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Transfers and municipal development in Colombia

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Abstract

This paper studies the effect of transfers from the General Participations System (SGP) on Colombian municipal development indicators during 2003–2017. A Municipal Development Index is proposed, considering indicators of educational achievement, health coverage, and crime rates. This index is studied in the municipal context using spatial autocorrelation techniques. A panel-type econometric model was estimated to evaluate the effect of transfers on the index. The results suggest that increases in education, health, culture, and recreation transfers generate positive, differential effects on the index. Transfers to the health sector have the most significant impact on the index.

Keywords: development; health; education; security; transfers.

1. INTRODUCTION

In the Colombian context, public policies aimed at the provision of health and education are primarily funded by a territorial transfer system known as the General Participations System (SGP), which since 2002 has allocated resources from the Central National Government to departments, districts and municipalities. In accordance with that legally stipulated in 2001 and 2007, these resources are distributed to subnational governments as special and sectoral budget items.

In the case of sectoral items, these cover 96% of the funds and include transfers to the education sector (58.5%), the health sector (24.5%) and two additional components that correspond to general-purpose accounts (11.6%), drinking water and basic sanitation (5.4%). These allocations are vital to municipal tax revenues, representing on average 71.76% of the total revenues of territorial entities during the period 2003–2017.

The importance of these resources within territorial entities contrasts with the lack of evidence on their relation to municipal development. In general, studies on the SGP focus primarily on its history, evolution, structure, distribution of resources, and the effects of its reforms (Galvis, 2014; Bonet et al., 2014; Olmos, 2007; Bonet and Pérez, 2017; Piñeros, 2010). Few studies consider the role of this transfer system on the levels of development on a territorial level in key dimensions such as education, health and violence.

Approaches to the measurement of municipal development in Colombia have included such indicators as the Quality of Life Index (QLI) and the Unsatisfied Basic Needs (UBN) Index. Although these measures are constructed within a broad conception of development, their calculation is limited by the availability of census information or by the continuity in their measurement. From the governmental point of view, efforts have been made by the Colombian National Planning Department (DNP) including the Comprehensive Performance Index (IDI), subsequently replaced by the new Municipal Performance Measurement (MDM).

In addition to these indices, other proposals have been developed, most notably the Social Progress Index prepared by the University of los Andes in collaboration with the Cómo Vamos Cities Network (2015) and the Social Exclusion Index estimated by Ayala and Meisel (2016). However, their results are limited to a small sample of municipalities, exclusively including the country's largest cities and metropolitan areas.

Given the above, the objective of this article was to study the impact of SGP resources allocated to education, health and general purpose accounts on development on a municipal level in Colombia during the 2003–2017 period. Toward this end, first, we proposed the creation of a new Municipal Development Index that included the variables of education, health and security using information from a harmonized data panel on a municipal level.

Second, the proposed index was analyzed using spatial econometric techniques in order to assess the degree of spatial dependence, both in the levels of the index and in its changes during the study period. Lastly, an econometric panel data model was estimated to evaluate the effect of transfers allocated to health, education, culture and recreation on the Municipal Development Index calculated.

The document is divided into five sections including this introduction. The second section provides a brief review of the literature on the proposed measures of municipal development and studies analyzing the determinants of development. The third section presents the proposed methodology, along with the description of the variables to be used in the proposed econometric model. Subsequently, the fourth section presents the results of the index and the econometric model and discusses their implications. Finally, the last section presents the conclusions of this research.

2. LITERATURE REVIEW

Measures of municipal development

On an empirical level, efforts have been made to materialize the concept of development as a synthetic measure built on available and easily interpretable information. Such is the case of the Human Development Index (HDI) compiled by the United Nations Development Programme (UNDP,

1990), which has been established as an essential tool for both assessments and comparisons of the overall progress of national territories using three basic dimensions: an aggregate parameter of earned and unearned household income; a composite indicator of a long and healthy life, and a composite indicator of the educational level attained by adults over 25 years of age and the expected years of schooling of the children.

In the Colombian context, the DNP developed an MDI that has been applied on a municipal level since 2006 to assess the performance of territorial entities with regard to effectiveness in meeting the goals of development plans, efficiency in the provision of public services, compliance with requirements for the application of resources, along with administrative and fiscal management. However, the function of this index focuses more on public administration than on the results of municipal development itself; moreover, it presents methodological and conceptual difficulties that reduce its explanatory capacity and usefulness to make decisions in public policy that contribute to the development process.

Angulo et al. (2018) presented a new methodological proposal for the measurement of municipal performance designed by the DNP called MDM. This methodology, applied on a municipal level for 2016, was calculated based on the management components and results through an adjustment factor that distinguishes the progress of the territories in minimum conditions of well-being. In the results component, the methodology analyzes the well-being of the population measured by education, health, public services, security and coexistence. In the management component, the application of resources from the SGP is evaluated, in addition to three other components.

In accordance with the above, it is pertinent to propose a development index for the country that considers key dimensions such as health, education and security, and that can be calculated and analyzed consistently over time.

Public policy and regional development

In addition to the identification of indicators and targets, territorial development requires resources for the execution of plans, programs and projects that change the socioeconomic reality of the population. In the Colombian case, the primary tool is the SGP. In what follows, some studies conducted on the effect of SGP resources on municipal development indicators in Colombia are described.

Through an efficiency analysis, Cano and Ramírez (2007) studied the impact of resources from transfers allocated to territorial entities and their application on the quality and coverage of education and health services in 2005. In the case of education, the analysis was conducted in 32 departments and 46 certified municipalities, of which only four departments and 18 municipalities were able to provide educational services efficiently. In turn, for the health component, 33 entities (the departments and Bogotá) were examined, of which only seven were able to provide health services efficiently, primarily due to funding under the subsidized regime.

Bonet et al. (2015) studied horizontal fiscal disparities in Colombia's departments and municipalities, while assessing the equalizing effect of SGP transfers. The authors found that transfers, specifically conditional transfers, were able to reduce horizontal fiscal disparities with a greater impact in municipalities than in departments, thus generating lower levels of municipal inequality, without losing sight of the fact that, as the authors emphasize, inequalities in tax collection per capita continue to be high and higher than the average of Latin American countries.

In turn, studies conducted by León and Benavides (2015) and Mendoza and Yanes (2014) assessed the effect of public investment on departmental economic dynamics in Colombia. In the first case, the authors used transfers from the central level to departments as a proxy for public investment during the 1994–2012 period. Using a panel data model, they found that investment did not have an impact on departmental GDP per capita growth. Mendoza and Yanes (2014), on the other hand, found a significant, albeit small, effect of investment on departmental dynamics.

Regarding the impact of the SGP reforms, Olmos (2007) analyzed the impact of the reform of the transfer regime (Legislative Act 011 of 2006) on the revenues of territorial entities. Based on the new formulas, the author estimated that between 2002 and 2006, territorial entities received COP\$7.59 billion less due to the creation of the SGP, and, following the approval of the reform in 2006, territorial entities had a shortfall of over COP\$52 billion in the 12 years following 2007.

In accordance with the above, few studies have provided a continuous and consistent measurement of development in Colombia due, to a large extent, to the scarcity of statistical information on key indicators. From a methodological perspective, advances have been made, as evidenced by the new MDM that incorporates a component of results considering the well-being of the population as the ultimate goal of public policy. At the empirical level, progress has been made in evaluating the efficiency of transfers to health and education through data envelope analysis (Cano and Ramírez, 2007). However, the need for further research that delves into the relation between SGP resources and their effect on municipal development is evident, given that the vast majority of existing indicators have been directed towards the management and public efficiency of local governments.

Development and its determinants

The concept of development considered in our study is understood as the process of improving the conditions of a population's quality of life by meeting their fundamental needs in education, health, and security, thereby enhancing individual capabilities. This concept originates in a combination of Max-Neef's needs approach (1993) with Sen's capability approach (1988 and 2000). Investments in education, health, culture and recreation are considered determinants of development.

In the case of education, from the aggregate point of view and according to the first endogenous growth models, this variable has direct and important effects on growth (Romer, 1986; Lucas, 1988). From an individual point of view, education not only increases knowledge and improves the skills of individuals, but also generates impacts on other social variables (Neira and Guisán, 2002; ECLAC, 2000a; Ariza and Retajac, 2020).

Generally speaking, the mechanisms of transmission from education to development can be divided into different components. First, investments aimed at increasing educational levels have a significant impact on the population, especially the most vulnerable, reducing their dropout and repetition rates, increasing their income in the medium and long term and thus mitigating the intergenerational reproduction of poverty (ECLAC, 2000b). On the other hand, more educated workers tend to be more productive and more likely to find a job, which increases wages and economic competitiveness in the

territories (Nuñez, 1999; Neira and Guisán, 2002; ECLAC, 2000a; Malassis, 1975). This makes it possible to boost the productive apparatus, promote social mobility and, with it, reduce crime and, in general, improve the living conditions of the population (Banco de la República de Colombia, 2014).

The health component has similar effects to education in relation to labor force productivity and poverty reduction, under different channels. It is recognized that workers with better health not only have better living conditions, but also tend to be more productive and efficient, which contributes to economic competitiveness (Rivera and Corrais, 2005; World Bank, 1993; Plata, 2011), and improves the income of individuals as well as the availability of free time for recreation and leisure (CMMS, 2006; Muirinen and Le Grand, 1985; Agudelo, 1999). In addition, better health conditions promote a favorable environment for the market and long-term investments, insofar as these generate a longer horizon to recoup the benefits of investments during retirement, which in turn is related to education, since better health leads to greater educational investments, because these generate long-term returns (WHO, 2003; Flores, 2006). Because of the above, in addition to being a social obligation, good health care is also a fundamental development goal and at the same time a means to accelerate it (Rivera and Corrais, 2005; World Bank, 1993).

Security is another crucial factor in development, since higher crime rates escalate displacement phenomena, limit certain economic activities that decrease trade in the territories, reduce investment, and drive illegal structures that destabilize the macroeconomic environment (López and Villamizar, 2017; Cotte and Castro, 2014). Criminality causes human losses and distorts agents' consumption and investment decisions about their lives, leading to the flight of human capital from the territories (Cotte and Castro, 2014; Martínez, 2001), thus causing a reduction in the level of economic development. In addition, insecurity generates economic costs associated with its prevention and control (Rubio, 1997), displacing resources that could be allocated to productive investments (Martínez, 2001).

Sports and recreation are commonly considered tools that contribute to development; hence such activities are recognized as a means to achieve the Sustainable Development Goals (SDGs). Along these lines, it has been affirmed that sports generate positive development in young people and prevent risk factors linked to violence, common crime and the consumption of hallucinogenic substances, particularly among populations in conditions of vulnerability (UNODC, 2021; Fernández et al., 2018).

Regarding the effect that sports and recreation can have on crime, although there is no consensus in the empirical literature about a clear causal relationship between sports and crime prevention, thanks to a greater availability of data, recent literature has provided evidence of a correlation between sports and a reduction in the incidence and probability of committing a crime (Brosnan, 2020; Jugl et al., 2021). The literature suggests that culture, recreation and sports work to prevent a wide range of social problems, strengthening social skills and defining positive behavioral parameters in young people, such as skills in conflict resolution, aggression control and leadership that could be useful in various dimensions of the individual (UNICEF-CEDAL, 2010; UNODC, 2021; Ekholm, 2013).

As mentioned above, physical activity and sports among young people promote social and personal values through human relationships that are established in practice (Durán et al., 2000). According to Ekholm (2013), young people could be deterred from criminal behavior when they recognize a higher risk of being detected by coaches or supervisors in the sports setting. Similarly, sports leads to good physical health, which subsequently improves mental health, thus developing a healthy lifestyle, essential for rehabilitation from criminal behaviors among vulnerable populations (Ekholm, 2013).

3. METHODOLOGY

Municipal Development Index

The proposed development index is comprised of three components: education, health and security. Each component is constructed from a sub-index rescaled between 0 and 1, from the indicators presented below.

Table 1. Description of variables

Dimension	Indicators
Education	Municipal average of the national standardized test Saber 11 ^a in the area of language
	Coverage in high school education (grades ten and eleven) ^b
Health	Number of persons enrolled in subsidized program
Security	Number of total thefts per thousand inhabitants

Notes: ^a Saber 11 is a standardized exam administered to 11th grade students in Colombia to assess performance in the areas of critical reading, mathematics, social studies, natural sciences and English. The test not only assesses knowledge of concepts, but also their application to solve problems in everyday life situations; ^b High school education, consisting of grades ten and eleven, is an educational cycle that prepares students for admission to higher education.
Source: compiled by the authors.

In the case of education, two indicators were considered: one for quality, and the other for coverage. The quality indicator is the average of the state tests for admission to higher education (Saber 11). Coverage involves enrollment in high school education. For the health component, we considered the number of persons enrolled in the subsidized healthcare program. Finally, the number of thefts per 100,000 inhabitants was considered for the security variable. Once the indicators had been scaled, the subscripts of each dimension were obtained and the geometric index calculated. The geometric index was as follows:

$$Development\ Index_{it} =$$

$$\sqrt[3]{(I.education_{it}) * (I.health_{it}) * (I.security_{it})} \quad (1)$$

In this case the subscripts i and t refer to the municipality and time period, respectively.

Spatial autocorrelation

Spatial autocorrelation allows for the study of the degree of positive or negative association of the variables of interest throughout the territory and identifying clusters in the variables of interest through the Local Indicators of Spatial Association (LISA).

The LISA procedure decomposes Moran's I and calculates how much each territorial entity contributes to the formation of the general value, thus obtaining a significance value for each cluster formed by the values of the variable in question of each municipality and its neighbors (Chasco, 2006). In this way, the figure of the cluster allows us to observe how each municipality differs from its neighbors, based on the type of spatial autocorrelation it demonstrates. According to Celemin (2009), the standardized local form of Moran's I for observation i takes the following form:

$$I_i = \left(\frac{Z_i}{m} \right) \sum_{j=1}^n W_{ij} * Z_j$$

Where W is the spatial weights matrix, which assigns the value of 1 to the neighbors of each territorial entity and the value of 0 to those that do not meet the previous condition. For the calculation of the spatial weights matrix, a queen-type location distribution is used, to the extent that municipalities have neighbors around all their borders. The Z_i observations are the deviations from the mean, in which the subscript i denotes a given spatial unit and the subscript j denotes the neighboring unit of i . Lastly, m is the variance term.

Moran's Index takes values between -1 and 1; values closer to 1 imply a positive autocorrelation, while those closer to -1 would involve a negative autocorrelation. It should be noted that if the value of the Moran's Index is close to 0, this would imply the absence of autocorrelation.

Panel Data Model

To evaluate the effect of the SGP on the level of municipal development, an econometric model of panel data was proposed. In principle, we sought data for the 1,122 municipalities that exist in Colombia for the 2003–2017 period. However, due to the scarcity of data, the analysis was ultimately conducted with 1,063 municipalities, covering 99.88% of the Colombian population and more than 94% of its territory. The departmental jurisdictions of Amazonas, Guainía and Vaupés and other municipalities for which no information was available and which are characterized by jungle territories with broad expanses of land and a low population density, were excluded from the analysis.

The panel data method was selected because this technique is compatible with the database available for the research, where different individuals (municipalities) are studied over a given period. The primary advantage of this technique is that it makes it possible to identify and control the unobserved idiosyncratic heterogeneity of the entities under study. The explanatory variables considered are related to the resources of transfers allocated to health, education, culture, recreation and sports, and from the geographical point of view with a variable that captures the distance of each municipality to its department capital. Based on the above, the equation to be estimated is given by the following expression:

$$\begin{aligned} \ln Municipal\ Development\ Index_{it} = & \beta_0 + \beta_1 \ln Transfers\ Education_{it} \\ & + \beta_2 \ln Transfers\ Health_{it} \\ & + \beta_3 \ln Transfers\ Culture,\ recreation\ and\ sports_{it} \\ & + \beta_4 \ln capital\ Distance_{it} + \alpha_i + u_{it} \end{aligned}$$

Where the coefficients β that accompany the explanatory variables are direct elasticities, α_i are the individual effects of the municipalities in the country and u_{it} is the idiosyncratic error term that contains all those variables not considered in the model. In accordance with the above, municipal development (measured by the geometric index) will be based on the logarithm of the resources of each municipality received from the SGP for education in per capita terms, the logarithm of SGP transfers to the health sector of the subsidized regime per person, as well as the logarithm of the resources received by each municipality through the general purpose component on a per capita basis for the items corresponding to culture, recreation and sports.

Data

The data source is the Municipal Data Panel of the Center for Economic Development Studies of the University of los Andes, from which the following modules were taken: general characteristics, good governance, health and services, education, and conflict and violence. These modules consolidate information in a unique and harmonized way in the country over a long period. The period selected is due to the availability of information for the construction of a balanced panel. The panel database is available on the website of the Center for Economic Development Studies (Centro de Estudios sobre Desarrollo Económico [CEDE] 2022). ¹

4. RESULTS AND DISCUSSION

Municipal Development Index

In terms of the analysis of the aggregate development index, Table 2 presents some descriptive statistics of the total index and its components. As may be observed, the average development index for 2003 stood at 0.49 with approximately 80% of the municipalities reporting levels of development between 0.40 and 0.59. During the period analyzed, there was an increase in the levels of development in the country. The mean index values went from 0.49 in 2003 to 0.56 in 2017, while the range between the 10th and 90th deciles in 2017 was between 0.47 and 0.63. This increase was mainly due to improvements in the health component, as may be observed in the health index column (see Table 2). This index was that in which the greatest variations in the mean and percentiles of the distribution were reported.

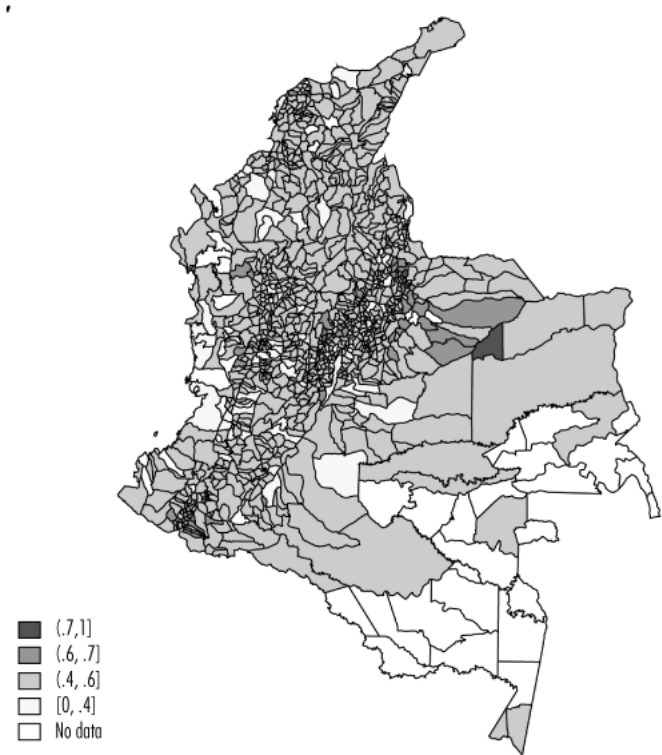
Table 2. Descriptive statistics of the Municipal Development Index

Statistics	Total Index		Education Index		Health Index		Security Index	
	2003	2017	2003	2017	2003	2017	2003	2017
Mean	0.49	0.56	0.43	0.46	0.30	0.40	0.92	0.94
Standard deviation	0.07	0.06	0.06	0.04	0.13	0.13	0.11	0.06
10th percentile	0.40	0.47	0.39	0.40	0.14	0.23	0.80	0.87
50th percentile	0.48	0.56	0.44	0.46	0.27	0.41	0.96	0.96
90th percentile	0.59	0.63	0.51	0.52	0.48	0.57	1.00	1.00

Source: Compiled by the authors, based on the CEDE.

In terms of spatial analysis, Figure 1 illustrates the distribution of the index throughout the national territory for 2003. According to this figure, for this period, the municipalities registering a low level of development (in white) are mainly concentrated in the Colombian Pacific zone, in the departments of Chocó and Valle del Cauca, as well as in part of Antioquia. Similar behavior is also observed in the central zone of Tolima, Boyacá, Cundinamarca and the capital district of Bogotá, in the latter case primarily explained by its low rates in coverage of the subsidized healthcare regime and the high number of thefts in that territory.

Figure 1. Municipal Development Index 2003



Source: compiled by the authors based on the CEDE.

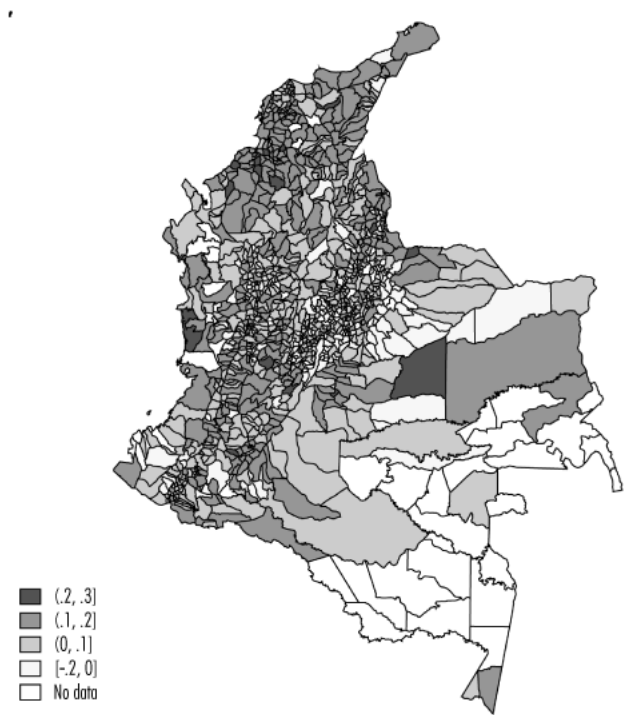
In general, most municipalities reported a basic level of development (light grey) in 2003. Some municipalities in the departments of Boyacá, Cundinamarca, Santander, Nariño and Casanare had intermediate levels of development (dark gray). The latter department is notable for its good

health coverage (subsidized regime) and low levels of insecurity. Lastly, only 0.8% of the municipalities were at the upper level of the distribution (deep gray). In this case, municipalities in the departments of Boyacá and Nariño marked high levels in the index, which is also consistent with low levels of insecurity and coverage of the subsidized regime.

Transfers and municipal development in Colombia

Figure 2 illustrates the absolute changes in the development index during the period considered. As may be observed in this figure and in line with the trend reported at the national level in Table 2, most municipalities registered increases in index values (light gray), while some municipalities in the departments of Cundinamarca, Antioquia, and to a lesser extent, Caquetá, and Meta, fell (white). It is worth noting that the departments of Antioquia, Cundinamarca and Chocó are the territories registered the most cases of municipalities that went from having the lowest levels to improved levels of development (dark gray color). Also worth noting are the increases on the Atlantic coast, particularly in the departments of Bolívar, Sucre, Magdalena and Cesar, results reflecting progress in education and health. This scenario is repeated in the south of the country, specifically in the departments of Valle del Cauca, Huila and Nariño.

Figure 2. Absolute variation in the Municipal Development Index 2003-2017



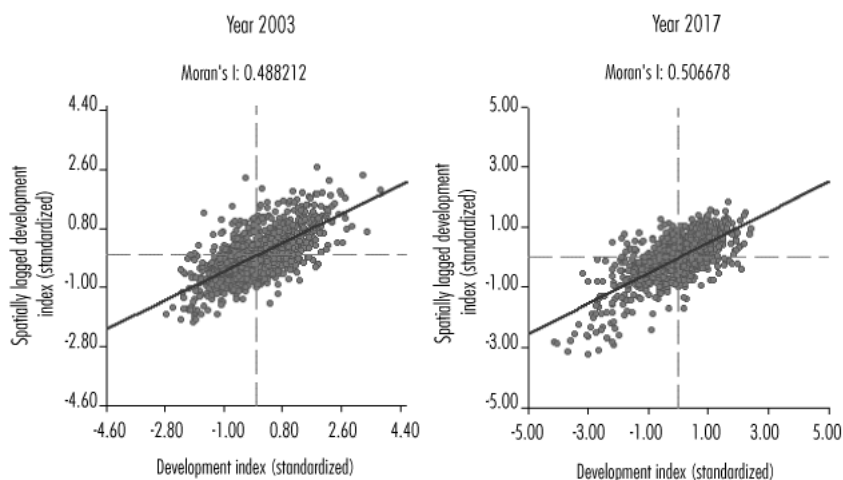
Source: compiled by the authors, based on the CEDE.

Spatial analysis

Moran Index

According to Figure 3, in 2003 the Moran index identified a positive autocorrelation with a value of 0.48, which indicates the importance of geographical space in economic and social development on a municipal level in Colombia. This territorial correlation increased in 2017, registering an index of 0.50, suggesting that municipal clustering continues to be relevant in the territories through similar levels of development, whether by a spatial association of only municipalities with high development, or, conversely, of territories with a low level of development.

Figure 3. Moran Index



Source: compiled by the authors based on CEDE

Local Indicators of Spatial Association (LISA)

Figure 4 illustrates the municipal clusters based on the spatial relationship of each municipality with its neighbors. In 2003, there was a highly developed cluster of municipalities in the Orinoquia region (departments of Vichada, Casanare and Arauca), which joined the departments of Boyacá, Santander and North Santander, due to a favorable performance in each of the dimensions of the index. In turn, three different agglomerations were identified in the department of Cundinamarca, one with low performance to the north of Bogotá (due to low coverage in the subsidized regime) and two with high development to the east and north of that department (explained to a large extent by the security variable). Likewise, an agglomeration with a considerable level of development was identified in the department of Nariño, explained by favorable indices in education and security.

Conversely, clusters classified with a low level of development include some territorial entities of the Pacific region (Chocó and Valle del Cauca), which are interconnected with municipalities in the department of Caldas, Risaralda and, subsequently, with territories in the department of Tolima, which is explained by insufficient health coverage in these entities. Along these same lines, concentrations of municipalities are identified in the department of Caquetá, and part of the Caribbean (in the departments of Magdalena, Córdoba and Guajira), which are rooted in poor conditions in education and health. Similarly, the department of Antioquia has an agglomeration of low development caused by a high degree of insecurity and low coverage in the health system.

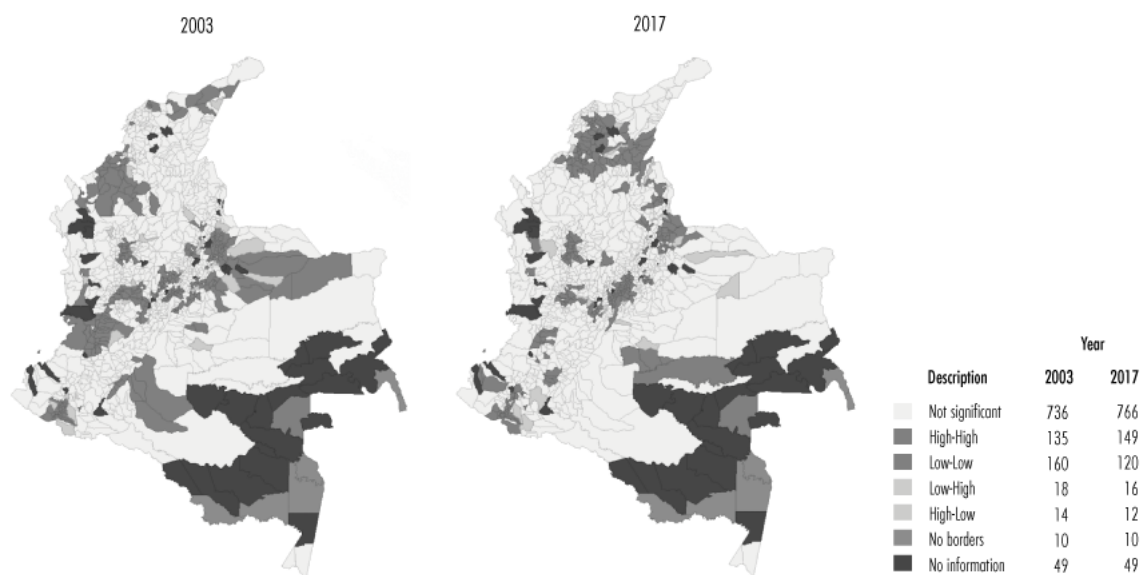
In addition to the above, municipalities such as Barracas, Guajira; San Vicente and Yolombó in the department of Antioquia (with good performance in terms of education and coverage in the subsidized regime), as well as Salento (in education) in Quindio, Rioblanco (in health) in Tolima, among others, which despite obtaining a score higher than the national average are surrounded by territorial entities with a low level of development; while municipalities such as Ipiales and Pasto (Nariño), Puerto Gaitán (Meta), Yopal (Casanare) and Chiquinquirá (Boyacá), among others, recorded a low performance in the development index, and are surrounded by municipalities with high values, in all cases due to a poor level of coverage by the subsidized regime, and unsatisfactory outcomes in educational quality, as is the case of Puerto Gaitán and Yopal.

In contrast, by 2017, the clusters previously identified in the Orinoquia region disappeared, and in turn, new agglomerations were established in the departments of North Santander, Cesar, Sucre and Bolívar, as well as in the department of Huila in the Andean region, and in Valle del Cauca. Additionally, in 2017 part of the agglomeration of Boyacá and Santander continued, with high levels of educational quality (see Figure 4).

It is worth noting that in parts of the Caribbean region, as in Orinoquia, we found a tendency toward the elimination of the low-development clusters observed; similar to that occurring in the Pacific, where clusters detected in 2003 had disappeared almost entirely by 2017. This did not occur, however, in the departments of Guaviare and Meta, where agglomerations with a low level of development increased.

In the case of the Caribbean region, evidence of remarkable progress was found throughout the study, which is corroborated by the formation of a significant agglomeration of high development in several municipalities of Córdoba, Cesar, Sucre, Magdalena, Bolívar, Atlántico and part of North Santander, explained mainly by the increases in the coverage of the subsidized healthcare regime in these territories, and to a lesser extent by advances in educational quality, reflected in the results of the Saber 11 tests.

Figure 4. Comparison of Local Indicators of Spatial Association, 2003 and 2017



Source: compiled by the authors based on the CEDE.

Similarly, the disappearance of the high-development cluster that existed in 2003 in the north of Cundinamarca may be perceived, and a low-development agglomeration located north of Bogotá for 2003 is confirmed. However, the latter expands involving the capital in 2017, which is primarily explained by the context of insecurity in which the city and the 31 municipalities connected to it are immersed.

Econometric results

Table 3 lists some descriptive statistics of the explanatory variables considered in the model. As may be observed in this table, in 2003 the real per capita value of transfers on a municipal level for educational quality totaled COP\$23,332 (approximately USD\$5), with substantial heterogeneity in its distribution. For 2017, the average did not vary significantly, but dispersion was reduced. This implied that inequality in terms of per capita resources for educational quality decreased in all municipalities during the period under study.

Table 3. Descriptive statistics of explanatory variables

Variables	2003			2017		
	Mean	P10	P90	Mean	P10	P90
Per capita transfers in quality and free education ^a	23 332	8 678	40 446	23 948	14 700	35 300
Per capita transfers in health ^a	68 488	34 108	110 050	110 072	63 488	153 949
Per capita transfers in recreation and culture ^a	11 186	3 530	21 445	8 111	2 435	16 857
Distance to the capital ^b	78.2	0	376.1	78.2	0	376.1

Notes: ^a in constant 2015 pesos; ^b in kilometers.

Source: Compiled by the authors based on the CEDE.

In the case of resources allocated to health, and unlike that occurring in education, the mean per capita resources increased by just over COP\$41,000, with significant growth at the top of the distribution. In other words, most municipalities showed improvement in the resources allocated. Finally, in the case of resources allocated to recreation and sports, these fell in per capita terms and inequality in the distribution of these resources increased. In accordance with the above, the average per capita amount of transfer resources allocated to these sectors had different behaviors, both in terms of growth and in distribution. In per capita terms, the municipalities improved in the amount allocated to health care and in the distribution of resources in education. Conversely, there was a decline both in the amount and distribution in recreation and culture.

Table 4 presents the estimates made to obtain the results of the econometric model. Column 1 lists the results of the fixed-effect estimates model, while Column 2 shows the results of the model corrected for heteroscedasticity and autocorrelation. Regarding the results of the fixed-effect model (using the Hausman and the Sargan tests), the estimates suggest that only transfers in education and health are correlated with the Municipal Development Index (although they exhibit differential marginal effects). Specifically, a 1% increase in transfers to education increases the rate by about 0.007%, while the same increase in health raises the rate by 0.18%. The item of transfers allocated to culture, recreation and sports was not statistically significant in this model.

Table 4. Results by fixed-effect panel

<i>Variable</i>	<i>MEF</i>	<i>Corrected panel</i>
Ln (SGP Education)	0.0069***	0.0199***
Ln (SGP Health)	0.1881***	0.2171***
Ln (SGP Culture-Sports)	0.0031	0.0209***
Ln (Capital distance)	-	0.0015
Temporal effect	Si	Si
R2		0.7533
Within	0.5678	
Between	0.8993	
Overall	0.7488	
Rho	0.4533	0.4237
Years	15	15
Municipalities	1 063	1 063
N	15 945	15 945

Notes: *** P-value<0.01; ** P-value<0.05; * P-value <0.10. MEF- Ministry of Economy and Finances.

Source: Compiled by the authors based on the CEDE.

In order to evaluate the presence of heteroscedasticity and autocorrelation in the residuals of the model, two tests were applied: the modified Wald test and the Wooldridge first-order test for serial autocorrelation. In both cases, the null hypotheses of homoscedasticity and non-autocorrelation were rejected. To resolve the two problems detected, the literature suggests estimating by Feasible Generalized Least Squares (FGLS), or by means of Panel Corrected Standard Errors (PCSE).

However, in their study of time series cross-section models (panel data) Beck and Katz (1995) demonstrated that PCSEs are more accurate than FGLSs in correcting the problems detected. For this reason, we decided to use PCSEs for the estimates in the last column of Table 4. In this case, the value of the estimated coefficients for health and education increased, while the coefficient associated with cultural transfers was found to be statistically significant.

According to our results, elasticities close to 0.02% were estimated in the case of transfers allocated to the areas of education, culture, and sports, while an elasticity of 0.21% was found in the case of transfers in health. Overall, the results suggest that the transfer system has a positive impact on the proposed development index.

Discussion

Econometric results suggest a differential impact of education, health and culture resources on municipal development. In particular, the marginal effect of transfers to the health sector is greater, which in principle may be explained by two factors. First, that the greatest changes in the indicators during the period under study occurred in the health coverage indicator, which increased by 30 percentage points between 2003 and 2017, reaching a coverage of more than 95% of the population in this last year. Low initial conditions of coverage, coupled with the fact that a significant percentage of SGP transfers were allocated to universal health coverage, led to this increase. Second, it is important to emphasize that, aside from coverage by the system, health is a basic determinant of human development, which in turn indicates that the health status of the population can condition results in other dimensions of development. In particular, the physical conditions of children and adolescents can have effects on their learning capacity and educational outcomes, limiting educational quality indicators.

On the other hand, it is recognized that the resources allocated to educational quality and to culture and sports are, in absolute terms, lower compared to transfers directed to health care, which may be associated with the lower marginal impact of these resources on the level of development of the municipalities. In contrast to the health index, the education indicator has not registered any evidence of progress, especially since the academic performance component, which accounts for 50% of the education index constructed, on average increased by only 0.77 percentage points in the period under study.

This is consistent with the fact that monetary resources may have a more direct impact on the coverage of the public health system compared to its potential impact on educational performance. The latter may be a function of complex factors that go beyond the resources allocated. As has already been observed in the review of the literature, there is a large set of institutional variables that, added to the socioeconomic conditions of households and the environment, influence the academic performance of students.

With regard to the resources allocated to transfers to culture and sports, these were included in the analysis because there is evidence that social programs, especially those focused on young people, can partially mitigate criminal incidence, which in turn, may be associated with lower school dropout rates in adolescents and, in general, better educational outcomes. In this case, the estimated effect is positive (although it is not very high) and

is accompanied by a fall in real terms of the resources per capita allocated to this item during the period under study. These results suggest the need for greater investment in the field, without overlooking the fact that there are other elements involved in crime, not considered in this study.

In terms of general recommendations, the results of this work suggest that it is necessary to advance in the construction of indices and/or development measures that incorporate a comprehensive vision accompanied by new methodologies, which allow for an explanation of the behavior of territorial development. At the same time, it is crucial to have a greater quantity and quality of statistical information on a municipal level. In this process, government entities play a key role.

5. CONCLUSIONS

The measurement of development, the understanding of its determinants and the evaluation of financing systems and distribution of resources at the territorial level are part of the agenda of different governments in developing countries and are of great interest to the academic community. Given these circumstances, this paper studied the effect that transfers from the General Participations System in Colombia have had on a synthetic index of municipal development constructed from the components of education, health and security during the period 2003–2017. Spatial autocorrelation techniques were used to analyze the index, while a panel data model was used to assess the incidence of transfers on the index.

The results of this index indicate that municipal development experienced improvement in a large part of the territorial entities during the period 2003–2017. These advances were mainly in the field of health and were accompanied by an increase in per capita transfers during the period. Only some municipalities in the departments of Cundinamarca, Antioquia and, to a lesser extent, Caquetá and Meta, registered lower levels of development in 2017 than in 2003.

From the spatial point of view, local indicators of spatial association suggested different types of agglomerations with divergent levels of development across Colombia. In 2003, the high-high-level development clusters were located in part of the Eastern Plains regions of Cundinamarca and Boyacá, while the low-low-level clusters were located in parts of the Caribbean region, Antioquia, Valle del Cauca and Caquetá. By 2017, these agglomerations had changed radically. The high-high-level development clusters were located in the Caribbean area, while the low-low-level clusters were dispersed throughout the center of the country.

In relation to the results of the econometric model corrected for heteroscedasticity and autocorrelation, the estimates suggest a positive and differential effect of the resources allocated to educational quality, health and culture and recreation on the estimated index. In particular, the estimated elasticities of education transfers and cultural transfers on the development index stood at 0.02%, while the elasticity of health transfers reached 0.21%. This greater differential effect in the case of health is explained by a significant increase in health coverage and in the amount of per capita resources allocated to this item during the period analyzed.

In general, these results allow us to conclude that government transfers allocated to education, the health system, culture and sports contributed to the increase in the level of development of Colombian municipalities. However, despite being the sectoral component with the highest budgetary allocation, the significant effects observed in the proposed index for transfers to health are not found in the investment in education. The design and implementation of a differential government policy for territories with little progress in the components of the development index and the need for greater quantity, quality and availability of information on a municipal level for better monitoring are posed as the main challenges in this case.

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