The Impact of Conditional Cash Transfers on Public Education Expenditures: A Political Economy Approach*

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Abstract

We investigate the impact of conditional cash transfers (CCT) on the level of public education expenditures chosen by majority voting. In our model, parents may send their children to work, instead of to (public or private) school. CCT may affect the choice of tax rate by altering the identity and/or the income level of the pivotal voter. Our simulation results explain the increase in education expenditures observed in Mexico and Brazil following the implementation of CCT programs. In Colombia, the pivotal voter is not eligible for the CCT program, which led to the relative stability in education expenditures per student.

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1 Introduction

Conditional cash transfer (CCT) programs were implemented in several developing countries during the 1990s. Under these programs, low-income households receive a cash transfer if their children attend school. Apart from alleviating poverty in the short term, these programs are intended to provide long-lasting benefits by raising children's human capital.

While CCT programs have been shown to increase school enrollment,[1] critics emphasize that the effects in terms of human capital are dubious (e.g., Reimers et al., 2006). Public school quality is typically very low in developing countries (Lockheed and Verspoor, 1991; Hanushek, 1995; Glewwe, 1999). In addition, the pressure over existing resources could increase as a result of larger enrollment, worsening public education quality.

A missing element in this debate is the effect that CCT programs may have on the political economy of public school expenditures. When they increase the pivotal voter's available income, CCT programs may lead to the choice of a larger tax rate to finance education, under the assumption that education is a normal good. If they alter public school enrollment, CCT programs may also change the identity of the pivotal voter, affecting the resulting choice of tax rate.

In this paper, we investigate the impact of CCT transfers on the level of public education expenditures chosen by majority voting. Our benchmark model is Gutierrez and Tanaka (2009), which extends Epple and Romano's (1996) model by accounting for the possibility that parents may send their children to work, instead of to (public or private) school. We first present the theoretical framework and discuss the main mechanisms through which CCT transfers may affect the choice of education expenditures. Since the final impact on education expenditures per student cannot be a priori determined, we calibrate the model using Brazilian, Colombian, and Mexican data for the year previous to the implementation of the respective CCT programs. We then simulate the impact of different CCT transfer levels on education expenditures and enrollment. By constrasting the results obtained in the simulation with the actual evolution of education expenditures and enrollment, we are also able to test our model predictions.

In the model, all the households have the same preferences regarding education and private consumption. However, families are heterogeneous with respect to their income. While education increases their utility, there is an opportunity cost associated to schooling.

[1] There is a growing literature on the evaluation of conditional cash transfer programs, which includes Attanasio et al. (2005), Baird et al. (2011), Barrera-Osorio et al. (2011), Behrman et al. (2005), Bursztyn and Coffman (2012), Coady and Parker (2004), de Brauw and Hoddinott (2010), Dubois et al. (2012), Ferreira et al. (2009), Maluccio and Flores (2005), Schady and Araujo (2006), Schultz (2004), Skoufias and Parker (2001), Souza and Cardoso (2009), and Todd and Wolpin (2006).

The latter may be related to foregone child labor earnings or to other indirect costs, such as material and transportation. These costs lead poor households to keep their children out of school. In contrast, rich households may prefer to send their children to higher quality private, instead of public schools, depending on the level of public school expenditures.

The key element in the model is that once a household is not attending a public school, it has no incentives to support public education expenditures. Indeed, its utility level is not affected by public school quality.[2] As shown by Gutierrez and Tanaka (2009), when some children are out of school and others are in private schools, an ends-against-the-middle equilibrium is always obtained. However, the identity of the pivotal voter will differ depending on whether the preferred tax-expenditure bundle is increasing or decreasing in voters' income. After calibrating the model, our simulation results show that the assumption of a preferred tax-expenditure bundle increasing in income is consistent with data from Brazil, Colombia, and Mexico.[3] This seems to be confirmed by most empirical studies (Epple and Romano, 1996).

Under relevant parameters, the tax rate chosen by the pivotal voter in Brazil and Mexico is always increasing in the benefit level distributed by the CCT program. In both countries, the pivotal voter is eligible for the CCT program and an increased transfer leads to the choice of a higher tax rate due to the income effect. Moreover, when education expenditures per student increase, private school enrollment declines. Consequently, the pivotal voter is characterized by a higher income and, therefore, chooses a higher tax rate.

Apart from a slight initial decrease in education expenditures per student caused by the decline in the number of children out of school, the trend is reversed for larger benefit values. Indeed, the higher tax rate largely compensates for any further increase in public school enrollment. When we consider the actual values distributed by the CCT program in Brazil and Mexico, we show that the model predicts quite well the increases in education expenditures per student (in real terms) that occurred in the two countries in the three years following the implementation of the program.[4] In contrast, our model overestimates the impact of the CCT programs in terms of enrollment. This is not surprising since not all eligible households actually take up the benefit. When we redo the simulation for Mexico

[2] The idea that households not benefiting from a publicly provided good may vote for low expenditures has been extensively explored in models combining public and private provision. The seminal paper is Stiglitz (1974), followed by Epple and Romano (1996), Glomm and Ravikumar (1998), Hoyt and Lee (1998), Chen and West (2000), Cohen-Zada and Justman (2003), Tanaka (2003), and Cattaneo and Wolter (2009), among others.

[3] Since the price elasticity of the demand for public education in Mexico is close to one, the assumption that the preferred tax-expenditure bundle is decreasing in income would, in principle, also be valid. However, additional simulation results presented in the paper seem to indicate that a preferred tax-expenditure increasing in income fits the data better.

[4] The only exception is the decrease in public education expenditures observed in Brazil in 2003.

considering that the impact on children out of school was zero, our results match the data much better.

The main difference in the Colombian setting is that the CCT program's coverage is much more restricted. As a consequence, the pivotal voter is not eligible for the CCT program. In such a context, the introduction of the CCT program has a negative impact on public education expenditures per student for any value of the transfer. This leads to an increase in private enrollment and, therefore, to a relatively poorer pivotal voter. Thus, the equilibrium tax rate gets smaller and the negative impact on education expenditures per student is even more severe. Once full school enrollment is attained, the model predicts that the level of public school enrollment, per student education expenditures, and the tax rate should remain pretty constant. Confronting the model with actual data, we are able to explain the relative stability in education expenditures (in real terms) observed in Colombia over the period 2002-2005.

Our results have a number of policy implications. As highlighted by previous literature (e.g., de Janvry and Sadoulet, 2006), CCT programs have fallen short of generating full enrollment in the countries where they have been implemented. Our simulations suggest that this is due less to the benefit level than to the current number of households receiving the transfer. More importantly, we show that while a relatively low transfer may reduce education expenditures per student, a more generous benefit may actually increase the level of education expenditures per student. However, this only happens when the program's coverage is large enough, so that the decisive voter is a program beneficiary. Thus, an argument can be made in favor of reducing targeting and instead distributing the benefit to even relatively richer households.

This paper is organized as follows: Section 2 presents the model; Section 3 presents the main assumptions and equations used in our simulation; Section 4 shows the calibration of the model using Brazilian, Colombian, and Mexican data; Section 5 presents the main results of our simulation with and without a CCT program; Section 6 concludes.

2 The Model

2.1 Basic Setup

In this section, we briefly outline the main features of the model and discuss how the introduction of a CCT program may alter the level of public expenditures chosen by majority voting.

We assume that the economy is composed of a continuum of households with one adult

and one child. The households are identical with respect to their preferences. These are defined over consumption, c, and their child's human capital, h, and represented by the utility function $U(c, h)$ assumed to be increasing, strictly quasi-concave, and twice continuously differentiable.[5] The child's human capital depends on the education quality it obtains.

Households are heterogeneous with respect to their income y. We suppose that $y \in [\underline{y}, \overline{y}]$ and is distributed according to the density function $f(y)$. The corresponding cumulative distribution function is $F(y)$. We normalize the population size to one. Average (and total) income is denoted by y_a and the median income by y_m.

All household incomes are taxed at the constant rate t. The government uses the tax revenues to finance the public education system. Public education is freely available at quality e to all households.[6] However, not all households make use of public schools. Some households do not send their children to school at all, since acquiring an education entails an opportunity cost w.[7] We normalize the human capital of a child who does not attend school to $l < e$. Moreover, the household may opt out of public education and instead send the child to a private school, where the household is able to choose the education quality s it wishes. We assume that education is a normal good.

Households below a certain income level y_b and enrolled in public schools are eligible for a conditional cash transfer $b \geq 0$. We assume that b is financed by government revenue other than that generated by t. Since voters choose e and t, but not b, assuming an alternative source of funding has little impact on our results. It also allows us to consider a cash transfer program that is not directly competing for public resources with the public education system. This setting also reflects the fact that, in most countries, the conditional cash transfer program is financed by the central government, while public education expenditures are chosen locally.

The technology available in this economy is such that e units of private consumption can be transformed into one unit of education of quality e, i.e., the price of education is

[5] Subscripts denote partial derivatives, that is, U_x is the partial derivative of the utility function with respect to x.

[6] By considering one homogeneous public education market, we rule out the possibility that the household's decision to live in a given community may depend on the quality of public education in that locality (Tiebout, 1956). Also, as discussed in Glomm and Ravikumar (2003), even when public school quality is homogeneous, children's education may differ depending on their parents' human capital level. Taking into account these possibilities seems natural and would constitute interesting extensions to this work.

[7] This may be related to foregone child labor earnings or to other indirect costs related to schooling. Undoubtedly, school attendance can be combined with some amount of child work, as shown by Souza and Cardoso (2009). Therefore, w does not represent the full child wage, but only the proportion of it that cannot be combined with schooling. We also assume that child labor is not taxed, which seems realistic given that children work mainly in the informal sector.

normalized to 1. We require that the government's budget balances, so that:

$$ty_a = e\theta, \tag{1}$$

where θ is the public enrollment rate.

The budget constraints of a household out of school, at public, and private school are given, respectively, by:

$$c_i = (1-t)y_i + w, \tag{2}$$

$$\begin{aligned} c_i &= (1-t)y_i + b \quad \text{if} \quad y_i \leq y_b, \quad \text{and} & (3)\\ c_i &= (1-t)y_i \qquad\quad \text{if} \quad y_i > y_b, & (4) \end{aligned}$$

$$c_i = (1-t)y_i - ps. \tag{5}$$

The corresponding utility functions of a household out of school, using public and private schools, are given by $U(c_i, l)$, $U(c_i, e)$, and $U(c_i, s)$, respectively.

Consider a household currently enrolled in a public school (not receiving the conditional cash transfer, for simplicity). The slope of its indifference curves (in absolute terms) in the (t, e) space denoted by $\eta(e, t)$ is:

$$\eta(t,e) = \left| \frac{\frac{\partial U}{\partial e}}{\frac{\partial U}{\partial t}} \right| = \frac{U_e\left((1-t)y_i, e\right)}{y_i U_c\left((1-t)y_i, e\right)}. \tag{6}$$

The slope $\eta(e, t)$ is not necessarily monotonic in y, as shown in (6). With the purpose of determining the voting equilibrium, we impose monotonicity conditions on the preferences over the tax-expenditure bundle (t, e) for the households attending public school.[8] We suppose that their preferred level of (t, e) either increases or decreases with income for those households at school. These two cases are denoted *slope rising in income* (or SRI), and *slope decreasing in income* (or SDI).

Clearly, two opposite effects influence household preferences. On the one hand, rich households favor a higher quality of public education because education is a normal good. This is the so-called *income effect*. On the other hand, the rich pay a larger share of educational expenditures under proportional income taxation. Since any increase in quality requires a raise in taxes, richer households support decreases in the quality of education in order to reduce their tax burden. This corresponds to the *substitution effect*. If the income effect is larger (resp. smaller) than the substitution effect, the richer the household the larger (resp. smaller) its preferred level of the tax-expenditure bundle. The effect that dominates

[8] This is a common assumption in the literature. See, for example, Epple and Romano (1996).

depends on the relative magnitudes of the income elasticity of education and the elasticity of substitution between consumption and education.[9]

2.2 Equilibrium

In this section, we begin by restating the main result of Gutierrez and Tanaka (2009) in Proposition 1, which establishes the necessary conditions for a voting equilibrium in the absence of a conditional cash transfer program, i.e., when $b = 0$.

Proposition 1 (Gutierrez and Tanaka, 2009)**.** *If a tax-expenditure pair* $(\tilde{t}, \tilde{e})$ *on the government budget constraint is an interior majority voting equilibrium, then:*

1. *there exists a parent with income* $\tilde{y}$ *who weakly prefers public education at the point* $(\tilde{t}, \tilde{e})$ *to public education at all other points in the government budget constraint;*
2. *there exists a parent with income* $y_h \leq \overline{y}$ *who is indifferent between public and private education at point* $(\tilde{t}, \tilde{e})$*;*
3. *there exists a parent with income* $y_l \geq \underline{y}$ *who is indifferent between sending his child to work or sending his child to public school at the point* $(\tilde{t}, \tilde{e})$*;*
4. $y_l \leq \tilde{y} \leq y_h$*;*
5. $\int_{\tilde{y}}^{y_h} f(y)dy = 0.5$ *under SRI and* $\int_{y_l}^{\tilde{y}} f(y)dy = 0.5$ *under SDI.*

Proof. See Gutierrez and Tanaka (2009). □

We now analyze the impact of the introduction of a CCT program on the equilibrium level of education expenditures. Since the CCT transfer increases household income, it may lead to the choice of a larger tax rate if the pivotal voter is eligible for it, i.e., $\tilde{y} \leq y_b$, due to the income effect.[10] The CCT program may also increase enrollment if $y_l < y_b$, and y_l actually takes up the benefit.[11]

Under SDI, Proposition 1 (point 5) suggests that an increase in enrollment would directly affect the identity of the pivotal voter when $y_l > \underline{y}$. To see this, note that in the presence of a CCT program, the income level y_l is implicitly defined by:

$$\Psi(e, t, b, w, y_i) \equiv U\left((1-t)y_l + w, l\right) - U((1-t)y_l + b, e) = 0. \tag{7}$$

[9] See Kenny (1978) for a detailed analysis.

[10] Note that the substitution effect is not in place since we have assumed that the cash transfer is non-taxable. If we consider instead that it is taxable, our simulation results do not change significantly.

[11] As will be shown later, y_l is eligible for the CCT program in Brazil, Colombia, and Mexico. However, the small impact on school enrollment, especially in Mexico, suggests that they are probably not receiving the benefit. We will return to this issue in Section 5.

The impact of an increase in b on y_l is given by:

$$\frac{\partial y_l}{\partial b} = -\frac{\Psi_b}{\Psi_y} = \frac{U_c\left((1-t)y_l + b, e\right)}{(1-t)\left[U_c\left((1-t)y_l + w, l\right) - U_c\left((1-t)y_l + b, e\right)\right]} < 0. \tag{8}$$

With an increase in b, the voter who is indifferent between going to public school or remaining out of school is characterized by a lower income level. Proposition 1 states that half of the population should be located between this household and the pivotal household, $\tilde{y}$, in order for $(\tilde{t}, \tilde{e})$ to be an equilibrium. Therefore, if the increase in b displaces y_l to the left, the new $\tilde{y}$ (if it exists) also moves to the left, corresponding to a lower income level. Since the preferred level of the tax-expenditure bundle is decreasing in income, its preferred choice corresponds to a higher tax rate.

Under SRI, the increased school enrollment does not directly affect the identity of the pivotal voter, as can be seen in Proposition 1 (point 5). However, any change in public education expenditures per student may lead to a change in private school enrollment and, therefore, affect the identity of the pivotal voter. For instance, if public school expenditures per student increase, one should expect that some relatively rich households would switch from private to public schools, i.e., y_h increases. Consequently, the new pivotal voter would have a larger income level and choose a larger tax rate under SRI.

Importantly, even if the tax rate increases, the amount of resources per student will not necessarily be higher. The cash transfer may attract new students to the public education system, potentially decreasing the amount of resources per student.

Thus, the net effect of the CCT transfer on public education expenditures per student cannot be a priori determined. Therefore, we will simulate the model using relevant data from Brazil, Colombia, and Mexico to establish the effect of the CCT programs implemented in these countries on education expenditures.

3 Simulation

In this section, we present the equations used to simulate the model under SDI and SRI. We first investigate the existence of a point that satisfies the necessary conditions stated in Proposition 1. Then, we verify whether this point is a global majority voting equilibrium by comparing it to several other points in the government budget constraint. We use the CES utility function:

$$U(c, h) = \beta h^{\rho} + (1-\beta)c^{\rho}. \tag{9}$$

It can be shown that the preferred bundle of tax-expenditure is increasing and decreasing in income for a CES utility function whenever $\rho < 0$ and $0 < \rho < 1$, respectively.[12] The price elasticity of the demand for public education is given by:

$$\varepsilon = \frac{1 - \frac{\rho}{1+\left(\frac{\beta}{1-\beta}\right)^{\frac{1}{\rho-1}}}}{\rho - 1}. \tag{10}$$

To simplify the notation, assume that $y_l < y_b < y_h$.[13] A bundle $(\tilde{t}, \tilde{e})$ satisfying the necessary conditions given in Proposition 1 is the solution to the following system of non-linear equations:

$$F_1 = \beta e^\rho + (1-\beta)((1-t)y_l + b)^\rho - \beta l^\rho - (1-\beta)((1-t)y_l + w)^\rho = 0 \tag{11}$$

$$F_2 = \beta s^\rho + (1-\beta)((1-t)y_h - s)^\rho - \beta e^\rho - (1-\beta)((1-t)y_h)^\rho = 0 \tag{12}$$

$$F_3 = ty_a - e\int_{y_l}^{y_h} f(y)dy = 0 \tag{13}$$

$$\begin{aligned} F_4 &= \int_{y_l}^{\tilde{y}} f(y)dy - 0.5 = 0, \quad \text{if } SDI, \text{ or} \\ &= \int_{\tilde{y}}^{y_h} f(y)dy - 0.5 = 0, \quad \text{if } SRI \end{aligned} \tag{14}$$

$$\begin{aligned} F_5 &= \rho\beta e^{\rho-1} - \rho(1-\beta)((1-t)\tilde{y} + b)^{\rho-1}\frac{dt}{de}\tilde{y} = 0 \quad \text{if} \quad \tilde{y} \le y_b \\ &= \rho\beta e^{\rho-1} - \rho(1-\beta)((1-t)\tilde{y})^{\rho-1}\frac{dt}{de}\tilde{y} = 0 \qquad \text{if} \quad \tilde{y} > y_b \end{aligned} \tag{15}$$

$$F_6 = \rho\beta e^{\rho-1} + \rho(1-\beta)\left[((1-t)y_l + b)^{\rho-1} - ((1-t)y_l + w)^{\rho-1}\right]\left[(1-t)\frac{\partial y_l}{\partial e} - y_l\frac{dt}{de}\right] = 0 \tag{16}$$

$$F_7 = \rho(1-\beta)\left[((1-t)y_h - s)^{\rho-1} - ((1-t)y_h)^{\rho-1}\right]\left[(1-t)\frac{\partial y_h}{\partial e} - y_h\frac{dt}{de}\right] - \rho\beta e^{\rho-1} = 0 \tag{17}$$

$$F_8 = y_a\frac{dt}{de} - \int_{y_l}^{y_h} f(y)dy - e\left[f(y_h)\frac{\partial y_h}{\partial e} - f(y_l)\frac{\partial y_l}{\partial e}\right] = 0 \tag{18}$$

$$F_9 = \rho\beta s^{\rho-1} - \rho(1-\beta)((1-t)y_h - s)^{\rho-1} = 0 \tag{19}$$

The conditions specified in equations (11)-(19) are necessary, but not sufficient for an equilibrium. A majority voting equilibrium requires that the candidate point defined by

[12] Since the CES utility function is homothetic, the income elasticity of education is one. The elasticity of substitution between consumption and education is given by $\frac{1}{1-\rho}$ and is therefore smaller than one when $\rho < 0$ (corresponding to SRI), and larger than one when $0 < \rho < 1$ (corresponding to SDI).

[13] This turns out to be the case in all our simulations.

this system of equations receives more than half of the votes when confronted by all the other possible points belonging to the government budget constraint. In order to verify this, let $(\tilde{t}, \tilde{e})$ be the tax-expenditure bundle preferred by the pivotal voter, $\tilde{y}$, and defined by equations (11)-(19). Take $(\hat{t}, \hat{e})$ to be any alternative tax-expenditure bundle. If it belongs to the government budget constraint, it satisfies the three equations:

$$K_1 = \beta\hat{e}^\rho + (1-\beta)((1-\hat{t})\hat{y}_l + b)^\rho - \beta l^\rho - (1-\beta)((1-\hat{t})\hat{y}_l + w)^\rho = 0 \quad (20)$$

$$K_2 = \beta s^\rho + (1-\beta)((1-\hat{t})\hat{y}_h - s)^\rho - \beta\hat{e}^\rho - (1-\beta)((1-\hat{t})\hat{y}_h)^\rho = 0 \quad (21)$$

$$K_3 = \hat{t}y_a - \hat{e}\int_{\hat{y}_l}^{\hat{y}_h} f(y)dy = 0 \quad (22)$$

Let y_k be the individual who is indifferent between public school at $(\tilde{t}, \tilde{e})$ and $(\hat{t}, \hat{e})$. y_k is defined by:

$$\begin{aligned} K_4 &= \beta\tilde{e}^\rho + (1-\beta)((1-\tilde{t})y_k + b)^\rho - \beta\hat{e}^\rho - (1-\beta)((1-\hat{t})y_k + b)^\rho = 0 \quad \text{if} \quad y_k \leq y_b \\ &= \beta\tilde{e}^\rho + (1-\beta)((1-\tilde{t})y_k)^\rho - \beta\hat{e}^\rho - (1-\beta)((1-\hat{t})y_k)^\rho = 0 \quad \text{if} \quad y_k > y_b \end{aligned} \quad (23)$$

Suppose first that the preferred bundle of tax-expenditure is decreasing in income, i.e., SDI. For all $(\hat{t}, \hat{e}) < (\tilde{t}, \tilde{e})$, we know that $y_k > \tilde{y}$. All the households with income higher than y_k prefer $(\hat{t}, \hat{e})$ to $(\tilde{t}, \tilde{e})$. The households with income lower than y_k compare public school at $(\tilde{t}, \tilde{e})$ with no school at $(\hat{t}, \hat{e})$, since in the latter case they pay lower taxes. Define y_j as the household indifferent between being out of school at $(\hat{t}, \hat{e})$ and attending public school at $(\tilde{t}, \tilde{e})$. y_j is given by:

$$K_5 = \beta e^\rho + (1-\beta)((1-t)y_j + b)^\rho - \beta l^\rho - (1-\beta)((1-\hat{t})y_j + b)^\rho = 0 \quad (24)$$

The political support for $(\tilde{t}, \tilde{e})$ against $(\hat{t}, \hat{e})$ comes from the households with income between y_j and y_k. Thus, in order for $(\tilde{t}, \tilde{e})$ to be a majority voting equilibrium when compared to lower levels of tax-expenditure, at least half the population must have income between y_j and y_k. Now consider that $(\hat{t}, \hat{e}) > (\tilde{t}, \tilde{e})$. In this case, $y_k < \tilde{y}$ under SDI. Household j is now defined as:

$$K_6 = \beta\hat{e}^\rho + (1-\beta)((1-\hat{t})y_j + b)^\rho - \beta l^\rho - (1-\beta)((1-\tilde{t})y_j + w)^\rho = 0 \quad (25)$$

Now, the voters supporting $(\tilde{t}, \tilde{e})$ against $(\hat{t}, \hat{e})$ are those with income higher than y_k or smaller than y_j. Thus, they have to constitute more than half of the voters when $(\tilde{t}, \tilde{e})$ is

compared to all alternatives representing a higher tax-expenditure bundle.

Now suppose that the preferred bundle of tax-expenditure is rising in income, i.e., SRI. For all $(\hat{t}, \hat{e}) < (\tilde{t}, \tilde{e})$, we know that $y_k < \tilde{y}$, where y_k is defined by (23). The households with income larger than y_k prefer $(\tilde{t}, \tilde{e})$ to $(\hat{t}, \hat{e})$. Define y_p as the household indifferent between public school at $(\tilde{t}, \tilde{e})$ and private school at $(\hat{t}, \hat{e})$, since $\hat{t} < \tilde{t}$. y_p is given by:

$$K_7 = \beta s^\rho + (1-\beta)((1-\hat{t})y_p - s)^\rho - \beta\tilde{e}^\rho - (1-\beta)((1-\tilde{t})y_p)^\rho = 0. \tag{26}$$

The political support for $(\tilde{t}, \tilde{e})$ against $(\hat{t}, \hat{e})$ comes from all households with income between y_k and y_p. If instead $(\hat{t}, \hat{e}) > (\tilde{t}, \tilde{e})$, we know that y_k given by (23) is larger than $\tilde{y}$. Therefore, all households with income lower than y_k prefer $(\tilde{t}, \tilde{e})$ to $(\hat{t}, \hat{e})$. As before, define y_p to be the income level of the household indifferent between public school at $(\hat{t}, \hat{e})$ and private school at $(\tilde{t}, \tilde{e})$:

$$K_8 = \beta s^\rho + (1-\beta)((1-\tilde{t})y_p - s)^\rho - \beta\hat{e}^\rho - (1-\beta)((1-\hat{t})y_p)^\rho = 0. \tag{27}$$

The political support for $(\tilde{t}, \tilde{e})$ against $(\hat{t}, \hat{e})$ comes from all households with income lower than y_k and larger than y_p. If this group represents at least half of the population for any $(\hat{t}, \hat{e})$, $(\tilde{t}, \tilde{e})$ is a majority voting equilibrium.

4 Calibration

We calibrate the model in order to fit as well as possible the income and education data of Brazil in 2000, Colombia in 2000, and Mexico in 1996, which correspond to the years before the CCT programs were implemented in the respective countries. The parameters we calibrate are μ, σ, w, β, and ρ and the data used is presented in Table 1.[14]

For simplicity, we assume that the income distribution is log-normally distributed, $\ln y \sim N(\mu, \sigma^2)$. Using the mean and median income presented in Table 1 (*Panel A*), we calculate μ and σ. The school enrollment data allows us to compute y_l and y_h, and we can calculate $\tilde{y}$ using (14). We also calculate total income by using the total number of households or total employment.[15] Then, using public expenditure per student and total public enrollment, we estimate an implicit tax rate, as shown in Table 1 (*Panel B*).

There are two additional variables for which we do not have reliable data, the human

[14] Data sources and details are available in Appendix A.

[15] Since the mean income for Colombia is available per worker and not per household, we use an estimation of total employment instead of total number of households to calculate total income. Details are presented in Appendix A.

Table 1: Calibration Data

	Brazil 2000	Colombia 2000	Mexico 1996
Panel A			
Mean income	11,999	6,374	33,286
Median income	5,262	3,699	18,853
Public expenditure per student	801	1,152	3,569
Out of school	5.5%	11.7%	7.8%
Public school	84.1%	66.0%	86.2%
Private school	10.4%	22.3%	6.0%
Panel B			
Total number of households	45,053,286	-	20,467,038
Total employment	-	16,118,225	-
Total income	540,580,294,426	102,742,346	681,272,416,000
Public primary and secondary enrollment	32,528,707	9,866,779	18,198,650
Total public education expenditures	26,067,993,096	11,370,000	64,947,926,500
Implicit tax rate	4.8%	11.1%	9.5%

Note: Data is annual, nominal and in local currency units (LCU): in Brazilian *reais* ($BRL/USD = 1.83$ in 2000), in *thousands* of Colombian *pesos* ($1,000\ COP/USD = 2.09$ in 2000), and in Mexican *pesos* ($MXN/USD = 7.60$ in 1996).

capital of a child who does not attend school, l, and private school expenditures, s. For the calibration, we arbitrarily suppose that l corresponds to 10 percent of public education expenditures and that private school expenditures are twice public school expenditures.[16] Using the data explained above and equations (10), (11), and (12), we can estimate the parameters w, β, and ρ for different values of the price elasticity of the demand for public education. The calibration results are presented in Table 2.

5 Results

5.1 Without a Conditional Cash Transfer Program

In this section, we present the main results of the simulation in the absence of a conditional cash transfer program. Using the values for μ, σ, w, β, ρ, and l, we simulate the model (11)-(19) for different price elasticities of demand for education. The candidate points for equilibrium are presented in Table 2. For each country, the first three lines correspond to

[16] This has little impact on our results. Note that s will then be estimated in our model.

SDI and the three last lines correspond to SRI. Apart from Colombia in the case of a price elasticity of -1.5, we were able to obtain convergence for all other elasticity levels.

As expected, the larger the price elasticity of demand for education (in absolute value), the larger the public school enrollment. This happens for two reasons. First, when demand is more sensitive to the price of education, even relatively rich households will prefer public, instead of private schools. Second, a larger price elasticity (in absolute value) is also associated with a larger β, as shown in (10). When β is larger, households tend to value education more heavily and even relatively poor households will prefer to send their children to school, instead of having them out of school.

The larger public school enrollment always increases the level of public school expenditures, even if the mechanisms under SRI and SDI are different. With a larger price elasticity, y_h and (14) imply that $\tilde{y}$ corresponds to larger income levels. As a consequence, under SRI, the level of public school expenditures chosen by the pivotal voter is larger. The larger price elasticity also implies that y_l is lower, and given (14), also $\tilde{y}$. Under SDI, this implies that the choice of public education expenditures is also larger.

We also highlight the values of the price elasticities that better fit the data of the three countries shown in Table 2. While the data from Brazil and Colombia[17] are both consistent with SRI,[18] the data from Mexico supports a price elasticity close to one, so that both SRI and SDI are possible.

Once a candidate point is identified, we test it against alternative bundles in a pairwise comparison using (20)-(27). In all the simulations we have done, $(\tilde{t}, \tilde{e})$ appeared to be a global majority voting equilibrium. Figure 1 illustrates typical results obtained, corresponding to the price elasticities highlighted in Table 2.

5.2 With a Conditional Cash Transfer Program

In this subsection, we simulate the model by introducing the conditional cash transfer program. In order to take account of each program specificity, we perform the analysis in a country-by-country basis.

[17] In our simulations for Colombia, we take into account that public schools charged fees of around 58 dollars (121 thousand Colombian pesos) in 2000 (Angrist et al., 2002).

[18] Gutierrez and Tanaka (2009) also show evidence of a preferred tax-expenditure bundle increasing in income for Colombia in their simulations, with an estimated price elasticity of -0.67.

Table 2: Simulation results in the absence of a conditional cash transfer program

	ε	β	ρ	w	e	t	$\hat{y}$	Out of school	Public school
Brazil 2000: $\mu = 1.661$, $\sigma = 1.284$, $h = 80.1$, $b = 0$									
SDI	-1.5	0.224	0.363	0.364	2.096	0.169	5.382	0.7%	96.9%
SDI	-1.25	0.156	0.218	0.259	1.432	0.110	5.768	2.8%	92.5%
SDI	-1.03	0.095	0.032	0.169	1.066	0.078	6.107	4.6%	88.2%
SRI	-0.99	0.084	-0.011	0.153	1.009	0.073	4.099	4.9%	87.4%
SRI	**-0.86**	**0.052**	**-0.179**	**0.105**	**0.797**	**0.056**	**3.715**	**5.6%**	**83.7%**
SRI	-0.66	0.016	-0.574	0.046	0.501	0.031	2.784	6.0%	74.9%
Colombia 2000: $\mu = 1.308$, $\sigma = 1.043$, $h = 111.52$, $b = 0$									
SDI	-1.5	0.500	0.500	1.756	-	-	-	-	-
SDI	-1.25	0.435	0.297	1.755	2.722	0.403	3.997	3.0%	94.5%
SDI	-1.03	0.357	0.044	1.807	2.262	0.307	4.617	8.4%	86.7%
SRI	-0.99	0.340	-0.015	1.831	2.165	0.289	3.195	9.3%	85.1%
SRI	-0.86	0.273	-0.257	2.001	1.825	0.228	2.927	11.4%	79.7%
SRI	**-0.66**	**0.141**	**-0.888**	**4.846**	**1.170**	**0.121**	**2.018**	**11.9%**	**66.2%**
Mexico 1996: $\mu = 2.937$, $\sigma = 1.066$, $h = 356.90$, $b = 0$									
SDI	-1.5	0.255	0.371	2.288	5.995	0.171	20.115	2.4%	95.0%
SDI	-1.25	0.184	0.223	1.760	4.420	0.119	22.086	5.9%	89.5%
SDI	**-1.03**	**0.116**	**0.033**	**1.263**	**3.578**	**0.092**	**23.215**	**7.7%**	**85.7%**
SRI	**-0.99**	**0.104**	**-0.011**	**1.172**	**3.433**	**0.088**	**15.600**	**7.9%**	**85.0%**
SRI	-0.86	0.066	-0.183	0.878	2.838	0.070	14.485	8.5%	81.7%
SRI	-0.66	0.022	-0.590	0.466	1.948	0.043	11.611	8.5%	73.9%

5.2.1 Brazil: Bolsa Escola

Bolsa Escola was introduced in 2001 and benefited almost 5 million households in the first year.[19] The program was targeted at households whose per capita income was below 90 reais per month (Bourguignon et al., 2003). Given that Brazilian households have, on average, 3.8 individuals, the annual household income threshold to be eligible for Bolsa Escola was 4,070 reais. This implies that the pivotal voter would be eligible for the cash transfer (see Table 2).

In Table 3 (*Panel B*), we show data on the program characteristics. We compute the average transfer per recipient household in 2000 reais using a price index.[20] Eligibility and

[19] In 2003, the program was unified with other social programs and called Bolsa Familia. Since our analysis mostly covers the pre-2003 period, we refer to the program as Bolsa Escola.

[20] An alternative approach would be to assume that each household receives the benefit for one single child. By calculating the average transfer per household, we are computing the benefit received by different children in the household. Under the assumption that the transfer received for one child generates spillover effects for other siblings, our strategy is valid. The approach adopted here is particularly convenient for PROGRESA and FA that distribute different benefit values depending on gender and grade.

Figure 1: All Simulations

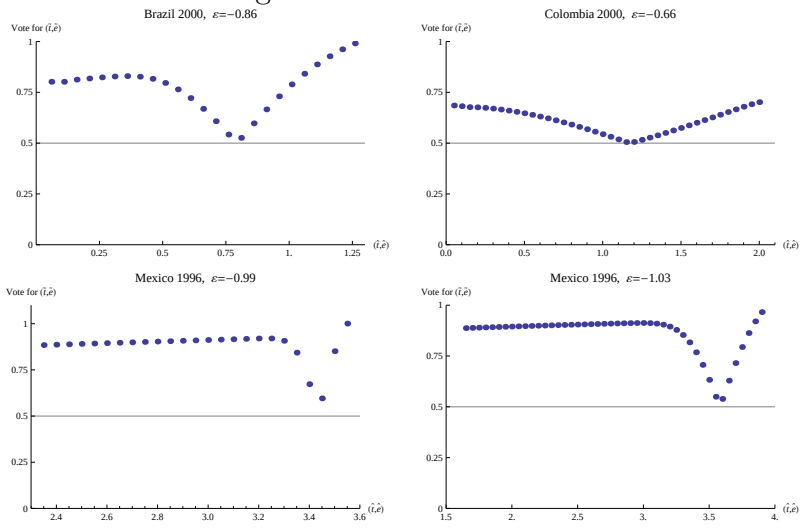


Table 3: Brazil - Bolsa Escola

A. Eligibility			
	2000		
Total population	169,799,170		
Number of individuals per household	3.8		
Annual household income threshold	4,070		
B. Program characteristics			
	2001	2002	2003
Number of recipient households	4,794,405	4,776,704	4,776,704
Total annual transfers	1,531,000,000	1,605,000,000	1,614,000,000
Average transfer per recipient household (current LCU)	319	336	338
Price index (2000=100)	106	114	130
Average transfer per recipient household (2000 constant LCU)	301	295	259

Note: Local currency units (LCU) are Brazilian *reais*.

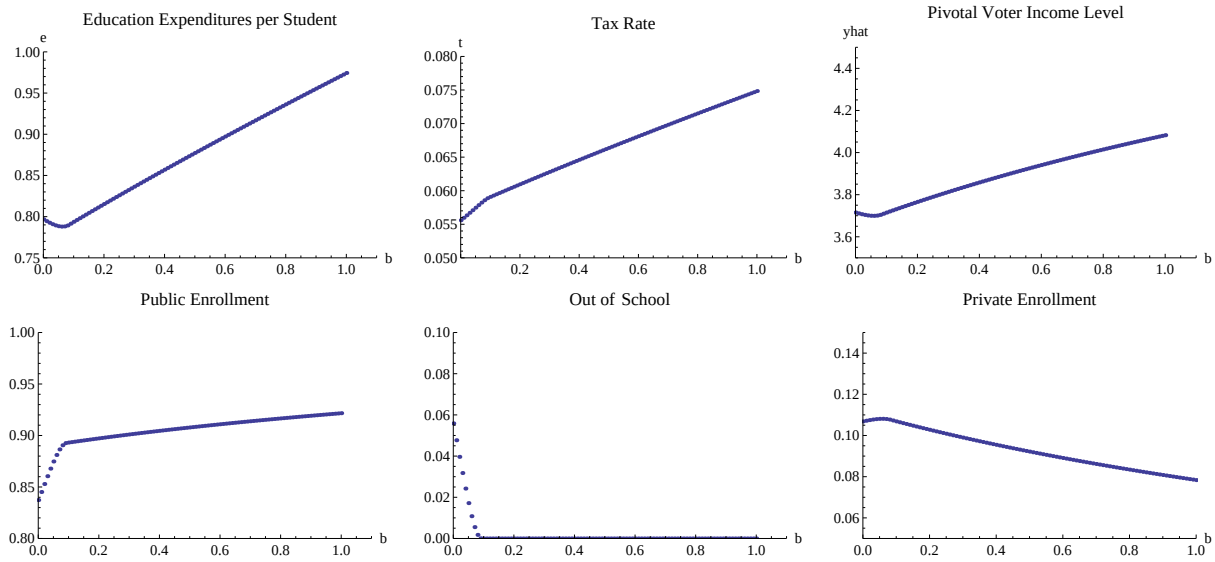
the average transfer per recipient in current reais were not significantly altered in the period 2001-2003. Consequently, the real value of the transfer decreased over time.

In Figure 2, we simulate our model for annual cash transfers ranging from 0 to 1,000 reais. The tax rate chosen by the pivotal voter is always increasing in the amount of the cash transfer. This happens for two reasons. First, the cash transfer increases the pivotal voter's available income and leads to the choice of a larger tax rate, due to an income effect. Second, when the larger tax rate translates into a larger education expenditure per student, some children switch from private to public schools. Consequently, the pivotal voter

is characterized by a larger income level and chooses a larger tax rate under SRI (due to (14)).

While education expenditures per student initially decrease, due to larger public enrollment, the trend is reversed once all children are attending school. At that point, the increase in public school enrollment is only a result of children switching from private to public schools, but the magnitude of this effect is never strong enough to reduce education expenditures per student.

Figure 2: Brazil - Bolsa Escola



In Table 4 (*Panel A*) we simulate the model for cash transfers that correspond to actual values distributed by Bolsa Escola.[21] The model predicts an increase in education expenditures of 3.7%, 8.5%, and 5.6% in the three years following Bolsa Escola implementation. The actual trends in education expenditures per student were 5.1%, 12.1%, and -7%. While the model does not predict the decrease in 2003, the model fits the data quite well during the period. In particular, the average over the period predicted by the model is 890 reais (in real terms), while the actual average was 889 reais (in real terms).

While school enrollment increased after the implementation of the program, the model tends to overestimate the effect. It predicts that no children would be out of school by 2001. This is probably due to the fact that, in reality, not all eligible households take up the transfer. However, our results in terms of the political economy of education expenditures remain valid as long as the pivotal voter is a program recipient.

[21] Since the benchmark for 2002 is education expenditures in 2001 when the program was already in place, we sum the values distributed in 2001 and 2002. The same procedure is adopted for 2003 and for the other countries. Differences are due to rounding.

Table 4: Brazil - Bolsa Escola: Some Specific Results

A. Simulation Results

	b	e	t	$\tilde{y}$	Out of school	Public school
2001	301	827	6.3%	3,814	0.0%	90.1%
2002	596	897	6.8%	3,939	0.0%	91.1%
2003	855	947	7.2%	4,034	0.0%	91.8%

B. Brazilian Data

	2001	2002	2003
Education expenditures per student (current LCU)	892	1,076	1,150
Education expenditures per student (2000 constant LCU)	842	944	881
Out of school	3.5%	3.1%	4.5%
Public school	87.7%	88.0%	86.4%

Note: Local currency units (LCU) are Brazilian *reais*.

5.2.2 Colombia: Famílias en Acción

Famílias en Acción (FA) was introduced in 2001[22] and targeted to families classified at level 1 in *SISBEN*.[23] As shown in Table 5 (*Panel A*), 24.6% of Colombian households are eligible for the subsidy. Considering the income distribution used in the simulation, this corresponds to all households with an income of less than 1,860.20. This implies that the pivotal voter is not eligible for FA and, therefore, we should not expect the program to have a large impact on public school expenditures.

We calculate the average transfer per recipient household in 2000 pesos using a price index in Table 5 (*Panel B*). While the increase in the number of recipient households has been moderate, the program's budget was increased in 2003 and remained relatively stable in 2004.

In Figure 3, we simulate the model for values of the transfer ranging from 0 to 2,000 pesos, considering that the pivotal voter is not eligible for the cash transfer. This implies that the program affects education expenditures only indirectly, through its effect on public and private enrollment. The cash transfer attracts poor households to public schools, decreasing education expenditures per student. This also leads to an increase in private enrollment,

[22] Since data for the program is not available for 2001, we consider the impact of FA on the period 2002-2004.

[23] *SISBEN*, Sistema de Identificación de Beneficiarios (Selection System for Beneficiaries) classifies households and individuals into six categories based on surveys conducted at the household level. See DNP (2003) for more information on *SISBEN*.

Table 5: Colombia - Famílias en Acción

A. Eligibility

	2000
Proportion of eligible households	24.6%
Annual household income threshold	1,860.20

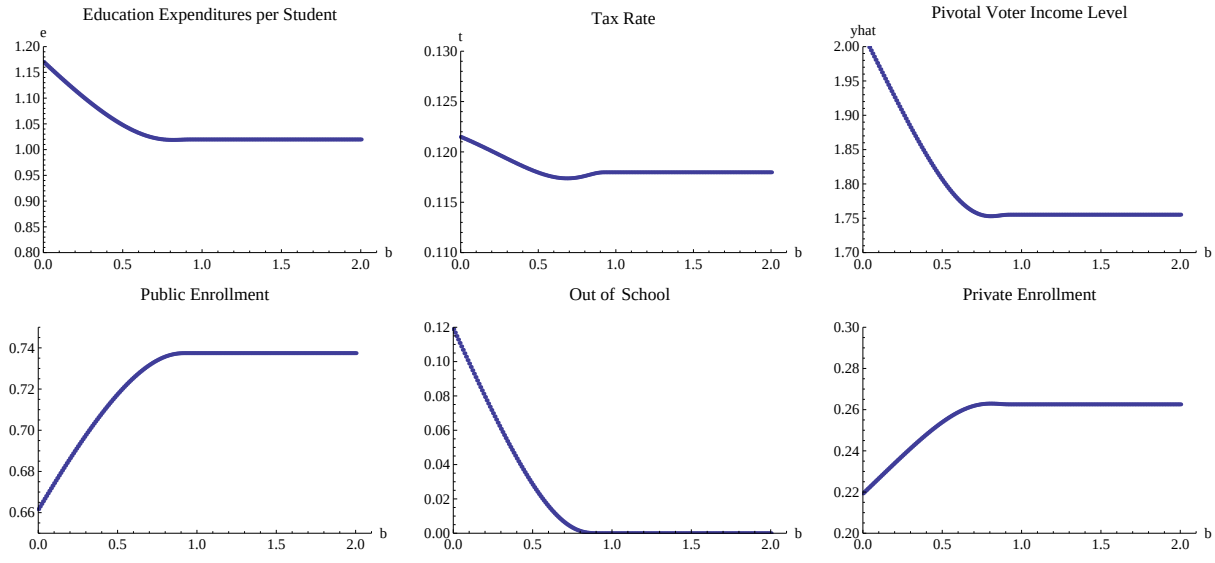
B. Program characteristics

	2002	2003	2004
Number of recipient households	301,962	333,562	337,552
Total annual transfers	97,138,803	188,524,921	190,817,013
Average transfer per recipient household (current LCU)	322	565	565
Price index (2000=100)	116	125	133
Average transfer per recipient household (2000 constant LCU)	276	452	426

Note: Local currency units (LCU) are *thousands* of Colombian *pesos*.

and to a pivotal voter characterized by a lower income level. Under SRI, this leads to the choice of a smaller tax rate, and to further decreases in education expenditures per student, generating even more private enrollment. The process is stabilized when all children are enrolled at school, which happens for cash transfers of around 900 pesos.

Figure 3: Colombia - Famílias en Acción



In Table 6 (*Panel A*), we present the results for some specific values of the cash transfer, which correspond to the values actually distributed by the program. The model predicts

quite well the relative stability (slight decline in real terms) of expenditure per student that characterized the Colombian education system in the three years following the implementation of the CCT program. Finally, the model overestimates enrollment levels by predicting that full enrollment would be attained by 2004. As with Bolsa Escola, this is probably due to the fact that the FA program is not reaching all eligible households.

Table 6: Colombia - Famílias en Acción: Some Specific Results

A. Simulation Results

	b	e	t	$\tilde{y}$	Out of school	Public school
2002	276	1,136	12.1%	1,933	8.9%	67.8%
2003	728	1,042	11.8%	1,766	1.7%	72.2%
2004	1,154	1,032	11.9%	1,749	0.0%	73.6%

B. Colombian Data

	2002	2003	2004
Education expenditures per student (current LCU)	1,181	1,249	1,343
Education expenditures per student (2000 constant LCU)	1,014	998	1,011
Out of school	10.7%(*)	10.3%(*)	9.0%(*)
Public school	69.7%	72.1%	73.6%

Note: Local currency units (LCU) are *thousands* of Colombian *pesos*. (*) designates data obtained by linear interpolation.

5.2.3 Mexico: PROGRESA

PROGRESA was introduced in 1997 and scaled up in subsequent years.[24] The program was targeted at households whose per capita income was below 320 pesos per month (Skoufias et al. (2001)). Considering that Mexican households have, on average, 4.54 individuals, the annual household income threshold to be eligible for PROGRESA is 17,455.30 pesos (Table 7, *Panel B*). Comparing to Table 2, this implies that the pivotal voter would be eligible for the cash transfer when the price elasticity is -0.99, but not -1.03. This fact will be reflected in our simulations.

Table 7 (*Panel B*) presents data on the program characteristics. Total annual transfers can be calculated using the information on the total federal budget allocated to the program, subtracting administrative costs. This allows us to compute the average transfer per recipient

[24] The program was renamed Oportunidades in 2002. Since our analysis is restricted to 1999, we use PROGRESA to designate it.

Table 7: Mexico - PROGRESA

A. Eligibility			
	1996		
Total population	92,982,699.00		
Number of individuals per household	4.54		
Annual household income threshold	17,445.30		
B. Program characteristics			
	1997	1998	1999
Number of recipient households	404,000	1,860,000	2,300,000
Total federal budget (current LCU)	466,000,000	3,354,000,000	6,713,000,000
Administrative costs	72,696,000	523,224,000	335,650,000
Total annual transfers	393,304,000	2,830,776,000	6,377,350,000
Average transfer per recipient household (current LCU)	974	1,522	2,773
Price index (1996=100)	120	140	164
Average transfer per recipient household (1996 constant LCU)	812	1,091	1,696

Note: Local currency units (LCU) are Mexican *pesos*.

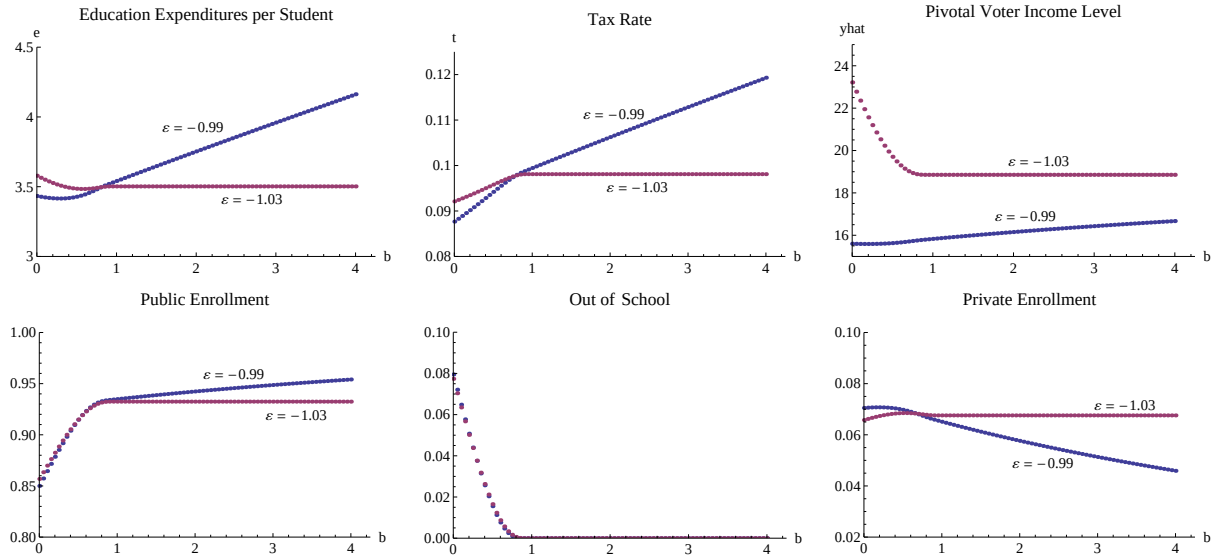
household.[25] We use the producer price index to calculate the present value of the transfers in 1996 pesos. This turns out to be quite important, since inflation over that period was quite substantial. Contrary to Bolsa Escola, PROGRESA's benefits were constantly updated to reflect price increases, so that the average transfer per recipient household in real terms increased over time.

Figure 4 presents the results of the simulation when the conditional cash transfer varies from 0 to 4,000, for price elasticities -0.99 and -1.03. The different trends with the two price elasticities are mainly due to the fact that the pivotal voter does not receive the cash transfer under SDI, given that her income level is above the program's threshold.

Under SRI, an increase in the transfer leads to the choice of a larger tax rate, due to the income effect and to the fact that the pivotal voter has a larger income when pupils previously enrolled in private schools switch to public institutions. The effect on education expenditures per student is a priori unclear since it depends on the resulting change in public school enrollment. As shown in Figure 4, a small value of the transfer may be associated with a slight decrease in education expenditures per student. However, the trend is reversed for larger values of the transfer since, above 950 pesos, there are no more children out of school.

[25] As mentioned above, an alternative approach would be to use the amount transferred per household. Since different values are paid to students from different gender in different school grades under PROGRESA, the approach of using average transfer per household presents even more advantages here.

Figure 4: Mexico - PROGRESA



While larger public school expenditures do attract some students from private schools, the increase in public school enrollment is much smaller than when some children remain out of school.

In the absence of a cash transfer, education expenditures are larger under SDI (i.e, $\varepsilon = -1.03$) than under SRI (i.e, $\varepsilon = -0.99$) and this remains true until full school enrollment is reached. As children previously out of school enter the school system, the pivotal voter is displaced to the left under SDI and therefore choses a larger tax expenditure bundle. However, when all children are enrolled in public or private school, the pivotal voter does not change anymore for $\varepsilon = -1.03$. Moreover, since she is not eligible for the cash transfer, there is no income effect and therefore the tax rate, education expenditures per student, and public/private enrollment remain constant thereafter.[26]

Finally, we compare the results of our simulation with those of Mexico by focusing on transfer values that correspond to actual PROGRESA transfers. In Table 8, we present the simulation results for the relevant cash transfers (*Panel A*) and the corresponding values of Mexican data (*Panel B*).

In Table 8 (*Panel A.1*), we present the results assuming that the CCT program affects children out of school, i.e., y_l. The impact under SDI is nil after 1998, since all children are already at school, and the pivotal voter is not a program recipient. Under SRI, the model predicts a trend similar to the one observed in the data, but falls short of explaining the

[26] If the pivotal voter was eligible for the cash transfer under SDI, the trend would be similar to that observed for SRI, and the tax rate and education expenditures would always be larger under SDI than under SRI.

Table 8: Mexico - PROGRESA: Some Specific Results

A. Simulation Results

A.1. With impact on children out of school

		b	e	t	$\tilde{y}$	Out of school	Public school
SRI	1997	812	3,498	9.8%	15,760	0.0%	93.3%
SRI	1998	1,903	3,733	10.6%	16,124	0.0%	94.2%
SRI	1999	3,599	4,082	11.7%	16,578	0.0%	95.2%
SDI	1997	812	3,326	9.3%	18,864	0.0%	92.6%
SDI	1998	1,903	3,329	9.3%	18,853	0.0%	92.6%
SDI	1999	3,599	3,329	9.3%	18,853	0.0%	92.6%

A.2. Without impact on children out of school

		b	e	t	$\tilde{y}$	Out of school	Public school
SRI	1997	812	3,619	9.3%	15,906	7.7%	86.0%
SRI	1998	1,903	3,861	10.1%	16,257	7.7%	86.8%
SRI	1999	3,599	4,225	11.2%	16,699	7.7%	87.8%
SDI	1997	812	3,578	9.2%	23,215	7.7%	85.7%
SDI	1998	1,903	3,578	9.2%	23,215	7.7%	85.7%
SDI	1999	3,599	3,578	9.2%	23,215	7.7%	85.7%

B. Mexican Data

	1997	1998	1999
Education expenditures per student (current LCU)	4,502	5,767	7,033
Education expenditures per student (1996 constant LCU)	3,753	4,133	4,301
Out of school	7.8%	7.8%	7.9%
Public school	85.9%	85.6%	85.2%

Note: Local currency units (LCU) are Mexican *pesos*.

whole increase in education expenditures per student observed over the period. Moreover, the model predicts that for the amount of cash transfers distributed per household, there are no more children out of school, which is not supported by the data. In fact, the impact on the enrollment rate of children aged 6 to 14 was nearly zero over the period, probably because only 4%, 19%, and 24% of eligible households were receiving the benefit in 1997, 1998, and 1999, respectively.

In order to account for that, we run the simulation again by assuming that y_l was not benefiting from the cash transfer. The results are presented in *Panel A.2* and are much closer to the actual Mexican data. The model predicts that education expenditures per student would increase annually by 5.4%, 6.7%, and 9.4% in 1997, 1998, and 1999, and this can be

compared to an actual annual increase of 5.2%, 10.1%, and 4.1%.[27]

6 Conclusion

In this paper we assume that the level of public education expenditures is related to household preferences. When households choose to send their children to a public school, private school, or remain out of school, we show that the introduction of a CCT program may alter the education expenditures per student chosen in a political economy framework. We then simulate our model using data from Brazil, Colombia, and Mexico.

Our simulation results show that while CCT programs may cause a slight initial decrease in education expenditures per student, this trend is reversed for larger values of the transfer for Brazil and Mexico. Two mechanisms explain these trends. First, the cash transfer increases the income of the pivotal voter, leading to the choice of a larger tax rate. Second, increased public education expenditures attracts households that previously enrolled their children in private schools. Under SRI, this implies that the pivotal voter is characterized by a larger income level and therefore chooses a larger tax rate. In contrast, the CCT program leads to a decrease in education expenditures in Colombia. The main reason for this difference is that the program's eligibility is more restricted and therefore the pivotal voter is not eligible for it. These results suggest that more generous CCT programs may be beneficial in terms of the political economy of education expenditures.

This mechanism seems to be much ignored in discussions related to education policy. It is often argued that increasing education quality should be a prerequisite for the increase in enrollment. Similarly, many critics of conditional cash transfer programs argue that the quality of education is too low to justify sending children to school. This model shows that CCT programs may contribute to increasing enrollment and also to improving education quality through the political economy of education expenditures.

We now briefly discuss how our results change if one considers that public education is financed through other tax schemes. We start by considering the hypothetical case in which the government could impose a lump sum tax on all households. In this case, only the income effect is present. Indeed, the tax paid by each individual is unrelated to her income level. Thus, the preferred level of educational expenditures is monotonically increasing under the assumption that education is a normal good, which is already what we obtain for the three countries under analysis. Another possibility is to consider taxes levied on consumption

[27] It is not surprising that the prediction accuracy decreases for 1998 and 1999. Among other things, one should expect changes in income distribution that are not reflected in this exercise. This may also explain why the model predicts a public school enrollment slightly larger than the observed.

rather than on income. This is especially relevant in the context of developing countries where indirect taxes frequently constitute an important part of the tax revenues. Moreover, this reinforces the fact that all households help finance the educational system, since one may argue that income taxes are normally not paid by very poor individuals. With commodity taxation, the results would be very similar except that child labor would also be taxed in this case.

Throughout, we have assumed that all individuals vote. In reality, some households do not vote, even when voting is compulsory. Clearly, if turnout is unrelated to household characteristics, our results are unchanged. However, if the decision to vote is related to household income or level of schooling, our results may change. The literature on developed countries shows a positive relation between income or education and the probability of voting. Few empirical studies investigate this issue in the context of developing countries. Fornos et al. (2004) investigate voter turnout in several Latin American countries. Their results suggest that turnout is not influenced by socioeconomic variables. However, Fumagalli and Narciso (2012) show that higher turnout is associated with higher levels of government expenditures. In any case, the introduction of voting abstention correlated with income or education level should be straightforward. Suppose that, to take it to the extreme, all the households with children not enrolled in school do not vote. In this case, the majority voting equilibrium would need to be redefined by taking into account only the households that vote.

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A Calibration Data Sources

	Colombia
Mean income	DNP (2006): Monthly average labor income in seven cities (Table C6-7c) × 12)/1,000.
Median income	DNP (2006): ((Monthly average labor income in seven cities (Table C6-7c) × 12)/1,000 × (Percentage of labor income of 3rd quintile in seven cities (Table 6-2a)))/0.2.
Public school expenditures	MEN (2012): Total public education expenditures (*Gasto público en educación básica y media*).
Out of school	DHS (2000): (Chapter II, Table 2.5.1, p.17) for 2000; DHS (2005): (Chapter 3, Table 3.8.1, p.42) for 2005. Data for intermediate years obtained by linear interpolation.
Public and private school enrollment	Enrollment by level and sector: Iregui et al. (2006): (Table 5, p.9) for 2000; MEN (2012): (*Matrícula por nivel y sector - Educación Basica y Media*) for 2002-2004.
Employment	DANE (2000a): (Total employment in seven cities/Total population in seven cities (Table C6-8_ENH 76-97)) × DANE (2000b): Population.
Households	DANE (2000b): Household estimations and projections (*Estimaciones y proyecciones de hogares y viviendas*).
Population	DANE (2000b): Population estimations and projections (*Estimaciones y proyecciones de población*).
Proportion of eligible households	DNP (2003): (Table 31, p.131).
CCT recipients	Acción Social (2006): (Table 3, p.12)
CCT budget	Acción Social (2006): (Table 4, p.13)
Price index	DANE (2012): *Indices - Serie de Empalme*, January.

Brazil	
Mean and median income	IBGE (2000): Monthly mean and median nominal income for individuals aged 10 or more, in the labour fource, with income (*Amostra-Trabalho e Rendimento*, Table 2908) × (Number of individuals aged 10 or more, in the labour fource, per household (*Amostra-Trabalho e Rendimento*, Table 2954)/ Total number of households (*Universo*, Table 156)) × 12.
Public school expenditures	INEP/MEC (2010): Public expenditure per student in grades 1-4 and 5-8 (Table 2.1) and INEP/MEC (2012): Public enrollment shares in grades 1-4 and 5-8.
Out of school	IBGE (2000): Population aged 7-14 attending or not attending school (*Amostra-Educação*, Table 2974) for 2000; IBGE (2012b): (Table 3.3) for 2001-2003.
Public and private school enrollment	IBGE (2000): Public and private school enrollment grades 1-8 (*Amostra-Educação*, Table 1972).
Households	IBGE (2000): Total number of households (*Universo*, Table 156).
Population	IBGE (2000): Total population (*Universo*, Table 202).
CCT recipients	CEPAL (2011): Database.
CCT budget	SPE (2005): (Table 5, p.25).
Price index	IBGE (2012a): Consumer Price Index (IPCA), *Séries históricas*, January.

Mexico	
Mean income	INEGI (1998): (Total quarterly revenue (in thousands) × 1,000 × 4)/ Total number of households (Table III.2, p. 72).
Median income	INEGI (1998): (Quarterly revenue of the 5th decile (in thousands) × 1,000 × 4)/ Total number of households (Table III.2, p.72).
Public school expenditures	INEE (2007): Public education expenditures per student per education level (Table AR07-1.1, p. 138) and DGPP (2012): Public enrollment shares in primary and secondary education in 1996-97 (*1990-99, Resumen por sector público y privado, Matrícula*).
Out of school	INEGI (2001): 1 - Proportion of the population aged 6-14 attending school (p. 130) (not available for 1996, but same proportion in 1995 and 1997).
Public and private school enrollment	DGPP (2012): (Public enrollment shares in primary and secondary education in 1996-97 (*1990-99, Resumen por sector público y privado, Matrícula*)).
Households	INEGI (1998): Total number of households (Table III.2, p.72).
Population	INEGI (2001): Population living in households (p.108).
CCT recipients	Scott (1999): (Table 5, p.17).
CCT budget	CIDE (2001): Anexo III (Table 1, p.143).
Administrative costs	Scott (1999): (Table 5, p.17), *Costos operativos*. Not available for 1997, used 1998.
Price index	INEGI (2003): Producer price index, tertiary sector, September.