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## Electoral impacts of uncovering public school quality: Evidence from Brazilian municipalities

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April 2012

# Electoral Impacts of Uncovering Public School Quality: Evidence from Brazilian Municipalities

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## ABSTRACT

### **Electoral Impacts of Uncovering Public School Quality: Evidence from Brazilian Municipalities\***

School accountability systems that establish the adoption of incentives for teachers and school managers usually impact positively students' performance. However, in many circumstances, school accountability systems may face institutional restrictions to establish rewards and sanctions to administrators. In that aspect, the Brazilian accountability system is an interesting example: Most of primary public schools are run by municipal officials and federal government cannot enforce the adoption of incentives at local level. However, because mayors of Brazilian municipalities are the ultimate responsible for public elementary education we provide evidence that in 2008 local election, just some months after the publication of the second wave of a new evaluation of public schools run every two years by federal government, mayors became electorally accountable for not improving school quality. The results show that, on average, one point increase in a 0-10 scale index from 2005 to 2007 increased by around 5 percentage points the probability of re-election. This effect is even greater in localities with lower per capita income and those where the fraction of children at school age is larger. Therefore, electoral accountability may play a complementary role in school accountability systems that had not yet been fully exploited by education and political economics and political science literatures.

JEL Classification: H11, H41, H52, H72 I21, I28

Keywords: public education, school accountability, electoral accountability, mayoral re-election races

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## 1. Introduction

It is now a well established fact in the empirical education literature that unobserved school quality plays an important role in explaining learning gains for primary school pupils (Hanushek, 2005). As a result, parental school choices cannot be fully informed, since schools will likely differ in unobserved quality. However, if uncertainty about school quality is relatively high it is plausible to expect that some private schools would have incentives to provide credible signals on their own quality in order to facilitate the sorting between students and schools.

Even though information on school quality is certainly valuable from the parents' perspective, the release of information on public schools is not expected to be a market outcome given the difference in incentives that their administrators generally face when compared to their private counterparts. In many countries, however, parents of children in public schools have benefited from the implementation of school accountability systems that, among other goals, run assessments and publicize school performances, decreasing therefore the uncertainty on public school quality.<sup>1</sup> Strong school accountability systems are in general responsible for: establishment of learning targets and minimal contents that schools should cover; evaluation of learning through assessment tests; publication of test results by school; adoption of specific policies in order to improve test results; and adoption of incentives (rewards and/or punishments) for teachers and school principals as function of school performance on assessment tests (Carnoy and Loeb, 2002).

There are some studies supporting the view that accountability systems have had a positive effect on students' outcomes as in Carnoy and Loeb (2002), Hanushek and Raymond (2004), Jacob et al (2003), and West and Peterson (2003). Indeed, according to Hanushek and Raymond (2002), school accountability systems that establish the adoption of incentives tend to have larger impacts on students' performance; they argue that the positive effects from NCLB are mainly due to the existence of direct rewards to the best schools and punishment to the worse ones. This result is in part explained by students' mobility restrictions that create local monopolies for public schools and

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<sup>1</sup> School accountability systems were introduced in the UK during the 80's and rapidly became an important educational managing tool in the US. For example, in 1996, 12 states in the US had some sort of school accountability whereas in 2000 39 states were adopting it. In 2001 federal government created the "No Children Left Behind" (NCLB) program.

impede that the publication of average assessment results by itself could have any discipline effect on administrators.

In many circumstances school accountability systems may not be strong due to institutional restrictions. In that aspect, the Brazilian accountability system that was created in the mid-90 is a representative example: Most of primary public schools are run by municipal authorities and even though federal government has covered all other aspects of strong accountability systems it does not have the institutional tools to enforce the “adoption of incentives”.

However, mayors of Brazilian municipalities are the ultimate responsible for the public elementary education and might be electorally accountable for low school quality. Thus, if school quality is valued by parents and if they vote based on retrospective information, mayors should respond to “electoral incentives” of delivering high quality education once information on quality becomes publicly available. Even if unintentionally, the Brazilian school accountability system might resemble a strong accountability system. Electoral accountability may play a complementary role in school accountability system that has not been fully exploited by education and political economics and political science literatures. This electoral channel may therefore serve as an alternative way to guarantee that the publication of average assessment results do have discipline effects on school administrators.

In this paper, we find evidence that for the Brazilian 2008 local elections in municipalities that faced substantial quality enhancement in municipal public schools, mayors faced an increase in the probability of being re-elected, when compared to 2004 local elections.<sup>2</sup> In 2005 and 2007 the federal government, through its Ministry of Education, ran assessment tests on almost every public school in Brazil. In 2007 there was the publication of the results of IDEB,<sup>3</sup> a public school quality index based on 2005 assessments. The indices at the national, state and municipal levels, and more importantly, at the school level, became publicized that year. In 2008, just some months before local elections, 2007 IDEB at all levels was publicized as well.

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<sup>2</sup> Mayors are elected in single round elections every four years. For municipalities with more than 200,000 voters, which were about 40 among 5500 in the 2008 elections, there are runoff elections.

<sup>3</sup> Basic Education Development Index (*Índice de Desenvolvimento da Educação Básica*). In 2007, according to the Ministry of Education, 99% of the public school systems were covered by these assessment tests.

We combine information on municipal 2005 and 2007 IDEB results and on 2004 and 2008 municipal election outcomes to investigate how the publication of the school quality index affected the relationship between school quality improvements and the probability of mayor re-election. Our results show that gains in school quality in municipal schools between 2005 and 2007 increased chances of re-election among eligible for a second term mayors in the 2008 election when we compare to a ‘placebo experiment’. In our placebo experiment, we run the same regression but using the 2004 election outcomes when, of course, information about school quality improvements between 2005 and 2007 were not available, and find no evidence of a positive relationship between those improvements and re-election in 2004. Voters in 2004 election were unable to use information on school quality to update their voting choices, but when that information became available, as in the 2008 election, they seem to have fully used it to punish and reward mayors.<sup>4</sup>

In principle, one may consider that more information is always better for voters. However, Besley and Smart (2007) present a game of incomplete information between the incumbent politician and voters/parents, in which that does not necessarily occur. In their model, there are two components, a discipline and a selection component, affecting voter’s welfare. If information on incumbent’s actions increases before election, in equilibrium, some incumbents will commit themselves to higher levels of quality in public goods whereas others will maximize rents in the first term lowering the quality of public goods provided. Thus, there is an ambiguous theoretical result on what happens to the quality level of the public good after increases in the information on incumbent’s actions.

In this paper we validate an important premise of Besley and Smart (2007) model by providing empirical evidence that when voters have better information they reward (punish) mayors that improve (deteriorate) the provision of the public education. By doing that we bridge the gap between the otherwise unrelated literatures on electoral accountability and on school accountability. In fact, to best of our knowledge, there are no studies that directly relate school quality and electoral accountability of incumbent mayors.

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<sup>4</sup> Leme, Louzano, Ponczek and Souza (2011) show that, in order to improve school quality, mayors all over the country have recently hired services from private schools to introduce in municipal public schools pedagogical changes involving restructuring curriculum contents, elaboration and use of teachers and students textbooks, and training and supervision of the teachers. That evidence can be interpreted as an anticipation effect of electoral accountability

The empirical literature on electoral accountability has been recently surveyed by Trounstein (2010). According to her, the vast majority of the research on electoral accountability is concentrated on federal level and to some extent state level elections, even though most of policies are clearly locally determined. Arceneaux (2005) finds through a survey that voters correctly associate public goods provided by different government levels with their voting choices. Specifically related to education, Berry and Howell (2007) show results of students' assessments and of school board elections over three electoral cycles in South Carolina. They present evidence that in the 2000 local elections for school boards voters held school board members accountable for the past performance of their schools. Interestingly, during the 2002 and 2004 school board elections, when public and media attention to testing and accountability systems decreased, measures of students' achievement did not seem to have impacted elections. Note that unlike our paper that focuses on elections for mayors, who may be held accountable for policy aspects other than public education, in school board elections one should expect a more evident relationship between re-election and students previous performances.<sup>5</sup>

From the school accountability and school choice literatures, there are some evidences that parents care about the quality of education and that people in fact react when they have more information on quality of schools. Hastings and Weinstein (2007) explore two experiments in a school district in US where schools were randomly selected to distribute information about their quality to the parents. They find evidence that receiving information increases the fraction of parents choosing higher performance schools. Figlio and Rouse (2006) investigate the threat of vouchers and stigma in Florida on the performance of low performing schools after the introduction of an accountability system. They find that the lower performing schools present significant gains in performance after the voucher threat. These gains are more due to the stigma of receiving a low grade than the voucher threat itself.

In the US after the NCLB implementation school principals faced direct incentives to perform, a feature that might attenuate the electoral channel as a relevant one for changes in public education. In contrast, principals of Brazilian public schools do not have direct incentives based on their

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<sup>5</sup> Our findings are also interesting in showing that voters are sophisticated enough not only to vote retrospectively but to hold the local level of government accountable for its appropriate policy areas, a result that is in line with the empirical evidence provided by Arceneaux (2005).



students' performance. Therefore, the electoral channel in the Brazilian educational system is the only available way to establish rewards and punishments as a function of school performance on assessment tests.<sup>6</sup>

Finally, it may be of a surprise that Brazilian mayoral elections are affected by quality of education given existing evidence that investments in construction and infrastructure are highly paid electorally.<sup>7</sup> We note that only recently results of IDEB became available at municipal level. Being more precise, the results of the 2005 and 2007 national assessments were released in 2007 and 2008 respectively, after the 2004 but before the 2008 Brazilian local elections. Thus, investments that increased school quality only became visible to voters in the 2008 election. We find that “visible expenditures” in education such as school construction are electorally important in the 2004 elections, but once voters have more precise information on school quality, those “physical capital” investments in education lose part of their relevance for re-election.

Our results are even stronger for municipalities in which: (i) demographics are such that there is a relatively greater demand for basic education; (ii) there is a larger share of poor families whose only alternative is public education.

This paper is divided as follows. Section 2 describes the Brazilian educational accountability system and how local elections are organized. In section 3, we propose an empirical methodology to identify the impact of increasing information on school quality on electoral outcomes and present the data sets. In section 4 we present and discuss results. Finally, in section 5 we conclude.

## **2. Institutional Background**

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<sup>6</sup> Although the federal government cannot reward and punish directly municipal school teachers and principals, that does not rule out that mayors themselves, responding to the electoral channel, implement municipal school accountability systems, creating direct incentives for teachers and school principals.

<sup>7</sup> See for instance Akhmedov and Zhuravkaya (2004) and Veiga and Veiga (2007). Construction and infrastructure investments typically suffer manipulation along the electoral cycle as described in Drazen and Eslava (2010) and Gonzalez (2002).

## 2.1. Brazilian Basic Educational System and School Quality Measures

Brazilian public basic education system is composed by elementary, middle, and high schools. They correspond to first to fifth grades, sixth to ninth grades and tenth to twelfth grades, respectively. They are publicly and privately provided, although more than 90% of the students are in public schools. Public education has passed in the last twenty years for reforms that have increased access and attempted to improve its quality. Part of the increased access can be explained by initiatives that allocated more resources for basic education such as FUNDEF (*Fundo de Desenvolvimento do Ensino Fundamental e Valorização do Magistério*) approved in 1996. FUNDEF leveled spending on education between states and municipalities in elementary schools (primary and middle schools) through transfers from a national fund. This initiative rose spending sharply in poorer states and municipalities. Increasing in enrollment followed because the municipality's education funding is based on the number of registered students. This created incentives for schools to recruit and retain students to fill vacancies (Carnoy, 2007).

Although the problem of access to education has been solved with a quick but somewhat disorganized growth of public school system in the 1990's, performance of Brazilian students' proficiency in national and international exams shows that the growth of the educational system was not matched by improvements in quality (OECD, 2010). There were two combined movements in the basic public education in order to increase the quality of education: Management decentralization and the introduction of a federal school accountability system.

School decentralization was characterized by transfers in the school authority level from state to municipalities. The decentralization of schools was a process that has begun in the 1990's and it was incentivized by the federal government through various laws and resource funds like FUNDEF, creating the legal basis and generating financial resources to enable the municipality to run its local education system. There are evidences that this funding have a significant impact on school resources and student outcomes. Indeed, Ferraz, Finan and Moreira (2011) find that negative variation of this school resource from federal transfers (due to corruption) reduced student proficiency and increased dropout and failure rates across Brazilian municipalities. Menezes-Filho and Pazello (2007) have also shown that the creation of FUNDEF increased local teachers' salaries. This increase had positive impact on students learning.

School Census data reveal that of all students enrolled in primary school in 1995, 56% were studying in state schools and 32% in municipal schools. In contrast in 2010, the share of primary school students in state schools decreased to 31% and of those in municipal schools increased to 52%.<sup>8</sup> This process was more pervasive among the first years of the primary education. In fact, of all students in elementary schools in 1995, 48% of them were enrolled in state schools and 42% in local schools. In 2010, 18% and 68% were attending state and municipal schools, respectively. On the other hand, of all students enrolled in middle school in 1995, 69% and 17% were attending state and municipal middle schools, respectively. In 2010, these figures changed to 50% and 38% attending state and municipal middle schools, respectively. Thus, the municipalities became the main responsible for the provision of education for vast majority of the elementary education students, whereas municipalities and states became more evenly responsible for the middle school students.

Among the potential advantages of a decentralized school model, an important one is the fact that decisions impacting the quality of teaching would be brought closer to the local population by reducing information asymmetries, agency costs and problems of collective decision. Moreover, it is argued that decentralization might solve the problem of heterogeneity of preferences among populations of different localities and could reduce corruption. (Galiani, Gertler and Schargrotsky, 2008)

School decentralization process was accompanied by instruments that enabled policy-makers to monitor performance of public schools. The first set of instruments for monitoring and evaluation that characterizes Brazilian accountability system was introduced with *Sistema Nacional de Avaliação da Educação Básica* (National Assessment of Basic Education or, simply, SAEB) in 1995.<sup>9</sup> SAEB is run by the Ministry of Education and is characterized by an exam in mathematics and Portuguese applied every two years in a sample of students from 4th to 8th grade elementary school and in 3rd grade of high school.

Other exams run by the Ministry of Education were implemented after SAEB. In 1998 *Exame Nacional do Ensino Médio* (National Examination of Secondary Education, or simply, ENEM) was

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<sup>8</sup> The bulk of remaining students were enrolled in private schools and very few in federal schools.

<sup>9</sup> Other initiatives to introduce school accountability systems occurred at the state and municipal level, but most of these projects did not have the necessary continuity to be well succeeded.

created and in 2005 the *Prova Brasil* (Brazil Exam), a biannual exam with census coverage at urban public school level in math and reading for 5th and 9th graders. In the 2007 edition of *Prova Brasil*, all state schools adhered to the exam and there was broad support from municipal authorities, leading to a coverage of over 99% of targeted population (Fernandes and Gremaud, 2009).<sup>10</sup>

After the first results of 2005 *Prova Brasil* were widely disseminated in 2006, one could say that Brazil had finally created its own national school accountability system. It was a “weak” accountability system since, unlike the US model, teachers and principals were not directly held accountable for the students results in the proficiency exam. In addition, the comparison between schools based on *Prova Brasil* did not take into account that they had different retention rates, allowing for important composition differences in student body.

In order to correct for the differential retention rates, the Ministry of Education constructed an index that took into account both performance and retention rates. Thus, in 2007 IDEB was created, running from 0 to 10, as it is a simple normalization of *Prova Brasil* times the school pass rate.

The IDEB became the instrument that informs population on school quality allowing pupils and parents to have a better informed school choice. Note that the IDEB is constructed for each public school and for the overall public school system (local and state separately). That has originated an informational channel that can be used to pressure teachers, principals, managers, and ultimately mayors responsible by improvements in the quality of education. The results of IDEB have been published by various media outlets and are available at the site of Ministry of Education.

As the mobility of students between schools is particularly limited within a given municipality as it may depend on the place of residence of the student, one of the most effective response channels from the population to IDEB results ends up being via political pressure, which we found in our paper to occur through mayoral elections.

## **2.2. Decentralization and Mayoral Re-election**

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<sup>10</sup> Fernandes and Gremaud (2009) argue that although the coverage rate is high, there is some evidence of ‘gaming the test’ in small scale, especially by forced absenteeism of worst students.

Most of enrollments in public *elementary* schools are in schools run by municipal authorities. There are 5565 municipalities in Brazil taking care of more than a hundred thousand municipal elementary schools (first to fifth grades) with around 11.5 million students, or 68% of the enrollment in the elementary education in 2010. Private schools and state and federal public schools respond for the remaining enrollments.

That is a relatively new pattern. Until the end of 1980's Brazilian municipalities had much less autonomy. The increase in municipal decentralization and autonomy was established in the 1988 Constitution. The new Constitution set up the responsibilities of municipalities, which include organization and provision of public services of local interest such as transportation, preschool, primary education and health services.

Given that high level of decentralization of public provision through Brazilian municipalities, mayors typically have substantial authority over local resources. That makes running and re-running for mayoral election politically attractive.

The re-election to executive positions in Brazil was established by Constitutional Amendment No. 16, July 4, 1997 and enforced for governors and the president in the 1998 election. Only one consecutive re-election is allowed. The executive mandate corresponds to four years at all federal, state, and municipal level. Mayors became eligible for a second term starting in the 2000 elections. Since then, it has been a tool often used by politicians. In the next section we describe the data set on electoral outcomes that help describing the profile of candidates.

### **3. Data Set, Sample Selection and Empirical Strategy**

#### **3.1. Data Set and Sample Selection**

Our goal is to estimate the electoral impact of the information release on public school quality improvements. There were mayoral elections allowing for re-elections in 2000, 2004, and 2008. There were two public releases of the quality of education index, IDEB. The 2005 IDEB was released in 2007, and the 2007 IDEB was released in 2008, three months before the 2008 mayoral

elections. Our sample consists of all municipalities that: (i) incumbent mayors were eligible to run for re-elections in 2004 or 2008; (ii) there were fewer than 200,000 voters; and (iii) there are elementary school IDEB indices for both 2005 and 2007 years. Thus, the sample includes both cases of municipalities that the incumbent mayor actually ran for re-election and those that they were allowed but decided not to do so. We chose to not restrict to municipalities where the incumbent actually ran for re-election because there could be a correlation between IDEB score and the mayor's decision of running on the election, a selection problem that would bias our estimators. Second, we restrict to municipalities with fewer than 200,000 voters in order to exclude those municipalities required by law to have run-off elections whenever there is no absolute majority winner in the first round election. Possibility of mayoral run-off elections changes the political competition at the municipal level, affecting incumbents' behavior (Chamon et al, 2011) and that is the main reason we did not include those municipalities in our sample. Moreover, of all 5565 municipalities, there are around only 40 municipalities with 200,000 or more voters in 2008. Under all these selection criteria there were 2,505 and 3,210 municipalities in 2004 and 2008, respectively.

Our measure of school quality is the municipal IDEB index. This index is calculated and publicly released by the Ministry of Education. It is a compounded index of proficiency and pass rates. Formally, it is a Cobb-Douglas type function  $IDEB_{mc} = PB_{mc} * PR_{mc}$ , where  $PB_{mc}$  is the Fifth grader or Ninth grader average test scores of municipality  $m$  and cycle  $c$  (elementary or middle school) from *Prova Brasil* standardized proficiency exam (Math and Portuguese); and  $PR_{mc}$  is the average pass rate for the cycle evaluated. IDEB index is normalized to range from 0 to 10.<sup>11</sup>

The IDEB index is obtained for elementary school (first to fifth grades) and middle school (sixth to ninth grades) separately. Since most of the municipal education systems are concentrated in the elementary school, we use the municipal IDEB index of the elementary school and we refer to this index as 'fifth grade IDEB'. Indeed, of all elementary school students in the municipalities in our sample in 2008, 73.4% of them were enrolled in municipal schools. In contrast, of all middle school students in the municipalities in our sample, 57.3% of them were enrolled in municipal schools.

Summary statistics for each variable used in the regressions are displayed in Table I. Out of all municipalities whose mayor was able to run for re-election in 2004, 40.2% re-elected the incumbent.

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<sup>11</sup> For details on the construction of IDEB index, see Fernandes (2007).

In 2008, this figure increased to 50.5%. Other important information about incumbent's profile is that the great majority of them are male and married, and about 40% has completed college.

[insert Table I around here]

Table I also shows that elementary school quality, measured by IDEB, has increased by 0.4 on average between 2005 and 2007, an increase greater than 10%, given the average 2005 IDEB was lower than 3.9. Municipal *per capita* education expenditure is divided into two variables: spending in the first two years and in the last two years in office. There are increases over time on the amount spent for both variables, but more accentuated in the final two years in office. Such pattern can also be seen in health and urbanism expenditures.

Finally, we also present some demographic characteristics that are used either as control variables or to capture heterogeneous effects along the values of these variables.

Candidate and result variables for 2004 and 2008 mayoral elections are available from *Tribunal Superior Eleitoral* (TSE), the Brazilian Supreme Court for elections, on their website. IDEB indices and enrollment figures in municipal schools are obtained from *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* (INEP), the research institute of the Ministry of Education. Disaggregated expenditures by municipalities are collected from FINBRA, public expenditure database from the *National Treasure of the Ministry of Finance*. All demographic variables come from the 2000 Census data from *Instituto Brasileiro de Geografia e Estatística* (IBGE), the Brazilian Census bureau. Radio and daily newspaper existence are available at 2001 *Perfil dos Municípios Brasileiros: Gestão Pública* from IBGE as well.

### 3.2. Empirical Strategy

Our goal is to test the hypothesis that there is a causal effect of changes in education quality (measured by  $\Delta IDEB$ ) during the incumbency term on the chances mayors face of being re-elected, once information on quality is available to voters.

Ideally, we would like to have a scenario in which (i) changes in IDEB were randomly distributed among incumbent mayors; and (ii) publication of IDEB was randomly assigned across

municipalities. Under such experiment we could test whether changes in IDEB affect chances of being re-elected and if that holds only when information on IDEB were public.

Obviously, such experiment does not exist as changes in IDEB are functions of mayors' effort and their managerial ability, which are unobservable to us. Also publication of IDEB occurred simultaneously for all municipalities. In order to deal with the lack of a real experiment, we have to rely on some hypotheses on the behavior of the unobservable determinants of mayoral re-elections. Fortunately, the nature of our data allows us to exploit some plausible identification restrictions to estimate the causal impact in this non-experimental environment.

First, consider the following model:

$$Y_{mt} = \alpha_t + \beta_t \Delta IDEB_{mt} + \gamma_t X_{mt} + \varepsilon_{mt} \quad (1)$$

where  $Y_{mt}$  is the re-election dummy of a incumbent mayor in municipality  $m$  and election  $t$ ;  $X_{mt}$  is a vector of observable covariates from mayors and municipalities;  $\varepsilon_{mt}$  is the unobserved component; and the remaining Greek letters are the unknown coefficients.<sup>12</sup>

To be able to identify the parameter  $\beta_t$  in Equation (1), one typically invokes a “selection on observables assumption”, which can be stated as the following condition:

$$Cov(\Delta IDEB_{mt}, \varepsilon_{mt} | X_{mt}) = 0. \quad (2)$$

The selection on observables assumption may not hold in this context as it is indeed possible that changes in school quality are correlated with the unobserved component. Mayor's efforts, municipality characteristics or any other component that are correlated to school quality change and mayor electoral potentiality that are observed by the voters but not observed by the econometrician are likely to exist.

Taking advantage from the fact that we have repeated cross-section of municipalities, we assume that the unobservable term  $\varepsilon_{mt}$  is additively separable into two components:

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<sup>12</sup> Note that the data is such that there is a one-to-one mapping between an incumbent mayor and municipality. For that reason we do not use different subscripts for mayors and municipalities.



$$\varepsilon_{mt} = c_{mt} + \mathcal{G}_{mt} \quad (3)$$

where  $c_{mt}$  is an unobservable component of the municipality associated with both the changes in the school quality and mayor re-election probability; and  $\mathcal{G}_{mt}$  is the idiosyncratic error term with zero mean and finite variance:  $\mathcal{G}_{mt}$  is independent of all other variables in the model. Equation (1) becomes

$$Y_{mt} = \alpha_t + \beta_t \Delta IDEB_{mt} + \gamma_t X_{mt} + c_{mt} + \mathcal{G}_{mt}. \quad (4)$$

When Equation (2) is not valid  $\beta_t$  cannot be identified from observable data, as its relation to the OLS estimand,  $p \lim(\hat{\beta}_{t,OLS})$ , regression will be

$$\beta_t = \frac{Cov(Y_{mt}, \Delta IDEB | X) - Cov(c_{mt}, \Delta IDEB | X)}{Var(\Delta IDEB | X)} = p \lim(\hat{\beta}_{t,OLS}) - \frac{Cov(c_{mt}, \Delta IDEB | X)}{Var(\Delta IDEB | X)}. \quad (5)$$

The term  $Cov(c_{mt}, \Delta IDEB | X)$  expresses how changes in IDEB are correlated to the systematic unobserved determinant of re-election,  $c_{mt}$ . Note that covariance term may be non-zero even after controlling for observed covariates  $X$ . Thus, OLS regression coefficients will be biased for the parameter of interest.

However, if the conditional expectation of the unobserved component is the same for both elections, that is, if

$$E[c_{m2008} | \Delta IDEB, X] - E[c_{m2004} | \Delta IDEB, X] = 0, \quad (6)$$

then we can identify the difference  $\beta_{2008} - \beta_{2004}$  as:

$$\beta_{2008} - \beta_{2004} = p \lim(\hat{\beta}_{2008,OLS}) - p \lim(\hat{\beta}_{2004,OLS}). \quad (7)$$

A less stringent condition imposes that the difference in Equation (6) is not necessarily zero, but independent of the actual IDEB change. If

$$E[c_{m2008} | \Delta IDEB, X] - E[c_{m2004} | \Delta IDEB, X] = E[c_{m2008} | X] - E[c_{m2004} | X], \quad (8)$$

then we can identify the difference  $\beta_{2008} - \beta_{2004}$  as the difference in derivatives:

$$\beta_{2008} - \beta_{2004} = \frac{\partial E(Y_{m2008} | \Delta IDEB)}{\partial \Delta IDEB} - \frac{\partial E(Y_{m2004} | \Delta IDEB)}{\partial \Delta IDEB}, \quad (9)$$

which can be consistently estimated as the parameter  $\delta$  of the following regression model:

$$Y_{mt} = \alpha + \beta \Delta IDEB_{mt} + \gamma T_t + \delta T_t * \Delta IDEB_{mt} + \theta X_{mt} + \lambda T_t * X_{mt} + \xi_{mt}, \quad (10)$$

where  $\xi_{mt} = (\varepsilon_{m2008} - \varepsilon_{m2004}) * T_t + \varepsilon_{m2004}$  and  $T_t$  is a dummy that equals one if  $t=2008$ .

In order to clarify the last identification result, consider the case of two different changes in school quality,  $\Delta IDEB'$  and  $\Delta IDEB$ , and the two election races, 2008 and 2004. The differences in expected probabilities of re-elections for a given year and level of covariates  $X$  between  $\Delta IDEB'$  and  $\Delta IDEB$  are

$$\begin{aligned} & E[Y_{m2008} | \Delta IDEB'] - E[Y_{m2008} | \Delta IDEB] \\ &= \beta_{2008} (\Delta IDEB' - \Delta IDEB) + E[c_{m2008} | \Delta IDEB'] - E[c_{m2008} | \Delta IDEB] \end{aligned} \quad (11)$$

and

$$\begin{aligned} & E[Y_{m2004} | \Delta IDEB'] - E[Y_{m2004} | \Delta IDEB] \\ &= \beta_{2004} (\Delta IDEB' - \Delta IDEB) + E[c_{m2004} | \Delta IDEB'] - E[c_{m2004} | \Delta IDEB] \end{aligned} \quad (12)$$

Applying the condition presented in Equation (8), the difference-in-difference coefficient of the expected probability of re-election is

$$\begin{aligned} & (E[Y_{m2008} | \Delta IDEB'] - E[Y_{m2008} | \Delta IDEB]) - (E[Y_{m2004} | \Delta IDEB'] - E[Y_{m2004} | \Delta IDEB]) \\ &= (\beta_{2008} - \beta_{2004}) (\Delta IDEB' - \Delta IDEB). \end{aligned} \quad (13)$$

Dividing both sides by  $\Delta IDEB' - \Delta IDEB$  and considering infinitesimal departures from  $\Delta IDEB$  we obtain Equation (9). At the same time, the difference-in-difference representation helps understand why the coefficient  $\delta$  is the parameter of interest, since it captures exactly the differential impact of changes over time of  $\Delta IDEB$  on  $Y$ , being precisely a ‘difference in derivatives’ parameter:

$$\delta = \frac{\partial E(Y_{m2008} | \Delta IDEB, X)}{\partial \Delta IDEB} - \frac{\partial E(Y_{m2004} | \Delta IDEB, X)}{\partial \Delta IDEB}. \quad (14)$$

Intuitively, the identification restriction imposed by (8) is that expected differences in unobserved components between elections do not depend on changes in school quality. Given that we allow for unobservables to be correlated with changes in school quality and mayor re-election probabilities, and that these expected differences are conditioned on the level of school quality and other observables, we believe that this may not be an implausible restriction. Also, the coefficient of interest can be interpreted as the partial correlation between changes in school quality and probability of re-election in 2008 netted out by the partial correlation between changes in school quality and probability of re-election in 2004. In fact, the 2004 and 2008 experiments can be interpreted as the ‘placebo’ and the ‘true experiment’ respectively. Another way to interpret the parameter  $\delta$  is by capturing the impact of increasing information on school quality, which in fact happened between 2004 and 2008 elections, on re-election chances. We present in the next section the results for the 2004 and 2008 regressions separately as well the ‘difference in derivatives’ regression described by equation (10). Before doing so, we discuss a potential limitation of our empirical methodology.

There is in principle one potential problem with the empirical methodology, which is related to the fact that we do not observe  $\Delta IDEB_{m,2004}$ .

We use as a proxy for  $\Delta IDEB_{m,2004}$  the value for the same municipality  $m$  in 2008. There may be some problems associated with that approach, in particular, the fact that the mayor in 2008 may not be the same as in 2004. Even if the mayor is the same, that is, if she was re-elected in 2004, she could not run for re-election in 2008. Therefore, the incentives during the mayor’s second time in office may not be the same. As a consequence, we could have a situation of very little variation around zero in the “imputed”  $\Delta IDEB_{m,2004}$  exactly for those mayors who won the election in 2004. Such combination would certainly make it difficult to reject the null hypothesis of no relation between changes in IDEB and re-election in 2004,

We show in the Appendix, however, that the differences in the way that re-eligible and non-re-eligible mayors in 2008 respond to the publication of 2005 IDEB are negligible. We also look at

differences between re-eligible and non-re-eligible mayors in 2008 given not only 2005 IDEB level but a series of other covariates, which are the same used in our main regression results. The difference in those two models remained statistically not significant. Those results support the idea that using as a proxy for  $\Delta IDEB_{m,2004}$  the value for the same municipality  $m$  in 2008 is not problematic at least for the subsample of incumbent winners in 2004.

Finally, if the mayors running for re-election in 2004 and 2008 are not the same, that is, if the incumbent in the 2004 race was not re-elected, one would expect to find that the increase in school quality for the subsequent administration would be negatively related to the re-election chances in 2004. To see why this would be the case, consider the case that incumbents in 2008 increased their IDEB from 2005 to 2007. By using that change as a proxy for what would have been the change in IDEB for the previous administration we associate election defeats with increases in IDEB. However, as seen in the next section, our results show no evidence that this could be the case.

#### **4. Results**

In this paper we are mainly concerned about capturing the impact of publication of improvements in education quality on election outcomes and therefore we need to net that effect out of the quantity effect induced by overall expenditures with education. Therefore, it is used as the independent variable in the regressions not only the vector of covariates and  $\Delta IDEB$ , but the logarithm of per capita spending on education as a way to separate the impacts of quantity and quality improvements. Note that we use two measures of spending: in the first two years and therefore, before the publication of IDEB during the 2005-2008 mandate, and the last two years. The reason we split expenditures this way has to do not only with political cycles of spending but also with the fact that we want a measure, such as expenditures in the first two years that were not influenced by changes in IDEB. Inclusion of expenditures in the final two years would give us partial effects of changes in IDEB.

We add controls for other types of expenditures as well, as all of them should satisfy the same budget restriction that education expenditures face. We also control for the baseline IDEB 2005, which is clearly (negatively) correlated to the change and, given the time frame it can be seen as a partial

measure of quality of previous administration.<sup>13</sup> Finally, for all regressions presented in this section we included the control variables presented in Table I: population, GDP, municipal average schooling years, HDI, Theil index and variables of politicians' gender, education, if they are married, if they belong to the same party as governor's and if they belong to the same party of the president.

We first measure the impact of changes in IDEB for both elections controlling for the level of IDEB in 2005 as it can be seen from Table II. The idea behind controlling for the 2005 IDEB level is to be able to obtain net impacts of effective actions towards improving school quality on electoral outcomes. Otherwise, if we did not control for the IDEB level, our estimates could have been mixing 'selection' (composition) effects with 'incentive' electoral effects to respond to the publication of IDEB.

We found no overall effects in 2004 elections. However, we do find a positive effect of IDEB increases on re-election chances, in the 2008 elections, when information on IDEB was actually available for voters.

**[insert Table II around here]**

We also control for educational expenditure on the model of probability of re-election. As expected, expenditures on education affected the probability of re-election for both elections and when expenditure variables of both first two years and last two years are used, we found an interesting cyclical effect, as the impact of expenditure in the first two years is negative (non-significant for 2004) while the impact of expenditure in last two years is positive. Expenditures on urbanism, which are typically visible and attract electoral attention, had positive impact on re-elections.

Interestingly, when we add expenditures in the regression, the coefficient on  $\Delta IDEB$  becomes even more positive. As Table II shows, an increase on IDEB during mayor's time in municipal office impacts the probability of re-election in 2008, but not in 2004. That is in accordance with the fact that voters did not have information about school quality on 2004 election, but they did have before 2008. For the difference estimator, we have that a one unit increase on  $\Delta IDEB$  raises about 5.7 percentage points the probability of re-election of the mayor. It also can be seen that there is no difference in the coefficients associated with quantity effects on elections. They were visible in both

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<sup>13</sup> See Table A.I in the Appendix.

elections and one should not expect that coefficients would change over time. Finally, the fact that the  $\Delta IDEB$  coefficient remained important after controlling for expenditures reveal that voters are sophisticated enough to reward mayors that are able to improve educational quality without rising spending significantly.

The results above strongly suggest that voters are concerned about school quality and the disclosure of IDEB added important information for the voter's decision. In order to obtain further evidences of this channel, we repeat the same exercise for different subpopulations to evaluate in which situations information about IDEB is more important for voters. The results are shown from Table III to Table VII.

Table III analyses the impact of changes in IDEB on re-election splitting the sample into two subsamples: municipalities with a proportion of poor people above the median value of the municipality distribution and those below the median.<sup>14</sup> The difference estimator results of Table III.a show that on municipalities below the median a one unit increase in  $\Delta IDEB$  increases the probability of re-election in about 12 pp., which is much higher than the result in Table II. Table III.b also evidences that on richer municipalities  $\Delta IDEB$  is not important on election, which can be justified by the fact that most public elementary schools are accessed by students from lower income families.

**[insert Table III around here]**

Table IV presents the results from the samples split between municipalities with and without local radio stations. Table V does the same between municipalities where there is circulation of local daily newspaper and where there is not. The idea of both tables is to distinguish situations based on easiness of access to information about IDEB. For both tables  $\Delta IDEB$  does not affect re-election, except for municipalities without radio. Thus, because we do not have precise information on how the media is influenced or controlled by local politicians, nor how voters access local media, these results are hardly conclusive. In fact, it may be the case that information on IDEB might have been accessed by population by other means than traditional media.

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<sup>14</sup> The proportion of poor people in each municipality is obtained from the 2000 census information. An individual is considered poor if her monthly per capita household income is below 2000 BRL\$75.50. This value corresponds to half of the minimum wage in that year.

[insert Table IV around here]

[insert Table V around here]

Table VI shows the impact of changes in IDEB for two groups of municipalities: those municipalities with a fraction of children in the population above the median value of the municipality distribution in 2000 and those and below that cutoff point. We find that a one unit increase in  $\Delta IDEB$  raises the probability of re-election about 11 pp. in municipalities with a large share of children. For cities with relatively fewer children there is no impact. The idea here is that changes in IDEB must be more important in municipalities where there are more potential students.

[insert Table VI around here]

## 5. Conclusions

This study examined whether there is demand for improvements in the quality of public education in Brazil using electoral accountability as the way to discipline educational system administrators. Our findings contributed to two otherwise unrelated bodies of the accountability literature: school and electoral accountability systems. We have linked these literatures by presenting evidence that retrospective voting in Brazilian localities provides incentives via rewards and punishments to school administrators that *de facto* strengthens the existing federal school accountability system. Thus, we show that a ‘weak’ school accountability system may become ‘strong’ as long as there is a parallel system that punishes and rewards those responsible for school quality. A weak school accountability system may therefore dispense its ‘rewards and punishments’ arm as long as there are ways to discipline school administrators. We found evidence that local elections could be one of those ways.

The theoretical predictions from the political agency literature are ambiguous. Increases in the information on the existing quality of public goods could even decrease the quality being supplied by reducing the number of incumbent mayors who would be willing to pay larger reputational costs. We found that from 2005 to 2007 there was an important increase in quality, so mayors in general reacted to the informational shock positively. As anticipated by them (and by the theory), they were

rewarded: Those who were able to pay the reputational cost of increasing quality of education between 2005 and 2007 had their re-election chances increased.

We analyzed the impact of changes in IDEB from 2005 to 2007 on the probability of re-election in the elections of 2004 and 2008 overall and for several subpopulations. The results revealed that IDEB changes, on average, positively affected the chances of re-election of the mayor. In fact, a one unit increase in IDEB from 2005 to 2007 increases the chances of mayor re-election in about 5 percentage points. An increase of one point in IDEB is indeed a feasible policy, as for municipalities in our sample the average change in IDEB from 2005 to 2007 was 0.5.

Other important results showed that the impact of IDEB is even higher in the poorest municipalities, and where there are more children. In these situations one unit increase in IDEB from 2005 to 2007 may increase the probability of re-election by more than 10 percentage points. However, the impact was not the same when we split the sample using media access as a source of heterogeneity.

Our results point out that there seems to be, at least for some specific groups, demand for improvements in the quality of public education in Brazil. In fact, voters take into account the efficiency of public managers in using resources and not just the amount spent on education. A next step is to study the mechanisms adopted by mayors to increase IDEB. Do they respond by changing the allocation of resources, changing management tools or they simply ignore –and get punished by that– people’s demand for increases in public education quality?

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**Table Ia - Summary Statistics - Incumbents' characteristics**

	2004			2008		
	N	Mean	Sd	N	Mean	Sd
<i>Election variables</i>						
Reelected	2505	0.4	0.49	3210	0.505	0.5
Male	2505	0.943	0.233	3210	0.908	0.289
Married	2489	0.827	0.378	3179	0.807	0.395
Age	2504	51.883	9.803	3206	50.813	9.904
Governor's party	2505	0.209	0.407	3210	0.165	0.372
President's party	2505	0.04	0.197	3210	0.08	0.271
<i>Politician's educational dummies</i>						
Incomplete middle school	2484	0.109	0.312	3178	0.125	0.331
Complete middle school or high school dropout	2484	0.174	0.379	3178	0.112	0.316
Complete high school or college dropout	2484	0.315	0.465	3178	0.332	0.471
Complete college	2484	0.402	0.49	3178	0.43	0.495

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

Source: TSE (Supreme Electoral Court)

**Table Ib - Summary Statistics – Municipal IDEB and Expenditures**

	2004			2008		
	<u>N</u>	<u>Mean</u>	<u>Sd</u>	<u>N</u>	<u>Mean</u>	<u>Sd</u>
Fifth grade change in IDEB ( $\Delta$ IDEB)	2505	0.403	0.523	3210	0.403	0.518
Fifth grade 2007 IDEB	2505	3.993	0.913	3210	3.891	0.904
Fifth grade 2005 IDEB	2505	3.59	0.929	3210	3.487	0.92
Ninth grade change in IDEB ( $\Delta$ IDEB)	1184	0.248	0.455	1628	0.233	0.467
Ninth grade 2007 IDEB	1517	3.396	0.776	2036	3.282	0.746
Ninth grade 2005 IDEB	1199	3.106	0.742	1643	3.01	0.702
Average per capita expenditure on education - first two years	2451	312.84	909.28	3130	336.18	150.17
Average per capita expenditure on education - last two years	2466	270.82	126.52	3116	412.84	177.10
Average per capita expenditure on health - first two years	2451	178.61	250.50	3130	250.86	130.60
Average per capita expenditure on health - last two years	2466	188.44	98.02	3116	307.16	156.00
Average per capita expenditure on urbanism - first two years	2451	74.89	78.39	3130	105.28	127.18
Average per capita expenditure on urbanism - last two years	2466	85.61	89.03	3116	142.81	141.02

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

Source: Expenditure variables are from Brazilian National Treasury. All other variables are from INEP.

**Table Ic - Summary Statistics - Municipalities' characteristics**

	<b>2004</b>			<b>2008</b>		
	<u>N</u>	<u>Mean</u>	<u>Sd</u>	<u>N</u>	<u>Mean</u>	<u>Sd</u>
Population (thousands)	2505	22.961	32.388	3204	22.385	31.194
GDP (millions of Reais)	2505	224.00	579.00	3204	204.00	596.00
Schooling years	2505	4.458	1.179	3204	4.275	1.215
HDI (Human Development Index)	2505	0.706	0.08	3204	0.694	0.082
Theil Index	2505	0.526	0.108	3204	0.527	0.11
Poor proportion	2505	0.445	0.220	3204	0.477	0.225
Radio station	2505	0.462	0.499	3204	0.455	0.498
Children population share (5 to 19 years old)	2505	0.322	0.041	3203	0.327	0.042
Dayly newspaper	2505	0.769	0.422	3204	0.736	0.441

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

Source: Variables radio station and dayly newspaper are from 2001 Profile of Brazilian Municipalities (IBGE). All other variables are from 2000 IBGE Census.

**Table II – Re-election regressions**

	2004			2008			Diff		
Fifth grade $\Delta$ IDEA	-0.005 (0.021)	-0.012 (0.021)	-0.014 (0.021)	0.038** (0.018)	0.040** (0.019)	0.043** (0.019)	0.043 (0.028)	0.051* (0.029)	0.057** (0.029)
2005 fifth grade IDEA	0.022 (0.018)	0.012 (0.019)	0.015 (0.019)	0.032* (0.017)	0.032* (0.017)	0.032* (0.017)	0.010 (0.025)	0.020 (0.026)	0.017 (0.026)
Average per capita expenditure on education - first two years		0.053 (0.039)	-0.066 (0.049)		-0.065** (0.032)	-0.188*** (0.058)		-0.119** (0.050)	-0.123 (0.075)
Average per capita expenditure on health - first two years		0.011 (0.028)	-0.041 (0.036)		0.066** (0.031)	0.003 (0.046)		0.056 (0.042)	0.044 (0.058)
Average per capita expenditure on urbanism - first two years		0.026** (0.012)	0.010 (0.014)		0.035*** (0.010)	0.010 (0.014)		0.009 (0.016)	-0.000 (0.020)
Average per capita expenditure on education - last two years			0.161*** (0.048)			0.128** (0.060)			-0.033 (0.076)
Average per capita expenditure on health - last two years			0.065 (0.040)			0.074 (0.050)			0.009 (0.064)
Average per capita expenditure on urbanism - last two years			0.026** (0.012)			0.038** (0.015)			0.012 (0.020)
Observations	2,469	2,400	2,344	3,160	3,057	2,973	5,629	5,457	5,317
R-squared	0.073	0.076	0.090	0.054	0.061	0.067	0.073	0.079	0.089

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

For all regressions, dependent variable is re-election success dummy. Robust standard errors in parentheses for 2004 and 2008 regressions. For the difference estimator, cluster standard errors in parenthesis.

We included the following covariates in all regression specifications: (Incumbent's characteristics) Male, Married, Age, Governor's party and President's party; (Demographic variables) Log(per capita GDP), Log(population), Theil Index, HDI and Schooling years.

**Table III.a – Re-election regressions by income per capita (poor municipalities)**

	2004			2008			Diff		
Fifth grade ΔIDEB	-0.041 (0.033)	-0.047 (0.034)	-0.045 (0.035)	0.069** (0.027)	0.070** (0.027)	0.074*** (0.028)	0.110*** (0.043)	0.118*** (0.044)	0.119*** (0.044)
2005 fifth grade IDEB	0.058** (0.029)	0.052* (0.029)	0.057* (0.030)	0.039 (0.025)	0.041 (0.025)	0.041 (0.026)	-0.020 (0.037)	-0.011 (0.038)	-0.015 (0.038)
Average per capita expenditure on education - first two years		-0.012 (0.060)	-0.107* (0.064)		-0.038 (0.048)	-0.212*** (0.073)		-0.026 (0.075)	-0.105 (0.095)
Average per capita expenditure on health - first two years		0.022 (0.042)	-0.054 (0.046)		0.146*** (0.041)	0.086 (0.062)		0.124** (0.059)	0.140* (0.077)
Average per capita expenditure on urbanism - first two years		0.026* (0.015)	0.005 (0.019)		0.031** (0.013)	0.019 (0.018)		0.005 (0.020)	0.015 (0.026)
Average per capita expenditure on education - last two years			0.155** (0.073)			0.241*** (0.078)			0.086 (0.108)
Average per capita expenditure on health - last two years			0.116** (0.056)			0.083 (0.066)			-0.033 (0.086)
Average per capita expenditure on urbanism - last two years			0.036** (0.017)			0.013 (0.021)			-0.023 (0.027)
Observations	1,146	1,118	1,087	1,659	1,608	1,540	2,805	2,726	2,627
R-squared	0.087	0.087	0.107	0.054	0.069	0.077	0.070	0.080	0.094

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

For all regressions, dependent variable is re-election success dummy. Robust standard errors in parentheses for 2004 and 2008 regressions. For the difference estimator, cluster standard errors in parenthesis.

We included the following covariates in all regression specifications: (Incumbent's characteristics) Male, Married, Age, Governor's party and President's party; (Demographic variables) Log(per capita GDP), Log(population), Theil Index, HDI and Schooling years.

**Table III.b – Re-election regressions by income per capita (rich municipalities)**

	2004			2008			Diff		
Fifth grade AIDEB	0.011 (0.026)	0.005 (0.027)	0.003 (0.027)	0.014 (0.025)	0.010 (0.026)	0.010 (0.026)	0.002 (0.038)	0.005 (0.039)	0.008 (0.039)
2005 fifth grade IDEB	-0.011 (0.025)	-0.023 (0.026)	-0.021 (0.026)	0.033 (0.024)	0.020 (0.025)	0.018 (0.025)	0.044 (0.036)	0.043 (0.037)	0.039 (0.037)
Average per capita expenditure on education - first two years		0.056 (0.050)	-0.024 (0.071)		-0.089* (0.047)	-0.105 (0.102)		-0.144** (0.070)	-0.081 (0.124)
Average per capita expenditure on health - first two years		-0.002 (0.039)	-0.029 (0.056)		-0.005 (0.043)	-0.071 (0.056)		-0.003 (0.059)	-0.042 (0.079)
Average per capita expenditure on urbanism - first two years		0.030 (0.019)	0.019 (0.023)		0.042** (0.017)	-0.007 (0.023)		0.012 (0.026)	-0.025 (0.032)
Average per capita expenditure on education - last two years			0.096 (0.064)			-0.017 (0.102)			-0.113 (0.120)
Average per capita expenditure on health - last two years			0.034 (0.059)			0.083 (0.067)			0.050 (0.089)
Average per capita expenditure on urbanism - last two years			0.018 (0.017)			0.072*** (0.024)			0.053* (0.029)
Observations	1,323	1,282	1,257	1,501	1,449	1,433	2,824	2,731	2,690
R-squared	0.096	0.103	0.112	0.063	0.070	0.081	0.099	0.108	0.118

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

For all regressions, dependent variable is re-election success dummy. Robust standard errors in parentheses for 2004 and 2008 regressions. For the difference estimator, cluster standard errors in parenthesis.

We included the following covariates in all regression specifications: (Incumbent's characteristics) Male, Married, Age, Governor's party and President's party; (Demographic variables) Log(per capita GDP), Log(population), Theil Index, HDI and Schooling years.



**Table IV.a – Re-election regressions by existence of local radio station (municipalities with radio)**

	2004			2008			Diff		
Fifth grade AIDEB	0.029 (0.031)	0.022 (0.031)	0.008 (0.031)	0.035 (0.029)	0.031 (0.029)	0.034 (0.029)	0.006 (0.042)	0.009 (0.043)	0.026 (0.043)
2005 fifth grade IDEB	0.041 (0.028)	0.028 (0.028)	0.030 (0.028)	0.009 (0.026)	0.003 (0.026)	0.003 (0.026)	-0.032 (0.038)	-0.024 (0.038)	-0.028 (0.038)
Average per capita expenditure on education - first two years		0.087 (0.055)	-0.040 (0.080)		-0.044 (0.048)	-0.183* (0.108)		-0.131* (0.074)	-0.144 (0.134)
Average per capita expenditure on health - first two years		0.009 (0.040)	-0.046 (0.059)		0.034 (0.041)	-0.021 (0.059)		0.025 (0.058)	0.026 (0.085)
Average per capita expenditure on urbanism - first two years		0.033* (0.017)	0.015 (0.020)		0.056*** (0.018)	-0.000 (0.023)		0.023 (0.025)	-0.015 (0.031)
Average per capita expenditure on education - last two years			0.153** (0.071)			0.138 (0.106)			-0.015 (0.126)
Average per capita expenditure on health - last two years			0.081 (0.062)			0.049 (0.067)			-0.033 (0.092)
Average per capita expenditure on urbanism - last two years			0.026 (0.019)			0.079*** (0.024)			0.053* (0.031)
Observations	1,146	1,121	1,103	1,441	1,414	1,385	2,587	2,535	2,488
R-squared	0.081	0.089	0.100	0.048	0.059	0.072	0.073	0.084	0.096

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

For all regressions, dependent variable is re-election success dummy. Robust standard errors in parentheses for 2004 and 2008 regressions. For the difference estimator, cluster standard errors in parenthesis.

We included the following covariates in all regression specifications: (Incumbent's characteristics) Male, Married, Age, Governor's party and President's party; (Demographic variables) Log(per capita GDP), Log(population), Theil Index, HDI and Schooling years.

**Table IV.b – Re-election regressions by existence of local radio station (municipalities without radio)**

	2004			2008			Diff		
Fifth grade ΔIDEA	-0.031 (0.027)	-0.040 (0.028)	-0.033 (0.029)	0.041* (0.024)	0.047* (0.024)	0.052** (0.025)	0.072* (0.037)	0.087** (0.039)	0.085** (0.039)
2005 fifth grade IDEA	0.006 (0.026)	-0.003 (0.026)	0.001 (0.027)	0.051** (0.022)	0.051** (0.023)	0.054** (0.023)	0.045 (0.034)	0.055 (0.035)	0.053 (0.036)
Average per capita expenditure on education - first two years		0.026 (0.052)	-0.088 (0.061)		-0.095** (0.044)	-0.214*** (0.070)		-0.121* (0.068)	-0.126 (0.091)
Average per capita expenditure on health - first two years		0.013 (0.042)	-0.038 (0.047)		0.089* (0.047)	0.029 (0.068)		0.076 (0.064)	0.067 (0.082)
Average per capita expenditure on urbanism - first two years		0.020 (0.016)	0.006 (0.021)		0.025* (0.013)	0.018 (0.018)		0.005 (0.021)	0.012 (0.027)
Average per capita expenditure on education - last two years			0.178*** (0.067)			0.129* (0.075)			-0.049 (0.101)
Average per capita expenditure on health - last two years			0.050 (0.058)			0.083 (0.072)			0.032 (0.092)
Average per capita expenditure on urbanism - last two years			0.024 (0.015)			0.010 (0.020)			-0.014 (0.025)
Observations	1,323	1,279	1,241	1,719	1,643	1,588	3,042	2,922	2,829
R-squared	0.075	0.076	0.092	0.068	0.072	0.076	0.082	0.086	0.095

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

For all regressions, dependent variable is re-election success dummy. Robust standard errors in parentheses for 2004 and 2008 regressions. For the difference estimator, cluster standard errors in parenthesis.

We included the following covariates in all regression specifications: (Incumbent's characteristics) Male, Married, Age, Governor's party and President's party; (Demographic variables) Log(per capita GDP), Log(population), Theil Index, HDI and Schooling years.

**Table V.a – Re-election regressions by existence of local daily newspapers (municipalities with newspaper)**

	2004			2008			Diff		
Fifth grade AIDEB	-0.021 (0.024)	-0.019 (0.024)	-0.023 (0.025)	0.003 (0.022)	0.006 (0.023)	0.011 (0.023)	0.024 (0.033)	0.024 (0.034)	0.034 (0.034)
2005 fifth grade IDEB	0.021 (0.021)	0.009 (0.021)	0.011 (0.021)	0.044** (0.019)	0.042** (0.020)	0.040** (0.020)	0.023 (0.029)	0.033 (0.029)	0.030 (0.029)
Average per capita expenditure on education - first two years		0.042 (0.042)	-0.066 (0.061)		-0.059 (0.038)	-0.157** (0.080)		-0.101* (0.058)	-0.091 (0.100)
Average per capita expenditure on health - first two years		0.039 (0.033)	-0.012 (0.046)		0.050 (0.036)	-0.012 (0.052)		0.010 (0.049)	-0.000 (0.070)
Average per capita expenditure on urbanism - first two years		0.028** (0.014)	0.015 (0.016)		0.029** (0.012)	-0.005 (0.017)		0.001 (0.018)	-0.020 (0.024)
Average per capita expenditure on education - last two years			0.138** (0.056)			0.091 (0.080)			-0.047 (0.097)
Average per capita expenditure on health - last two years			0.050 (0.049)			0.074 (0.059)			0.025 (0.076)
Average per capita expenditure on urbanism - last two years			0.025* (0.014)			0.052*** (0.019)			0.027 (0.024)
Observations	1,899	1,846	1,810	2,325	2,259	2,211	4,224	4,105	4,021
R-squared	0.072	0.077	0.088	0.054	0.059	0.066	0.076	0.082	0.091

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

For all regressions, dependent variable is re-election success dummy. Robust standard errors in parentheses for 2004 and 2008 regressions. For the difference estimator, cluster standard errors in parenthesis.

We included the following covariates in all regression specifications: (Incumbent's characteristics) Male, Married, Age, Governor's party and President's party; (Demographic variables) Log(per capita GDP), Log(population), Theil Index, HDI and Schooling years.

**Table V.b – Re-election regressions by existence of local daily newspapers (municipalities without newspaper)**

	2004			2008			Diff		
Fifth grade ΔIDEB	-0.038 (0.042)	-0.028 (0.044)	-0.037 (0.044)	0.016 (0.035)	0.014 (0.035)	0.010 (0.036)	0.054 (0.055)	0.043 (0.056)	0.047 (0.057)
2005 fifth grade IDEB	0.018 (0.042)	0.006 (0.044)	0.023 (0.045)	0.003 (0.033)	0.007 (0.035)	0.014 (0.036)	-0.015 (0.053)	0.000 (0.056)	-0.009 (0.056)
Average per capita expenditure on education - first two years		0.072 (0.081)	-0.079 (0.077)		-0.082 (0.061)	-0.248*** (0.090)		-0.154 (0.098)	-0.170 (0.117)
Average per capita expenditure on health - first two years		-0.050 (0.053)	-0.067 (0.056)		0.145** (0.059)	0.048 (0.092)		0.195** (0.080)	0.115 (0.108)
Average per capita expenditure on urbanism - first two years		0.021 (0.023)	-0.013 (0.031)		0.051*** (0.019)	0.044* (0.025)		0.030 (0.030)	0.057 (0.040)
Average per capita expenditure on education - last two years			0.255*** (0.097)			0.230** (0.102)			-0.025 (0.144)
Average per capita expenditure on health - last two years			0.058 (0.080)			0.100 (0.095)			0.043 (0.123)
Average per capita expenditure on urbanism - last two years			0.032 (0.024)			0.009 (0.026)			-0.023 (0.035)
Observations	570	554	534	835	798	762	1,405	1,352	1,296
R-squared	0.108	0.108	0.133	0.063	0.083	0.093	0.085	0.097	0.114

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

For all regressions, dependent variable is re-election success dummy. Robust standard errors in parentheses for 2004 and 2008 regressions. For the difference estimator, cluster standard errors in parenthesis.

We included the following covariates in all regression specifications: (Incumbent's characteristics) Male, Married, Age, Governor's party and President's party; (Demographic variables) Log(per capita GDP), Log(population), Theil Index, HDI and Schooling years.

**Table VI.a – Re-election regressions by municipal proportion of children at school age (large share of children)**

	2004			2008			Diff		
Fifth grade $\Delta$ IDEB	-0.026 (0.033)	-0.031 (0.033)	-0.033 (0.034)	0.068** (0.027)	0.070** (0.028)	0.071** (0.028)	0.094** (0.042)	0.101** (0.043)	0.105** (0.044)
2005 fifth grade IDEB	0.058** (0.028)	0.052* (0.029)	0.061** (0.029)	0.039 (0.025)	0.040 (0.025)	0.042 (0.026)	-0.019 (0.037)	-0.012 (0.038)	-0.019 (0.038)
Average per capita expenditure on education - first two years		-0.036 (0.055)	-0.116* (0.062)		-0.047 (0.046)	-0.179** (0.069)		-0.011 (0.070)	-0.063 (0.092)
Average per capita expenditure on health - first two years		0.009 (0.039)	-0.054 (0.045)		0.148*** (0.041)	0.093 (0.061)		0.139** (0.057)	0.147* (0.076)
Average per capita expenditure on urbanism - first two years		0.021 (0.015)	0.000 (0.018)		0.035*** (0.013)	0.023 (0.017)		0.014 (0.020)	0.023 (0.025)
Average per capita expenditure on education - last two years			0.136* (0.071)			0.175** (0.077)			0.039 (0.106)
Average per capita expenditure on health - last two years			0.119** (0.056)			0.077 (0.065)			-0.042 (0.085)
Average per capita expenditure on urbanism - last two years			0.029* (0.016)			0.015 (0.020)			-0.015 (0.026)
Observations	1,171	1,142	1,111	1,666	1,614	1,549	2,837	2,756	2,660
R-squared	0.095	0.096	0.114	0.058	0.075	0.081	0.077	0.088	0.100

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

For all regressions, dependent variable is re-election success dummy. Robust standard errors in parentheses for 2004 and 2008 regressions. For the difference estimator, cluster standard errors in parenthesis.

We included the following covariates in all regression specifications: (Incumbent's characteristics) Male, Married, Age, Governor's party and President's party; (Demographic variables) Log(per capita GDP), Log(population), Theil Index, HDI and Schooling years.

**Table VI.b – Re-election regressions by municipal proportion of children at school age (small share of children)**

	2004			2008			Diff		
Fifth grade ΔIDEB	0.001 (0.026)	-0.005 (0.027)	-0.007 (0.027)	0.018 (0.025)	0.012 (0.026)	0.014 (0.026)	0.017 (0.038)	0.018 (0.039)	0.021 (0.039)
2005 fifth grade IDEB	-0.006 (0.025)	-0.021 (0.026)	-0.025 (0.026)	0.035 (0.024)	0.024 (0.024)	0.021 (0.025)	0.041 (0.036)	0.044 (0.036)	0.046 (0.037)
Average per capita expenditure on education - first two years		0.105** (0.051)	0.013 (0.072)		-0.090* (0.048)	-0.205** (0.104)		-0.195*** (0.071)	-0.218* (0.124)
Average per capita expenditure on health - first two years		0.003 (0.041)	-0.034 (0.060)		-0.003 (0.043)	-0.076 (0.058)		-0.006 (0.060)	-0.042 (0.084)
Average per capita expenditure on urbanism - first two years		0.037* (0.021)	0.027 (0.024)		0.041** (0.017)	-0.006 (0.024)		0.004 (0.027)	-0.033 (0.034)
Average per capita expenditure on education - last two years			0.100 (0.066)			0.097 (0.103)			-0.003 (0.121)
Average per capita expenditure on health - last two years			0.027 (0.060)			0.083 (0.068)			0.057 (0.091)
Average per capita expenditure on urbanism - last two years			0.023 (0.018)			0.068*** (0.025)			0.045 (0.030)
Observations	1,298	1,258	1,233	1,494	1,443	1,424	2,792	2,701	2,657
R-squared	0.092	0.105	0.116	0.060	0.066	0.077	0.095	0.105	0.116

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

For all regressions, dependent variable is re-election success dummy. Robust standard errors in parentheses for 2004 and 2008 regressions. For the difference estimator, cluster standard errors in parenthesis.

We included the following covariates in all regression specifications: (Incumbent's characteristics) Male, Married, Age, Governor's party and President's party; (Demographic variables) Log(per capita GDP), Log(population), Theil Index, HDI and Schooling years.

## APPENDIX

**Table A. I - Relation between IDEB changes and IDEB level**

	2004			2008		
	Not re-eligible	Re-eligible	Difference	Not re-eligible	Re-eligible	Difference
2005 fifth grade IDEB	-0.362*** (0.019)	-0.401*** (0.016)	-0.039 (0.033)	-0.366*** (0.025)	-0.391*** (0.014)	-0.025 (0.034)
Log(per capita GDP)	0.074*** (0.026)	0.074*** (0.023)	-0.000 (0.033)	0.044 (0.033)	0.085*** (0.020)	0.042 (0.037)
Log(population)	-0.070*** (0.012)	-0.072*** (0.011)	-0.003 (0.015)	-0.060*** (0.016)	-0.074*** (0.009)	-0.015 (0.018)
Schooling years	0.089*** (0.027)	0.064*** (0.024)	-0.025 (0.035)	0.057 (0.035)	0.081*** (0.021)	0.024 (0.040)
HDI	0.873** (0.413)	1.954*** (0.367)	1.082** (0.544)	2.001*** (0.535)	1.305*** (0.321)	-0.696 (0.614)
Theil Index	-0.150 (0.102)	-0.145 (0.090)	0.005 (0.125)	-0.105 (0.140)	-0.162** (0.078)	-0.056 (0.144)
Observations	1,738	2,505	4,243	1,031	3,204	4,235
R-squared	0.177	0.205	0.194	0.179	0.198	0.194
F-stat <sup>1</sup>			1.37			0.79

Standard errors in parentheses

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

The F-stat is the test statistics used for testing that all coefficients are the same for the models in which the incumbent is eligible and ineligible for re-election.