

# Do more decentralized local governments do better?

## An evaluation of the 2001 decentralizing reform in Colombia

Darwin Cortés\*

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### Abstract

In this paper I evaluate the impact of the 2001 decentralizing reform in Colombia. I first develop a model of incomplete contracts à la Hart et. al. (1997) in which local governments choose what fraction of a divisible project is contracted with the private sector. I show that the fraction contracted with the private manager increases with decentralization if local governments receive positive net gains from the (non contractible) innovations that makes the private manager. In the empirical part I use data of Colombia's municipalities. I look at the effect of the 2001 reform on enrollment in precollege school. While all municipalities are subject to earmarked national transfers, with the reform some of them received more responsibilities in providing education (deeper decentralization) than the others. Particularly important, the reform entitles the more decentralized municipalities to sign subsidy contracts with private schools. Departments (the regional governments) are entitled to sign this type of contracts for the less decentralized municipalities. Since the rule for municipalities to receive more responsibilities follows an exogenous population threshold, I can implement Regression Discontinuity Design. Enrollment is measured through two variables: the number of students enrolled in public schools and the number of subsidized students enrolled in private schools. Results suggest that more decentralized municipalities have subsidized more students in private schools. The difference accounts for 20% of enrolment in private schools and 3% of population in schooling age in 2005. There are no significant differences among municipalities regarding enrolment in public schools.

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\*Toulouse School of Economics and Universidad del Rosario. E-mail: darwin.cortes@univ-tlse1.fr. I made the empirical part of this paper during my stay at the University of Padua.

## 1 Introduction

Decentralization has been at the core of the debate on government organization in the last decades. Nowadays, fiscal decentralization is an objective in both developed and developing countries that is promoted by international organizations such as the World Bank.

The economic theory has distinguished several reasons that explain why decentralization may do better. The usual advantage argued is that local governments have better information on local preferences (Persson and Tabellini, 2000). That is, they are better to match local preferences. Besides, local governments may be more productive for several reasons. Among the political incentives, it has been argued that local governments are more accountable to citizens (Seabright, 1996). Increased accountability makes them to better accomplish their tasks. In addition, decentralization may foster initiative of local politicians provided that they have political career concerns (Aghion and Tirole (1997), Myerson (2006) and Enikolopov and Zhuravskaya (2006)). However, local governments may be more likely to be captured by interest groups (Bardhan, 2002).

Benefits from decentralization have been measured empirically in both developed and developing countries. For instance, Faguet (2004) points out that decentralization in Bolivia has improved responsiveness of government to local needs (matching preferences). Barankay and Lockwood (2007) show that fiscal decentralization has improved educational attainment in Swiss cantons (productive efficiency).

The aim of this paper is to assess whether the 2001 decentralizing reform in Colombia has made the more decentralized municipalities to enrol more children. I first develop a model of incomplete contracts à la Hart et. al. (1997) in which local governments choose what proportion of a divisible project is contracted with the private sector. Local governments may contract with a public manager (public school) or a private manager (private school). Managers may make two (non-contractible) innovations: a quality increasing innovation (QII) and a cost reducing innovation (CRI). I show that more decentralized local governments assigns a larger fraction of the project to the private manager if government's gains from private QII outweighs government's losses from private CRI.

The 2001 reform is a complex reform on the financing and the provision of public services, mainly, education and health. With respect to education, it reorganized the system of national transfers to lower tiers of government. In particular, it hardened local governments' budget constraints and provided subnational governments incentives to increase enrolment. More important to my purpose, the reform has two characteristics: first, it established a process to certify municipalities. The certification process consists of the devolution of a teachers' payroll following some criteria to reduce cost and a reorganization of schools creating institutions that offer all grades of precollege schooling. A certified municipality

is more decentralized in the sense that it receives more responsibilities in the provision of public education. The reform devolved the management of personnel and other resources (buildings, material, etc.) to those municipalities. Non certified municipalities are less decentralized since they only received the management of other resources different from personnel. Second, the reform allowed more decentralized municipalities to sign contracts with private schools. Departments (the regional governments) were entitled to sign this type of contracts for the less decentralized municipalities.

How may the reform affect enrollment in precollege school? First, it provided sub-national governments (departments and municipalities) with strong incentives to increase enrollment. So I expect that the reform has increased enrollment. Second, the reform established two parallel organizations in the provision of education: In one system, municipalities are more decentralized (the certified ones) and in the other system, municipalities are less decentralized (the non certified ones). There is no reason to think that both types of municipalities will increase enrollment in the same amount. Even if national transfers are based on enrollment, local governments not only care about enrolment but also about education quality. Therefore, if the amount of pupils deteriorates education quality, the local government will care about the fraction of pupils assigned to private schools. The main theoretical result mentioned above may be re-expressed in the following terms: the more decentralized municipalities contract a larger fraction of non-enrolled pupils with private schools if, in the private school, the reduction in quality that comes from the CRI is not larger than the increase in quality that comes from the QII.

Enrolling children in private schools may be more productive than enrolling them in public schools at least for two reasons. First, because it reduces quality deterioration in public schools. Second, because private schools are both more accountable to parents and less likely to be controlled by interest groups like teachers' unions. I thus believe that the CRI in the private school is not very costly in terms of quality deterioration in that school. The main hypothesis I want to prove is that the more decentralized municipalities contract more enrolment with private school than the less decentralized municipalities do.

To identify the effect of the reform on enrolment is crucial to recognize that the reform may have caused general equilibrium effects. These effects make very difficult to find a credible control group for a conventional quasi-experiment approach. In particular, a differences-in-differences approach that uses private schools as a control group is likely to lack from fulfilling the identifying assumption that, in absence of treatment, the unobserved differences between public and private schools are the same over time.

I identify the effect of the reform on enrolment exploiting the fact that the Law established an exogenous rule to certify municipalities, that is, to decentralize municipalities: all municipalities with more than 100 thousand inhabitants in 2001 and all departments must follow the process of certification. Certified municipalities are in charge of personnel and

non-personnel resources, and subsidy contracts. Departments are in charge of personnel management and subsidy contracts for the non-certified municipalities. It allows me to estimate causal effects with a Regression Discontinuity Design. The approach allows for variables that may affect enrolment to be very different in average among certified and non certified municipalities. But it presumes that those variables are not very different in a small neighborhood around the threshold defining the treatment. Then, assuming that all observable and non observable variables that may affect enrolment are smoothly distributed around the threshold, any discontinuity in enrolment may be credibly attributed to the reform. Identification relies on continuity checks of relevant variables. Therefore, I do not identify a general effect of the reform on enrolment, but differences across more decentralized and less decentralized municipalities.

The main result of this paper suggests that more decentralized municipalities (i.e. the certified municipalities) have subsidized more students in private schools, mainly in Primary and Lower Secondary levels. The difference represents around 20% of enrolment in private schools and 3% of population in schooling age. Although I treat the reform as a black-box and do not identify the mechanism the effect goes through, the result is consistent with the theory. Indeed, government benefits from subsidy contracts may be of different nature. They may be political rents (more chances for the political party to keep the power or more chances for the incumbent politician to be promoted to more important positions), economic rents (lower price in contracts with private schools), informational rents (better control of private schools' actions), etc. Less decentralized municipalities share those benefits with departments. The result is robust to differences in education prices (tuition fees), size of schooling population, variables of public finance (income and spending of municipalities), political economy, poverty and violence.

Additional results show that although enrolment in public schools has increased after the reform, there are no significant differences among more decentralized and less decentralized municipalities.

The rest of the paper is organized as follows. Section 2 provides a context of the public education in Colombia and describes the reform with detail. Section 3 presents a very simple model that gathers the main economic traits of the reform and provides a hypothesis. Section 4 discusses the empirical framework and presents the identification strategy and descriptive statistics. Section 5 presents results; and Section 6 concludes.

## **2 The experiment**

Precollege education in Colombia consists of 12 mandatory years divided in three levels: 1 mandatory year of preschool, 5 years of primary and 6 years of secondary. Public education is one of the most important components of the public sector in Colombia. In 2001, 36% of

central government tax revenues were allocated in public education, teachers conform the largest group of public employees (26% of total public employees in 1999) and the public expenditures on education increased up to 3.8% GDP on average in the 1990s. Besides, 7.2 million students attended public schools (75% of all students), which were instructed by 290 thousand teachers (68% of all teachers) in 52 thousand schools (75% of total schools).

The three levels of government (i.e. nation, departments and municipalities) have intervened in the provision of public education. The responsibilities assigned to each of these levels have changed through several reforms in the last 50 years. Two different processes can be distinguished. From 1960 to 1985 there was a centralization process in which the nation was in charge of most administrative functions of the sector. The aim of this process was to provide both more economic rationality to and equity among teachers' payment. During the 1950s there was a highly decentralized system in which remuneration of teachers depended basically on the level government hiring them, regardless of their education level or workload. As a result, teachers' contracts were very instable and unequal. *Nationalization* provided more labor stability to teachers but made the system less sensitive to local needs and preferences.

Since 1986 a decentralization process is being carried out. On the political grounds, citizens began to elect mayors of municipalities. Before, mayors were appointed by the President of the Republic. Citizens began to elect governors of departments with the new Political Constitution, adopted in 1991. On the economic grounds, main rules on decentralization of education are included in Law 60 of 1993, which establishes the responsibilities of each government tier in the provision of education and the rules and formulae to distribute national revenues to the lower governments. This law was revoked by Law 715 of 2001, which provided new formulae to distribute national revenues and introduced changes in the provision of public education.

Both decentralizing reforms have several common aspects. First, both established a *certification* mechanism in order for both departments and municipalities to receive responsibilities from the national government. In practice, this mechanism served more as a way to improve technical capacity of local governments than as a screening mechanism. Second, funding comes mainly from national transfers and those transfers are earmarked almost totally. Therefore, there is almost no room for local governments to allocate budget across sectors (e.g. education, health, etc.). Anyway, all tiers of government may finance education. Third, teachers' wage ladder is nationally determined. Local governments may not compete among them for teachers through wages and, in general, payments for performance are not allowed. Finally, school principals have almost no power. Main responsibilities of education provision are assigned to either governors or mayors. The other big piece of power is held by the teachers union. The teachers union has a national-wide coordination council with delegates in each department and municipality.

## 2.1 The situation prior the 2001 reform

Let us now look at the differences between the regimes. Before the reform, national transfers were distributed with formulae based on past teachers payroll. National transfers of each year were established based on spending in personnel from the previous year. This introduced an intertemporal inertia that made difficult for governments to react accurately to shocks.

Second, national transfers were organized in three different funds. One to each tier of subnational government and the other to cover deficits of subnational governments. Since the three tiers of government participated in the provision of education in such a way that their responsibilities were overlapped, there were soft budget constraint issues. In particular, subnational governments had incentives to hire teachers that were financed by the national government.

Third, public education were mostly provided by schools that covered just a part of precollege education. Most of them provided primary education. Some other provided secondary education. Just a few provide all the precollege education. Moreover, inside a municipality, schools had no links that guarantee pupils the access to complete precollege education. Indeed, it is well documented that dropout rate is very large when pupils pass from primary to secondary.

Finally, governments did not implement subsidies to private schools or vouchers as an strategy to increase enrolment. Although subsidies were not specifically forbidden the teachers' union exerts a strong opposition to its implementation. The single relevant exception was the subsidies program implemented in the department of Antioquia in the second half of the 1990s.

The main arguments for the reform from specialists and congress representatives can be summarized in three points: first, overlapped responsibilities of governments decrease accountability. Having separated responsibilities would make citizens to have a clearer idea of incumbent politicians' performance while in office. Second, the high risk of public deficits. In particular, national transfers formulae were based on the current income of central government. This income experimented huge fluctuations between 1995 and 2001. In good times (1995 - 1996) teachers payroll increased a lot, which increased the risk of default of local governments in bad times (1997 - 2000). The central government had to cover these deficits with additional resources. Finally, there was a large fraction of children in schooling age out from school. Deepening decentralization may help to enrol this population by improving matching of needs.

## **2.2 Deepening decentralization: the reform in 2001**

With the reform, national transfers were reorganized in a single fund independent from the current income of national government. Besides, transfers are not based anymore on the teachers payroll but on the number of students through a per-pupil budget. Therefore, there is a strong incentive to increase enrolment.

In order to eliminate the soft-budget-constraint issues, per-pupil transfers to education are divided in two: one part is assigned to cover the cost of providing the service (it basically consists of the personnel cost plus a fraction to cover the administration cost) and a budget intended to cover investment in material, buildings, etc. On top of that, the reform established that the spending on personnel cannot exceed the national transfers allocated to this input. Local governments must show enough financial capacity if want to hire additional teachers.

Indeed, the reform established two parallel ways to organize governments in provision. Management of personnel and non-personnel inputs are now assigned either both to the municipalities or one to each level of subnational government. Municipalities must follow the process of certification in order to receive both tasks and both per-pupil transfers. The non-certified municipalities only deal with non-personnel inputs and receive the respective national transfer. Departments must also follow the process of certification. They deal with personnel inputs (and receive the respective national transfer) of their non-certified municipalities.

Finally, subsidies to private schools are explicitly allowed for the certified entities. In order to have a better understanding of the reform in the next section I explain how the certification process and the subsidy scheme work.

## **2.3 Certification and subsidies to private schools**

As said before, certified municipalities are entitled with the management of both personnel and non-personnel inputs and receive both per-pupil transfers. Non-certified municipalities manage the non-personnel inputs and the respective department manages the personnel. Each entity receives the respective per-pupil budget.

The reform establishes that those municipalities that had more than 100 thousand inhabitants in 2001 and departments must follow the process of certification. Those municipalities with less than 100 thousand inhabitants in 2001 must not follow the certification process (but may do so afterwards). Municipalities obtain the population size from the National statistics office in order to know whether they must follow the certification process.

The certification of municipalities involves a reorganization of both personnel (teachers, directive teachers, principals, administrative personnel) and schools, with the aim for the

departments to devolve *optimal* personnel payrolls to the certified municipalities. The reorganization of personnel is based on the minimal pupils-per-teacher ratios established by the Decree 3020 of 2002 and the organization of the labor time of teachers established by the Decree 1850 of 2002. The reorganization of schools have the aim to arrange schools in institutions providing preschool, primary and secondary education under the administration of a single principal. The norms in this regard were established in the Ministry Order 15 of 2002.

The local governments had to elaborate a proposal of personnel payroll by the 15th of July of 2002<sup>1</sup>. These proposals were subject to a technical revision by the ministry of education. Afterwards, they had to make the modifications pointed out by the ministry, if any. Besides, the local governments presented a list of the provisional personnel. This process took more time than expected. Forty (40) municipalities were certified in 2003. The four districts were certified automatically with the law as were the departments. Two municipalities (Pasto and Armenia) had already been certified in 1997 under the Law 60<sup>2</sup>.

After the process of definition of payrolls, the correspondent civil servants (i.e. teachers, directive teachers, principals and school administrative personnel) were incorporated to them. The process began in 2003 giving priority to the personnel already having a permanent appointment in the payroll. Then, the local governments had to verify whether the personnel fulfilled the legal requirements to continue in the payroll.

On the other hand, the subsidy scheme works as follows: certified entities (departments and municipalities) may contract with private schools to increase enrolment. Non-certified municipalities must go to the respective department in order to have access to subsidies contracts, because they are not entitled to sign this type of contracts.

The private schools interested in signing subsidy contracts must previously inscribe themselves before the respective certified government. The aim of this inscription is to make clearer the contracting process and to guarantee a minimum level of education quality. Anyway, being on the list does not mean signing a subsidy contract.

Subsidy contracts are one-year long (the schooling year) and establish a per-pupil price and a number of pupils. Mayors and governors must choose a school or schools from the private schools on the list. Although mayors and governors are free to negotiate on prices, the contracted price must not exceed the per-pupil budget transferred by the nation. Indeed, since governments have all bargaining power, the actual contracted price has been a part of the per-pupil transfer.

To sum up, the reform has three main components. First, it established two parallel

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<sup>1</sup>By the 15th of July, 2002 for the largest municipalities and by the 30th of October, 2002 for the other municipalities

<sup>2</sup>All the departments, except from the poorest department, Chocó, were also certified under the previous law. Chocó was certified automatically with the new Law in 2001.



organizations of the provision of education. One more decentralized than the other. In the more decentralized organization, municipalities are in charge of both personnel and non-personnel resources. Besides, municipalities may sign subsidy contracts with the private schools in order to further increase enrollment. In the less decentralized organization, municipalities only deal with non-personnel resources. Departments are in charge of personnel resources and subsidy contracts of their municipalities. Second, municipalities must follow a process of certification in order to have the more decentralized organization. Certification is obtained after a reorganization of the personnel payroll and a reorganization of schools. Last but not least, the reform set up an exogenous rule for municipalities to go for the certification, that is, to have the more decentralized provision of education. The rule says that municipalities with more than 100 thousands inhabitants in 2001 must follow the process of certification. Therefore, after the reform, the smaller municipalities have a less decentralized provision of education and the larger municipalities have a more decentralized provision of education.

### 3 A theoretical model

The reform may be considered as entitling local governments with one project: enrolling children in schools. Both departments and municipalities received the correct incentives to do so. However, these governments not only care about increasing the number of enrolled children but also care about education quality. In education as in other services, there is a potential trade-off between the objective of maximizing the number of enrolled pupils and maximizing quality education. Since children out from school is around 15% of population in schooling age (almost 50% for upper secondary education) in 2002, the project, subject of the reform, has important scale effects, i.e. enrolling children may have important effects on education quality.

I build up a model based on Hart, Schleifer, and Vishny (1997). Although the model is very abstract, it draws important insights about the economics of the reform. The model considers a divisible project. The (local) government,  $G$ , must choose what proportion of the project will be performed by the private manager (private school),  $M_P$ , and what proportion by the public manager (public school),  $M_G$ . Both the private and the public manager may implement a cost reducing innovation (CRI) and a quality increasing innovation (QII). These innovations are not contractible and require managers to exert effort. I denote efforts as  $e$  and  $i$ , respectively. If innovations happen, renegotiation occurs. CRI reduces the project cost in  $c(e)$  and reduces social benefit of the project in  $b(e)$  (due to a reduction in education quality). The net effect of the QII on the social benefit is  $\beta(i)$ .

The crucial assumption of my model is that the reduction in quality due to the CRI,  $b(e)$ , is affected by the fraction of the project assigned. The larger the fraction the larger

the reduction. Formally, let  $\alpha$  be the fraction of the project assigned to the private sector. The social benefit that comes from the private manager's action is  $\alpha [B_0 - \alpha b(e) + \beta(i)]$ . The fraction of the *original* project,  $\alpha B_0$ , assigned to the private manager is affected by his prior efforts. The social benefit that comes from the public manager's action is  $(1 - \alpha) [B_0 - (1 - \alpha)b(e) + \beta(i)]$ . The assumption gathers the scale effect mentioned above. It reflects the fact that putting more students in the same classroom is less costly than building new classrooms for the new students. The literature on economics of education has drawn attention to the negative relationship between classroom size and education quality (Angrist and Lavy, 1999). The model in Hart et al. (1997) does not have this assumption. Therefore, in their model the project is assigned either to the public manager or to the private manager.

The total social benefit  $B$  that comes from the project is

$$B = \alpha [B_0 - \alpha b(e) + \beta(i)] + (1 - \alpha) [B_0 - (1 - \alpha)b(e) + \beta(i)]$$

The total social benefit from the *original* project,  $B_0$  is affected by the prior efforts from managers. The first term in the RHS correspond to the benefit from the contract with the private manager. The second term corresponds to the benefit from contract with the public manager. The cost of project is equal to  $C = C_0 - c(e)$ . Since efforts  $e$  and  $i$  are costly for managers then the overall cost for managers is  $C + e + i = C_0 - c(e) + e + i$ .

It is assumed that gains from renegotiation are split 50 : 50. It is also assumed that only the possessor of the residual control rights has the right to approve any innovation. Any innovation in the public school must be approved by the government. No innovation in private school must be approved by the government. However, only the CR Innovation is in the interest of the private school. The QI Innovation in private school will require renegotiation, otherwise no payment will come from the QII. Notice that in the case of the public school, the government will fire the public manager once the innovations are done. In particular it is assumed that  $G$  can realize a fraction  $1 - \lambda$  of the gains from both innovations by the public manager. Coefficient  $\lambda$  gathers specific human capital embodied in  $M_G$  and institutional aspects like union strength. When  $\lambda = 1$  the public manager is irreplaceable.

The government pays price  $P_0$  to the manager. The payoff for the manager of the public school is

$$U_{M_G} = (1 - \alpha) \left[ P_0 - C_0 + \frac{\lambda}{2} (c(e) + \beta(i) - (1 - \alpha)b(e)) - e - i \right]$$

$M_G$  must renegotiate on both innovations.

The payoff for the manager of the private school is

$$U_{M_P} = \alpha \left[ P_0 - C_0 + \frac{1}{2} \beta(i) + c(e) - e - i \right]$$

$M_P$  only renegotiates on the quality innovation.

Finally, the payoff for the government is

$$U_G = (1 - \alpha) \left[ B_0 - P_0 + \left(1 - \frac{\lambda}{2}\right) (c(e) + \beta(i) - (1 - \alpha)b(e)) \right] + \alpha p \left[ B_0 - P_0 + \frac{1}{2}\beta(i) - \alpha b(e) \right] \quad (1)$$

The proportion  $p \in [0, 1]$  is a measure of decentralization. The larger  $p$  is, the deeper decentralization is. This coefficient gathers the fact that non-certified municipalities cannot contract directly with private schools. A fraction of the benefits from contracts with the private school goes to the department. In general  $p \neq 0$  because non-certified municipalities have the information on the number of children to be potentially enrolled in private schools. Indeed, the non-certified municipalities may differ in bargaining power regarding the department. Larger municipalities and pivotal municipalities in politics may enjoy larger bargaining power.

I assume that functions  $c$  and  $\beta$  satisfy Inada conditions. That is,  $c(0) = 0$ ,  $c' > 0$ ,  $c'(0) = \infty$ ,  $c'(\infty) = 0$ ,  $c'' < 0$  and  $\beta(0) = 0$ ,  $\beta' > 0$ ,  $\beta'(0) = \infty$ ,  $\beta'(\infty) = 0$ ,  $\beta'' < 0$ . Besides, function  $b$  satisfies  $b(0) = 0$ ,  $b' \geq 0$ ,  $b'' \geq 0$ . Finally, I assume that  $c' - b' > 0$ , i.e., that the Cost Reducing Innovation is valuable.

Timing is as follows: first  $G$  chooses  $\alpha$ ; then,  $G$  writes contract(s) with  $M_G$  and/or  $M_P$ . Afterwards,  $M_G$  and  $M_P$  choose efforts  $i$  and  $e$ . Finally, if no renegotiation, the basic good is supplied. However, renegotiation will occur.

From now on let us assume that  $\lambda = 1$  (the public employee is irreplaceable) and  $p = 1$  (the government is completely decentralized). The first assumption is plausible in a context with a strong teachers union. In Colombia, school principals are teachers elected as directive personnel.

### 3.1 The first best

Consider the first best as a benchmark. The maximum social welfare is obtained by solving

$$\max_{\alpha, e, i} \{c(e) + \beta(i) - ((1 - \alpha)^2 + \alpha^2) b(e) - e - i\}$$

The optimal  $\alpha$  is  $\alpha^* = \frac{1}{2}$ . Since the quality reduction of cost innovation depends on the fraction of the project given to each manager, the optimal fraction is to give half of the project to each manager. Any deviation will cause additional reductions in education quality. The first order conditions for  $e$  and  $i$  are

$$c'(e^*) - \frac{1}{2}b'(e^*) = 1$$

$$\beta'(i^*) = 1$$

### 3.2 Equilibrium

Both  $M_G$  and  $M_P$  take  $\alpha^e$  as given, since it is chosen by the government in a previous stage.

The problem for  $M_G$  is  $\max_{e,i} (1 - \alpha^e) \left[ \frac{1}{2} (c(e) + \beta(i) - (1 - \alpha^e)b(e)) - e - i \right]$ . Let us denote the unique solution by  $(e_G, i_G)$ , then the first order conditions are

$$\begin{aligned} \frac{1}{2} (c'(e_G) - (1 - \alpha^e)b'(e_G)) &= 1 \\ \frac{1}{2} (\beta'(i_G)) &= 1 \end{aligned}$$

The problem for  $M_P$  is  $\max_{e,i} \alpha^e \left[ \frac{1}{2}\beta(i) + c(e) - e - i \right]$ . Let us denote the unique solution by  $(e_P, i_P)$ , then the first order conditions are

$$\begin{aligned} c'(e_P) &= 1 \\ \frac{1}{2}\beta'(i_P) &= 1 \end{aligned}$$

**Proposition 1**  $e_P > e^*$ ,  $i_P < i^*$ ,  $e_G < e^*$  and  $i_G \leq i_P < i^*$  (with  $i_G < i_M$  unless  $\lambda = 1$ )

#### Proof

See Hart et al. (1997).

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In the first stage,  $G$  maximizes its utility with respect to  $\alpha$

$$\begin{aligned} \max_{\alpha} (1 - \alpha) \left[ B_0 - P_0 + \frac{1}{2} (c(e_G) + \beta(i_G) - (1 - \alpha)b(e_G)) \right] + \\ \alpha \left[ B_0 - P_0 + \frac{1}{2}\beta(i_P) - \alpha b(e_P) \right] \end{aligned}$$

s.t.  $\alpha \in [0, 1]$

The first order condition for the interior solution is

$$\begin{aligned} \frac{\partial U_G}{\partial \alpha} &= - \left[ B_0 - P_0 + \frac{1}{2} (c(e_G) + \beta(i_G) - (1 - \alpha)b(e_G)) \right] \\ &\quad + \frac{1}{2}(1 - \alpha)b'(e_G) \\ &\quad + \left[ B_0 - P_0 + \frac{1}{2}\beta(i_P) - \alpha b(e_P) \right] \\ &\quad - \alpha b'(e_P) = 0 \end{aligned}$$

From which

$$\alpha^G = \frac{b(e_G) - \frac{1}{2}c(e_G)}{b(e_G) + 2b(e_P)}$$

**Proposition 2** *The proportion in equilibrium  $\alpha^e$  assigned to the private sector is*

$$\alpha^e = \begin{cases} 0 & \text{if } c(e_G) \geq 2b(e_G) \\ \alpha^G & \text{if } c(e_G) < 2b(e_G) \end{cases}$$

**Proof** It comes directly by examining  $\alpha^G$  and taking into account that  $\alpha^e$  must be in  $[0, 1]$ . ■

The proportion  $\alpha^e$  is equal to zero if the reduction in cost coming from CRI is very large (twice the reduction in quality). This is due to the fact that the public manager is irreplaceable. Notice that the interior solution,  $\alpha^G$ , is always smaller than  $\frac{1}{2}$ . To see this, suppose that is not true. Then,  $\alpha^G > \frac{1}{2}$ . From the expression for  $\alpha^G$  it can be seen that the inequality holds only if  $b(e_G) - c(e_G) > 2b(e_P)$ . The last expression is not possible under my assumptions because the LHS term is always negative and the RHS term is always positive. Then,

**Proposition 3** *The proportion  $\alpha^e$  in equilibrium is always smaller than the proportion in the first best,  $\alpha^* = \frac{1}{2}$ .*

The result comes from the fact that the government only internalizes half of the net benefit from quality innovation in the private school. Furthermore, government bears all benefit reduction (quality reduction) from cost innovation in the private school while perceives no benefits from the cost reduction coming from that innovation.

Let us now consider the case  $p < 1$ . The following proposition holds

**Proposition 4** *The proportion  $\alpha^e$  assigned to the private manager increases with decentralization if  $b(e_P) < B_0 - P_0 + \frac{1}{2}\beta(i_P)$ .*

**Proof** Maximizing Equation (1) (making  $p < 1$  and  $\lambda = 1$ ) with respect to  $\alpha$ , we obtain that the interior solution is given by

$$\alpha^G = \frac{b(e_G) - \frac{1}{2}c(e_G) - (1-p) [B_0 - P_0 + \frac{1}{2}\beta(i_P)]}{b(e_G) + 2pb(e_P)} \quad (2)$$

Decentralization is gathered by coefficient  $p$ . Taking the partial derivative with respect to  $p$ ,

$$\frac{\partial \alpha^G}{\partial p} = \frac{B_0 - P_0 + \frac{1}{2}\beta(i_P) - 2\alpha^G b(e_P)}{2pb(e_P) + b(e_G)} \quad (3)$$

Equation (3) is positive if  $\alpha^G < \bar{\alpha} \equiv \frac{B_0 - P_0 + \frac{1}{2}\beta(i_P)}{2b(e_P)}$ . Since  $\beta(i_G) = \beta(i_P)$ , plugging expression (2) in (3) and making some calculations gives

$$\left[ B_0 - P_0 + \frac{1}{2} (c(e_G) + \beta(i_G) - b(e_G)) \right] - \frac{1}{2}b(e_G) > -\frac{b(e_G)}{2b(e_P)}(B_0 - P_0 + \frac{1}{2}\beta(i_P)) \quad (4)$$

Since  $B_0 - P_0 + \frac{1}{2} (c(e_G) + \beta(i_G) - b(e_G)) > 0$ , a sufficient condition for Inequality in Equation (4) to hold is  $B_0 - P_0 + \frac{1}{2}\beta(i_P) > b(e_P)$ . Therefore, in that case,  $\alpha^G$  is smaller than  $\bar{\alpha}$  and  $\frac{\partial \alpha^G}{\partial p} > 0$ . ■

Coefficient  $p$  has two contrary effects on the government's utility: it increases the benefit coming from contracting with private school, increasing utility. It increases the effect of quality reduction of CRI in private school on government payoff, decreasing utility. The net effect is positive if reduction in quality of CRI in the private school is not too large. In this case, decentralization increases contracting with private schools. Notice that if the project in the public school is valuable enough for the government then the inequality in (4) always holds. On the contrary, if the project with public school is not very valuable for the government and quality reduction of CRI is large enough in both schools, there may be the case that  $\alpha^G > \bar{\alpha}$ . In this case, contracting with the private school decreases with decentralization.

To sum up, the equilibrium fraction of the project that the local government assigns to the private manager is smaller than the optimal fraction. This is so because the local government does not internalize all the social benefit from the QII in the private school. More important, decentralization affects the fraction of project contracted with the private manager. If the losses in quality coming from the CRI in the private school are low enough, more decentralized municipalities contract a larger fraction of the project with the private school.

Let us now return to the colombian case. On the one hand, the organization of education provision in which municipalities deal with all responsibilities in providing education (that is the case of certified municipalities) may be associated to a large  $p$  in the sense described in the model. They manage to perceive a large portion of the benefits and costs from contracting with private schools. On the other hand, the government organization in which municipalities and departments play a role (that is the case of non-certified municipalities) may be associated to a smaller  $p$ . Benefits and costs from contracting with private schools are shared among non-certified municipalities and departments.

The government  $G$  has been rationalized as a municipality government. However, notice that, for the less decentralized organization, the government  $G$  may also be rationalized as the department. The key point is that the degree of decentralization may affect contracting with the private sector.

The following hypothesis comes directly from Proposition 4,

**H1.** Provided that the reduction in quality of the cost reducing innovation is not too large, more decentralized municipalities contract more enrolment with private schools than less decentralized municipalities do.

## 4 The empirical study

The literature of quasi-experiments allows to analyze the effect of an exogenous change or *treatment* when the control group is not random. The paper's goal is to estimate the

effect of the 2001 education reform on enrollment. The challenge of analyzing causality of a reform like this is to find the appropriate control group such that the effect of the reform be identified.

Usually a natural candidate as a control group for a reform affecting public schools are private schools. However, this reform allows certified entities (departments and municipalities) to subsidize enrolment in private schools. Subsidies to private schools are a crucial characteristic of the reform that poses a serious doubt on comparing enrolment in public schools with that in private schools.

I will use a Regression Discontinuity (RD) design to exploit the rule of certifying municipalities<sup>3</sup>. This rule is completely exogenous since it establishes that all municipalities with 100 thousands inhabitants or more in 2001 must be certified, i.e. must be in charge of all tasks related to the provision of education. This rule provides a well-defined cut-off point that produces sharp discontinuities, i.e., treatment is a discontinuous function of the population size in 2001. The treatment group will be the certified municipalities and the control group will be the non-certified municipalities.

Assuming that other characteristics of municipalities (observable and non observable) are continuous at the cutoff, any discrete difference in enrolment between certified and non certified municipalities can be attributed to the reform. Therefore, I do not identify a general effect of the reform on enrolment. I instead try to identify the effect of having a more decentralized provision on enrolment.

Notice that the identifying assumption of continuity of other variables related to enrolment is crucial. To illustrate the point, consider for instance that at the same moment of the introduction of the reform there is an exogenous shock on prices of private education, say tuition fees. Moreover, consider that the size of shock varies discretely between certified and non certified municipalities. In this case, any difference in enrolment could not be identified as an effect of the reform.

Some other caveats about the approach are in order. Although department and municipal governments have been subject to the same formal rules, the autonomy of them with respect to the national government is far from being homogeneous. Historically, Bogota and Antioquia have been more autonomous than the other regions. They have had better organized education offices than other departments or cities. Therefore, municipalities from Antioquia, both certified and non certified, have likely interacted in systems that are actually more decentralized before the reform. Moreover, Antioquia implemented an scheme of subsidies to private school since the second half of the 1990s<sup>4</sup>.

Law and decrees that implemented the reform established deadlines for the process of

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<sup>3</sup>See Shadish, Cook, and Campbell (2002) for an overview and Hahn, Todd, and Van der Klaauw (2001) for a non-parametric presentation.

<sup>4</sup>This was a special program financed with a World Bank credit.

certification. It is not surprising that some municipalities had been certified without having completed the payroll's organization. In average the payroll's organization took more time than certification. At department level is important to mention the case of Chocó. This department is the least developed in the country. Unlike the other departments, Chocó was not certified under the previous regime. Nevertheless it was certified automatically in 2001 without having received the personnel payroll from the nation. The lack of technical capacity in Chocó rendered impossible to certify its capital, Quibdó, even though it had to by law. This caveat implies that in practice the reform was not made as planned. Both delayed implementation and automatic certification may likely reduce the effect on enrollment. The size of this downward bias is difficult to measure.

#### 4.1 Identification

The RD strategy acknowledges that the control and treatment group might be different. For instance, the average enrolment in public schools in non certified municipalities amounts to 3858 students in 2001. While it is up to 39975 students in certified municipalities in that year.

Assuming that other observable and non observable characteristics of municipalities affecting enrolment are continuous with respect to population size, any discontinuity observed in enrolment between certified and non certified municipalities in a small neighborhood around the cutoff can be attributed to the reform.

Specifically, let  $O_m$  be an outcome variable of enrolment for municipality  $m$  and  $C_m$  be the dummy variable defining the treatment. It is a discontinuous function of population size in 2001,  $C_m = \mathbf{1}(S_m \geq 100000)$ . I will estimate the following equation:

$$O_m = \alpha_0 + f(S_m - S_m^c) + \theta C_m + \varepsilon_m \quad (5)$$

where  $S_m^c = 100000$ . If  $f(S_m - S_m^c)$  is well specified then  $\theta$  identifies the effect of reform. Allowing for interactions, the model becomes

$$O_m = \alpha_0 + f(S_m - S_m^c, C_m) + \theta C_m + \varepsilon_m. \quad (6)$$

where  $f(S_m - S_m^c, C_m)$  is

$$\begin{aligned} f(S_m - S_m^c, C_m) &= \alpha_1(S_m - S_m^c) + \alpha_2(S_m - S_m^c)^2 \\ &+ \beta_1((S_m - S_m^c) * C_m) + \beta_2((S_m - S_m^c)^2 * C_m). \end{aligned} \quad (7)$$

and  $f(S_m - S_m^c, C_m) = f(S_m - S_m^c)$  if  $\beta_1 = \beta_2 = 0$ .



I will use different measures of enrolment as outcome variable. The first part of the analysis focuses on  $O_m = \Delta Y_m = Y_{post} - Y_{pre}$ , where  $Y_{post}$  is the number of students in municipality  $m$  in a post-reform year and  $Y_{pre}$  is the number of students in municipality  $m$  in a pre-reform year. I perform this exercise for students enrolled in public schools. Notice that, if identifying assumptions hold, the effect of treatment is identified by

$$E[\Delta Y_m | C_m = 1, S_m - S_m^c = 0] - E[\Delta Y_m | C_m = 0, S_m - S_m^c = 0] = \hat{\theta}.$$

Afterwards, I make the same exercise using the number of students subsidized in private schools. Since there are no subsidies before the reform, the outcome variable becomes  $O_m = Y_{s_{m,post}}$ . If the identifying assumptions hold, the effect of treatment is identified by

$$E[Y_{s_{m,post}} | C_m = 1, S_m - S_m^c = 0] - E[Y_{s_{m,post}} | C_m = 0, S_m - S_m^c = 0] = \hat{\theta}.$$

Although the law was approved in 2001, it was implemented in 2003. The main part of the results shown below take 2001 as the pre-reform year in order to account for anticipation effects. Indeed, knowing that in the future, transfers will be based on per-pupil budgets, municipal governments could try to increase enrolment before the law was implemented. I also use 2000 and 2002 as pre-reform years in order to check results.

To check the identifying assumption of continuity, I take two pre-reform years, 2000 and 2001, to construct a variable in differences as  $\Delta Y_m$ . Estimations of Equations (5) and (6) using this variable should show no discontinuity. Besides, I estimate these equations using other variables at the municipal level as dependent variable, including: tuition fees, municipal taxes per capita, investment in human capital (teachers training), buildings, material, measures of poverty, political elections, etc. Afterwards, these variables were included as controls in the estimations with enrolment.

Since the observable variable (population in 2001) defining treatment is discrete, I run parametric estimations for each year clustering errors at the municipal level. I further check for specification error by pooling samples across years and calculating confidence intervals for both identical and independent errors.

Colombia has more than one thousand municipalities. Only 40 of them were certified with the reform. Other 6 municipalities were certified before, 4 districts<sup>5</sup> and 2 intermediate cities<sup>6</sup>. The rest of municipalities are non certified. Two of the 40 municipalities certified in 2003 are very large with respect to the others (outliers). In the estimations, I use two samples. A full sample with around 1021 non certified municipalities and 38 certified municipalities. A sample defined with a window of  $\pm 80000$  inhabitants around the cutoff, with around 340 non certified municipalities and 18 certified municipalities. Quibdó, the 6 municipalities certified before 2003 and the two outliers<sup>7</sup> are excluded from all estimations.

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<sup>5</sup>Bogotá, Barranquilla, Santa Marta and Cartagena.

<sup>6</sup>Pasto and Armenia.

<sup>7</sup>Cali and Medellín.

It is clear that the sample has much more non certified municipalities than certified ones. Estimations with interactions as in Equation 6 help to check whether the estimated polynomial is driven by municipalities beyond the cut-off point.

## 4.2 Data and descriptive evidence

Data on enrolment comes from DANE (the national statistics office) and the Ministry of Education. Every year both private and public schools report information on different variables including enrolment. This information is used by the ministry of education to calculate enrollment rates by sector (public and private) at the municipal level. Data on municipal finance comes from questionnaire information gathered annually by the National Department of Planning. Data on tuition fees come from the questionnaire filled in by secondary senior students for a national test administered every year.

Although a before-after analysis is not a causal analysis, it gives us an idea on how enrolment has changed after the reform. Figure 2 shows the number of students in precollege education (total and different levels), attending either public or private schools in the last eleven years. The total number of students seems to have an small increase in trend after the reform. This is the net effect of a trend increase in enrolment in secondary (upper and lower) and a trend decrease in primary and pre-primary. Besides, trends in gross enrolment rates in Figure 3 seem to have had larger changes after the reform. The trend of gross enrolment rate in precollege education has increased after the reform. It reflects an increase in the trend of gross enrolment in secondary and pre-primary that outweighs a decrease in the trend of gross enrolment rate in primary.

Table 1 shows some characteristics of certified and non certified municipalities. In 1993, 45% of households in non certified municipalities and 31% of households in certified municipalities were poor, in average. Regarding variables on conflict, we see that the conflict intensity has decreased between 2000 and 2005. Both types of municipalities receive a similar quantity of displaced people per thousand inhabitants. However, displaced people are more often expelled from non certified municipalities. Regarding taxes to industry and commerce, certified municipalities collect 31 thousand pesos per capita (15 dollars) while non certified municipalities collect 23 thousand pesos (11 dollars), in average.

The reform is reflected in the municipal spending per capita, transfers to municipalities per capita and the proportion of transfers in municipal income. Before the reform 45% of municipal income in certified municipalities were transfers. After the reform it amounts to 63%. Similarly, transfers to certified municipalities were about 85 thousand pesos per capita in 2000 and became about 246 thousand pesos per capita in 2005. On the other hand, transfers have represented around 60% of municipal income in non certified municipalities, while transfers have been around 135 thousand pesos per capita, both before and after the

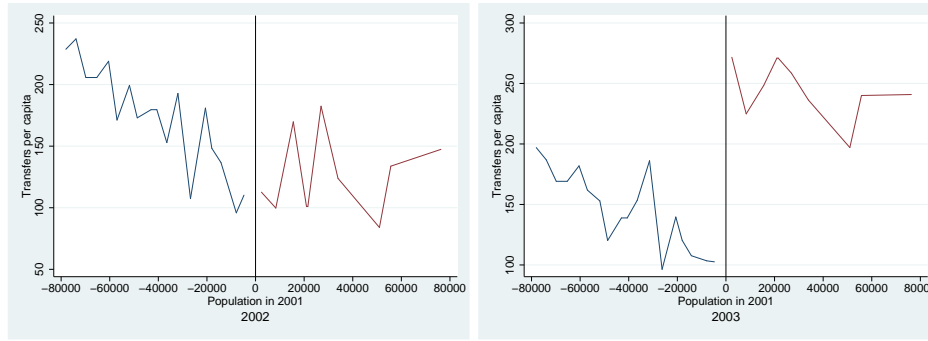


Figure 1: **Transfers to municipalities per capita**

reform. In Figure 1, we have transfers per capita just before and after the reform was implemented. Population in 2001 has been normalized around the cutoff of 100 thousand inhabitants. In 2002, transfers per capita around the cutoff amounted to 110 thousand pesos. It has no visible difference among certified and non certified municipalities. In 2003 non certified municipalities received a similar amount while certified municipalities received 270 thousand pesos.

Enrolment in public and private schools appears in Tables 2 and 3. Precollege enrolment in public schools from non certified municipalities is about 7500 students in 2001, in average. It increases to 8200 students in 2003. In certified municipalities it amounts to about 23500 students in 2001 and rises up to 26500 students in 2003. In both types of municipalities, around 60% of these students are undertaking primary studies, 25% are following lower secondary courses, 8% are in upper secondary and 7% in pre-primary. Precollege enrolment in private schools from non certified municipalities is about 985 students in 2001, in average. It decreases to 900 students in 2003. In certified municipalities enrolment in private schools also decreases from 6644 to 6248 students in the same period.

Table 4 shows the increase of precollege enrolment in public schools with respect to the enrolment in 2001. It increases along the period for both non certified and certified municipalities, except from the last year in which enrolment seems to increase more in non certified municipalities.

Finally, tables 5 and 6 show the subsidized enrolment in private schools. On the one hand, non certified municipalities subsidized 155 students in 2003, in average. This amount keeps stable until 2006, when increases up to 403 students, in average. Most of subsidized students are attending either primary or lower secondary school. On the other hand, certified municipalities subsidized 614 students in 2003, in average. This number rises up to 1245 students in 2006. Alike non certified municipalities, most subsidized students are following primary or lower secondary studies. As was mentioned previously, the department of Antioquia had developed a subsidy program before the 2001 reform. The maximum number

of subsidized students in a non certified municipality is larger than that in any certified municipality. Table 6 shows subsidies without Antioquia. The maximum number of subsidized students becomes very similar among non certified and certified municipalities, showing that non certified municipalities from Antioquia subsidize a large number of students.

## 5 Results

### 5.1 Effects on enrolment

Let me first consider the effect on the variation in the number of students attending public schools. I estimate equations for each year and each level of schooling (including the total). Table 7 reports the estimations of coefficient  $\theta$  using the quadratic form in equation 6. Certified municipalities seem to have a larger variation in enrolment in upper secondary in 2002. It amounts to 212 students. At the cutoff, this represents around 6.5% of the 16-17-years-old population and 12% of upper-secondary students in public schools, in that year. This difference may be interpreted as an anticipation effect of the reform. That is, certified municipalities may have anticipated the fact that national transfers are assigned based on the number of pupils.

On the other hand, non certified municipalities seem to have a larger increase in pre-primary in 2005 and primary in 2006. The first one amounts to 774 students. At the cutoff, it represents around 33% of the 6-years-old population and 43% of pre-primary students in public schools, in those years. The second one goes up to 1672 students, which represents 13% of 7-11 years-old population and 14% of students in public schools. In all the other years and levels there are no significant differences among certified and non certified municipalities.

In Figure 4 we see that the quadratic form reproduces relatively well the distribution of enrolment across population size. However, Table 8 shows that the quadratic form seems to be not significant and that the treatment shows no effect with lower-order polynomials. In addition, Table 9 show the estimates of  $\theta$  from Table 8 adding a department fixed effect. Except from the anticipation effect in 2002, treatment effects disappear.

Let me now consider the effect on subsidized enrolment in private schools. Since there is no subsidized enrolment before 2003, except from Antioquia, I run regression excluding municipalities from that department<sup>8</sup>. Table 10 shows the estimations of subsidized enrolment in 2005 for the different levels of education, using different polynomials. We see there that the estimates of  $\theta$  are relatively stable across specifications and statistically significant. Estimates of  $\theta$  using specification (4) are summarized in Table 11. It shows that the treatment has an effect in subsidized enrolment in all levels in the period 2004 - 2006. The

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<sup>8</sup>I also estimate the model including a dummy for Antioquia and results still hold and are similar.

larger differences were in 2005. Certified municipalities subsidized 833 students more than non certified municipalities. At the cutoff, it represents around 20% of enrolment in private schools and 3% of population in schooling age, in that year. These students are distributed in pre-primary (97 students), primary (430 students), lower secondary (253 students) and upper secondary (53 students). The difference in pre-primary represents around 22% of enrolment in pre-primary private schools and 4% of the 6-years-old population. The difference in primary represents around 30% of enrolment in primary private schools and 3.4% of the 7-6-years-old population. The difference in lower secondary amounts to about 20% of enrolment in lower secondary private schools and 2.8% of the 12-15-years-old population. Finally, the difference in upper secondary goes up to 7.5% of enrolment in upper secondary private schools and 1.3% of the 16-17-years-old population. The estimates with linear interactions and the observed data for 2005 are depicted in Figure 5. Treatment effects in 2005 and 2006 are still significant using a more restricted sample ( $\pm 80$  inhabitants ) (Table 12).

## 5.2 Continuity checks and Robustness

The previous findings are valid if the identifying assumptions hold. First, in absence of treatment, enrolment must be continuous at the cutoff. Table 14 reports the estimates of  $\theta$  using the variation of enrolment between 2001 and 2000 as dependent variable with different polynomials. Since both years are before the reform, any discontinuity would threat identification. Estimates for all levels of education and specifications for both public and private schools show no discontinuity.

Moreover, Urquiola and Verhoogen (2006) show that RD design should be applied with caution in settings where parents have significant school choice and schools are free to set prices. In this case, there may be discontinuities that are not caused by the treatment. The authors illustrate the issue using the case of Chile since there is a well-spread voucher system in that country. Although I use information at the level of municipalities, it is worthy to say that Colombian households do not face such a competitive market, in part because there is no a substantial voucher system<sup>9</sup>. Besides, prices of private schools are regulated since beginning nineties, so that competition on prices is limited. However, nothing of this prevents discontinuities in prices across municipalities. I use data on tuition fees reported by senior secondary students each year as a proxy of tuition fees in precollege schools. Table 15 reports estimates of  $\theta$  using tuition fees as dependent variable. It shows no discontinuities in tuition fees in either sector for all years in the period of study.

Another crucial variable is the structure of population. Discontinuities in the population

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<sup>9</sup>The largest voucher program in Colombia, the PACES program, assigned 125000 vouchers in middle nineties. It amounts to less than 2% of the aggregated enrolment. See Angrist and et al. (2002) and Angrist, Bettinger, and Kremer (2006) for an evaluation of PACES program.

in schooling age may cause discontinuities in enrolment. Table 16 shows the results for population in schooling age in 2005 using different specifications. None of these models show significant differences in schooling-age population at the cutoff. Estimates of  $\theta$  with model (4) in Table 16 for all years are summarized in Table 17. They show no difference between certified and non certified municipalities (See Figure 6).

Other municipal variables may influence or may be affected by the reform. A set of regressions were done using them as dependent variables. These variables include municipal taxes per capita, transfer dependence, proportion of investment in several items (new infrastructure, maintenance, material and equipment and teachers training) and own resources per capita spent in education. Table 18 shows the results. Except from own resources per capita in 2004, there are no discontinuities in any of these variables.

New regressions on subsidized enrolment controlling for these and other variables were estimated. Table 19 shows the results for 2005<sup>10</sup>. Column (1) shows the estimation with linear polynomial and interactions for the total subsidized enrolment (Column (4) from Table 10). Column (2) shows the treatment effect while controlling for department fixed effects. Although the treatment effect decreases a little bit, it is significant. The other columns control by some measures of poverty. SISBEN is a measure implemented to target poor people that establishes levels. Subsidized enrolment decreases with population in SISBEN-1 (poorest people) and increases with population in SISBEN-3 (not so poor). The second panel of Table 19 shows treatments effect controlling by some municipal budget variables like tax income per capita, Transfers per capita, municipal education spending per capita, transfers dependence (Transfers/Total income). The third panel of Table 19 show treatment effect controlled by other variables of education investment, including (lagged) proportion of investment in new infrastructure, maintenance, material and equipment, training of teachers and own resources spent in education. The fourth panel of Table 19 show treatment effects controlled with financing variables that may be related with pork-barrel spending. Drazen and Eslava (2007) find that politicians may use some expenditures to target voters in pre-electoral times. In particular, they find that politicians may increase current spending (bureaucracy) and some investment expenditures like sport, housing and health in order to attract voters. The fifth panel of Table 19 shows conflict variables like forced displaced population, killings and attacks and combats of different illegal armies. The guerrilla attacks have a significant negative influence in subsidized enrolment. The last panel of the same Table shows variables of political elections. Part of the effects of decentralization may arise from political grounds. Dparty is dummy equal to one if the department governor and the municipal major belong to the same party. I also include a dummy for the main political parties in Colombia, the percentage of winning elections and the voter turnout. Treatment effects are robust to all these controls.

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<sup>10</sup>These exercises were performed for the other years with similar results.

Finally, since population is a discrete variable I further check for robustness to specification error. Following Lee and Card (2006) the literature usually deals with this problem by clustering errors by each observation of population (municipalities), as I have done. The authors show that this procedure is useful when the specification error is identical. However, when the specification error is independent we need to inflate standard error even more to account for different errors. To do so I pool yearly samples in a single one in order to have more than one observation for each municipality. The estimates provide the average subsidized enrolment in the period 2003 - 2006. Table 20 shows the results for different polynomials. The average difference in subsidized enrolment among certified and non certified municipalities amounts to 541 students. All schooling levels have significant differences. Following the procedure in Lee and Card (2006), I estimate the robust confidence intervals. With identical specification error the confidence intervals come from the standard error of running the regression with the micro data clustered by municipalities. The inflated variance with independent specification error comes from estimations collapsing the data at the cell level. Notice that the confidence interval with 95% of significance for independent SE is wider than the interval for identical SE. The treatment effect survives for all levels and total except from upper secondary.

## 6 Concluding remarks

The 2001 reform substantially modified how public social services (education, health, etc.) are provided in Colombia. Regarding education, it introduced several changes, ranging from transfers mechanism to school organization. The reform introduced differences across municipalities in the organization of education provision. Particularly important, the reform established an exogenous rule that divided municipalities in two groups. One group has a more decentralized organization of education provision than the other.

Results suggest that more decentralized municipalities have significantly subsidized more students in private schools. The difference amounts to 20% of enrolment in private schools and 3% of population in schooling age. The result is consistent with a model in which local governments sign an incomplete contract fractioned between a public and a private school. Although, I do not identify the specific channel through which the reform works, the result is robust to alternative explanations. In particular, political election variables and expenditures related to political pandering have no effect on subsidized enrolment.

In addition, tuition fees of private schools and the size of population in schooling age have no discrete variations at the threshold defining the treatment, therefore differences in subsidized enrollment cannot be attributed to differences in these variables. Additional controls show that subsidized enrolment decreases with extreme poverty and increases with milder poverty. This result is important for policy issues because it suggests that the

students financed with subsidies in private schools do not belong to the poorest households. Poorest households may require additional resources (e.g. transport to school) or money incentives to send children to schools. Finally, subsidized enrollment decreases with variables measuring the internal conflict and increases with transfers per capita.

Additional results show that although enrolment in public schools has increased after the reform, decentralization has had no effect on this variable. The theoretical model I have developed predicts that decentralization affects the *fraction* of enrollment contracted with private schools. But it says no word on the *level* of enrolment. The model needs more structure in order to provide an explanation on this regard. In particular, in a context in which there are no difference in taxes and national transfers are earmarked, it seems that differences in the level of enrollment in public schools across more and less decentralized municipalities have to do with differences in credit constraints to finance the construction of new schools. The econometric exercises show that there no difference between more and less decentralized municipalities regarding the fraction of spending spent in new infrastructure. A complete analysis on this issue requires both an additional piece of theory and empirical exercises. This is left for future research.

## References

- Aghion, P. and J. Tirole (1997). Formal and real authority in organizations. *The Journal of Political Economy* 105, 1–29.
- Angrist, J., E. Bettinger, and M. Kremer (2006). Long-term educational consequences of secondary school vouchers: Evidence from administrative records in colombia. *American Economic Review* 96(3), 847–862.
- Angrist, J. and et al. (2002). Vouchers for private schooling in colombia: Evidence from a randomized natural experiment. *American Economic Review* 92(5), 1535–1558.
- Angrist, J. and V. Lavy (1999). Using maimonides’ rule to estimate the effect of class size on scholastic achievement. *Quarterly Journal of Economics* 114(2), 533–575.
- Barankay, I. and B. Lockwood (2007). Decentralization and the productive efficiency of government: Evidence from swiss cantons. *Journal of Public Economics* 91, 1197–1218.
- Bardhan, P. (2002). Decentralization of governance and development. *Journal of Economic Perspectives* 16, 185–205.
- Drazen, A. and M. Eslava (2007). Electoral manipulation via voter-friendly spending: theory and evidence. Working Paper.



- Enikolopov, R. and E. Zhuravskaya (2006). Decentralization and political institutions. Working Paper, forthcoming *Journal of Public Economics*.
- Faguet, J.-P. (2004). Does decentralization increase government responsiveness to local needs?: Evidence from bolivia. *Journal of Public Economics* 88(3-4), 867–893.
- Hahn, J., P. Todd, and W. Van der Klaauw (2001). Identification and estimation of treatment effects with a regression-discontinuity design. *Econometrica* 69(1), 201–09.
- Hart, O., A. Schleifer, and R. Vishny (1997). The proper scope of government: Theory and an application to prisons. *The Quarterly Journal of Economics* 112(4).
- Lee, D. S. and D. Card (2006). Regression discontinuity inference with specification error. Working Paper 322, National Bureau of Economic Research.
- Myerson, R. (2006). Federalism and incentives for success of democracy. *Quarterly Journal of Political Science* 1, 3 – 23.
- Persson, T. and G. Tabellini (2000). *Political Economics: explaining economic policy*. MIT press.
- Seabright, P. (1996). Accountability and decentralisation in government: an incomplete contracts model. *European Economic Review* 40(1), 61–89.
- Shadish, W., T. Cook, and D. Campbell (2002). *Experimental and Quasi-experimental designs*. Houghton Mifflin.
- Urquiola, M. and E. Verhoogen (2006). Class size and sorting in market equilibrium: theory and evidence. Working Paper.

## Appendix

Table 1: Descriptive statistics: Certified and non certified

	2000			2005		
	Certified	Non Certified	Total	Certified	Non Certified	Total
Pop. 2001 ( $\pm 80th$ )	135018.8	37754.68	42604.41	135018.8	37754.68	42604.41
NBI 1993 (% poor)	31.17	45.26	38.21	31.17	45.26	38.21
Forced Displ (exp) xth	2.8	15.1	14.5	1.9	7.7	7.4
Forced Displ (rec) xth	8.9	8.2	8.2	3.3	4.4	4.3
Ind Com Tax pc	30.96	23.19	27.29	32.20	23.35	27.77
M Education spending pc	26.53	32.90	29.59	161.65	27.78	93.87
M Transfers pc	85.02	133.01	107.72	246.77	136.34	191.56
Transfer Dependence	0.45	0.62	0.53	0.63	0.57	0.60

Table 2: Enrolment in Public schools

2001, Non certified						2001, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	492.91	334.76	23	1891	343	Preprimary	1687.39	432.47	958	2719	18
Primary	4648.91	2335.75	772	14459	343	Primary	13330.39	5332.56	7433	29925	18
Lower Sec.	1746.55	1167.28	133	6346	343	Lower Sec.	6374.17	1583.71	3816	9724	18
Upper Sec.	523.22	392.49	0	2144	343	Upper Sec.	1954.61	577	1188	3588	18
Total	7602.99	4004.99	1046	24204	343	Total	23827.17	7239.64	13504	44991	18
2003, Non certified						2003, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	625.73	420.9	56	2714	343	Preprimary	1965.11	735.94	987	3591	18
Primary	4684.25	2428.98	842	15882	343	Primary	14109.06	5922.54	7451	30583	18
Lower Sec.	2157.15	1418.35	245	9326	343	Lower Sec.	7709.22	1557.11	4913	10375	18
Upper Sec.	656.04	489.81	30	2983	343	Upper Sec.	2524.39	553.11	1721	4122	18
Total	8209.48	4463.33	1342	30938	343	Total	26639.11	8046.07	15072	47212	18

Table 3: Enrolment in Private schools

2001, Non certified						2001, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	72.81	131.02	0	916	343	Preprimary	557.56	304.99	83	1338	18
Primary	426.08	745.45	0	5486	343	Primary	2687.78	1356.04	541	5950	18
Lower Sec.	274.42	483.64	0	2812	343	Lower Sec.	1763.22	1195.51	412	4736	18
Upper Sec.	113.37	199.47	0	1139	343	Upper Sec.	789.44	528.35	173	2161	18
Total	982.9	1653.38	0	10817	343	Total	6644.72	3755.31	1733	17315	18
2003, Non certified						2003, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	81.52	179.6	0	1780	343	Preprimary	548.61	371.67	21	1711	18
Primary	376.24	753.14	0	6475	343	Primary	2415.61	1319.43	199	5483	18
Lower Sec.	260.46	507.85	0	4140	343	Lower Sec.	1705.44	1293.15	220	5504	18
Upper Sec.	99.93	196.78	0	1171	343	Upper Sec.	837.56	711.44	54	3103	18
Total	903.88	1668.37	0	13287	343	Total	6248.39	4158.19	1209	18928	18

Table 4: Total Enrolment in Public schools (Diff wrt 2001)

Non certified						Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
2002	333.05	835.23	-3017	4422	343	2002	1164.67	1202.2	-954	3860	18
2003	606.49	1159.72	-5782	6762	343	2003	2811.94	2631.09	-595	8309	18
2004	813.45	1394.28	-5228	9865	343	2004	3445.44	2728.75	711	9588	18
2005	1061.57	1570.74	-4926	8949	343	2005	4043.56	3554.25	103	11230	18
2006	1204.03	1715.99	-5035	11081	343	2006	4000.72	4084.8	-596	14402	18

Table 5: Subsidized Enrolment in Private schools

2003, Non certified						2003, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	7.48	37.43	0	384	343	Preprimary	53.72	99.65	0	309	18
Primary	74.56	349.56	0	3408	343	Primary	258.56	531.74	0	1812	18
Lower Sec.	60.57	183.74	0	1577	343	Lower Sec.	191.94	368.88	0	1373	18
Upper Sec.	10.39	38.61	0	318	343	Upper Sec.	60.89	125.69	0	438	18
Total	154.65	542.63	0	5392	343	Total	614.06	1077.75	0	3911	18
2004, Non certified						2004, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	11.8	66.16	0	685	343	Preprimary	101.11	200.79	0	842	18
Primary	68.83	286.68	0	3086	343	Primary	300.89	408.8	0	1526	18
Lower Sec.	51.66	150.53	0	1203	343	Lower Sec.	209.61	279.78	0	958	18
Upper Sec.	8.65	31.48	0	332	343	Upper Sec.	54.17	127.57	0	452	18
Total	142.57	471.41	0	4650	343	Total	707.94	824.57	0	2538	18
2005, Non certified						2005, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	9.58	48.96	0	568	343	Preprimary	139.56	174.09	0	585	18
Primary	83.65	386.34	0	3695	343	Primary	572	673.31	0	1943	18
Lower Sec.	61.49	170.31	0	1697	343	Lower Sec.	356.83	416.27	0	1481	18
Upper Sec.	9.32	30.94	0	291	343	Upper Sec.	91.39	137.57	0	476	18
Total	164.64	583.49	0	5832	343	Total	1209.22	1217.42	0	4207	18
2006, Non certified						2006, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	31.76	110.52	0	1072	254	Preprimary	135.5	207.71	0	675	18
Primary	202.37	745.48	0	6370	254	Primary	564.72	657.23	0	1832	18
Lower Sec.	142.75	342.37	0	2656	254	Lower Sec.	377	423.45	0	1314	18
Upper Sec.	23.74	52.31	0	353	254	Upper Sec.	107.89	156.54	0	502	18
Total	402.63	1177.39	0	10424	254	Total	1245	1223.56	0	3988	18

Table 6: Subsidized Enrolment in Private schools w/o Antioquia

2003, Non certified						2003, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	1.33	8.07	0	66	296	Preprimary	38.19	81.54	0	285	16
Primary	6.16	35.31	0	278	296	Primary	203.56	482.41	0	1812	16
Lower Sec.	9.04	46.75	0	410	296	Lower Sec.	177.56	386.99	0	1373	16
Upper Sec.	2.48	16.46	0	168	296	Upper Sec.	55	128.87	0	438	16
Total	20.92	109.49	0	972	296	Total	486.88	1074.18	0	3911	16

2004, Non certified						2004, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	4.8	42.31	0	685	296	Preprimary	61.13	81.93	0	187	16
Primary	18.01	87.83	0	1013	296	Primary	240.94	284.24	0	760	16
Lower Sec.	23.72	83.7	0	862	296	Lower Sec.	187.06	274.52	0	958	16
Upper Sec.	4.75	20.01	0	236	296	Upper Sec.	30.69	85.27	0	338	16
Total	52.64	191.41	0	2217	296	Total	521.25	648.74	0	2204	16

2005, Non certified						2005, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	3.8	26.21	0	371	296	Preprimary	127.81	169.77	0	585	16
Primary	15.74	122.91	0	1969	296	Primary	526.69	624.5	0	1943	16
Lower Sec.	21.19	76.47	0	910	296	Lower Sec.	353.69	439.12	0	1481	16
Upper Sec.	3.88	18.98	0	242	296	Upper Sec.	86.31	140.86	0	476	16
Total	45.3	231.03	0	3592	296	Total	1098.44	1241.81	0	4207	16

2006, Non certified						2006, Certified					
Variable	Mean	Std. Dev.	Min.	Max.	N	Variable	Mean	Std. Dev.	Min.	Max.	N
Preprimary	14.18	69.58	0	831	207	Preprimary	150.19	216.37	0	675	16
Primary	44.3	177.26	0	2006	207	Primary	543.31	659.20	0	1832	16
Lower Sec.	46.45	159.13	0	1866	207	Lower Sec.	344.38	426.27	0	1314	16
Upper Sec.	7.29	20.64	0	112	207	Upper Sec.	92.25	143.03	0	502	16
Total	114.68	376.87	0	3870	207	Total	1139.5	1255.37	0	3988	16

Table 7: Enrolment in Public schools, estimates of  $\theta$   
Variation wrt. 2001

	(2002)	(2003)	(2004)	(2005)	(2006)
Pre- primary	-109.023 (120.631)	-76.590 (319.882)	19.085 (312.283)	-773.753 (442.816)*	-749.201 (501.842)
Primary	-261.948 (397.362)	-419.572 (918.906)	39.518 (1102.779)	-871.942 (1103.677)	-1671.956 (995.589)*
L. Second	469.015 (317.181)	-53.220 (488.411)	532.000 (534.198)	475.174 (691.066)	417.533 (643.807)
U. Second	211.967 (110.358)*	138.477 (157.117)	166.175 (218.227)	241.353 (262.423)	-76.674 (191.354)
Total	310.010 (656.444)	-410.904 (1566.482)	756.778 (1841.266)	-929.167 (2013.452)	-2080.298 (1980.567)

Table 8: Enrolment in Public schools, different specifications

P-P 2005	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.006 (.006)	.010 (.006)	.003 (.007)	.007 (.005)	.005 (.001)***	.005 (.001)***
pob2001sq	1.36e-08 (5.54e-08)	4.69e-08 (5.99e-08)	-1.40e-08 (6.17e-08)	2.51e-08 (4.86e-08)		
certif2003	-773.753 (442.816)*	-320.139 (291.807)	-278.277 (346.589)	-259.736 (347.671)	-287.627 (326.593)	-114.800 (231.897)
pobXcertif	.037 (.036)		.009 (.013)		.006 (.010)	
pobsqXcertif	-4.06e-07 (4.62e-07)	-5.65e-08 (2.03e-07)				
cons	550.295 (151.415)***	621.013 (156.967)***	499.458 (158.415)***	577.990 (118.368)***	525.300 (79.188)***	550.353 (84.487)***
N	361	361	361	361	361	361
r2	.141	.128	.129	.127	.129	.123
P 2006	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.030 (.017)*	.033 (.017)**	.024 (.018)	.015 (.010)	.012 (.004)***	.012 (.004)***
pob2001sq	1.83e-07 (1.63e-07)	2.17e-07 (1.62e-07)	1.26e-07 (1.68e-07)	2.76e-08 (9.62e-08)		
certif2003	-1671.956 (995.589)*	-1210.921 (774.649)	-638.520 (792.142)	-684.964 (805.412)	-554.849 (741.531)	-525.823 (580.491)
pobXcertif	.037 (.076)		-.021 (.033)		.001 (.018)	
pobsqXcertif	-8.47e-07 (9.57e-07)	-4.92e-07 (4.51e-07)				
cons	1244.245 (432.295)***	1316.120 (424.030)***	1138.212 (438.073)***	941.497 (291.480)***	906.944 (254.435)***	911.152 (250.555)***
N	361	361	361	361	361	361
r2	.067	.065	.061	.06	.059	.059
U.S 2002	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.004 (.003)	.002 (.003)	.004 (.003)	.0006 (.001)	.001 (.0006)**	.001 (.0006)*
pob2001sq	2.36e-08 (2.69e-08)	8.65e-09 (2.56e-08)	3.16e-08 (2.56e-08)	-6.14e-09 (9.60e-09)		
certif2003	211.967 (110.358)*	8.463 (131.757)	67.385 (86.165)	49.492 (94.637)	88.456 (82.348)	14.052 (74.490)
pobXcertif	-.016 (.006)***		-.008 (.005)		-.003 (.002)	
pobsqXcertif	1.19e-07 (7.83e-08)	-3.84e-08 (6.33e-08)				
cons	153.513 (80.982)*	121.787 (77.987)	168.348 (78.259)**	92.563 (44.829)**	110.106 (43.731)**	99.321 (41.979)**
N	361	361	361	361	361	361
r2	.092	.07	.084	.068	.075	.066

Table 9: Enrolment in public schools, estimates of  $\theta$  with Department FE

	Variation wrt. 2001				
	(2002)	(2003)	(2004)	(2005)	(2006)
Pre- primary	-72.276 (113.707)	107.927 (278.088)	226.282 (272.859)	-439.943 (348.016)	-390.957 (368.240)
Primary	-108.748 (364.301)	-93.733 (991.381)	491.126 (1147.510)	-315.274 (1152.775)	-957.898 (896.237)
L. Second	402.734 (274.839)	-68.886 (460.804)	590.216 (467.079)	511.221 (689.114)	497.411 (611.923)
U. Second	200.649 (102.591)*	125.245 (148.347)	122.920 (218.209)	257.157 (244.806)	-85.873 (171.491)
Total	422.359 (609.987)	70.552 (1521.140)	1430.543 (1745.298)	13.160 (1951.855)	-937.318 (1718.622)

Table 10: Subsidized enrolment in 2005

	(1)	(2)	(3)	(4)	(5)	(6)
Pre-Primary						
pobtotal2001	-0.0003 (.00008)	.0003 (.0003)	.00004 (.00009)	.00008 (.00003)**	.00006 (.0001)	
pob2001sq	-8.00e-10 (7.12e-10)	2.15e-09 (2.58e-09)	1.18e-10 (5.38e-10)			
certif2003	131.780 (71.773)*	118.661 (62.829)*	97.343 (43.341)**	97.121 (47.413)**	96.744 (44.985)**	107.633 (27.909)***
pobXcertif	-0.0007 (.001)	-0.001 (.001)		-0.0003 (.0003)		
pobsqXcertif	3.17e-09 (2.84e-09)					
cons	4.353 (2.703)*	14.503 (9.338)	3.752 (5.891)	7.111 (2.756)***	5.643 (11.560)	1.021 (.313)***
N	926	926	926	926	926	926
r2	.345	.343	.329	.328	.328	.326
Primary						
pobtotal2001	.00003 (.0003)	-0.0002 (.001)	.00004 (.0003)	.0003 (.00009)***	-0.0002 (.0005)	
pob2001sq	-1.74e-09 (2.41e-09)	-3.72e-09 (8.09e-09)	-2.01e-09 (1.32e-09)			
certif2003	384.255 (224.640)*	393.053 (195.082)**	411.080 (129.858)***	430.392 (140.581)***	421.215 (134.838)***	385.288 (98.638)***
pobXcertif	.0007 (.004)	.0009 (.004)		-0.0008 (.0009)		
pobsqXcertif	-2.12e-09 (9.02e-09)					
cons	18.093 (11.908)	11.287 (29.054)	20.378 (20.703)	24.101 (8.328)***	-11.655 (39.400)	3.597 (.982)***
N	926	926	926	926	926	926
r2	.353	.353	.352	.349	.34	.338

Table 10 Continued...

L. Secondary	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.001 (.0008)*	.0001 (.0006)	.00007 (.0002)	.0003 (.0001)**	-.00009 (.0003)	
pob2001sq	7.54e-09 (5.30e-09)	-9.43e-10 (4.46e-09)	-1.46e-09 (7.77e-10)*			
certif2003	205.621 (124.701)*	243.404 (109.474)**	237.957 (83.986)***	252.869 (90.185)***	245.341 (87.518)***	227.293 (60.308)***
pobXcertif	-.001 (.002)	-.0003 (.002)		-.0007 (.0005)		
pobsqXcertif	-9.12e-09 (7.12e-09)					
cons	61.207 (26.322)**	31.976 (19.670)*	29.229 (13.784)**	35.224 (11.493)***	5.892 (21.237)	13.553 (1.538)***
N	926	926	926	926	926	926
r2	.246	.244	.243	.243	.231	.23
U. Secondary	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.0002 (.0002)	-.0002 (.0002)	.00009 (.0001)	.00006 (.00003)*	.00009 (.0002)	
pob2001sq	1.14e-09 (1.15e-09)	-1.75e-09 (1.84e-09)	-3.58e-11 (5.50e-10)			
certif2003	22.651 (44.904)	35.532 (38.669)	53.599 (26.543)**	53.139 (30.100)*	53.780 (28.038)*	71.158 (25.803)***
pobXcertif	.0006 (.0009)	.0009 (.001)		.00006 (.0003)		
pobsqXcertif	-3.11e-09 (2.27e-09)					
cons	10.990 (5.847)*	1.024 (7.027)	10.136 (5.398)*	7.067 (2.808)**	9.565 (12.413)	2.188 (.334)***
N	926	926	926	926	926	926
r2	.215	.213	.199	.199	.199	.192
Total	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.001 (.001)	.0001 (.002)	.0002 (.0006)	.0007 (.0002)***	-.0001 (.0008)	
pob2001sq	6.14e-09 (7.20e-09)	-4.27e-09 (1.46e-08)	-3.38e-09 (2.29e-09)			
certif2003	744.307 (393.142)*	790.650 (343.344)**	799.980 (243.168)***	833.522 (262.165)***	817.080 (252.497)***	791.372 (176.074)***
pobXcertif	-.0006 (.006)	.0004 (.008)		-.002 (.001)		
pobsqXcertif	-1.12e-08 (1.72e-08)					
cons	94.644 (35.790)***	58.790 (54.043)	63.495 (36.250)*	73.503 (19.376)***	9.445 (64.172)	20.359 (2.391)***
N	926	926	926	926	926	926
r2	.393	.392	.392	.391	.383	.383

Table 11: Subsidized enrolment, estimates of  $\theta$ , model (4)

	(2003)	(2004)	(2005)	(2006)
Pre-primary	17.285 (14.556)	36.592 (22.753)*	97.121 (47.413)**	100.793 (57.883)*
Primary	92.795 (64.651)	184.516 (78.308)**	430.392 (140.581)***	358.856 (150.958)**
L. Second	67.102 (62.045)	159.391 (74.196)**	252.869 (90.185)***	231.059 (96.451)**
U. Second	16.766 (23.699)	33.008 (24.088)	53.139 (30.100)*	65.805 (26.467)**
Total	193.948 (160.827)	413.507 (176.640)**	833.522 (262.165)***	756.513 (272.388)***

Table 12: Estimates of  $\theta$  for subsidized enrolment,  $W \pm 80$ th

	(2003)	(2004)	(2005)	(2006)
Pre-primary	13.310 (15.167)	29.774 (24.137)	106.543 (51.362)**	96.867 (63.296)
Primary	67.012 (68.197)	120.033 (94.579)	406.537 (152.205)***	339.113 (156.958)**
L. Second	65.844 (68.029)	92.156 (87.852)	228.431 (93.112)**	208.547 (100.531)**
U. Second	21.668 (24.540)	14.695 (25.138)	50.810 (28.929)*	56.598 (28.094)**
Total	167.833 (174.719)	256.658 (209.230)	792.321 (277.561)***	701.125 (282.329)**

Table 13: Estimates of  $\theta$  for subsidized enrolment, 2005. Different samples

	(Full)	(w/o A)	(W80)	(w/o A)
Pre-primary	111.399 (47.050)**	97.121 (47.413)**	125.084 (50.537)**	106.543 (51.362)**
Primary	410.881 (158.888)***	430.392 (140.581)***	393.400 (179.579)**	406.537 (152.205)***
L. Secondary	198.805 (84.352)**	252.869 (90.185)***	181.158 (89.271)**	228.431 (93.112)**
U. Secondary	47.897 (29.013)*	53.139 (30.100)*	45.004 (27.338)*	50.810 (28.929)*
Total	768.983 (261.062)***	833.522 (262.165)***	744.646 (287.435)***	792.321 (277.561)***
N	1044	926	355	310



Table 14: Public and Private enrolment, estimates of  $\theta$ 

Variation	(1)	(2)	(3)	(4)	(5)
2001-2000					
Pre-primary	105.711 (78.306)	93.515 (79.582)	79.909 (71.284)	78.167 (65.188)	74.263 (68.850)
Primary	304.311 (362.763)	298.008 (378.430)	254.467 (325.798)	220.267 (300.444)	21.068 (320.314)
L. Second	79.394 (228.458)	-.451 (239.056)	30.856 (206.020)	129.253 (185.537)	92.561 (202.370)
U. Second	-82.509 (85.456)	-128.847 (87.832)	-96.690 (69.840)	-26.826 (63.137)	-25.684 (78.325)
Total	406.907 (639.074)	262.225 (664.315)	268.541 (586.200)	400.861 (544.130)	162.208 (588.307)
Pre-primary	2.892 (73.808)	4.105 (58.076)	-12.561 (58.272)	-10.445 (57.402)	-17.624 (55.220)
Primary	-379.555 (374.223)	-30.568 (373.850)	-41.568 (255.067)	-21.980 (264.862)	-75.441 (231.500)
L. Second	48.808 (247.953)	-112.838 (161.965)	-209.858 (186.723)	-206.349 (184.161)	-205.376 (182.404)
U. Second	89.469 (134.792)	-43.512 (79.179)	-126.811 (90.621)	-123.494 (87.882)	-130.284 (88.738)
Total	-238.386 (642.812)	-182.814 (501.783)	-390.798 (431.280)	-362.267 (431.200)	-428.724 (409.988)

Table 15: Tuition fees, estimates of  $\theta$ 

		2000	2001	2002	2003	2004	2005	2006
Public	Coef	-0.07472	0.117173	0.222518	0.337281	-0.25331	0.103325	0.210001
	SE	0.286374	0.30916	0.300375	0.357833	0.35281	0.3008	0.2901
Private	Coef	0.069669	0.026087	-0.11612	-0.32477	0.935683	0.415024	-0.04963
	SE	0.691119	0.817843	0.801712	0.826128	1.028172	1.08488	1.104675

Table 16: Population in schooling age, 2005

6 years (P.P.)	(1)	(2)	(3)	(4)	(5)
pobtotal2001	.020 (.002)***	.025 (.001)***	.022 (.0005)***	.024 (.0004)***	.022 (.001)***
pob2001sq	-2.82e-08 (1.18e-08)**	8.52e-09 (7.98e-09)	-1.16e-09 (4.37e-09)		
certif2003	187.604 (194.593)	51.319 (170.089)	-146.857 (130.137)	-136.923 (196.998)	-114.741 (200.841)
pobXcertif	-.003 (.004)	-.007 (.004)*		-.002 (.002)	
pobsqXcertif	3.72e-08 (1.42e-08)***				
cons	2257.718 (62.057)***	2382.699 (42.273)***	2263.732 (56.528)***	2353.704 (31.793)***	2231.448 (91.168)***
N	1059	1059	1059	1059	1059
r2	.976	.976	.974	.975	.974
<hr/> <hr/>					
7-11 years (P)					
pobtotal2001	.104 (.007)***	.122 (.005)***	.114 (.002)***	.119 (.002)***	.110 (.005)***
pob2001sq	-1.18e-07 (4.83e-08)**	2.55e-08 (3.60e-08)	-1.19e-08 (1.90e-08)		
certif2003	784.794 (835.418)	251.382 (729.576)	-514.378 (562.609)	-311.407 (825.982)	-183.354 (837.435)
pobXcertif	-.010 (.016)	-.027 (.018)		-.013 (.007)*	
pobsqXcertif	1.45e-07 (6.01e-08)**				
cons	11526.180 (253.429)***	12015.350 (180.934)***	11555.650 (242.875)***	11928.660 (131.038)***	11222.890 (381.685)***
N	1059	1059	1059	1059	1059
r2	.982	.982	.981	.982	.98
<hr/> <hr/>					
12-15 years (L.S.)					
pobtotal2001	.085 (.004)***	.092 (.003)***	.089 (.001)***	.092 (.0008)***	.085 (.002)***
pob2001sq	-5.62e-08 (2.96e-08)*	-1.34e-09 (1.95e-08)	-1.41e-08 (8.90e-09)		
certif2003	415.857 (488.032)	212.053 (427.422)	-49.579 (334.097)	241.603 (419.446)	342.423 (436.531)
pobXcertif	-.003 (.009)	-.009 (.011)		-.010 (.004)***	
pobsqXcertif	5.56e-08 (3.55e-08)				
cons	9023.424 (154.745)***	9210.326 (98.789)***	9053.265 (134.948)***	9214.877 (72.523)***	8659.203 (192.658)***
N	1059	1059	1059	1059	1059
r2	.989	.989	.989	.989	.988

Table 16 Continued...

16-17 years (U.S.)					
pobtotal2001	.043 (.002)***	.042 (.0007)***	.042 (.0006)***	.042 (.0003)***	.041 (.0007)***
pob2001sq	6.63e-09 (1.18e-08)	-1.87e-09 (4.99e-09)	-2.34e-09 (1.14e-09)**		
certif2003	-23.006 (209.680)	8.546 (190.600)	-1.219 (145.368)	49.775 (154.212)	63.860 (161.894)
pobXcertif	-.001 (.003)	-.0003 (.004)		-.001 (.001)	
pobsqXcertif	-8.60e-09 (1.29e-08)				
cons	4201.436 (61.678)***	4172.500 (33.353)***	4166.637 (48.655)***	4178.850 (28.292)***	4101.216 (56.473)***
N	1059	1059	1059	1059	1059
r2	.992	.992	.992	.992	.992
6-17 years					
pobtotal2001	.252 (.013)***	.281 (.009)***	.266 (.004)***	.277 (.003)***	.259 (.008)***
pob2001sq	-1.96e-07 (8.73e-08)**	3.08e-08 (6.50e-08)	-2.95e-08 (3.25e-08)		
certif2003	1365.255 (1587.659)	523.248 (1399.423)	-712.107 (1087.474)	-156.991 (1474.480)	108.161 (1498.655)
pobXcertif	-.017 (.029)	-.044 (.034)		-.027 (.013)**	
pobsqXcertif	2.30e-07 (1.09e-07)**				
cons	27008.830 (459.229)***	27781.000 (324.263)***	27039.400 (448.802)***	27676.220 (234.373)***	26214.820 (662.692)***
N	1059	1059	1059	1059	1059
r2	.988	.988	.987	.988	.987

Table 17: Estimates of  $\theta$  for schooling age

	(2000)	(2001)	(2002)	(2003)	(2004)	(2005)
6y (P.P.)	-93.643 (150.180)	-111.384 (164.377)	-119.744 (172.627)	-127.576 (181.877)	-136.076 (191.780)	-136.923 (196.998)
7-11y (P)	-52.662 (547.474)	-67.323 (561.923)	-112.068 (613.925)	-169.751 (673.385)	-224.649 (740.657)	-311.407 (825.982)
12-15y (L.S.)	383.115 (302.155)	370.507 (316.782)	336.057 (330.585)	302.574 (351.670)	273.009 (378.522)	241.603 (419.446)
16-17y (U.S.)	73.074 (147.314)	70.049 (145.030)	64.924 (144.190)	59.037 (145.669)	54.808 (149.149)	49.775 (154.212)
6-17 years	309.473 (1021.400)	261.929 (1070.724)	169.190 (1143.833)	63.675 (1234.431)	-32.719 (1340.891)	-156.991 (1474.480)

Table 18: Municipal variables, estimates of  $\theta$ 

		2000	2001	2002	2003	2004	2005
Indcom tax pc	Coef	-23.79239	-17.3016	-16.0779	-16.5259	-10.9987	-12.0241
	SE	25.76347	38.16338	24.87574	23.61143	24.17673	26.15784
Transfer Dependance	Coef	-15.89178	-3.93054	-8.4063	16.4423	22.62189	9.074143
	SE	16.17543	22.4373	14.87432	16.03444	16.04439	16.08947
New Infrast. Pr	Coef	7.71673	-16.5308	-1.64219	-10.8094	-29.9388	28.54641
	SE	20.28258	19.71799	22.78878	21.37888	20.20122	21.46547
Maintenance Pr	Coef	1.82856	-3.11078	-14.5736	5.496327	24.6655	-4.35077
	SE	18.6598	20.86069	21.60079	19.82585	17.19535	15.99594
Material Pr	Coef	-0.1718808	-3.19041	19.73534	-2.60885	2.33478	-16.8146
	SE	11.01243	14.8149	14.00262	13.2639	13.20635	11.77068
Human K. Pr	Coef				-0.81079	2.285262	4.874338
	SE				4.460615	5.79237	5.129494
Own resources pc	Coef	0.0197928	-0.86913	-0.67324	-1.53328	-6.62187	* 0.314567
	SE	0.3961256	1.087305	1.023665	4.334384	3.586451	4.485452

Table 19: Subsidized enrolment 2005, robustness to controls

Poverty	(1)	(2)	(3)	(4)	(5)	(6)
certif2003	833.522 (262.165)***	804.957 (248.860)***	804.661 (248.664)***	810.321 (241.629)***	819.218 (248.839)***	818.433 (240.263)***
NBI (% poor)			-.181 (.315)			
SISBEN-1				-.005 (.002)**		
SISBEN-2					.004 (.004)	
SISBEN-3						.015 (.006)**
Dept. Dummy	NO	YES	YES	YES	YES	YES
N	926	926	926	926	926	926
r2	.391	.459	.459	.485	.464	.492

Table 19 Continued...

	(1)	(2)	(3)	(4)	(5)	(6)
certif2003	802.356 (248.658)***	802.380 (248.692)***	792.325 (249.778)***	802.256 (248.680)***	807.291 (249.683)***	794.392 (232.778)***
TaxIncpc	.0007 (.0009)					
IndComTaxpc		.001 (.001)				
EducSppc			.001 (.0006)*			
Transfpc				.00002 (1.00e-05)*		
TransfDep					-.192 (.228)	
Tuition fee						-5.659 (9.307)
Dept. Dummy	YES	YES	YES	YES	YES	YES
N	911	911	909	911	916	282
r2	.461	.461	.474	.461	.461	.498
Educ. Fin.	(1)	(2)	(3)	(4)	(5)	(6)
certif2003	797.000 (250.037)***	791.251 (250.302)***	789.425 (249.790)***	792.378 (250.050)***	792.852 (249.811)***	792.836 (249.871)***
NewInfrPr(-1)	.249 (.173)					
MaintInfrPr(-1)		-.267 (.225)				
MaterialPr(-1)			.448 (.409)			
HumanKPr(-1)				-.141 (.782)		
Freepc					.008 (.006)	
SpecOwnpc						.021 (.020)
Dept. Dummy	YES	YES	YES	YES	YES	YES
e(N)	913	913	913	913	909	909
e(r2)	.474	.474	.474	.473	.474	.474

Table 19 Continued...

Other Fin.	(1)	(2)	(3)	(4)	(5)	(6)
certif2003	805.168 (250.328)***	792.676 (249.842)***	802.336 (248.658)***	790.532 (248.030)***	792.357 (250.038)***	790.379 (250.035)***
mq	-30.618 (38.036)					
TotalInvpc		.00003 (.00003)				
CurrentSppc			.0002 (.0001)			
HealthPr				-0.059 (.297)		
SportPr					.298 (1.986)	
HousingPr						-1.566 (1.347)
Dept. Dummy	YES	YES	YES	YES	YES	YES
N	924	909	911	914	914	914
r2	.462	.474	.461	.473	.473	.473
<hr/>						
Conflict	(1)	(2)	(3)	(4)	(5)	(6)
certif2003	805.467 (248.767)***	805.408 (248.755)***	801.778 (247.548)***	801.007 (244.579)***	802.852 (249.142)***	798.823 (243.725)***
Forced Displ (exp)	.008 (.071)					
Forced Displ (rec)		-.082 (.090)				
killings			-1.600 (1.396)			
gue				-8.182 (4.113)**		
para					-5.247 (7.181)	
conflict						-8.362 (3.873)**
Dept. Dummy	YES	YES	YES	YES	YES	YES
N	921	921	926	926	926	926
r2	.46	.46	.461	.468	.459	.47
<hr/>						
Elections	(1)	(2)	(3)	(4)	(5)	(6)
certif2003	718.855 (235.904)***	722.533 (235.233)***	722.024 (235.190)***	720.648 (235.307)***	725.720 (234.853)***	
dparty	21.739 (20.918)					
dliberal		7.406 (12.889)				
dconsev			-2.212 (6.479)			
pctwin					.236 (.419)	
trnout						-5.85 (.460)
Dept. Dummy	YES	YES	YES	YES	YES	YES
N	776	776	776	776	776	776
r2	.44	.439	.439	.439	.439	.439

Table 20: Subsidized enrolment 2003 - 2006, pooled sample

Pre-primary	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.00008 (.0001)	.0002 (.0002)	.0001 (.00006)*	.0001 (.00004)***	.00008 (.00009)	
pob2001sq	-5.32e-10 (1.08e-09)	7.55e-10 (1.47e-09)	-1.49e-10 (3.13e-10)			
certif2003	75.270 (43.427)*	69.868 (38.655)*	60.326 (27.730)**	62.195 (29.938)**	61.291 (28.893)**	77.030 (17.886)***
pobXcertif	-.0003 (.0006)	-.0005 (.0008)		-.0001 (.0002)		
pobsqXcertif	1.37e-09 (1.89e-09)					
cons	11.415 (5.090)**	15.663 (5.957)***	10.816 (4.527)**	13.170 (3.395)***	8.368 (7.130)	1.767 (.364)***
N	3213	3213	3213	3213	3213	3213
r2	.191	.19	.187	.188	.186	.182
Primary	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.0006 (.0006)	.0004 (.0006)	.0003 (.0002)	.0005 (.0001)***	.00009 (.0003)	
pob2001sq	7.58e-10 (4.42e-09)	-1.32e-09 (4.94e-09)	-1.70e-09 (9.49e-10)*			
certif2003	242.267 (137.694)*	251.003 (120.838)**	246.996 (86.261)***	264.441 (93.005)***	257.989 (90.384)***	275.934 (63.656)***
pobXcertif	-.0004 (.002)	-.0002 (.003)		-.0008 (.0006)		
pobsqXcertif	-2.22e-09 (6.88e-09)					
cons	50.490 (22.088)**	43.622 (19.455)**	41.586 (15.015)***	47.987 (10.142)***	13.704 (25.840)	6.177 (.972)***
N	3213	3213	3213	3213	3213	3213
r2	.251	.251	.251	.25	.24	.239
L. Secondary	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.0007 (.0007)	.0004 (.0004)	.0002 (.0001)	.0004 (.0001)***	-.00003 (.0002)	
pob2001sq	2.46e-09 (4.75e-09)	-1.35e-10 (3.19e-09)	-1.68e-09 (5.67e-10)***			
certif2003	161.643 (103.154)*	172.551 (91.949)*	156.226 (69.899)**	173.918 (74.564)**	167.089 (73.203)**	161.009 (45.478)***
pobXcertif	-.001 (.002)	-.0008 (.002)		-.0008 (.0003)**		
pobsqXcertif	-2.77e-09 (5.84e-09)					
cons	55.918 (22.036)**	47.342 (15.408)***	39.049 (12.052)***	47.786 (10.894)***	11.496 (15.949)	14.047 (1.431)***
N	3213	3213	3213	3213	3213	3213
r2	.142	.142	.141	.142	.124	.124

Table Continued...

U. Secondary	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.00006 (.00009)	-.00005 (.0001)	.00007 (.00005)	.00008 (.00002)***	.00004 (.00008)	
pob2001sq	-1.58e-10 (7.26e-10)	-1.08e-09 (1.17e-09)	-2.61e-10 (2.44e-10)			
certif2003	26.421 (34.347)	30.298 (30.675)	38.954 (22.190)*	41.290 (24.108)*	40.640 (23.329)*	48.531 (15.973)***
pobXcertif	.0003 (.0005)	.0004 (.0006)		-.00008 (.0001)		
pobsqXcertif	-9.85e-10 (1.44e-09)					
cons	8.680 (3.156)***	5.631 (4.373)	10.028 (3.507)***	9.201 (2.094)***	5.751 (6.444)	2.442 (.287)***
N	3213	3213	3213	3213	3213	3213
r2	.15	.15	.145	.142	.14	.138
Total	(1)	(2)	(3)	(4)	(5)	(6)
pobtotal2001	.001 (.001)	.0009 (.001)	.0006 (.0004)*	.001 (.0003)***	.0002 (.0006)	
pob2001sq	2.53e-09 (9.61e-09)	-1.78e-09 (9.33e-09)	-3.79e-09 (1.66e-09)**			
certif2003	505.601 (274.859)*	523.720 (243.437)**	502.503 (179.307)***	541.843 (192.267)***	527.010 (187.701)***	562.503 (121.094)***
pobXcertif	-.001 (.004)	-.001 (.005)		-.002 (.001)*		
pobsqXcertif	-4.60e-09 (1.38e-08)					
cons	126.503 (46.767)***	112.257 (38.642)***	101.479 (29.213)***	118.144 (22.474)***	39.320 (45.143)	24.432 (2.449)***
N	3213	3213	3213	3213	3213	3213
r2	.261	.261	.261	.261	.247	.247



Table 21: Robust Confidence Intervals

	Variable	L.S.	Confidence	Interval
Identical Specification Error	Pre-primary	95	3.440048	120.9493
	Primary	95	81.91736	446.9644
	L. Secondary	95	27.58499	320.2517
	U. Secondary	95	-6.023275	88.60228
	Total	95	164.5166	919.1702
Independent Specification Error	Pre-primary	90	3.5693225	120.82
		95	-7.4451348	131.83445
		99	-29.474049	153.86337
	Primary	90	67.549263	461.33253
		95	30.557502	498.32429
		99	-43.426021	572.30781
	L. Secondary	90	10.247198	337.58948
		95	-20.503137	368.33982
		99	-82.003808	429.84049
	U. Secondary	90	-11.083187	93.662193
		95	-20.922904	103.50191
		99	-40.60234	123.18135
	Total	90	138.38983	945.29697
		95	62.589459	1021.0973
		99	-89.011277	1172.6981

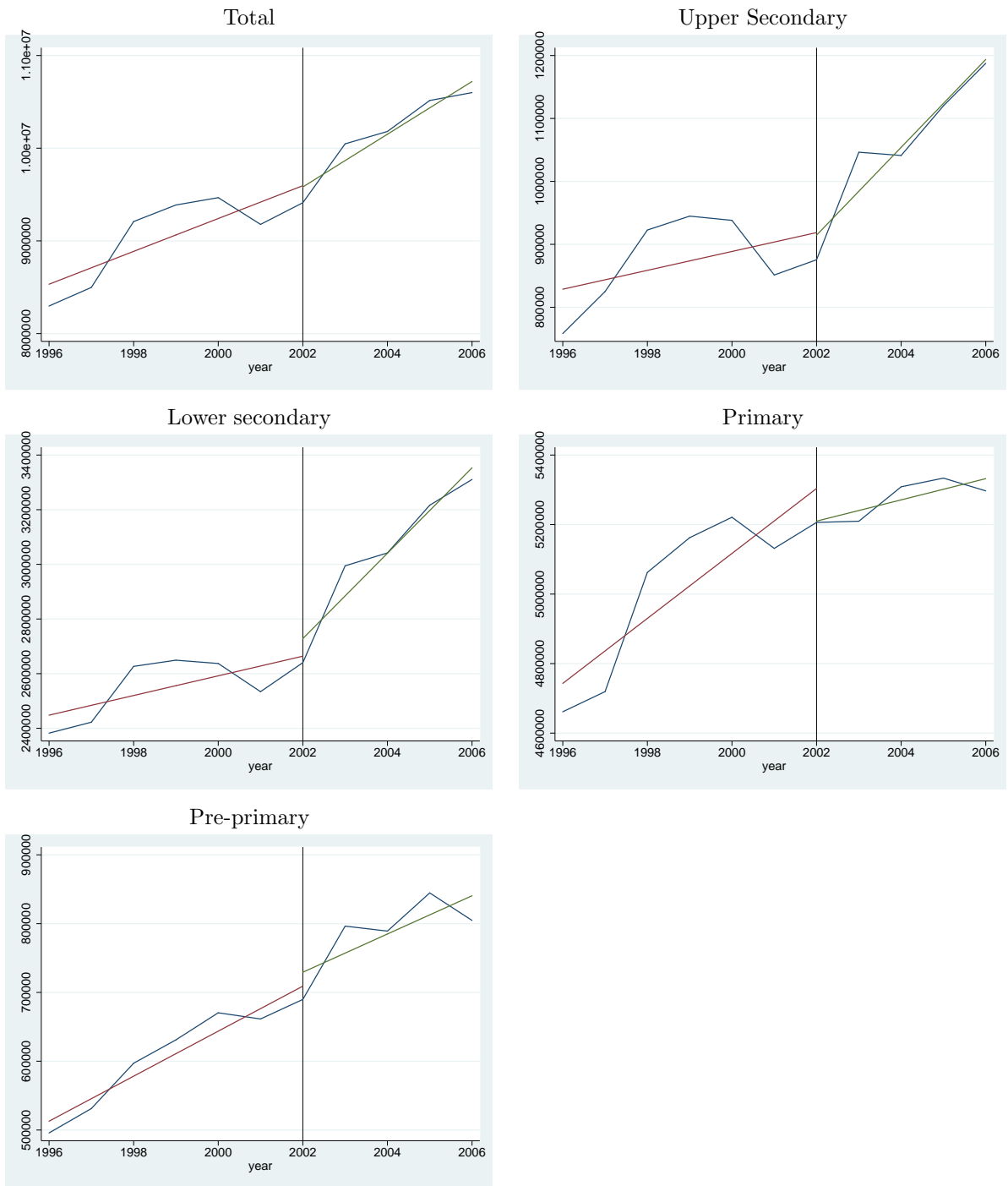


Figure 2: Aggregated Enrolment

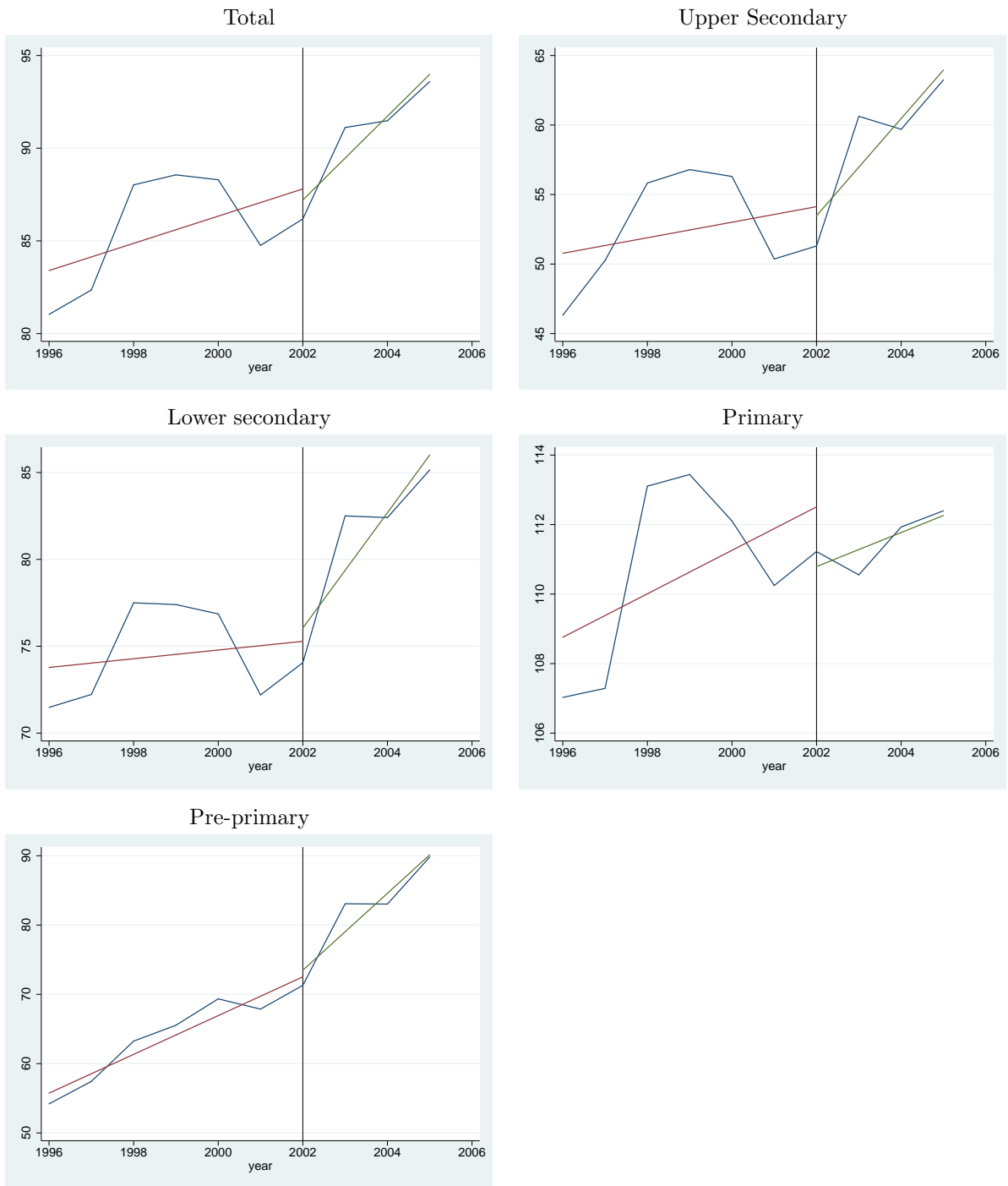
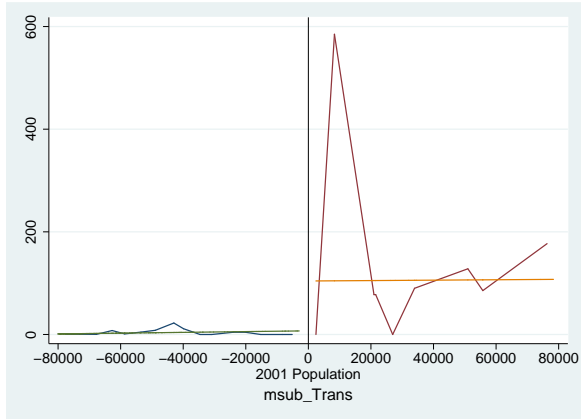


Figure 3: Gross Enrolment Rate

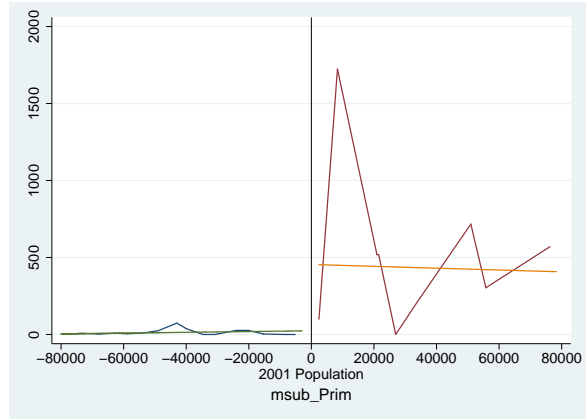


Figure 4: Enrolment in Public schools

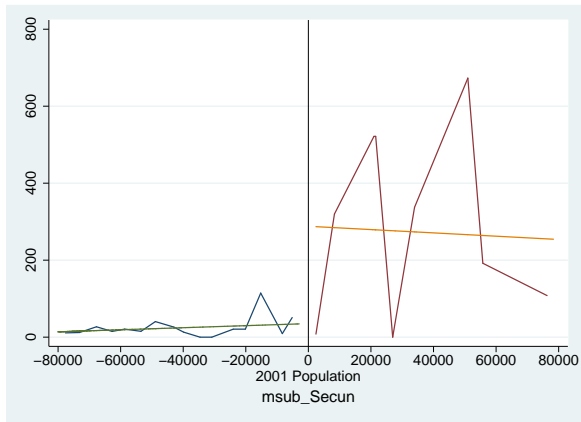
Pre-primary



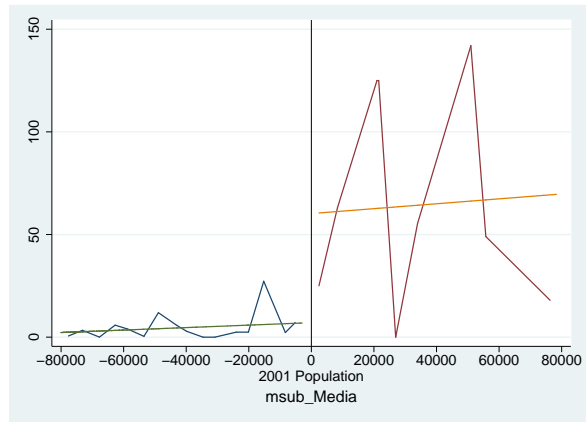
Primary



Lower Secondary



Upper Secondary



Total

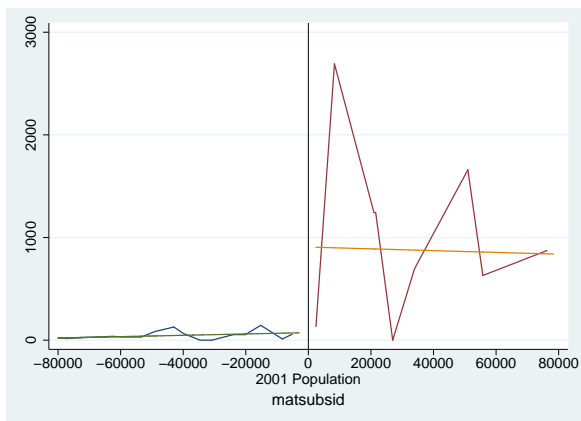


Figure 5: Subsidized enrolment by level, 2005

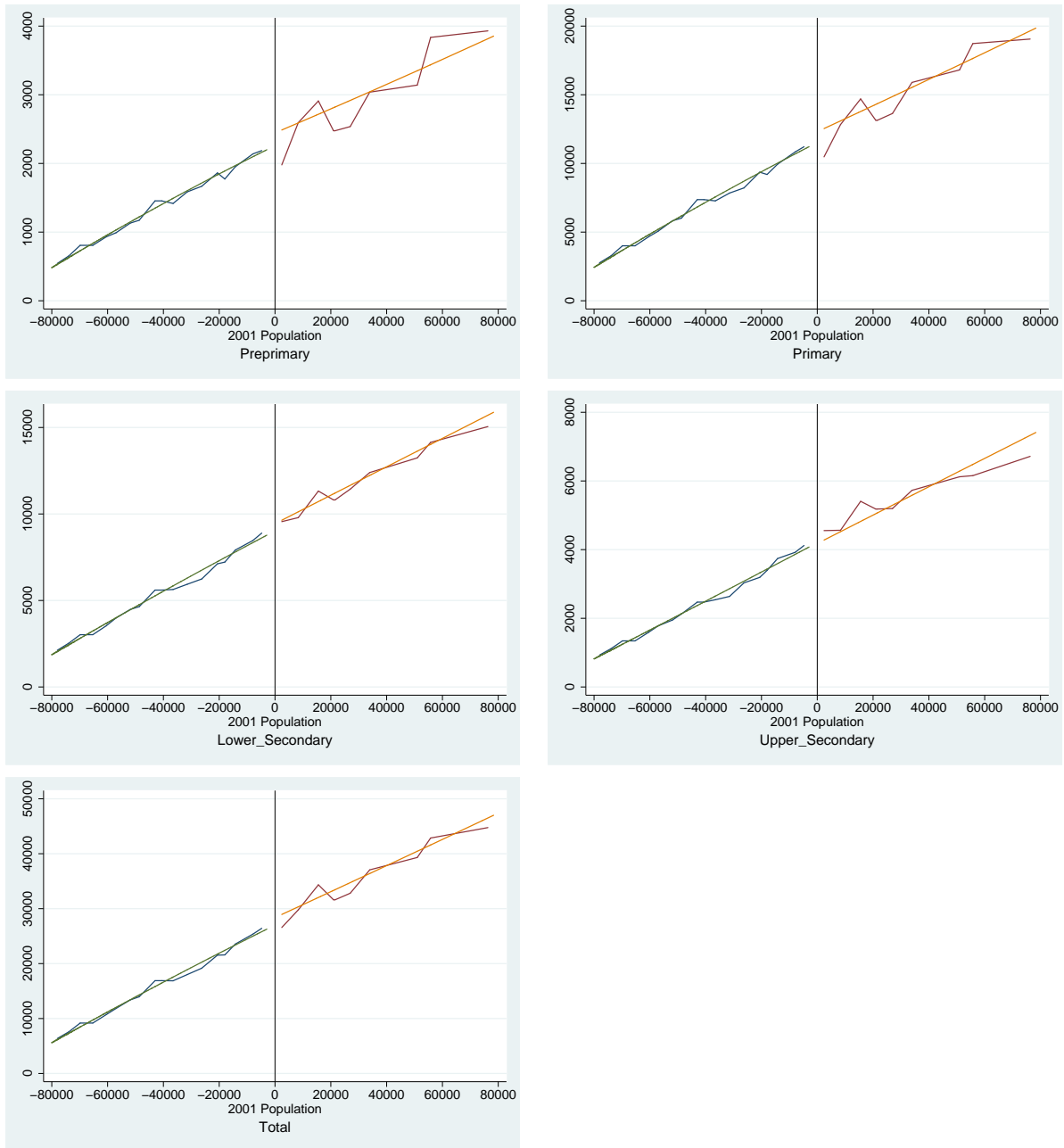


Figure 6: Population in schooling age