

Amenity index at the subnational level in Ecuador

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1. Introduction

The Latin American countries are the most unequal countries in the world, not only considering income inequality across individuals but also across regions within countries. Specifically, in Latin America, on average, the ratio between the richest region and the poorest region is approximately 8 times while in OECD countries, this ratio reaches only 2 times (Silva Lira et al. 2010). In Ecuador, the VAB per capita (excluding oil) of the richest region is 33.5 times higher than that of the poorest region. Such high disparity across regions in economic terms is reflected in an unequal availability of basic services, transport activity, cultural amenities, and urban infrastructure in general. Thus, people living in lagged regions with limited availability of such amenities are prone to move to larger places looking for better life conditions. According to Albouy et al. (2021), people migrate to pursue better incomes as well as better amenities. In this sense, laggard regions with already limited urban amenities lose working people, which move to the rich regions, augmenting regional disparities. For this reason, regions, specifically those that are left behind, need to attract and more importantly, retain population to improve their development and resilience (OECD, 2023). This requires investment to increase and improve their basic conditions in terms of transportation, health and educational infrastructure, entertainment, and culture activities, and other urban amenities. This study, looking at the Ecuadorian case, aims to construct an amenity index at the subnational level including several dimensions.

Data and Methodology

To conduct this study, data was exhaustively collected from several information sources. We use data at two geographical levels: provincial and cantonal, and 57 variables grouped in 11 dimensions: 1. art, 2. food services, 3. education, 4. entertainment-sports, 5. childcare and eldercare institutions, 6. health, 7. utilities, 8. transport activity, 9. social capital, 10. environment quality and 11. security. Using this exhaustive data, a principal component analysis (PCA) is conducted in two stages. In the first stage, 17 partial indexes were constructed using PCA and based on these subindices, a global index of amenities was constructed. Two temporal approaches were analyzed: a global index using information between 2009 and 2020 and an evolutive approach using three indexes for 2012-2014, 2015-2017 and 2018-2020.

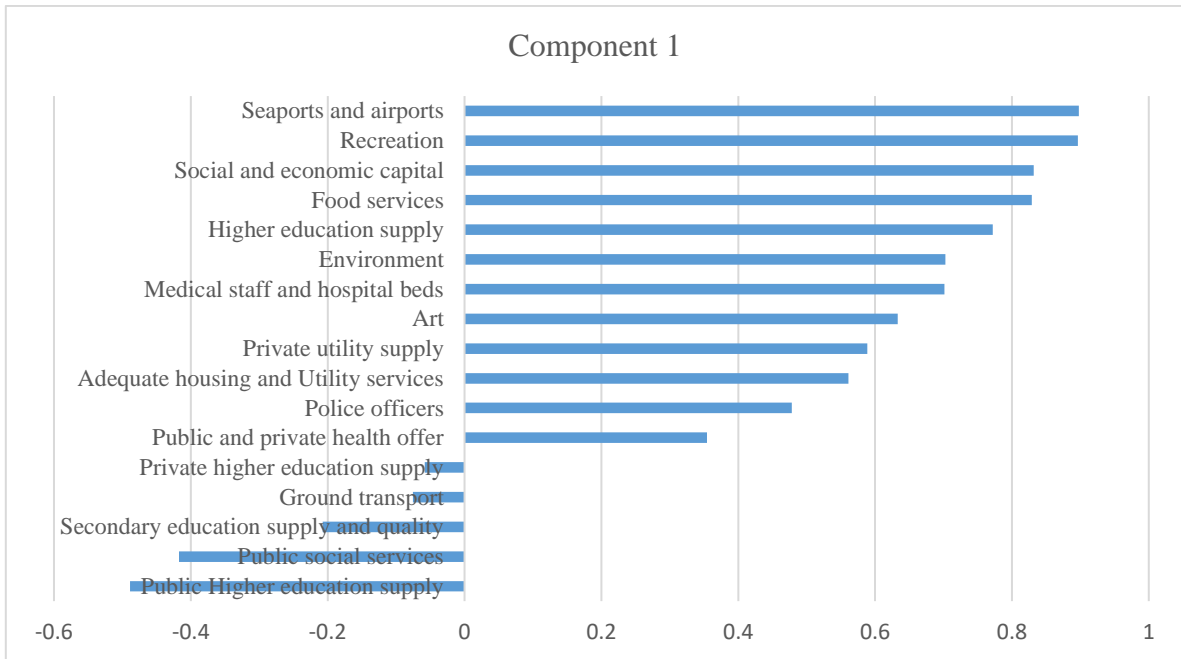
Results

Resulting synthetic indexes depend on the data employed. The principal components of the provincial and cantonal indexes differ. The global amenity indexes at the provincial and cantonal level are explained by two components in 62.4% and in 41.2%, respectively.

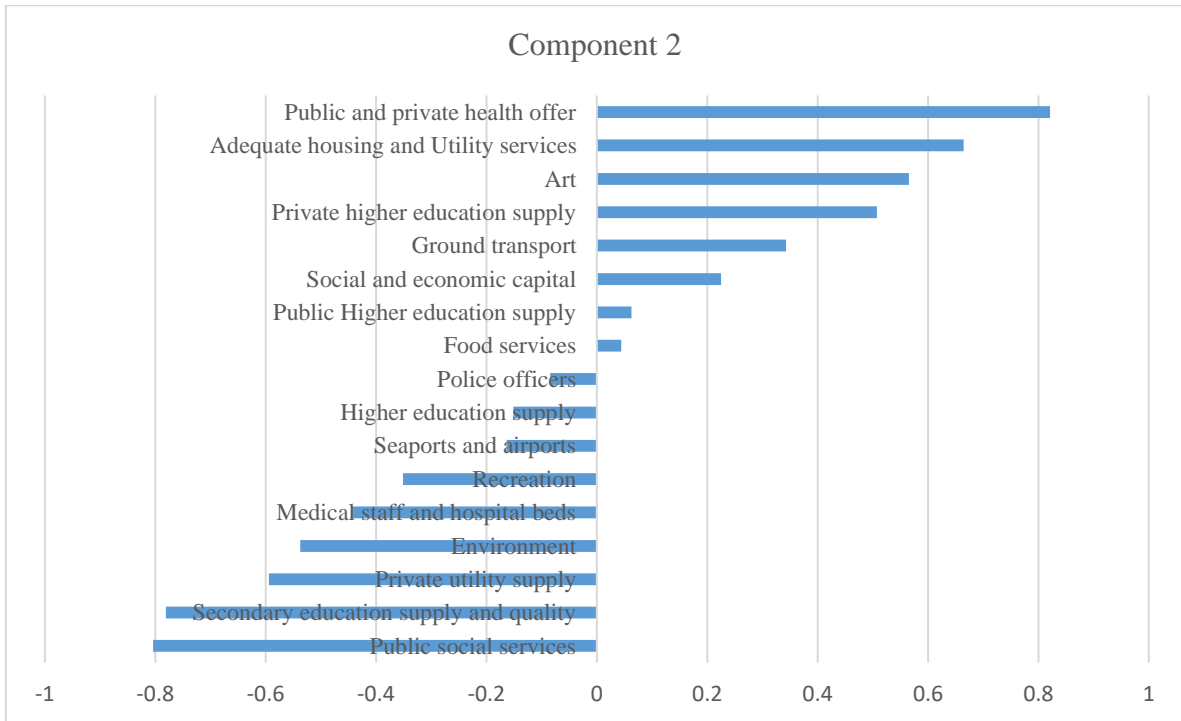
The global Amenity Index at the province level is composed of 17 subindices and at the cantonal level, it is composed of 19 subindices, based on the obtained indices for each dimension in the previous stage. The cantonal index includes, in addition to the 17 subindices of the provincial index, 1 subindex from the social services dimension and 1 subindex from the security dimension. For the provincial Amenity index, the first and second principal components account for 38% and 24.4% of the total variance, respectively, totaling 62.4% of the total variance. As seen in Figure 1, the first principal component is highly related to many amenities such as seaports and airports, recreation activities, social and economic capital, food services, higher education supply, environmental amenities, health staff and infrastructure, art, private utility supply, adequate housing and utility services and police officers. This first component is negatively correlated with public higher education and public social services. This index is called Market amenities and environment care. Figure 3 shows that provinces with high scores in this index (darker purple) are Galapagos, Pichincha and Pastaza, which implies that these provinces are attractive for private firms which provide many services in different aspects, improving the urban amenities in these places. In addition, these provinces are characterized by a good performance in environment care. Provinces with low scores in this index (lighter purple) are Los Ríos, Esmeraldas and Santa Elena. This result implies that these provinces are less attractive to firms and therefore, less urban services exist. The low level of market-created amenities is combined with more public social services and public higher education.

The second principal component (see Figure 2) of the provincial Amenity index is highly and positively related to public and private health services, adequate housing, art and private higher education supply, and negatively related to public social services, secondary education supply and electricity and waste treatment. Overall, this index is called Infrastructure in health, private higher education, housing and art. In Figure 4 is shown that provinces with high scores in this index (darker purple) are Pichincha, Azuay and Tungurahua. Those provinces have adequate utility provision, health and higher education services but a low level of public social services and basic education. Provinces with low scores in this index (lighter purple) are Morona Santiago, Pastaza and Galápagos, which indicates that these provinces are characterized by a low level of private higher education and a high level of basic education establishments, childcare and eldercare, basic services such as electricity and waste management.

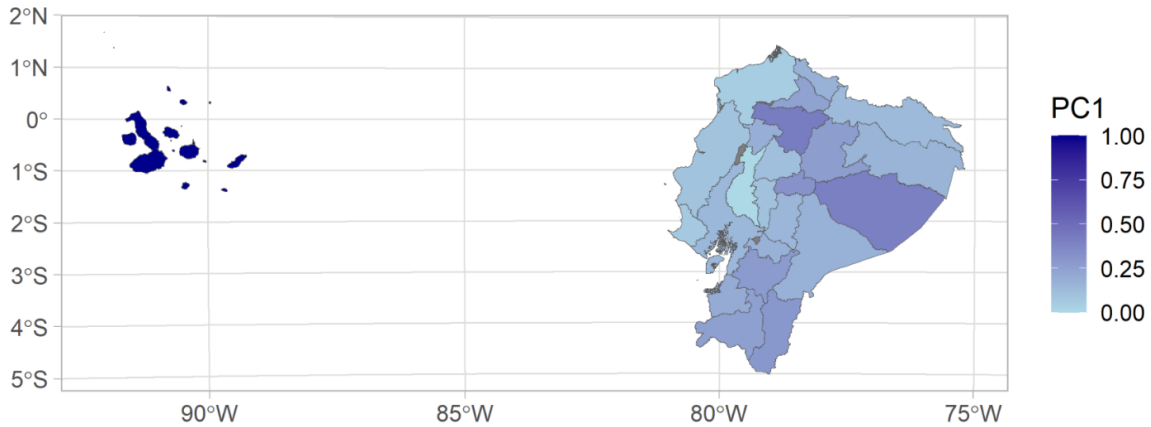
Insert Figure 1. Correlations between the first component of the provincial index and the dimensions of the index.



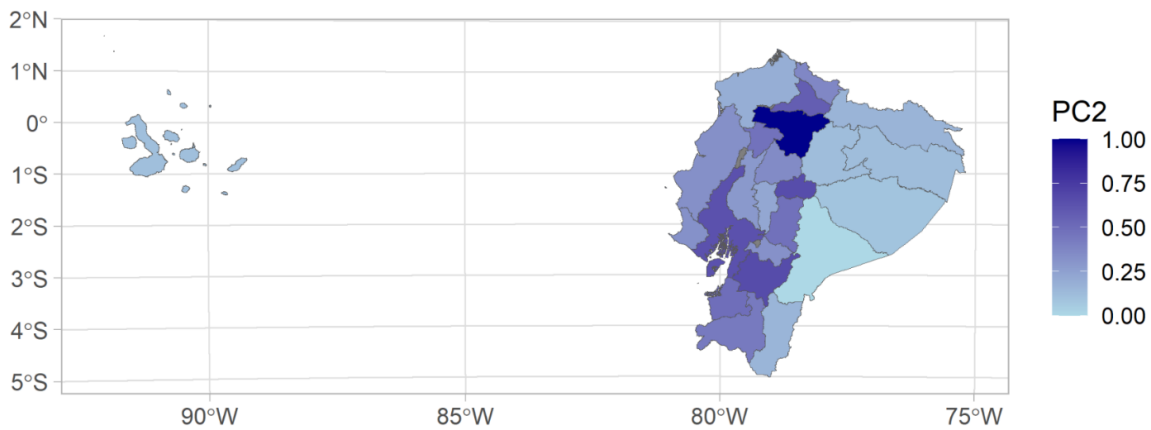
Insert Figure 2. Correlations between the second component of the provincial index and the dimensions of the index.



Insert Figure 3. Heat map of the first component of the provincial index called Market amenities and environment care.



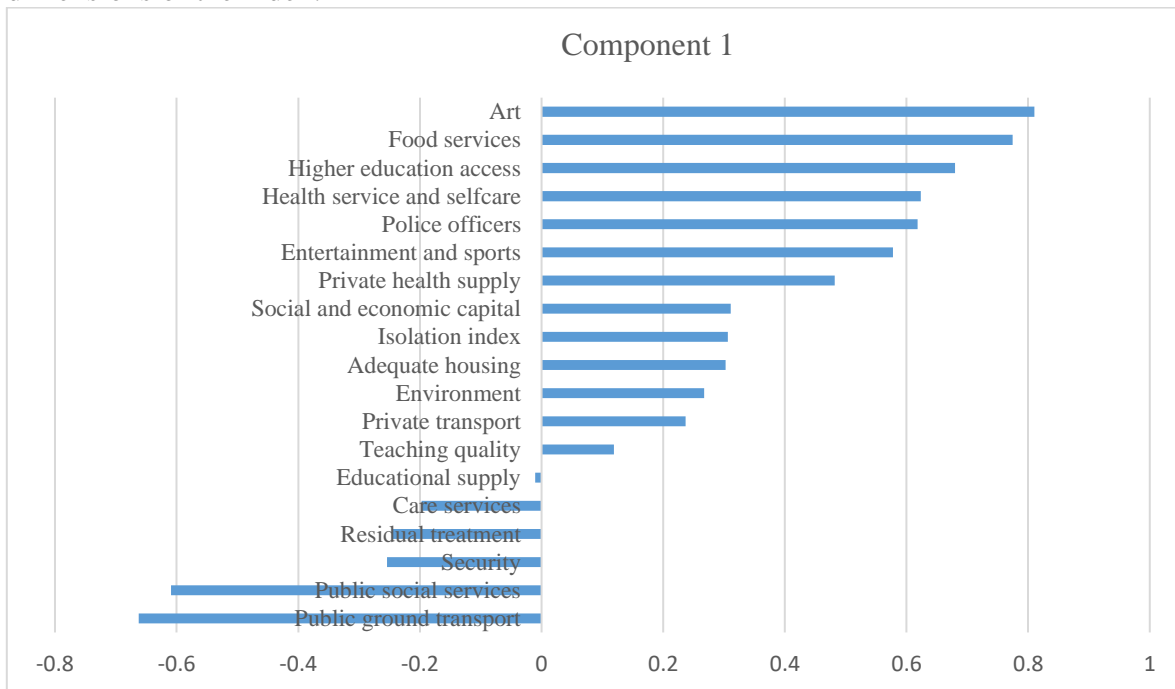
Insert Figure 4. Heat map of the second component of the provincial index called Infrastructure in health, private higher education, housing and art.



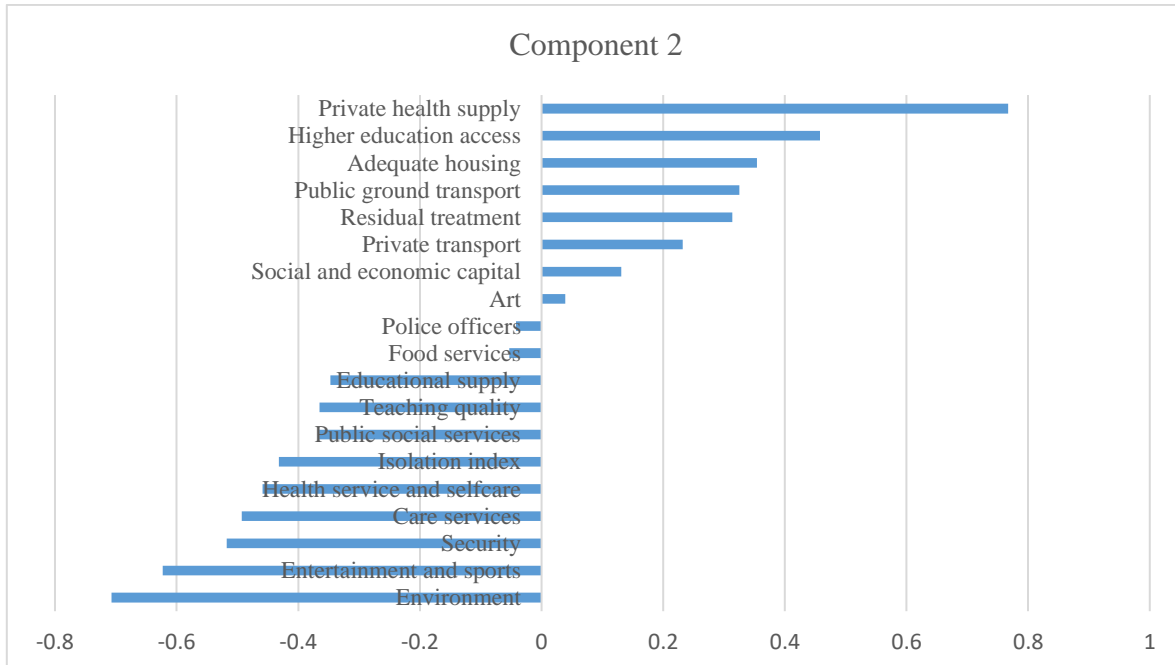
For the cantonal Amenity index, the two principal components account for 41.2% of the total variance. As shown in Figure 1, the first principal component is highly and positively related to art, food services, higher education access, health service and selfcare, police officers, entertainment and sports and private health supply and negatively related to public ground transport and public social services. This index is called Services and quality of life index. Cantons with the best scores in this index are San Cristóbal, Santa Cruz, Quito and Rumiñahui. Cantons with the worst scores are Chilla, Taisha, Olmedo y Huamboya.

The second principal component (see Figure 5) is highly and positively related to private health supply and higher education access and negatively related to environment and entertainment and sports. Therefore, this index is called private health and higher education. As shown in Figure 8 Cantons with the best scores in this index are La Libertad, Durán, El Triunfo, Quevedo and Quito. These cities have a good provision of private health services and higher education access but a low provision of entertainment and sports activities. Cantons with the worst scores are San Cristóbal, Isabela, Aguarico and Arajuno, which indicates that these cities have a low provision of private health supply and higher education access but good provision of entertainment and sports activities.

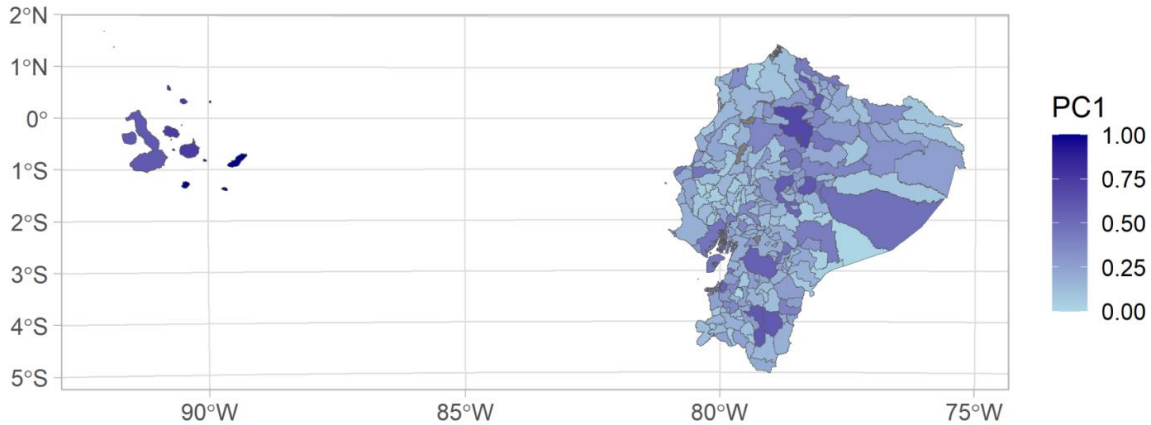
Insert Figure 5. Correlations between the first component of the cantonal index and the dimensions of the index.



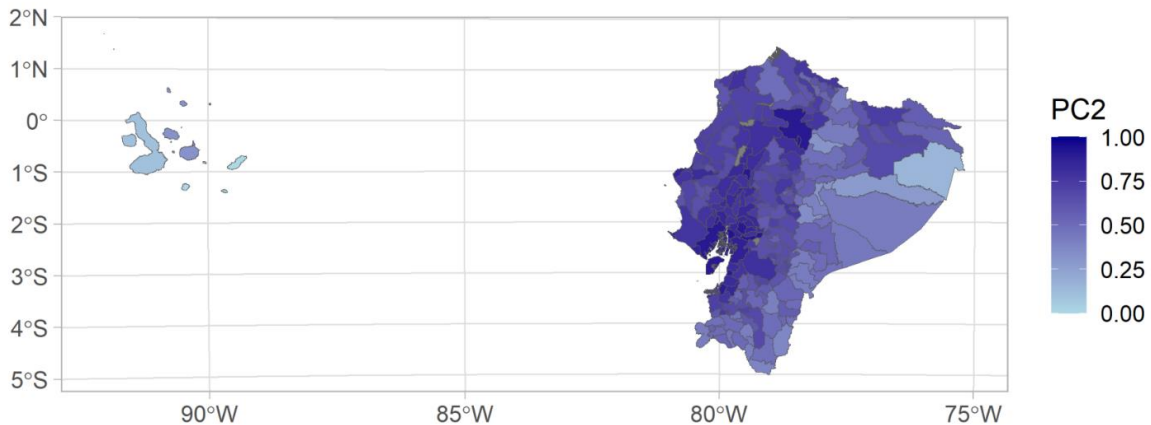
Insert Figure 6. Correlations between the second component of the cantonal index and the dimensions of the index.



Insert Figure 7. Heat map of the first component of the cantonal index called Services and quality of life index.



Insert Figure 8. Heat map of the second component of the cantonal index called private health and higher education.



4.1 Provincial and cantonal Rankings

The provincial/cantonal rankings, shown in the Appendix C, were constructed based on the average of the positions of each province/canton in each dimension of the Amenity index. Galapagos, Tungurahua, Pichincha, and Azuay are at the top of the provincial ranking with position averages of 5.88, 8 and 8.24, respectively. Galapagos, a province dedicated to tourism, is positioned in the first quintile, mostly in the first position, in 13 dimensions: food services, art, security, environment, public social services, air and maritime infrastructure, social capital, recreation, adequate housing, public basic services, higher education supply, high school education supply and public health services. However, Galapagos ranked in the last positions in the diversity index of the public higher education and private supply of primary and secondary education. Tungurahua excels in ground transportation and in the high school education and quality index. Pichincha, the home of the country's capital, occupies positions in the first quintile in 8 dimensions: art, high school education and quality index, private supply of primary and secondary education, public social services, private health services, adequate housing, air and maritime infrastructure, and social and economic capital. Nevertheless, its performance in environment and safety appears among the worst. Guayas, which is the home of the largest city in Ecuador, does not appear in the first positions of the ranking, it is at the 17th position. In the Coastal and Amazon regions, the best-ranked

provinces are Santo Domingo (14th place) and Pastaza (6th place). The provinces that occupy the last positions are Los Ríos, Santa Elena and Esmeraldas. All of them exhibit critical conditions in most of dimensions. Los Ríos ranked in the last quintile in 11 dimensions: art, food, higher education supply, private supply of primary and secondary education, recreation, public health services, adequate housing, ground transport, air and maritime infrastructure, social and economic capital and environment. Santa Elena ranked in the last quintile in 8 dimensions: art, higher education supply, private education supply, recreation, public health services, adequate housing, ground, air and maritime transport activity, social and economic capital and environment.

It is worth noting that the two first principal components of the global index slightly vary with respect to the average position across dimensions.

Cantonal ranking

Cantons in the first positions of the ranking are Rumiñahui, Calvas, San Cristóbal and Santa Cruz with average positions of 63.6, 73.2, 73.2 and 73.05, respectively. Such averages show that even best cantons do not perform well in all dimensions. For example, Rumiñahui is ranked in the first quintile in 12 dimensions (19 in total) such as private health services and sedentarism, adequate housing index, social and economic capital, and police staff. In other dimensions such as environment, public social services and security, Rumiñahui does not have the best scores. San Cristobal and Santa Cruz perform well in 12 and 11 dimensions, respectively.

Consistently with the provincial rankings, the best cantons belong to the best-ranked provinces: Rumiñahui (Pichincha), Calvas (Loja), San Cristobal and Santa Cruz (Galapagos), Giron (Azuay), and Baños de Agua Santa and Ambato (Tungurahua). Cantons that occupy the last positions are Quinsaloma, Palenque, Pueblo Viejo and Baba, which ranked in the last quintiles in 7, 11, 9 and 8 dimensions, respectively. They hardly have at least one dimension with good performance, in general, all their amenities are poor. These cantons belong to the worst-ranked province, Los Rios.

4.2 Temporal analysis of the amenity index

To perform the temporal analysis, the first principal component is used. At the provincial level, the first principal component explains 34.4%, 32.7% and 31.5% of the variance in the 2012-2014 period, in the 2015-2017 period and in the 2018-2020 period, respectively. In each period, the first component is correlated with different dimensions. For 2012-2014, the first component is positively correlated to the indexes of social capital, recreation, food services and art; and negatively correlated to the indexes of diversity in higher education and unfinished baccalaureate. In the 2015-2017 period, the first component is positively correlated with recreation, ground transportation, higher education offer, food services and social and economic capital. For the 2018-2020 period, the index shows a positive correlation with almost all indexes, especially, with recreation, air and sea transportation, higher education supply and food services.

Results show that the provinces of Galapagos, Pichincha and Pastaza have consistently occupied the first three positions throughout the three periods. On the contrary, the provinces of Esmeraldas and Los Ríos ranked in the 23rd and 24th positions, respectively, indicating unfavorable conditions of their amenities. Regarding the temporal evolution, Carchi and Bolívar are the provinces with positive increases across both periods, indicating improvements in their amenities. By contrast, Guayas has experienced position decreases along periods from 13th position in the 2012-2014 period to 17th position in the 2015-2017 and to the 21st position in 2018-2020 period. Likewise, Santo Domingo de los Tsáchilas has experienced a decline, falling from the 11th place in the initial period to 12th and 17th place in the following two periods.

Regarding the temporal cantonal analysis, 108 out of 220 cantons record position increases across periods. Cantons that have experienced significant improvements over time are San Vicente (Manabí province), San Fernando (Azuay province), Daule (Guayas province) and San Pedro de Huaca, which moved up 48, 36, 33 and 33 positions, in average over time, respectively. By contrast, cantons with a deterioration in their conditions in terms of amenities over time are Santa Clara (province of Pastaza), Sevilla de Oro (Azuay province), El Chaco (province of Napo) and Espíndola (Loja province), which moved down in average, 61, 52, 42 and 40 positions over time, respectively.