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Enrollment and quality levels of Colombia's public basic education: Has fiscal decentralization improved them?

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Abstract

This paper provides empirical evidence of the impact of fiscal decentralization on Colombia's public basic education. Based on the social and economic data available for 1,003 municipalities and 13,670 public schools, for the last decade, we confirmed that decentralization has had a positive and non-monotone effect on education enrollment. Likewise, our results suggest that it has had a positive impact on quality, once several variables, commonly used to explain performance differences, were controlled. Assuming that the effects of decentralization might have been uneven between regions and within them, we specified panel data and cross section econometric models for all municipalities as a whole, for size-based municipal categories, and for the towns which receive education funding directly from the central government or not.

JEL Classification: H41, H71, H77, I22, I38

Keywords: Public Goods, Local Taxation, Intergovernmental Relations, Education Expenditures, Government Programs

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1. Introduction

In the late 20th century, many Latin American countries began implementing a series of decentralization policies after a long tradition of centralized governance. These policies, which rebalanced expenditure functions and revenue sources between central and sub-national governments, became the core of institutional reforms. In Colombia, the process dates back to the late 1960s when the central government began transferring a significant percentage of its tax revenues to the regions. The 1991 Political Constitution brought about an increase of these resources as well as an era of greater regional decision-making autonomy. The election of mayors and governors by popular ballot, which became possible by the late 1980s and early 1990s respectively, illustrates well the spirit of the time.[1]

The objectives of decentralization policies in Colombia were similar to those of other developing countries. However, the scope of these policies must be understood in each particular national context, including its history, economic system, institutional circumstances and political traditions.[2] The general goals of decentralization were to improve the institutional capacity of municipal governments and to strengthen their fiscal responsibility, their political autonomy and their efficiency to provide goods of collective consumption. These objectives were inspired by two classical and fundamental decentralization premises worldwide recognized: First, Oates' hypothesis, which affirms that because local governments are closer to citizens, they have privileged information to respond better to their needs; and second, Tiebout's hypothesis, for which local governments have stronger incentives to perform well on local affairs, evident advantages to get the most out of public resources, and the will to implement innovative ways.[3]

In empirical terms, fiscal decentralization has remained an international trend over time, although uneven across countries, and not without evident obstacles. In Latin America, the measure of sub-national expenditures as percentage of national expenditures reveals that fiscal decentralization increased from an average of 13% in 1985 to 19% in 2005.[4] Not surprisingly, Colombia reached this regional indicator precisely by 2005. Consequently, local governments are playing an increasingly significant role in the provision of basic infrastructure services (roads, transportation and basic sanitation: water, sewage and garbage

[1] In Colombia, governors are the heads of the intermediate level of government; they govern geographic departments, which are political-administrative units similar to states or provinces in North America, but not as autonomous as them. The expressions *department* or *departmental governments* in this document, refer to these geographic-governmental units).

[2] Bird and Rodriguez (1999)

[3] Tiebout, C (1956) and Oates, W (1972)

[4] United Cities and Local Governments (2010).

collection) as well as social services (health and education). Nevertheless, in Colombia, as in many other countries, the intergovernmental fiscal system must still undergo adjustments to optimize the performance of local governments and to facilitate their effective collaboration with the central administration.

In the area of social services, education has been privileged by decentralization efforts from the start. Currently, the public education system offers primary and secondary schooling to around 10 million students at 13.670 institutions across the country. This system is financed mainly through transfers from the central government that are basically used to pay the salaries of more than 300.000 teachers. However, in recent years, the municipal governments of the country's most populated cities have made important budgetary efforts to complement these financial allocations. In general, local governments manage basic education services (pre-school, primary, basic and upper secondary levels, technical and vocational training), and the central government administers higher education.

Even though it is widely asserted that the coverage of basic education is almost universal, the data indicate that enrollment net rates differ significantly across the 1.118 municipalities. Regarding quality, education outcomes, measured by a diversity of indicators, have demonstrated that private schools usually perform better than their public counterparts.[5] Clearly, if most funding goes to pay teacher salaries, little is left to improve facilities and acquire books and other education tools. In addition, if decentralization efforts modify the funding of public education only marginally, major changes in the quantity or quality of the services are unlikely to occur.

This paper analyzes some of the abovementioned issues from an empirical standpoint. In particular, it provides evidence of the effects of Colombia's fiscal decentralization on enrollment (access to the basic education system) and performance (quality of the services). Since decentralization may have uneven effects within the regions and between them, we performed the analysis for all municipalities as a whole and by channel of funding (whether they receive education transfers directly from the central government, as *certified municipalities*; or indirectly, as *non-certified municipalities*, through departmental governments).

Following this introduction, our study is organized as follows: Section 2 provides an overview of decentralization in Colombia by describing its institutional setting, and the revenue and expenditure trends derived from the 1991 Political Constitution. Section 3

[5] Perfetti (2012) provides official evidence of both the net-enrollment-rate differences between the regions and the performance (test-scoring) disparity of the private vs. the public education institutions.

describes the data and econometric models used to assess empirically the effects of fiscal decentralization. Section 4 discusses results, and Section 5 presents some conclusions.

2. An overview of decentralization in Colombia

2.1 Institutional setting

In Colombia, decentralization efforts began in the late 1960s, for the most part. Their goal was to strengthen the institutional capacities of municipal authorities, their financial responsibility and their degree of autonomy concerning policy decisions. The literature on fiscal federalism regards these objectives are decentralization's key advantages. Indeed, bringing decision-makers closer to citizens has been deemed instrumental in narrowing down information asymmetries, improving the accountability of local governments, and rendering the provision of public goods more efficient.

Moreover, beyond this enhanced efficiency in the administration of public resources, in many developing countries, decentralization efforts became essential to internal democracy and governance processes. In a broad sense, decentralization became their new development "paradigm," their institutional-reform strategy during the late 20th century. In Colombia, the transition from the highly centralized system, which had prevailed for many decades, towards a more participative scheme was remarkable.

Concerning the availability of resources, the Colombian decentralization process was based on a gradual increase of financial transfers to the regions. This funding would allow local governments to provide essential development services such as education, health and basic sanitation that had registered historical deficits. The Political Constitution of 1991 (PC-91) declared the Government accountable for guaranteeing the full and universal provision of these services to the population, as a means to reduce income inequality. From a political perspective, the election of mayors by popular ballot started in 1988 (Legislative Act No. 1 of 1986), and the popular election of departmental governors began in 1992. Thereafter, these increased political self-reliance and transferred funds were supplemented with other administrative and financial measures.

Although the PC-91 propelled Colombia's decentralization process, it has been mentioned that this trend actually started some three decades earlier, when the government began transferring a significant percentage of its tax revenues to the regions. Law 33 of 1968 stipulated the assignment of an increasing share of the sales tax revenues to municipalities, up to a ceiling of 30% to be reached by 1971. Subsequently, Law 46 of 1971 created the so-called *situado fiscal* to implement the automatic transfer of an increasing share of the current

revenues of the central government to the departments. The specific purpose of these *situado* funds was to finance basic education and health services. During the 1980s, the replacement of the sales tax for the value added tax, VAT (Law 14 of 1983) introduced some changes to the transfer system to municipalities; one of them was the gradual increase of VAT transfers up to50% to be reached in 1992 (Law 12 of 1986).

The PC-91 introduced new criteria to define the size of the *situado* as well as the extent and purpose of the transfers to municipalities. Law 60 of 1993 regulated the constitutional mandates; however, because of financial constraints, they did not become feasible until the early 2000s. Consequently, by the turn of the century, two additional reforms to the transfer systems became necessary.

The first reform combined the two existing transfer systems, the s*ituado fiscal* and the *participación municipal*, into a single basket called the *Sistema General de Participaciones*, SGP (General Participation System) (Legislative Act 1 and Law 715 of 2001). Its radical change was to separate the size of the transfers from the current revenues of the central government by defining real growth rates for the SGP. Furthermore, the SGP assigned new weights to the three major funding targets: basic education (58.5%), health (24.5%), and a general-purpose destination (17%) that included basic sanitation programs (particularly drinking water, sewage, and garbage collection). As for the geographical distribution criteria, there were no substantial changes with respect to the previous regime. Population size remained the main variable for resource allocation (i.e. population served and to be served in terms of education and health services; urban and rural location; conditions of extreme poverty, etc.).

The second reform took place in 2007 and basically aimed at rectifying the transitory scheme used to calculate the amount of transfers set in 2001. This reform introduced higher real-growth rates for the SGP until 2016, and added new resources for the education sector. After 2016, the transfer funding will be linked back to the (historical) dynamics of the central government's current revenues.

In the transition towards decentralization, financial transfers became the main source of revenue for regional (municipal and departmental) governments. This phenomenon was similar throughout the Latin American countries that undertook this kind of reforms.[6] However, the prominence of transfers was particularly evident in Colombia, where they represented nearly 50% of the total funding of regional governments by the end of the 1990s.

[6] Gomez and Jiménez, J. (2011)

In the 2000s, the importance of transfers diminished only slightly and the increased dependence from them may have lessened the fiscal efforts of local authorities. However, as shall be explained in the following section, the degree of transfer-dependence was different across municipalities.

From an overall tax-collection perspective, in Colombia, sub-national governments collect nearly 19% of tax revenues (2006-2010, on average), and they execute approximately 13% of those revenues (excluding expenditures financed with transfers). These figures are consistent with international indicators according to which in developing countries, regional and local governments combined account only for some 11% of the overall tax collection, and explain 13% of tax-revenue expenditures. In OECD countries, these figures are higher: 18% for overall tax-collection and 33% for tax-revenue expenditure.[7]

2.2 Municipal revenue and expenditure trends after the 1991 Political Constitution

In the early 90s, municipalities, as a whole, had annual revenues of 1.6% of the GDP; of them, 53% came from their own income (taxes, fees and fines), and 46% were transfers from the central government. Two decades later, these resources have more than tripled (in percentages of the GDP). This sharp increase is explained by: The larger transfers driven by the CP-91; arise in the municipalities' own income; and the royalties received from the exploitation of non-renewable natural resources (a new source of funding that emerged in the mid-1990s).[8] Between 1990 and 2010, local tax revenues climbed up from 0.7% to 2% of the GDP. This shows the important efforts made by municipalities, even though they differ from town to town, as shall be illustrated below.

Nowadays, Colombia has a total of 1.123 municipalities located in 32 departments. Of them, there is fiscal data for 1.103. Table 1 shows the number of municipalities, the average population density by department, and other economic and education variables. The differences between regions are evident. The central region and two western departments explain two-thirds of the overall national output. In fact, the city of Bogotá explains 26%, and the departments of Antioquia, Valle del Cauca, Santander and Cundinamarca explain 14%, 10%, 7%, and 5% respectively. These regions are the most densely populated and have the highest per-capita incomes. The per-capita GDP for Bogotá (COP$15.2 million in 2010) is twice the national average, and four times the average of municipalities located in the poorest

[7]Bird, R. (2012), Op cit,.

[8]The PC-91 also fixed guidelines for the liquidation and distribution of royalties from natural resource exploration

departments (Cauca and Chocó). Bogotá's public revenues, also in per-capita terms, are five times the average of any municipality in the country, and ten times the average of the poorest municipalities. Not surprisingly, these municipalities display the lowest rates of education coverage.

It has been mentioned that municipalities differ in their degree of dependence from transfers and in their local tax efforts. In order to examine these differences, we classified them in seven size categories based on population and self-generated income (criteria established by Law 617 of 2000). On this scale, municipalities in a top "special" category are those with larger populations and higher tax revenues, and municipalities in the last (sixth) category are the least populated (less than 10.000 inhabitants) and the ones with lower tax revenues. To have an idea of the overall distribution of the country's municipalities: By 2010, 995 of them, or 90% of the total, belonged to the sixth category. By contrast, the top "special" category included only 6 municipalities, each of them with a population above 500.000 (Table 2).

Figure 1 shows a comparison between tax-revenue to expenditure ratios for major municipal categories, out of which two conclusions may be drawn. First, that the larger a municipality is, the more likely it will be to finance its spending with local taxes. Hence, during the 90s, large municipalities in the "special" category financed over 50% of their spending with self-generated taxes, while municipalities of the sixth category only financed 13%. Population density and participation in the national economy allow larger municipalities to have dynamic tax bases and to expand the tax burden more easily. However, over the past two decades, the gap between the tax-revenue/expenditure ratios of "special" level and sixth-category municipalities has been decreasing substantially. Second, during the 90s, the ratios for all municipalities fell and thereafter, they stabilized or even reversed their trend in some categories (the special and the sixth).

Figure 2 illustrates the transfers to expenditure ratios for several municipal categories. As expected, larger municipalities (special and first categories) depend less from transfers to finance their expenditure programs (0.24 and 0.44 in the early 90s, respectively). However, and quite surprisingly, these ratios increased throughout the 2000s. By contrast, the degree of transfer-dependence of smaller municipalities is considerably higher (above 0.9 in the early 90s), yet it has declined sharply over the last decade. Consequently, the gap between large and small municipalities concerning this indicator (transfer-dependence to finance local spending) has been narrowing.

Figure 3 displays municipal spending distributions for leading programs that were financed with both self-generated revenues and central-government transfers. Over the last twenty years, the overall spending increased 4 percentage points of the GDP (from 2.8% to 6.8%), and the most significant raise occurred in social programs (education and health), more than in infrastructure. However, this growth took place mainly throughout the 90s, probably as a result of the lofty social commitments of the PC-91.

Between 1990 and 2009, the funding for the public education system (which covers primary, basic and upper secondary levels) rose from 1.2% to 3% of the GDP, and the funds to co-finance the public health system went from 0.1% to 1% of the GDP. The education expenditure included both self-financed and transfer-financed spending for the certified and the non-certified municipalities.[9] Meanwhile, the funding for the road infrastructure (secondary and tertiary networks) increased from 0.1% to 0.4% of the GDP, and the resources for electricity and drinking water facilities went from 0.1% to 0.2% of the GDP. Spending on bureaucracy remained stable at around 1% of the GDP. Undoubtedly, the largest fiscal effort was made on education, with the expectation that significant achievements in terms of the system's quality and coverage would reflect it. We shall analyze these issues in the following section of this document.

3. Decentralization and public education: Model specifications and estimations

3.1 The Data

In order to assess the effects of decentralization on the public education system empirically, we first compiled a wide array of information. We obtained the annual revenues and expenditures of the 1,103 municipal governments, since 1990, from the National Planning Department (NPD), and we complemented this data with input on local spending by programs from Colombia's Central Bank [*Banco de la República*]. From all this information, we devised some standard indicators of the decentralization degree of municipalities (i.e. their levels of decision-making autonomy) for the total sample, the main municipal categories and the certified and non-certified towns.

The Ministry of National Education and the Colombian Institute for the Promotion of Higher Education (*ICFES*, Spanish acronym) informed our variables on enrollment rates, *ICFES*-test scores, number of public schools, rates of students and teachers, for both public and private institutions. In addition, their data-bases provided us with input on average class-

[9] Certified municipalities administer directly their education transfers, whereas those of non-certified municipalities are managed by the intermediate-departmental levels of government.

sizes, percentages of tuition-paying students in the public system and the mothers' level of education. However, these data were available only since 2001. The National Administrative Department of Statistics (*DANE*, Spanish acronym), the *Agustín Codazzi* Geography Institute and the Colombian Federation of Municipalities provided us with additional economic, social and demographic information which we used in the control variables of our econometric models.

Table 3 provides the main statistics for the set of variables used in the models. The municipal decentralization indicator for the full sample reached a simple average level of 13.1% between 2005 and 2010. Because of the large number of small municipalities (90% of the total), this percentage could be biased downward. In fact, category-sixth towns have a fiscal decentralization level of 11%, while large, special-category towns reach decentralization level of 41.2%. On average, the net coverage (enrollment) rate for the basic education levels (primary, basic and upper secondary as a whole) stands at 85%, and the average municipal size corresponds to 40,125 inhabitants. Regarding some quality-related variables, the mean size of each class is 27 students, the mean score of the ICFES-test (taken upon completion of secondary education) was 43.2 in 2010 (with a better performance in language than in mathematics), and 24% of all public-system students pays some kind of fees for the service.

3.2. Effects on school enrollment

Concerning the role that fiscal decentralization could play as determinant of public school enrollment, we estimated first the following reduced-form model:

$$E_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 FD_{it}^2 + \beta_3 G_{it} + \beta_4 PO_{it} + \beta_5 Cl_{it} + \beta_6 T_{it} + \varepsilon_{it} \qquad (1)$$

where the key variables are the net enrollment rate (E_{it}) and the degree of fiscal decentralization (FD_{it}). The latter defined as the share of the local tax revenues in a given municipality's total income, which is a standard measure of local autonomy. We also used the ratio local tax revenues to total expenditure as an alternative measurement of fiscal decentralization, yet the results are not reported because they are virtually equivalent. We are particularly concerned about the sign and statistical significance of β_1 as it captures the average effect of decentralization on the coverage of the public education system. Given that in Colombia, decentralization has been a gradual process over a long period of time, we also

assessed its non-monotone effect by using the quadratic term FD_{it}^2. Therefore, if the sign of β_2 is negative, as expected theoretically, then the non-monotonic relationship between decentralization and the coverage of public education could be described by an inverted U-shaped curve.

In the equation (1) above, we controlled two types of possible additionally explanatory variables: socioeconomic variables (including some fiscal indicators) and education specific variables. The first group includes the per capita local public spending (G_{it}) and the population size in the natural logarithm (PO_{it}), as an attempt to explain the expansion of education coverage associated mostly to the flow of wealth actually spent by the municipalities. Between the second type of variables we focused on the class-size (Cl_{it}), measured as the average student-teacher ratio for each municipality, and on the percentage of public-school students who pay any tuition fees (T_{it}). Since both could imply a marginal access restriction to the education system, we could not ignore them. By restrictions on the length of the time data, we don´t use time dummy variable which are typically use to control possible institutional reforms, political-electoral cycles at sub-national levels, and even national aggregate shocks, all of which represent changes over time but not between municipalities

In addition to the average impact of decentralization on the access to the public education system as whole, we analyzed the differential effect between certified and non-certified municipalities.[10] There are 62 certified municipalities that serve 51% of the public-school student population. As mentioned above, these municipalities receive direct transfers from the central government (not from departmental authorities), which is a signal of their higher fiscal autonomy. Departmental governments could have a marginal discretion on the allocation of some municipal funds, which may limit the autonomy of non-certified towns. We attempt to capture this differential effect with the following reduced-form model:

$$E_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 FD^2 + \beta_3 (FD_{it} * Cf_{it}) + \beta_4 G_{it} + \beta_5 PO_{it} + \beta_6 Cl_{it} + \beta_7 T_{it} + \varepsilon_{it} \quad (2)$$

where Cf_{it} is a dummy variable that takes the value of 1 if municipality i is certified, and 0 otherwise.

[10] We also estimated equation (1) for municipalities of the sixth category, in order to capture any differences in the value of parameters with respect to the full sample. Nevertheless, the results are not reported because are virtually equivalent, maybe because their large share within the total (90%).

We estimated equations (1) and (2) using panel data models for 1,099 Colombian municipalities over the 2005–2010 timeframe. Unfortunately, we were unable to estimate the panel data for a longer period because of restrictions in our enrollment data. In principle, the estimation could be biased by unobserved heterogeneity between municipalities. However, through a fixed effects (FE) estimator, we controlled all of the unobserved explanatory variables that vary between municipalities but remain stable over time. We confirmed the suitability of using a panel data model with fixed effects through the Hausman test (1978).

3.3. Effects on school quality

We assessed the effects of fiscal decentralization on the quality of the public education system through the following reduced-form model:

$$Q_{ij} = \beta_0 + \beta_1 FD_{ij} + \beta_2 PO_{ij} + \beta_3 GDP_j + \beta_4 ME_{ij} + \beta_5 Cl_j + \beta_6 T_{ij} + \varepsilon_{ij} \quad (3)$$

where the endogenous variable, public-school quality Q_{ij}, was measured by the average score obtained on the "*Saber–11*" test, commonly known as the ICFES exam. This is a compulsory exam taken by all students upon completion of their upper secondary (high school) education. It basically evaluates language, mathematics, philosophy, social studies (history and geography), biology, chemistry and physics competences and knowledge. In our analysis, we defined the variable Q_{ij} (average-public-school scores in town i of department j) as: i) the simple average scores on the seven above mentioned areas; ii) language scores, and iii) mathematics scores. Language and mathematics are recognized worldwide as the areas that synthesize the basic skills acquired through education (hence, a measure of quality).

As in the previous models, we controlled specific socio-economic and education explanatory variables that could influence significantly the quality of education. We used the size of municipalities (PO_{it}, in natural logarithm) and the availability of resources, employing as proxy the departmental-GDP, in per capita terms (GDP_j). Because of data restrictions, we allowed GDP fluctuations across departments, but not between the municipalities that belonged to the same department, which restricts our results. The education specific variables are the same that we used in the enrollment model, but include a new important control which is the percentage of students, by municipality, whose mother completed technical education at least (or greater, ME_{ij}). Since students from more educated

homes have an advantage, this variable is expected to affect the scores of the ICFES exam positively.

In terms of the quality of education, on average, certified municipalities would be expected to score better than non-certified towns, simply because of the inherent advantages of large cities (i.e. libraries, cultural events, private-education spillover effects, easy access to additional education services, and others). Moreover, because certified municipalities have larger coverage rates, we may hypothesize that they have invested their public funding in quality improvements. The model described by the equation below (4) let us to examine empirically these issues:

$$Q_{ij} = \beta_0 + \beta_1 FD_{ij} + \beta_2 \left(FD_{ij} * Cf_i\right) + \beta_2 PO_{ij} + \beta_3 GDP_j + \beta_4 ME_{ij} + \beta_5 Cl_j + \beta_6 T_{ij} + \varepsilon_{ij} \quad (4)$$

where Cf_{it} is a dummy variable that takes the value of 1 if municipality i is certified, and 0 otherwise.

Since the ICFES-exam has evolved over time, its scores are not strictly comparable from year to year. Therefore, we used a cross-section econometric model for some selected years (2001, 2005 and 2010) instead of a panel data model. Given the nature of this topic and the technique employed to estimate the parameters, we computed the test of white robust standard errors to solve the heteroscedasticity problem evident in the Figure 4.

4. Results

Table 4 confirms our initial expectation of a positive correlation between the municipal fiscal decentralization degree and the access to public basic education (primary, middle and upper secondary levels, jointly). As has been demonstrated by previous studies, the municipalities more decentralized are also the wealthiest, the most densely populated and those with highest concentrations of urban populations.[11] Table 5 shows the positive correlation between fiscal decentralization and the scores of public schools in the ICFES exam, together with the other variables associated to education quality. As was expected, local government spending and regional GDP are also positively correlated with both the enrollment and quality levels of basic public education. Consequently, it is crucial to include this set of variables in the model as controls to avoid omitted variable bias or potential endogeneity problems.

[11] Faguet and Sánchez (2007).

4.1. Average and non-monotone effects of fiscal decentralization on public-school enrollment.

The average effect of fiscal decentralization on public school enrollment was first estimated for the full sample, using OLS with fixed effects for the period 2005-2010 (equation 1). Table 6 shows the results introducing the control variables progressively starting from the column three. As expected, β_1 is positive and statistically significant throughout models 2 to 5, reaching a final value of 0.11. This result implies that, once other possible explanatory factors have been controlled, the impact of an increase of 10 percentage-points in fiscal decentralization would represent an extra 1.1 percent of students having access to public education. In terms of the standard deviation of the fiscal decentralization degree (12 percent), the result means a 1.28 percentage-point increase for one-standard-deviation change.[12]

In addition, our estimations confirmed a new finding: The non-monotone effect of decentralization on enrollment rates. As was theoretically expected, the parameter β_2 in equation (1) has a negative sign and it is statistically significant, which means that the relationship between fiscal decentralization and public-education coverage could be described by an inverted U-shaped curve. Using the parameters β_1 (the average effect) and β_2 (the non-monotone effect), we estimated the optimal decentralization level for the access to education services, given by the ratio - $\frac{\beta_1}{2\beta 2}$, which reached 27% in our model. From a descriptive statistics perspective (Table 2), this figure is far above the average for all Colombian municipalities (13%). However, this optimal decentralization level (27%) could have been already attained in the special and first category municipalities, as could be inferred from Figure 1.

Moreover, Table 6 shows that large municipal spending (in per capita terms) has positive effects on school-coverage rates, while large populations and high education fees payments have the opposite effect. The sign and statistical significance of these parameters remain stable across all specifications, and are consistent with empirical findings

[12] The positive (average) effect of fiscal decentralization on student enrollment for public schools in Colombia was found previously by Melo (2005) and Faguet et al. (2007). However, our findings differ from theirs because of the methodology and the data employed (period and municipal sample). Although there was certain methodological similarity with Faget, et al., the period is clearly different and so is the empirical strategy used to find the heterogeneous effect of decentralization across municipalities.

worldwide.[13] The coefficient for class sizes is not statistically different from zero in any of the estimates.

Finally, we made a distinction between certified and non-certified towns to assess the heterogeneous average effect of fiscal decentralization on net enrollment rates. Let us recall that the first type receives direct transfers from the central government (not indirect funding through departmental authorities), which suggests their higher fiscal autonomy. Table 7 shows that the size of the average effects (β_1) for the non-certified municipalities (1,037 out of 1,099 in the year 2010) reaches 0.104, while the parameter for their certified counterparts (62 out of 1,099) is -0.041. This last result comes from the sum of $\beta_1 + \beta_2$ in equation (2). Interestingly, the average effect size for non-certified municipalities is quite close to that of the full sample. The negative sign of the coefficient for the certified municipalities is quite surprising. It might imply that an increase in their own tax income (relative to overall revenues) not necessarily means higher investments in school-enrollment, probably because these towns already have high coverage rates, or because they have already achieved the optimal decentralization level for the expansion of this service.

4.2 Fiscal decentralization effects on public-school quality

The effects of fiscal decentralization on the quality of public schools were estimated through cross-section econometric models (by OLS) for the years 2001, 2005 and 2010. Unfortunately, we were unable to estimate these models for previous years (because test-score information was unavailable) or through the panel data technique (because of the time-related inconsistencies of test-scoring). We used the information of more than 860 towns for the three selected years (1,086 for the year 2010). To find the average effect and the differences between municipalities, we followed the same strategy: The model was run first for the full sample (equation 3) and then for the certified and non-certified municipalities (equation 4). In addition, for this case we show explicitly the results for the sixth-category towns.

Table 8 presents the results selecting first, as an endogenous variable, the simple average score on the seven areas evaluated through the ICFES exam: language, mathematics, philosophy, social studies (history and geography), biology, chemistry and physics. The fiscal decentralization parameter (β_1 of equation 3) is positive and highly significant throughout the selected years and for all the cases under analysis: total sample, certified and non-certified

[13] For instance, see Caldeira et al. (2012).

towns, and the sixth-category municipalities. Our estimates for the full sample indicate that a 10 percentage-point increase in fiscal decentralization could imply a 0.3 percent increase in the average test scores of public-school students. The extent of this impact is slightly higher in 2010, and for smaller (sixth-category) towns. Not surprisingly, the size of the impact is clearly higher for the certified municipalities ($\beta_1 + \beta_2$ of equation 4), and particularly as of 2005, which may indicate that because they already have the highest basic-education coverage, their fiscal efforts are (presumably) devoted to quality-related programs.[14]

The control variables, usually employed to explain school-performance differences, show statistically significant parameters and with the expected signs. In general, neither large population sizes (β_2) nor large class sizes (β_5) benefit school performance. These results are robust across the different model specifications and over time. Most empirical studies have reached similar outcomes, which may imply that, ceteris paribus, students from schools with relatively small classes score better on the tests.[15] Moreover, municipal income levels (β_3) have the most significant and positive effect on the school performance. This result is not surprising since the regions and households with better incomes may provide additional extra-curricular support to the learning process.

The parental education level may be a relevant variable to determine schooling outcomes. The results of the percentage of students (by municipality) whose mother had completed at least technical education confirm this variable's positive effect (statistically high significance was found across all models). Consequently, in the full sample model for the year 2010, the impact of a 10 percentage-point increase in the total number of mothers with technical education levels or above, would imply a 0.8 percent improvement in the average scores obtained by public-school students.

Finally, we estimated equations (3) and (4) using two alternative measures of education quality: the average language and mathematics scores of public schools by municipality. Both indicators offer a more precise measure of quality, particularly when they are compared over time. In addition, they are widely understood as the essential competences

[14] This presumption is supported at least by the case of Bogotá, which provides public-education services to a significant share of the country's student population. Thus for instance, of the total budget approved for 2013 (COP $ 11.5 billion), nearly 30% will finance education (COP $ 3.3 billion), not only in terms of teacher salaries, but also, and particularly, in terms of their training, available technology, infrastructure, as well as student nutrition (see http://impuestos.shd.gov.co/portal/page/portal/portal_internet_sdheltiempo.com).

[15] Using data from TIMSS (Trends in International Mathematics and Science Study), Breton (2012) confirms the negative effect of class size on the mathematics performance of fourth-grade students in Colombia. His analysis provides further evidence of other relevant determinants, such as the profiles of students, teachers and households, but does not refer to the possible direct influence of fiscal decentralization.

to be developed by the education system.[16] We confirmed the sign of these parameters and their statistical significance (Tables 9 and 10). However, we would like to point out two interesting differences with respect to the previous results. First, the size of the parameters is larger, particularly when related to fiscal decentralization, municipal income and parental education level; second, the size of the parameters associated to fiscal decentralization increases progressively when mathematics scores are used as the dependent variable, but it decreases when they are replaced by language scores (particularly in 2010).

5. Concluding remarks

By the turn of the 20th century, Colombia, as many other Latin American countries, intensified a fiscal decentralization process, after a long tradition of centralized governance. Several reforms, backed up by the 1991 Political Constitution, sought to rebalance expenditure functions and revenue sources between central and sub-national governments. Moreover, they intended to grant increased political and decision-making autonomy to the regions. Consequently, local governments began to play an increasingly significant role in the provision of social and basic infrastructure services.

Within the social-service efforts, education was privileged by the fiscal decentralization from the start. Official analyses indicate that, in last 30 years, public spending per student has tripled at the primary level, and doubled at the secondary level.[17] Currently, the public education system serves some 10 million students with more than 300.000 teachers. This system is mostly financed through transfers from the central government; however, in recent times, the local governments of the country's largest cities have begun to make important self-budgetary efforts. Even though the coverage of basic education is believed to be almost universal, the data indicate that enrollment net rates differ significantly across municipalities. Regarding quality, education outcomes have persistently indicated that private schools generally perform better than their public counterparts. Consequently, current public policy challenges concerning basic education deal with narrowing the gaps between net school enrollment across regions, and quality standards between the private and public institutions.

This paper provided empirical evidence of the effects of Colombia's fiscal decentralization process on both the access to basic education services (enrollment) and their

[16] See again Breton (2012) op. cit.
[17] Perfetti (2012), Op. cit.

performance (quality). We assembled a set of social and economic variables, based on public-finance information for 1,003 municipalities and education data for 13,670 public schools. Since decentralization may have uneven effects between regions and within them, we specified econometric models for all municipalities as a whole, for size-based municipal categories and for town types (certified and non-certified) depending on whether they receive the education transfers directly from the central government or not.

The following are our most relevant results: (i) The positive and non-monotone effect of decentralization on public-education enrollment rates was confirmed. The parameters estimated suggested an optimal level of fiscal decentralization of 27%, for a better access to education services. This percentage may have been already attained in municipalities of the special and first category. However, this figure is far above the decentralization average for all Colombian municipalities (13%). The size of this effect for non-certified municipalities is lower because they have less fiscal autonomy. (ii) Across the several models, it was observed that large municipal spending have positive effects on school coverage rates, while large population and high education fees payments have the opposite effect. (iii) Concerning public-education quality, assessed through the ICFES-test scores, we found that it is positively affected by fiscal decentralization. The size of this impact is clearly larger for the certified municipalities (62 out of 1,099), particularly as of 2005. This may be related to the fact that since these towns have the highest basic-education coverage, they can devote increased fiscal resources to quality-related programs. Interestingly, the size of the parameters associated with fiscal decentralization increases progressively when mathematic scores are used as the dependent variable, but it decreases when they are replaced by language scores. (iv) Control variables, which are usually employed to explain school-performance differences, show parameters that are statistically significant and with the expected signs. In particular, a large class size does not benefit school performance, while the municipal income level and the parental education level have a crucial positive effect on the student's school performance.

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Table 1.Chief indicators for regions in Colombia

Department	Demographic				Economic					Public Education			
	Number of Municipalities	Area (Km^2)	Population	Population Density	GDP 2010 ($MM 2010 = 100)	Share of National GDP	GDP percapita ($ 2010= 100)	Public Expenditure percapita / *	Public Revenue percapita / *	Number of schools	Number of students	Number of teachers	Net Enrollment Rate
Amazonas	11	109.665	72.017	0,7	271	0,1%	3.763.000	547.551	84.573	27	19.278	787	77,13%
Antioquia	125	63.612	6.066.003	95,4	58.118	13,7%	9.580.938	1.008.471	280.594	3827	1.231.088	36.674	92,17%
Arauca	7	23.818	247.541	10,4	3.620	0,9%	14.623.840	1.000.105	97.688	81	59.152	2.396	75,43%
Archip San Andrés	2	44	73.320	1.666,4	745	0,2%	10.160.938	283.097	n.a.	244	193.985	6.749	92,25%
Atlántico	23	3.388	2.314.460	683,1	17.774	4,2%	7.679.545	777.135	231.132	12	9.878	453	67,55%
Bogotá D.C	1	1.605	7.363.782	4.588,0	111.920	26,3%	15.198.712	1.249.358	570.359	313	430.849	12.786	95,96%
Bolívar	46	25.573	1.980.012	77,4	16.512	3,9%	8.339.343	710.518	180.565	403	1.005.700	27.818	90,78%
Boyacá	123	23.189	1.267.652	54,7	10.994	2,6%	8.672.727	830.599	147.569	326	502.882	15.425	90,88%
Caldas	27	7.888	978.342	124,0	6.708	1,6%	6.856.498	531.220	137.445	312	299.049	11.235	85,91%
Caquetá	16	88.965	447.767	5,0	1.958	0,5%	4.372.810	617.040	76.074	256	184.473	7.930	86,83%
Casanare	19	44.640	325.621	7,3	6.772	1,6%	20.797.184	1.887.283	324.998	182	118.485	4.038	82,80%
Cauca	42	29.211	1.319.120	45,2	6.069	1,4%	4.600.794	538.919	77.635	91	90.558	3.572	99,42%
Cesar	25	22.905	966.450	42,2	7.885	1,9%	8.158.725	884.106	117.930	599	328.992	11.573	85,41%
Chocó	31	46.530	476.149	10,2	1.864	0,4%	3.914.741	828.062	58.340	236	263.572	8.613	90,12%
Córdoba	30	24.392	1.582.784	64,9	8.177	1,9%	5.166.213	702.191	77.441	180	146.671	5.661	79,24%
Cundinamarca	116	22.605	2.477.036	109,6	21.580	5,1%	8.712.025	703.350	205.069	486	423.245	15.308	93,47%
Guainía	9	56.073	38.328	0,7	133	0,0%	3.470.048	337.529	41.922	376	459.605	17.103	89,04%
Guaviare	4	20.848	103.307	5,0	370	0,1%	3.581.558	698.174	68.106	85	10.473	410	69,08%
Huila	37	53.460	1.083.189	20,3	6.847	1,6%	6.321.150	766.064	106.840	36	23.006	839	62,15%
La Guajira	15	19.890	818.740	41,2	4.794	1,1%	5.855.339	957.964	66.945	245	252.585	9.406	88,80%
Magdalena	30	23.188	1.201.501	51,8	5.718	1,3%	4.759.047	630.095	77.749	140	221.381	4.990	85,16%
Meta	29	85.635	870.921	10,2	15.924	3,7%	18.284.092	991.662	226.139	246	356.188	12.241	96,25%
Nariño	64	33.268	1.639.560	49,3	6.355	1,5%	3.876.040	633.919	62.259	193	188.232	6.771	91,27%
Norte de Santander	40	21.658	1.297.951	59,9	7.031	1,7%	5.417.000	552.245	100.754	2199	379.544	14.281	81,50%
Putumayo	13	24.885	326.093	13,1	1.913	0,5%	5.866.425	631.107	69.101	285	293.585	9.920	85,36%
Quindio	12	1.845	549.662	297,9	3.452	0,8%	6.280.223	544.790	143.784	178	85.272	3.468	79,32%
Risaralda	14	4.140	925.117	223,5	6.365	1,5%	6.880.211	663.163	184.975	85	108.777	3.738	89,60%
Santander	87	30.537	2.010.393	65,8	29.432	6,9%	14.639.924	869.711	259.284	402	386.773	15.144	90,70%
Sucre	26	10.917	810.664	74,3	3.172	0,7%	3.912.842	793.466	74.580	725	243.118	8.464	100,43%
Tolima	47	23.562	1.387.621	58,9	9.064	2,1%	6.532.043	606.383	126.089	293	316.929	11.337	87,10%
Valle del Cauca	42	22.140	4.383.277	198,0	42.691	10,0%	9.739.517	679.063	237.487	388	757.740	20.763	89,64%
Vaupés	6	54.135	41.534	0,8	95	0,0%	2.287.283	683.961	59.939	19	9.179	380	60,09%
Vichada	4	100.242	63.670	0,6	577	0,1%	9.062.353	1.029.281	49.251	200	17.993	659	79,78%
Total and Averages	1.123	1.124.453	45.509.584	265	424.900	100%	7.798.883	762.654	144.457	13.670	9.418.237	310.932	

Source: Authors' calculations from IGAC, DNP, DANE and Ministry of Education data.

Table 2. Municipal categories, 2010 (Law 617 of 2000)

Category	Population	Own revenues (ICLD)*	Number of municipalities	Percentage
SPECIAL	> 500.000	> 400.000	6	0,54
FIRST	100.001-500.000	100.000-400.000	16	1,45
SECOND	50.001-100.000	50.000-100.000	16	1,45
THIRD	30.001-50.000	30.000-50.000	20	1,81
FOURTH	20.001-30.000	25.000-30.000	25	2,27
FIFTH	10.001-20.000	15.000-25.000	24	2,18
SIXTH	< 10.001	< 15.000	995	90,29
Total			1.102	100

/* Expressed in Minimum Legal Monthly Wages

Table 3. Descriptive statistics

Variable	year(s)	Obs.	Mean	Std. Dev.	Min	Max
Averages:						
Degree of fiscal decentralization (%)	2005 - 2010	6.545	0,13	0,12	0,00	0,82
Net enrollment rate for basic education (Public Schools)	2005 - 2010	6.548	0,85	0,16	0,17	2,32
Municipal expenditures (Per capita. thousands of COP$ 2005=100)	2005 - 2010	6.557	668	534	0,348	8.993
Population (In thousands of inhabitants)	2005 - 2010	6.601	40,1	244	0,885	7.364
Class Size (municipal)	2005 - 2010	6.596	0,92	0,76	0,00	20,50
Students who pay tuition in public system (%)	2005 - 2010	6.018	0,24	0,35	0,00	1,00
Mothers with higher level of education (%, technological or greate	2001	935	0,05	0,05	0,00	0,42
	2010	1.096	0,07	0,05	0,00	0,35
Class Size (number of students per-teacher)	2005	1.121	26,46	3,44	0,75	48,41
	2010	1.116	26,96	4,11	7,54	78,07
GDP per capita (Thousands of COP $, 2010=100) *	2001	1.122	6.414	4.923	2.174	40.574
	2005	1.122	6.895	3.291	2.215	23.564
	2010	1.122	8.225	3.720	2.287	20.797
ICFES Average Score	2001	935	43,09	1,19	39,49	46,47
	2005	967	43,31	1,39	38,48	50,94
	2010	1.096	43,22	1,79	37,26	52,97
ICFES Lenguage Score	2001	935	44,69	1,70	38,74	51,21
	2005	967	43,98	2,82	34,53	58,82
	2010	1.096	44,68	1,65	34,86	51,64
ICFES Math Score	2001	935	40,11	1,09	34,90	44,60
	2005	967	43,45	1,48	38,50	52,42
	2010	1.096	42,40	2,99	33,39	58,47

Source: Authors' calculations from DNP, DANE, Ministry of Education, and ICFES data.

Table 4. Correlation -School enrollment

Variables	FD	Net Enrollment Rate	Public spending per capita	Population Size	Class-Size	Tuition
FD	1					
Net Enrollment Rate	0.23180***	1				
Public spending per capita	-0.08057***	0.11135***	1			
Population Size	0.19797***	0.04406***	-0,00155	1		
Tuition	-0,02031	-0.02783*	-0.04289***	-0,00317	-0,01203	1

*** p<0.01, ** p<0.05, * p<0.1

Table 5. Correlation –School quality

Variables	FD	Average	Lenguage	Math	Population Size	Mother Education	Class-Size	GDP per capita	Tuition
FD	1								
Average	0.27273***	1							
Lenguage	0.30598***	0.87794***	1						
Math	0.28251***	0.92800***	0.78711***	1					
Population Size	0.19515***	0.06042*	0.06840*	0,05686	1				
Mother Education	0.15883***	0.23933***	0.21118***	0.24668***	0.11729***	1			
Class-Size	-0.06297*	-0.15485***	-0.13331***	-0.17763***	0.18314***	0.07187*	1		
GDP per capita	0.21433***	0.24328***	0.25637***	0.2956204***	0,04567	0.10583***	-0.27348***	1	
Tuition	0.08570**	0.13382***	0.11137***	0.15214***	0,00227	0.16219***	-0.13898***	0.17399***	1

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations.

Table 6. Estimation of Equation 1
Endogenous variable: Net enrollment rate
Full sample

Dep. Var: Ei,t Full Sample	(1)	(2)	(3)	(4)	(5)
Degree of Fiscal Decentralization $FD_{i,t}$	-0.002	0.112**	0.100**	0.081*	0.107**
	(0.024)	(0.044)	(0.044)	(0.043)	(0.045)
Non Monotone Effect of FD $FD^2_{i,t}$		-0.249***	-0.197**	-0.152*	-0.200**
		(0.082)	(0.081)	(0.081)	(0.083)
Per capita local public sepending $G_{i,t}$			0.038***	0.039***	0.035***
			(0.003)	(0.003)	(0.003)
Population Size $PO_{i,t}$				-0.186***	-0.209***
				(0.026)	(0.027)
Class - Size of Students $CI_{i,t}$					-0.000
					(0.000)
Share of students paying for tuition $T_{i,t}$					-0.010***
					(0.003)
Constant	0.851***	0.844***	0.819***	2.600***	2.828***
	(0.003)	(0.004)	(0.004)	(0.247)	(0.260)
Observations	6,538	6,538	6,538	6,538	5,968
R-squared	0.000	0.002	0.035	0.044	0.046
N° Municipalities	1,098	1,098	1,098	1,098	1,095
Municipalities FE	YES	YES	YES	YES	YES
Hausman	6.48E-16	3.74E-16	1.82E-15	1.98E-24	1.41E-25

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculations.

Table 7. Estimation of Equation 2
Endogenous variable: Net enrollment rate
Certified vs. non-certified municipalities

Dep. Var: $E_{i,t}$ Full Sample	(1)	(2)	(3)	(4)	(5)	(6)
Degree of Fiscal Decentralization $FD_{i,t}$	-0.002	0.112**	0.110**	0.098**	0.077*	0.104**
	(0.024)	(0.044)	(0.044)	(0.044)	(0.043)	(0.045)
Non Monotone Effect of FD $FD^2_{i,t}$		-0.249***	-0.219***	-0.177**	-0.113	-0.166*
		(0.082)	(0.085)	(0.083)	(0.083)	(0.085)
Dregree of Fiscal Descentralization $FD_{i,t}$ Certified			-0.112	-0.077	-0.146*	-0.145*
			(0.082)	(0.081)	(0.081)	(0.086)
Per capita local public sepending $G_{i,t}$				0.037***	0.039***	0.035***
				(0.003)	(0.003)	(0.003)
Population Size $PO_{i,t}$					-0.192***	-0.213***
					(0.026)	(0.027)
Class - Size of Students $CI_{i,t}$						0.000
						(0.000)
Share of students paying for tuition $T_{i,t}$						-0.010***
						(0.003)
Constant	0.851***	0.844***	0.846***	0.820***	2.653***	2.871***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.248)	(0.261)
Observations	6,538	6,538	6,538	6,538	6,538	5,968
R-squared	0.000	0.002	0.002	0.035	0.045	0.046
N° Municipalities	1,098	1,098	1,098	1,098	1,098	1,095
Municipalities FE	YES	YES	YES	YES	YES	YES
Hausman Test	6.48E-16	3.74E-16	5.67E-16	3.39E-15	3.53E-25	3.40E-26

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations.

Table 8. Estimation of Equations 3 and 4
Endogenous variable: Average score in the seven areas of the ICFES exam

	2001			2005			2010		
Dependet Var: $Q_{i,t}$ Average of 7 Subjets	Full Sample	Certified	6th category	Full Sample	Certified	6th category	Full Sample	Certified	6th category
Dregree of Fiscal Decentralization, $FD_{i,t}$	0.0304***	0.0300***	0.0350***	0.0301***	0.0273***	0.0337***	0.0388***	0.0361***	0.0388***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)
Dregree of Fiscal Decentralization, FDi,t -Certified		0.0012			0.0170***			0.0472***	
		(0.005)			(0.007)			(0.009)	
Population Size, $PO_{i,t}$	-0.0017***	-0.0017***	-0.0023***	-0.0001	-0.0007	-0.0015**	-0.0022***	-0.0036***	-0.0046***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Students whose mothers have higher education (%), ME i,j	0.0624***	0.0624***	0.0579***	n.a.	n.a.	n.a.	0.0820***	0.0754***	0.0763***
	(0.008)	(0.008)	(0.008)				(0.011)	(0.011)	(0.012)
Class-Size of Students, $Cl_{i,t}$	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0008***	-0.0003**	-0.0003**	-0.0004*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita, GDP_j	0.1470**	0.1457**	0.1120	0.8754***	0.8369***	0.8229***	0.5598***	0.4613***	0.4237**
	(0.068)	(0.068)	(0.071)	(0.131)	(0.131)	(0.139)	(0.149)	(0.149)	(0.165)
Share of students paying for tuition, Ti,t	n.a.	n.a.	n.a.	0.0056***	0.0053***	0.0039***	0.0045*	0.0040	0.0030
				(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
Constant	0.4521***	0.4525***	0.4581***	0.4356***	0.4415***	0.4563***	0.4442***	0.4605***	0.4697***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.008)
Observations	865	865	772	954	954	861	1,086	1,086	984
R-squared	0.207	0.207	0.193	0.149	0.155	0.147	0.169	0.188	0.158

White robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations.

Table 9. Estimation of Equations 3 and 4
Endogenous variable: Average language scores– ICFES exam

	2001			2005			2010		
Dependet Var: $Q_{i,t}$ Average on Languaje Test	Full Sample	Certified	6th category	Full Sample	Certified	6th category	Full Sample	Certified	6th category
Dregree of Fiscal Decentralization, $FD_{i,t}$	0.0476***	0.0481***	0.0542***	0.0764***	0.0719***	0.0867***	0.0385***	0.0361***	0.0376***
	(0.005)	(0.005)	(0.006)	(0.008)	(0.008)	(0.011)	(0.005)	(0.005)	(0.006)
Dregree of Fiscal Decentralization, FDi,t -Certified		-0.0021			0.0277**			0.0419***	
		(0.007)			(0.013)			(0.009)	
Population Size, $PO_{i,t}$	-0.0018***	-0.0017**	-0.0025***	-0.0003	-0.0012	-0.0033***	-0.0015***	-0.0027***	-0.0034***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Students whose mothers have higher education (%), ME i,j	0.0879***	0.0879***	0.0865***	n.a.	n.a.	n.a.	0.0610***	0.0552***	0.0542***
	(0.011)	(0.011)	(0.012)				(0.010)	(0.010)	(0.011)
Class-Size of Students, $Cl_{i,t}$	-0.0005***	-0.0005***	-0.0005***	-0.0004	-0.0004*	-0.0007**	-0.0002	-0.0002*	-0.0002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita, GDP_{j}	0.1003	0.1026	0.0583	1.9993***	1.9366***	1.9026***	0.6345***	0.5470***	0.5401***
	(0.097)	(0.097)	(0.101)	(0.262)	(0.263)	(0.281)	(0.137)	(0.137)	(0.153)
Share of students paying for tuition, Ti,t	n.a.	n.a.	n.a.	0.0091***	0.0087***	0.0064***	0.0025	0.0020	0.0013
				(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.4667***	0.4659***	0.4735***	0.4261***	0.4357***	0.4629***	0.4506***	0.4650***	0.4704***
	(0.006)	(0.006)	(0.007)	(0.009)	(0.011)	(0.013)	(0.005)	(0.006)	(0.007)
Observations	865	865	772	954	954	861	1,086	1,086	984
R-squared	0.209	0.209	0.182	0.174	0.178	0.146	0.165	0.183	0.138

White robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculations.

Table 10. Estimation of Equations 3 and 4
Endogenous variable: Average mathematics scores- ICFES exam

	2001			2005			2010		
Dependet Var: $Q_{i,t}$ Average on Math Test	Full Sample	Certified	6th category	Full Sample	Certified	6th category	Full Sample	Certified	6th category
Dregree of Fiscal Decentralization, $FD_{i,t}$	0.0175***	0.0156***	0.0204***	0.0167***	0.0162***	0.0181***	0.0616***	0.0579***	0.0649***
	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.006)	(0.008)	(0.008)	(0.010)
Dregree of Fiscal Decentralization, FDi,t -Certified		0.0073			0.0036			0.0654***	
		(0.005)			(0.007)			(0.015)	
Population Size, $PO_{i,t}$	-0.0012***	-0.0015***	-0.0019***	0.0005	0.0003	0.0001	-0.0030***	-0.0050***	-0.0066***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Students whose mothers have higher education (%), ME i,j	0.0335***	0.0335***	0.0309***	n.a.	n.a.	n.a.	0.1360***	0.1269***	0.1320***
	(0.008)	(0.008)	(0.009)				(0.018)	(0.018)	(0.019)
Class-Size of Students, $Cl_{i,t}$	-0.0004***	-0.0004***	-0.0004***	-0.0001	-0.0001	-0.0003	-0.0006**	-0.0007***	-0.0008**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita, GDP_j	0.2128***	0.2049***	0.1809**	0.6401***	0.6319***	0.6418***	1.3632***	1.2268***	1.1203***
	(0.067)	(0.068)	(0.071)	(0.149)	(0.150)	(0.162)	(0.245)	(0.245)	(0.271)
Share of students paying for tuition, Ti,t	n.a.	n.a.	n.a.	0.0031**	0.0030**	0.0025*	0.0086**	0.0079*	0.0063
				(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.004)
Constant	0.4172***	0.4199***	0.4241***	0.4261***	0.4273***	0.4323***	0.4374***	0.4598***	0.4772***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.007)	(0.009)	(0.010)	(0.013)
Observations	865	865	772	954	954	861	1,086	1,086	984
R-squared	0.098	0.101	0.098	0.048	0.048	0.037	0.196	0.210	0.189

White robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations.

Figure 1. Tax revenue to expenditure ratio for the main categories of municipalities

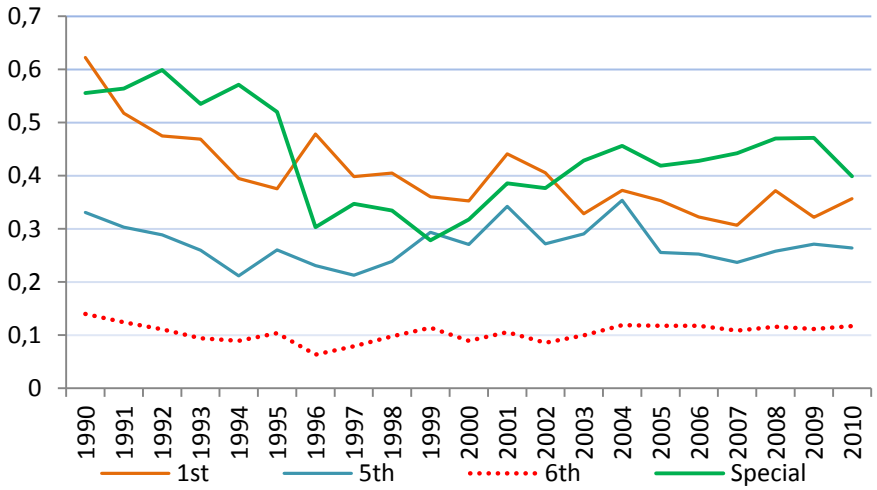


Figure 2. Transfers to expenditure ratio for the main categories of municipalities

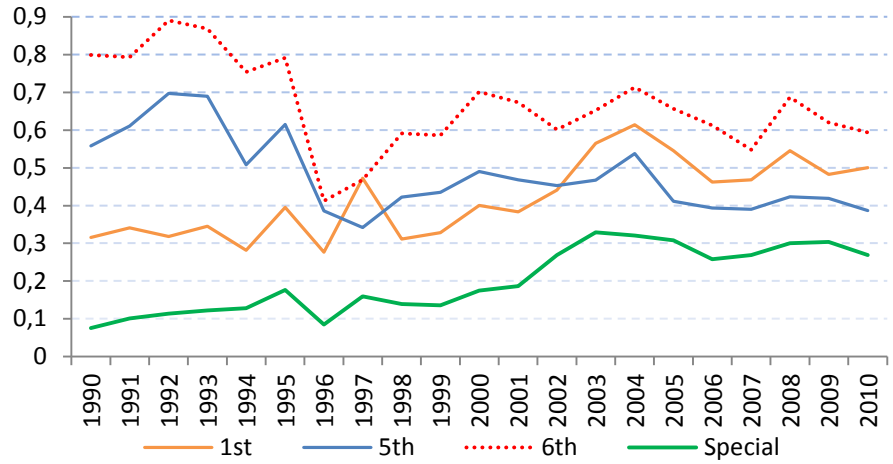
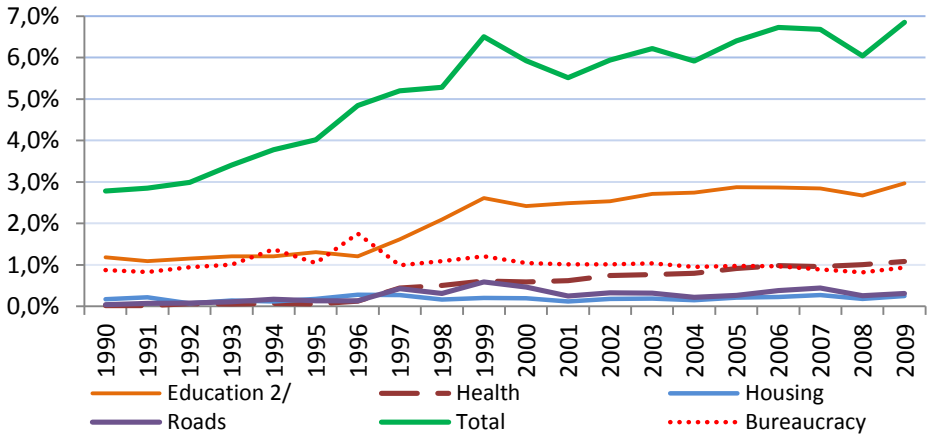


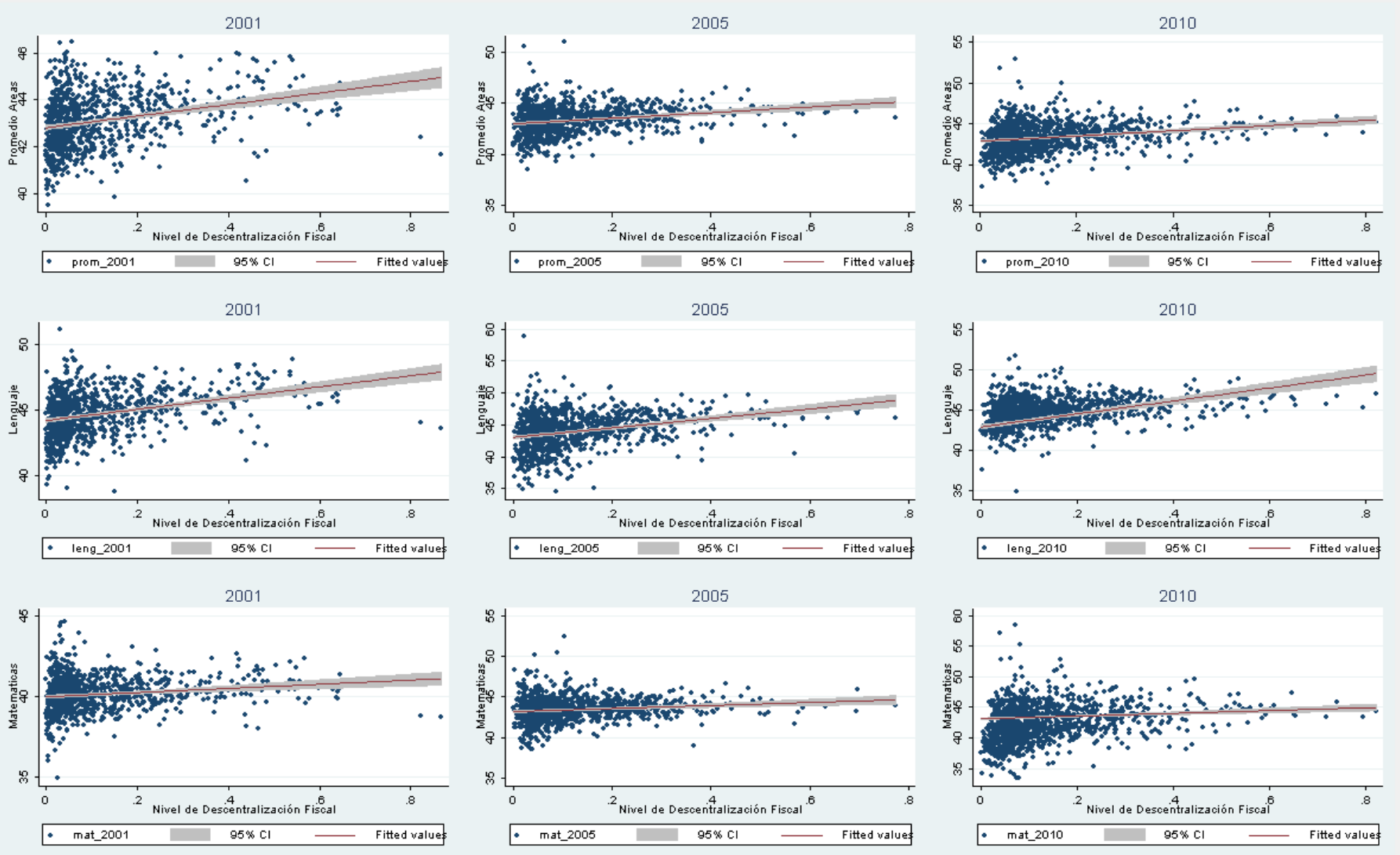
Figure 3. Local expenditure programs (Percentages of GDP)1/



1/ Financed with both own-revenues and transfers from central government.
2/ Education expenditures include self-financed and transfer-financed spending (both for certified and non-certified municipalities).

Source: Authors' calculations from DNP and DANE data.

Figure 4. Fiscal decentralization level (horizontal axis) and average ICFES exam scores (vertical axis)



Source: Authors' calculations from DNP and ICFES data.