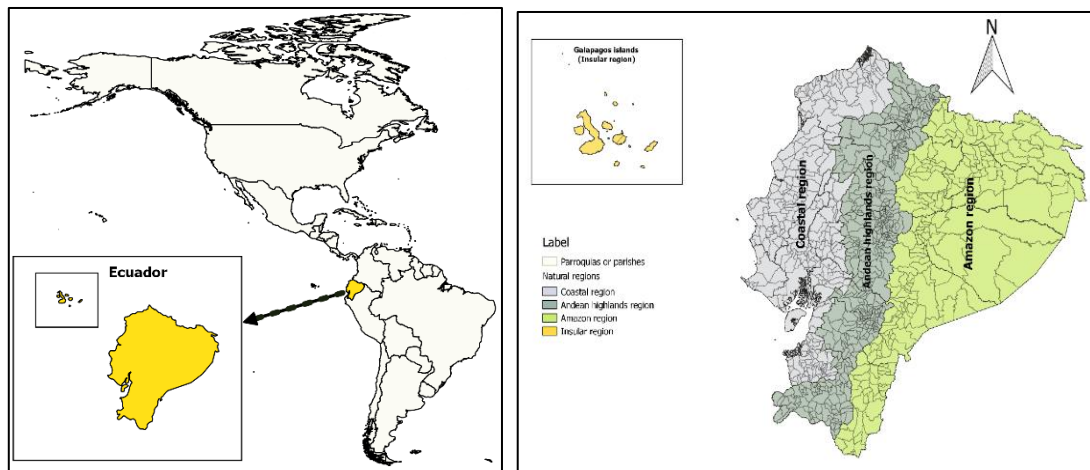
³ For more detail, see Obaco et al., 2017.

(224), and parishes (1,024), (see panel B of figure 1).⁴ Provinces are the most aggregated administrative division; meanwhile parishes are the closest to the conceptualization of municipality. Ecuadorian authorities consider urban areas as inhabitants living in the head of each canton, otherwise they are rural areas. Thus, this characterization of urban does not consider peripheral population beyond the head of the cantons.

In terms of population, Ecuador has about 17 million inhabitants in 2018. In terms of ethnicity composition, Ecuador has a variety of self-identification ethnic groups such as mestizo (majoritarian), indigenous, white, black and others. As for the urbanization, it is considered that Ecuador has faced a rapid urbanization process since 1960 (Villacis & Carrillo, 2012). The current urbanization rate is about 65%, being lower than the average of Latin America that is around 70%. However, Ecuadorian urbanization process is characterized by extreme poverty. It is considered that around 35% of the urban population in Ecuador lives in slums in 2014 (UN, 2015).

Considering the Ecuadorian authority definition of urban as a starting point, most of the population is concentrated in two urban parishes: Guayaquil, which is in the Coast, and Quito, which is in the Highlands. According to the 2010 census, these two cities have 27% of the total population, and the 35% of the total urban population; thus, these two urban areas could be considered as metropolitan cities, nevertheless only Quito has this category.⁵

Figure 1. Ecuador



Source: INEC-Ecuador, Administrative boundaries based on the year 2010.

Elaboration: The authors.

⁴ Numbers of administrative divisions according to the 2010 census of population and dwelling.

⁵ According to the 2010 census, the four most populated cities are Guayaquil has 2'291,158 inhabitants, Quito has 1'619,146, Cuenca has 331,888 and Santo Domingo has 305,632 inhabitants.

4. FUAs identification in Ecuador

As it was mentioned, the urban identification in Ecuador does not follow international standards of urban areas. Thus, we cannot determine the total number of cities existing in Ecuador. We focus only in the FUAs identification to explore urbanization in Ecuador.

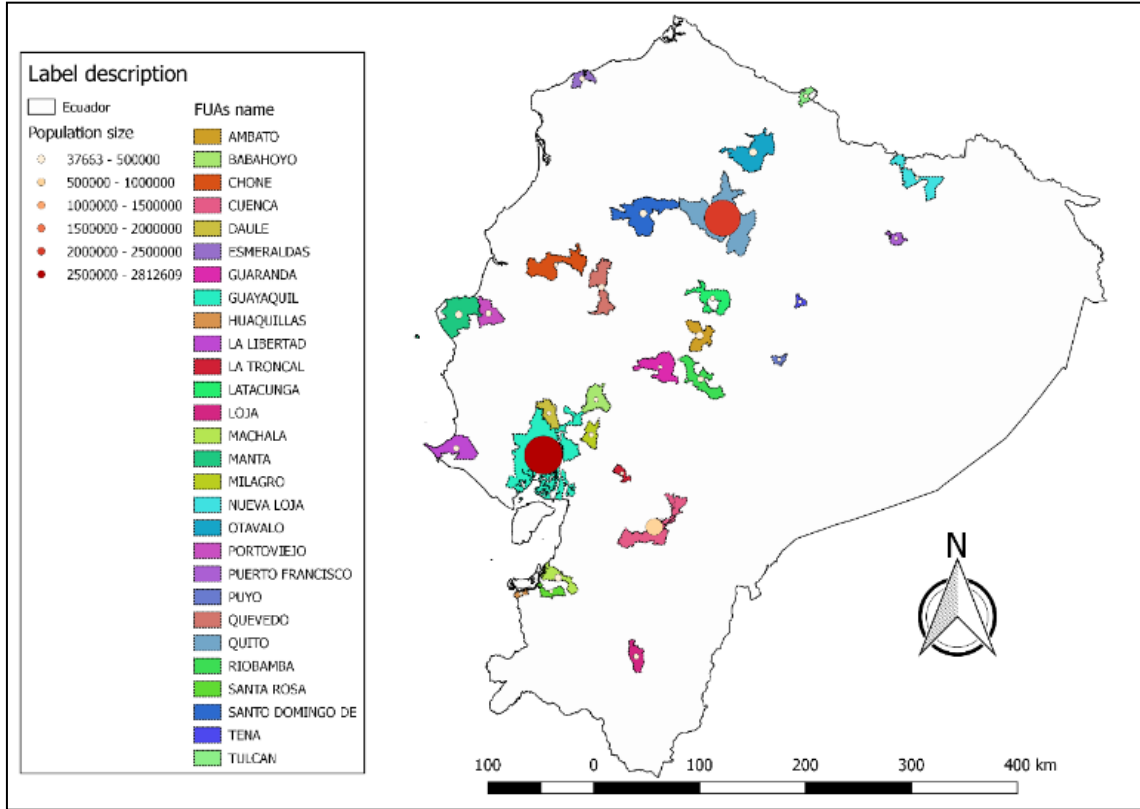
We use the FUAs identification made by Obaco et al. (2017).⁶ These authors based on satellite imagery of LandScan data to identify population density and travel time using the road network system of Google maps and Open Street Maps to cover the connection between urban cores and the hinterlands. Data used for the identification is between 2010 and 2014. The novelty of this approach is given by allowing to vary the travel time according the parameters of expansion that are calculated on the geographical extension of the urban cores. The parameters for the travel time model which is based on the commuting flows of Colombia. Then, it is applied in Ecuador. The preferred identification of FUAs is based in which allows to verify more urban cores across the country. As Ecuador is not a densely populated country, authors analyze the 28 FUAs that were identified under a minimum threshold of 500 inhabitants or more per squared kilometer and 25,000 inhabitants in order to be considered as an urban core. The 28 FUAs allow to have representative urban cores in the Amazon (not highly populated region). They are composed by 34 urban cores in Ecuador, allowing for some polycentricity structure. If the thresholds were increased to the minimum applied by the OECD (1,000 inhab. and 50,000 inhab. to be an urban core), 20 urban cores could be identified with a total of 20 FUAs. Thus, we present the main analysis using the 28 FUAs. Moreover, results do not change when the 20 FUAs are analyzed as they are mostly small sized. Thus, the model was validated on sensibility test and robustness checks.

Figure 2 shows the 28 identified FUAs in Ecuador. The Ecuadorian FUAs system is majorly dominated by small FUAs. The two FUAs of metropolitan size are Guayaquil and Quito. There are 11 FUAs in the Coastal region, 13 in the Highlands, and 4 in the Amazon. Thus, we have a sample that covers urbanization even in the less populated zones of Ecuador. In Galapagos the population density is too much lower than in the Amazon, thus the Galapagos Islands are not included in the final list of FUAs. The Ecuadorian FUAs show the heterogeneous composition in terms of administrative boundaries because they are very small in the Highland, and large in Coastal and Amazon regions.

⁶ For further detail, see Obaco et al. (2017).

However, the administrative boundaries are relatively large compared with the urban core extension in most of the cases. The FUAs cover around the 7% of the total country extension and the two metropolitan areas around 3% of the total country's extension.

Figure 2. FUAs in Ecuador



Source: INEC-Ecuador, and Obaco et al. (2017). Administrative boundaries and population based on the year 2010 -2014.

Elaboration: The authors.

5. Data

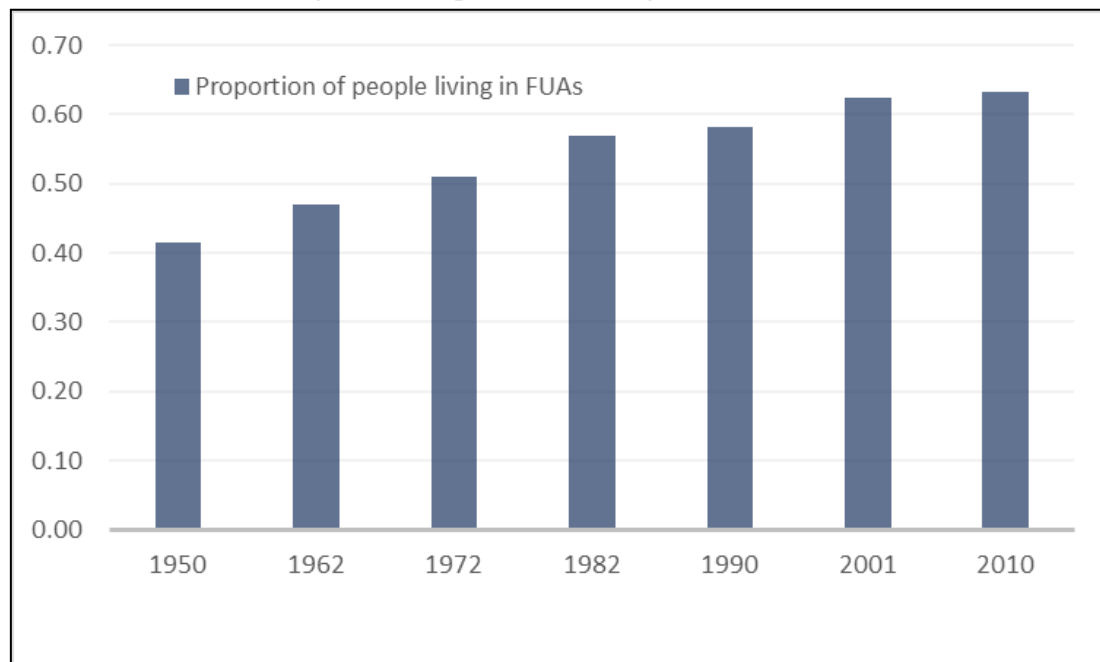
We use information from the Ecuadorian censuses in order to explore the urbanization process over time. The first census was in 1950. The historical population comes from the National Institute of Statistical and Census (INEC).⁷ To compare the FUAs of Ecuador with the international OECD dataset, we divide the OECD's FUA in four groups: OECD, Europe, Colombia and Ecuador.

⁷ The data from Ecuador is available at <http://www.ecuadorencifras.gob.ec/banco-de-informacion/>. Moreover, we assume that the geographical extension of the FUAs identified through the period 2014 – 2010 are the same and fixed over time, because there is not information of the historical boundaries of the parishes over the time. The OECD database is available at <http://www.oecd.org/cfe/regional-policy/functionalurbanareasbycountry.htm>.

6. Urbanization in Ecuador

Figure 3 shows the total FUAs population according to their respective Ecuadorian censuses. The number of people living in FUAs has rapidly increased between 1950 and 2010. In 1950, the total FUAs population was around 40% of the total population, being mostly settled in the rural area. In 1972, the population living in FUAs reached around the 50% of the total; and, in 1990, the population living in FUAs reached the 60%. For 2010, the total population living in FUAs is around 63%. Thus, the highest increase in the urban population is presented from 1962 to 1982, around 0.77% per year.

Figure 3. Population living in the FUAs



Source: INEC, Ecuador.

Elaboration: The authors.

Table 1 shows the average of the FUAs size distribution of the 28 FUAs according to the information gathered in the censuses. In 1950, the FUAs size distribution was below 0.5 million, composed by 26 FUAs of below 0.2 million and 2 FUAs between 0.2 and 0.5 million. In 1990, appears the first FUAs of large metropolitan size, and one FUA between 0.5 and 1.5 million, 3 FUAs were between 0.2 and 23 FUAs were below 0.2 million. In 2010, the distribution is given by 2 FUAs larger than 1.5 million, there are no FUAs between 0.5 and 1.5 million, 10 FUAs were between 0.2 and 0.5 million, and the remaining (16 FUAs) were below 0.2 million.

Table 1. FUAs size distribution in Ecuador (Average size)

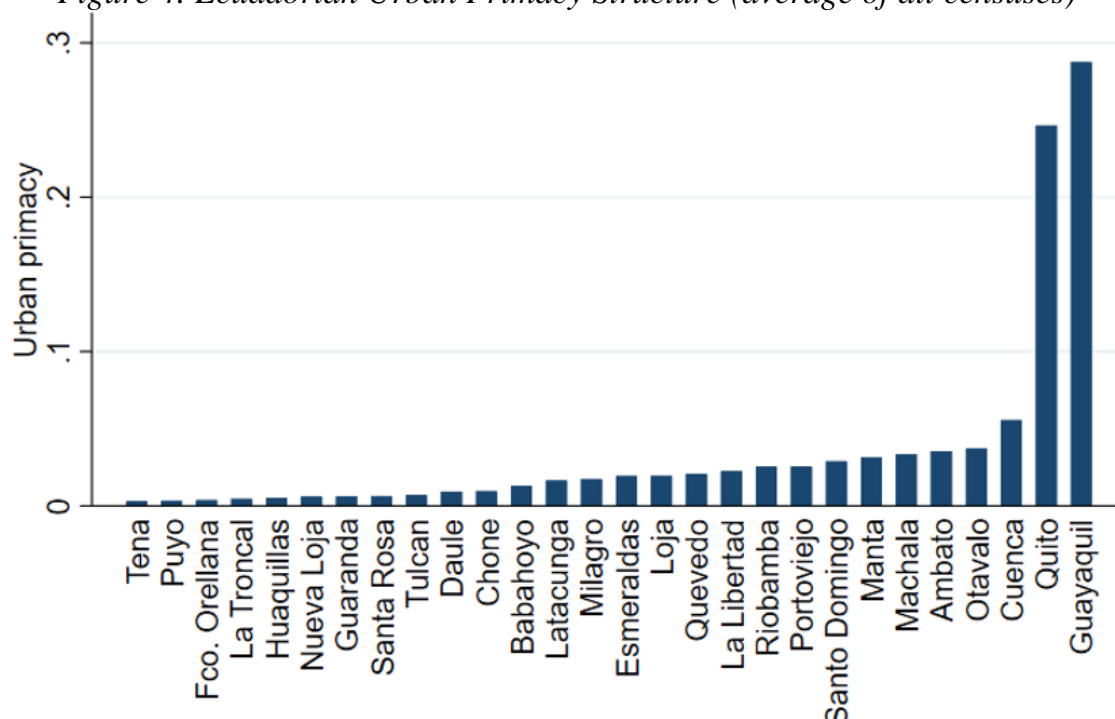
FUAs	1950	1962	1974	1982	1990	2001	2010
FUAs greater than 1.5 M					1,611,884	2,028,966	2,436,027
FUAs between 0.5 - 1.5 M		544,506	812,374	1,173,644	1,376,630		
FUAs between 0.2 - 0.5 M	292,986	458,255		253,454	245,632	284,534	291,813
FUAs less than 0.2 M	28,577	42,476	65,218	79,505	80,529	91,241	86,048
no FUAs	1,873,765	2,368,872	3,201,281	3,472,337	4,070,608	4,566,649	5,316,535
Total population	3,202,757	4,476,007	6,521,710	8,060,712	9,648,189	12,156,608	14,483,499

Source: INEC, Ecuador.

Elaboration: The authors.

Figure 4 presents the average of the urban primacy of the FUAs in Ecuador for the period 1950-2010. We can observe the primacy of the two largest FUAs, Guayaquil and Quito during the whole period of time. However, in the last decades the urban population has been mainly driven by the small FUAs, while the largest cities have grown slowly. In detail, from 1962 – 1982, the largest urban population change has been experimented in the Amazon and Coastal cities.

Figure 4. Ecuadorian Urban Primacy Structure (average of all censuses)



Source: INEC, Ecuador.

Elaboration: The authors.

7. The international context

Figure 4 shows the composition of the Ecuadorian FUAs system and a comparison to OECD countries, Europe, and Colombia in the year 2014. The comparison to Colombia is relatively important because both, Ecuador and Colombia share borders.⁸ There were identified 53 FUAs in Colombia. As we can see, both systems are quite homogeneous. The Ecuadorian urban structure is still growing, and this growth is based on the small and medium sized FUAs (lower than half million inhabitants). If we compare the FUAs in Ecuador identified with the minimum threshold applied by the OECD, the same structure of these FUAs are based on the small FUA size. Additionally, a weak composition of metropolitan size (between 0.5 and 1.5 million inhabitants) is observed.

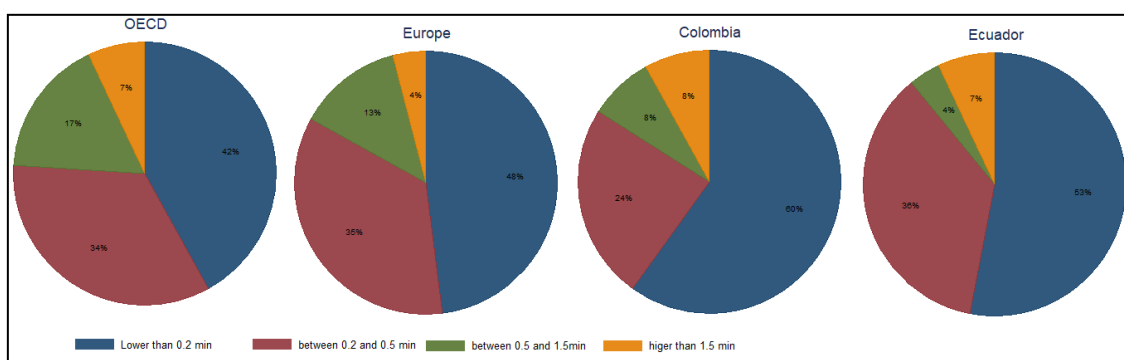
Clearly, Ecuadorian FUAs structure follows the international pattern. Europe is the exception since it has a more diverse composition. Furthermore, like Ecuador, Colombia has larger administrative boundaries compared with the real extensions of the urban cores.

Figures 5 shows the share of population contained in the FUAs of metropolitan size with respect to the total population by country. When the FUAs of metropolitan size (Guayaquil and Quito) of Ecuador are compared with 290 FUAs of the metropolitan size of 32 countries, the Ecuadorian metropolitan areas are below the global average, and even below their Latin America partners (Colombia, Chile and Mexico).⁹ The same results are obtained when we compared with the 20 FUAs of different threshold.

⁸ The Latin America sample of FUAs considers Mexico, Chile and Colombia. We use this year because the FUAs of Ecuador and Colombia have full information for this year. The OECD sample does not present information either for the FUAs of Ecuador and Colombia.

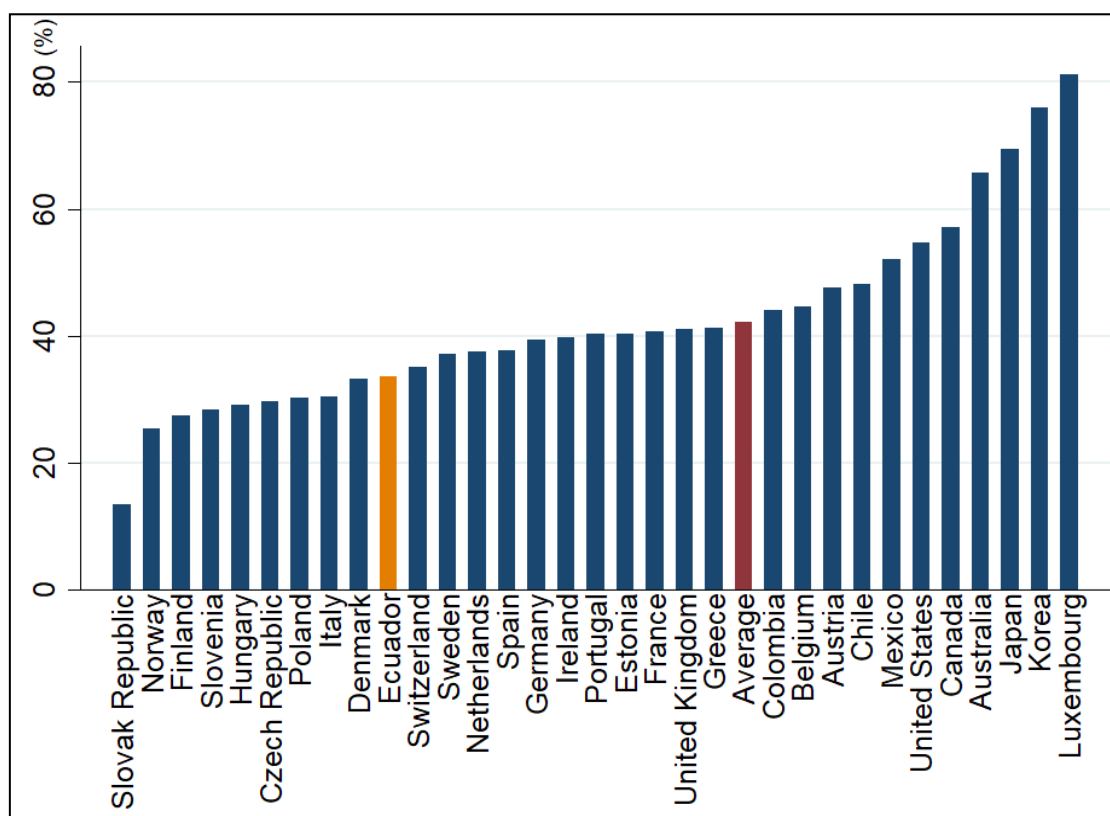
⁹ Information of the FUAs was gathered from <https://measuringurban.oecd.org/#story=0>, the Information of Ecuador was taken from Obaco et al. (2017). Information about Turkey and China are not available yet.

Figure 4. FUAs size classification in the year 2014



Note: Information taken from OECD and INEC, Ecuador. Elaboration: The authors.

Figure 5. Share of metropolitan areas in overall population in the year 2014



Note: Information taken from OECD and INEC, Ecuador.

Elaboration: The authors.

8. Conclusions

This work presents the urbanization process of Ecuador using the concept of Functional Urban Area and also compares with the international context. As for the urbanization in Ecuador several considerations are obtain. First, we show that Ecuador does not provide a clear concept of urban areas that draws the attention. Second, the lack of commuting data is also presented in the country. These two important facts are relevant for a better planning of urban areas.

Later, we analyze 28 FUAs identified in Ecuador. Most FUAs are small size, one of medium size and two of large metropolitan sizes in Ecuador. The largest increasing of the urban population is given during the period of 1962 – 1982. Additionally, the two largest cities, Guayaquil and Quito, are being prevailing over time, although the urban growth is mainly driven by the small FUAs in the last decades. This is important because it could show some trend to the decentralization of the urban system.

Next, we compare the data of Ecuador with the international database of the OECD. The FUAs of Ecuador also follow the composition of the urban structure of Colombia and the whole sample of the OECD that means to be composed mainly by the small FUAs size. Moreover, the largest two Ecuadorian cities are below the average of the metropolitan FUAs of the OECD.

Finally, we highlight the importance of standardizing the concept of urban areas to give a better comparison among countries. In this line, the OECD presents an important advance in the collection of data that is shown in this work.

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