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Corrupting Learning: Evidence from Missing Federal Education Funds in Brazil

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TEXTO PARA DISCUSSÃO

No. 562

Corrupting Learning: Evidence from
Missing Federal Education Funds in
Brazil

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Corrupting Learning:

Evidence from Missing Federal Education Funds in Brazil*

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Abstract

While cross-country analysis suggests that corruption hinders economic growth, we have little evidence on the mechanisms that link corruption to long-run economic development. We provide micro-evidence on the consequences of corruption for the quality of education. We use data from the auditing of Brazil's local governments to construct objective measures of corruption involving educational block grants transferred from the central government to municipalities. Using variation in the incidence of corruption across municipalities and controlling for students', schools' and municipal characteristics, we find that corruption significantly reduces the school performance of primary school students. Students residing in municipalities where corruption in education was detected score 0.35 standard deviations less on standardized tests, and have significantly higher dropout and failure rates. We also provide evidence on the mechanisms that link corruption and mismanagement to learning and school attainment. The results are consistent with corruption directly affecting economic growth through the reduction of human capital accumulation.

JEL: D73, I21, H72

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1 Introduction

Policies aimed at reducing corruption have become an integral component of several countries' development strategies (Rose-Ackerman 2004). These policies are predicated on the idea that corruption distorts the allocation of resources away from their most productive uses and thus presents a significant barrier to economic growth (Shleifer and Vishny 1993). But corruption can also impose significant long-run costs through its effects on the provision and quality of key public services ((Svensson 2005), Mauro (1995), World Bank (2003)). In education, high levels of corruption might be particularly harmful if it limits human capital accumulation.¹

Evidence from cross-country data supports the idea that corruption can reduce educational quality. As seen in Figure 1, there is a strong negative relationship between a country's corruption level and its performance on the PISA international exams.² In spite of the clear negative correlation, there are several reasons why one should be cautious about interpreting this relationship as causal. First, there are many institutional and cultural differences across countries that determine both its level of corruption and the quality of education. Moreover, as has been well documented, subjective cross-country measures of corruption are subject to important shortcomings (Svensson 2005). Thus, despite its importance, empirical evidence on the welfare consequences of corruption remain remarkably sparse.³

This paper aims to fill this gap by providing micro-evidence on the effects of corruption and mismanagement of education funds on the academic performance of public school students in Brazil. Brazil provides an ideal case to examine the effects of corruption in education. Despite large expenditures on primary schooling per pupil, the performance of students on the international PISA examination is among the worst in the world (see panels A and B of Figure 2). Even within Brazil, the association between spending per pupil and academic performance among primary school children in public schools is weak (see panels A and B of Figure 3). To overcome the data constraints that have limited cross-country analysis,

¹See for example Glewwe and Kremer (2006); Pritchett and Filmer (1999).

²Figure 1 plots the relationship between the performance on the PISA international exams in 2006, after accounting for expenditures on primary schooling per pupil, and a country's corruption index. The PISA examination is available in 2006 for 56 countries when we include only those countries for which we also have information on spending in primary education per pupil. The corruption index is from Kaufmann, Kraay, and Mastruzzi (2009), we invert the sign of the control of corruption index.

³A number of recent studies have provided new insights into measuring corruption. See for example Bandiera, Prat, and Valletti (2008), Di Tella and Schargrodsky (2003), Ferraz and Finan (2008), Olken (2007), Reinikka and Svensson (2004). Our study complements this literature by estimating the extent of corruption from educational grants.

we assemble a new data set based on a program initiated by the Federal Government that audits local governments' for their use of federal funds. Based on audit reports, we quantify local-level corruption and mismanagement associated with federal block grants earmarked for education.⁴ We then link these corruption measures to data on the educational achievement of primary school students across 1488 public schools located in 365 municipalities throughout Brazil. We estimate the effects of corruption on dropout rates, failure rates, and performance on a national standardized exam.

This data set, which represents one of the first large scale attempts to measure corruption in education at a local level, has several advantages over the existing literature.⁵ First, because our estimates are based on audit reports, we also have information available for block grants in other sectors (e.g. health and infrastructure). Thus, we can distinguish between the effects of corruption in education versus overall corruption. By controlling for corruption in other sectors, our estimates do not reflect general levels of corruption or public good provision in the municipality. Second, the effects of corruption are identified separately from the effects of mismanagement practices in education. Corrupt politicians may have low management skills or hire poor managers, both of which may negatively affect educational outcomes. Our data can distinguish between these different types of irregularities. Third, even within education we can also distinguish between the various sectors and programs within which the corruption occurred. This allows us to disentangle the mechanisms that link corruption and mismanagement of resources to educational attainment. Finally, our complementary data includes information on a large set of student and household-level characteristics, allowing us to account for important differences in student attributes that might otherwise confound our estimates.

We find that the educational outcomes of students residing in municipalities where corruption was uncovered are significantly lower than those of students residing in municipalities where no corruption was detected. For instance, test scores on a standardized Language and Math exam among 4th graders are 0.35 standard deviations lower in corrupt municipalities. Corruption is also associated with higher dropout rates and failure rates among primary school children. These results remain even after controlling for measures of mismanagement and corruption in other areas, suggesting that unobserved determinants of corruption more

⁴The data were constructed based on the audit reports used in Ferraz and Finan (2009), but exploit the detailed reports from the educational grants.

⁵See Reinikka and Svensson (2004) for estimates of local capture of education grants using expenditure tracking surveys. See Bjorkman (2007) and Reinikka and Svensson (2007) for an examination of the effects of reducing capture of public funds on schooling outcomes.

generally are not driving our results. Our results are also robust to alternative measures of corruption. To provide further robustness to our results, we also examine whether corruption in educational funds in the municipality affects the schooling outcomes of children attending private school. We find no effects of corruption on the dropout and failure rates of children attending private school, suggesting that children are neither sorting into private schools nor that differences in education performance are driven by municipal level unobserved characteristics.

If corruption diverts funds intended for schooling inputs then educational inputs should also be lower in municipalities with more corruption. We demonstrate that this is indeed the case using three independent data sources. Based on Brazil's school census, we find that the percentage of teachers who had received pedagogical training is 10.7 percentage points lower compared to non-corrupt municipalities. Schools in corrupt municipalities are also less likely to have a computer lab or a science lab. From independent directors' and teachers' surveys, we also find that both teachers and school directors of schools in municipalities where corruption was detected are much more likely to report that a lack of resources and teaching supply are serious problems. When we decompose our corruption measure by the type of program in which the corruption occurred, we find that corruption occurring in the funds intended for the payment and training of teachers is associated with poor schooling outcomes.

Given the negative costs associated with corruption in education, the natural question becomes how to reduce it. Our findings show that corruption in education is significantly lower in municipalities that hold school principals accountable through elections, as opposed to having the mayors appoint them. These results suggest that electoral accountability, even in the context of school management, can be an important mechanism for improving governance.⁶

Overall, this study contributes to the literature on corruption and its consequences for economic growth and development. While the general consensus argues that corruption harms economic development, with few exceptions, the evidence is based on cross-country comparisons using subjective or self-reported measures of corruptions (e.g. Mauro (1995)). Our study complements and extends this literature in two important ways. First, we examine the effects of corruption using sub-national variation and objective measures of corruption in education. Second, our findings lend empirical support to the importance of reducing

⁶See Ferraz and Finan (2009) for the relationship between electoral accountability and corruption in municipal governments.

corruption in promoting education attainment of primary school children, thus highlighting the long-run costs of corruption. Finally, our study also relates to a large literature that examines whether school resources affect student achievement. Differently from the existing literature, however, an important contribution of this paper is to argue that corruption in education does more than simply reduce school supplies. Corruption also affects schooling infrastructure, distorts schooling inputs, reduces teachers' salaries thus potentially affecting their motivation, and may even lower children's nutrition levels. Thus, we should not interpret the effects of corruption as simply shifting the school budget constraint, but rather a reduced-form effect of these various distortionary channels.⁷

The paper proceeds as follows. Section 2 provides an overview of Brazil public education system and corruption program that conducted the audit reports. Section 3 describes our conceptual framework and outlines our empirical strategy. In Section 4, we describe the data, including how our corruption measures were coded. Section 5 presents our results, and Section 6 concludes.

2 Background

2.1 Decentralization and Block Grants for Education

In 2005, Brazil transferred over US\$2.6 billion in educational grants to municipal government and spent 4.5 percent of its GDP on public education. Unfortunately, these expenditures have not led to improvements in academic performance. For instance, on the 2006 Programme for International Student Assessment (PISA) test among 15 year old students, Brazil ranked 54th among 57 countries in mathematics and ranked 49th out of 56 countries in reading. Brazil also placed well below Mexico and Argentina, both of which spend on average similar amounts on primary education.

Brazil's local governments are much to blame for this poor performance. The constitution dictates that states and municipal governments share the responsibility for the provision of primary and secondary education. In practice, however, most state governments manage secondary schools, while municipal governments manage primary schools (*ensino fundamental*). By 2005, approximately 85% of all first to fourth grade primary schools were

⁷In an environment where schools lack basic infrastructure, text books, school lunches, and qualified teachers, Harbison and Hanushek (1992) argue that even modest resources can in fact have significant effects on student learning.

managed by municipal governments.⁸ In order to guarantee adequate investments in education, Brazil's constitution mandates that at least 25 percent of all state and municipal revenues are spent for educational purposes. Local governments are thus responsible for building schools, providing adequate infrastructure, distributing school lunches and school transportation, training teachers, and paying salaries.

To cover these costs, the federal government transfers to states and municipalities large sums of resources in the form of block grants.⁹ On top of that, a new financing scheme named FUNDEF was created in 1997 to equalize the amount of resources available for education across regions.¹⁰ It consists of a state fund to which state and municipal governments contribute 15 percent of specific taxes and transfers. The fund, which totaled US\$13.7 billion in 2005, is then redistributed to state and municipal governments on the basis of student enrollment. The federal government supplements local governments in states where per student allocations fall below an established spending floor. The FUNDEF constitutes a large share of resources available to mayors, but the use of resources is not completely free. For instance, the rule stipulates at least 60 percent of FUNDEF revenues must be spent on teachers' salaries.

To monitor the use of these federal funds and ensure compliance with federal guidelines, local councils were established, comprising of representatives of the municipal government, teachers, and parents.¹¹ Unfortunately, these councils have been mostly ineffective. They have either been captured by local mayors or do not meet regularly enough to effectively monitor the use of these resources (Transparência Brasil 2005). That these local councils are unable to fulfill their role as an effective watchdog is not too surprising. Throughout Brazil, governments are under the control of local elites and powerful mayors who often divert resources for their own benefits.¹²

⁸See Madeira (2007) for details of the school decentralization process and its impacts in the state of São Paulo.

⁹The largest block grant, called Fundo de Participação dos Municípios, was created in the 1960s and distribute resources to municipalities based on their population and the state's income per capita.

¹⁰FUNDEF stands for Fundo de Manutenção e Desenvolvimento do Ensino Fundamental e de Valorização do Magistério. See Gordon and Vegas (2005) and Menezes-Filho and Pazello (2007) for a detailed description of FUNDEF.

¹¹These councils are called *Conselhos de Acompanhamento e Controle Social*.

¹²Corruption at the local level is not unique to Brazil. Elite capture of public resources at local levels is a serious concern for several countries throughout the world (Rose-Ackerman 1999).

2.2 Embezzlement and Misuse of Educational Block Grants

With the large influx of central government transfers to municipalities, the potential for local capture has increased dramatically. Resources for education and health, the largest grants received by local governments, have become attractive targets for rent-seeking politicians. The most common embezzlement tactics include the use of fake receipts, purchases without proper call-for-bids, over-invoicing of goods and services, and payments made to contractors without service provision.¹³

Among the transfers made to municipalities for educational spending, FUNDEF is the largest block grant and the source of much of the embezzlement. In a report by *Transparência Brasil*, based on audits executed by the *Controladoria Geral da União (CGU)*, the federal government controller's office, estimated that approximately 13% to 55% of FUNDEF's total budget between 2001 and 2003 was lost to fraud.¹⁴

Cases of mayors diverting resources from these educational block grants are countless. During 2005 alone, there were 26 news stories about the misuse of FUNDEF resources in the Brazilian press.¹⁵ Some examples are helpful to illustrate how prevalent the problem has become. In the municipality of Placas, in the North of Brazil, the ex-mayor could not attest to how he spent US\$1.25 million of FUNDEF funds between 2003 and 2004. Moreover, when auditors asked the new mayor that took office in 2005 for documents and receipts, he said that all documents disappeared from the archives during the government transition.¹⁶ The new mayor of Camaragibe, state of Pernambuco, also had a surprise when he took office in January 2005. He discovered that US\$400,000 from the FUNDEF account was transferred by the ex-mayor to a private bank account.¹⁷

Examples of teachers not receiving their full salaries are also widespread. In May 2009, approximately 90 percent of municipal school teachers in Itabuna, Bahia received less than half of their monthly salary, after approximately US\$100,000 "disappeared" from the FUNDEF account.¹⁸ In the municipality of Senador Alexandre Costa, Maranhão, teachers did not receive their 13th monthly salary and bonus because the mayor had diverted all of the funds from FUNDEF. By April 2007, despite the school year having started in early Febru-

¹³See Ferraz and Finan (2009) for a description of corruption practices in local governments.

¹⁴See *Transparência Brasil* (2005).

¹⁵See www.deunojornal.org.br/busca.php?assunto=463

¹⁶"Dinheiro do FUNDEF é o maior alvo de desvios", *O Globo* 06/25/2006.

¹⁷"Desvio do FUNDEF atrasa salários de professores", *O Globo* 03/27/2005.

¹⁸See "Professores de Itabuna recebem só metade do salario", in the Blog *Pimenta na Muqueca*, assessed in 05/04/2009.

ary, all municipal schools were still closed and without energy due to the lack of payments.¹⁹ In Gonçalves Dias, state of Maranhão, 129 municipal teachers did not received their salaries during 9 months in 2004. They went on strike and it was only in December that the municipal government paid part of their earnings. The new mayor, who inherited the debt, negotiated to pay 40 percent of back pay in exchange for having the new salaries paid on time.

Although teachers protest these situations, in many cases they are forced to accept these arrangements in order for their current salary to be paid on time. According to Francisco Carlos Custódio, the municipal Secretary of Education for Gonçalves Dias: “Many teachers were angry with the situation, but accepted the offer because they were afraid of not receiving their future salaries.”²⁰ Mayors have been reported to engage in other forms of coercion as well. For instance, in the municipality of Traipu, a geography teacher and local representative of the teachers’ union, was transferred from an urban school where she taught geography to high school students to a rural school to teach small children after she denounced the mayor’s misuse of educational grants. In the municipality of Viçosa, Alagoas students that participated in protests were forbidden to use the municipal bus that transports students to the only secondary school, which was located in the neighboring municipality.²¹ The small city of Satuba in Alagoas provides a particularly extreme case. In June 2003, Paulo Bandeira, a teacher started a campaign to denounce the mayor for embezzling funds. Soon after, he was found tortured and killed.

While mayors have found ways of coercing teachers, this does not suggest that all cases of corruption go unpunished. In 2005 the Federal Police arrested 8 mayors and 4 ex-mayors in the state of Alagoas with charges of diverting US\$1 million from the FUNDEF.²² The ex-mayor of Cocal, in the state of Piauí, was also arrested accused of diverting US\$1.2 million from the FUNDEF. He had already been impeached from public office in 2008 for corruption allegations.²³ In December 2008, after a long investigation, the Federal Police arrested 9 mayors, 7 municipal secretaries and 64 public servants for diverting resources from education and health funds in 16 municipalities in the state of Bahia. The police

¹⁹Taken from a public complaint made by a citizen from Senador Alexandre Costa on a public email sent to Arlindo Chinaglia, the President of the National Congress, in April 2007.

²⁰“Desvio do FUNDEF atrasa salários de professores”, *O Globo* 03/27/2005.

²¹See the report “Irregularidades na utilização de recursos públicos - Alagoas”, written by the NGO *Ação Educativa*, available at <http://www.acaoeducativa.org.br>.

²²See *O Globo*, “Dinheiro do FUNDEF é o maior alvo de desvios”. 25/06/2006)

²³“PI: ex-prefeito é preso por desvios de fundo do Fundeb e do FUNDEF”, *Correio Braziliense*, 01/30/2009

estimated that approximately US\$11.5 million was embezzled.²⁴ In April 2009, the Federal Police arrested four ex-mayors and 17 other persons in the municipalities of Montes Altos, São Pedro da Água Branca and Governador Edison Lobão, in the south of Maranhão. They were accused of diverting R\$6.5 million from educational grants during 2008.²⁵

Given its prevalence in the education sector, corruption can severely impact a student’s ability to learn through a variety of ways. First, when teacher salaries are delayed or not paid in full due to corruption, this can affect teachers’ motivation or the functioning of the school. In some cases, teachers go on strike or the school shuts down. Second, school quality is also comprised when funds intended for new classrooms or school supplies are diverted. Insufficient school inputs may not only have a direct effect on a student’s ability to learn but also affect a teacher’s ability to teach. Third, corruption also occurs in the provision of school lunches. For children of poor households, these meals can represent an important source of daily calories. If corruption reduces these calories, then enrollment or regular attendance may suffer.

In sum, Brazil’s local governments receive large sums of resources through educational block grants. A significant share of these resources is misused and diverted, thus affecting educational quality. Brazil’s local governments provide an ideal setting to examine how local corruption affects educational outcomes. In Section 4 we describe Brazil’s anti-corruption program and how we used the audit reports from this program to build measures of misuse and diversion of resources from educational block grants.

3 Theoretical Framework

This section presents a simple analytical framework for exploring the relationship between corruption and school achievement. Corruption can affect student achievement through various channels. We highlight these channels using an educational production function, which forms the basis for our estimation equation.

We begin with a standard production function for learning. A child’s achievement, A , is determined by a set of individual, family, schooling inputs:

$$A = g(S, F, W, Q, I) \tag{1}$$

where S denotes years of schooling, F is a vector of predetermined individual and family

²⁴See A Tarde, “Prefeitos envolvidos na Operação Vassoura-de-Bruxa devem ser ouvidos até sexta”.

²⁵See “PF prende quatro ex-prefeitos e mais 17 pessoas no MA”, Estado de S.Paulo 04/28/2009.

characteristics, such as the child innate ability or the education of the parents. The vector W denotes the set of school characteristics that determine a child’s achievement, such as the availability of computer laboratories or textbooks. The vector Q represents teacher inputs, such as teacher effort or qualification. The vector I represents parental inputs, which might include parental assistance or even how much nutrition is provided to the child.

Based on information revealed in audit reports, corruption may affect the educational production function through at least three channels. First, resources intended for school supplies are either diverted completely or over-invoiced leading to an undersupply of schooling inputs. This mis-allocation of funds will reduce either the quality or supply of schooling inputs, W . A second source of corruption uncovered in the audits is the diversion of resources intended for teacher training or wages and bonuses, Q . This type of corruption may not only directly affect a teacher’s ability to convey the material, but may also reduce their motivation or incentive to do so. Thirdly, corruption associated with school feeding programs was often detected. In Brazil, school lunches are an important source of calories for low-income households. The absence of school lunches may have a significant impact on a child’s nutritional levels, I , and his ability to learn.

Given these various channels through which corruption can affect student achievement, we augment Equation 1 as follows:

$$A = g(S, F, W(c), Q(c), I(c)) \tag{2}$$

where W , Q , and I are functions of the level of corruption in the municipality. Equation 2 also assumes that predetermined individual and family characteristics, and years of schooling are not affected by corruption.

To estimate the effects of corruption on student achievement, we can linearize Equation 2 as:

$$A_{sm} = \alpha + \beta c_m + Z'_{sm} \delta + X'_m \gamma + \epsilon \tag{3}$$

where A_{sm} is student achievement in school s in municipality m , c_m is the level of corruption in education that was detected in the municipality, Z_{sm} is a vector of predetermined student (e.g. gender, age, race, etc) and family characteristics (e.g. parent’s education, assets, etc), X_m is a vector of municipal characteristics that may affect student achievement, and ϵ denotes a random error term. Under the assumption that $E[c_m \epsilon | X_m Z_{sm}] = 0$, the coefficient β captures the reduced-form effects of corruption on student achievement.

The principal identification issue confronting the estimation of equation 3 is the possibility

that c_m is correlated with unobserved factors that affect student achievement. For instance, municipalities with less corruption may offer more public goods and other amenities that might affect student achievement. Returns to education may also be higher in areas with less corruption. It is also possible that families that value education may choose to live in municipalities with less corruption. In this situation, we will over-estimate the negative effects of corruption on education.

To address these concerns, we present several robustness checks. First, we re-estimate equation 3 controlling for corruption detected in other sectors (e.g. health and infrastructure). Controlling for corruption in sectors other than education is likely to proxy for many of the unobservable characteristics that are both correlated with corruption in education and determine student achievement. Second, using the audit reports we also construct a measure of mismanagement of education resources. This allow us to disentangle the effects of corruption from the effects of mismanagement. Our third main robustness check uses private schools as a placebo test. Here, we re-estimate equation 3 using educational outcomes of children who attend private school as the dependent variable. Under this specification, we would expect $\hat{\beta} = 0$, since corruption in public expenditures should not affect private school outcomes. Similarly, we also test whether the effects of corruption on educational outcomes differ in municipalities with private schools. If more able children are sorting into better schools in corrupt areas, we might expect the effects of corruption to be larger in corrupt municipalities that offer a private schooling option. We test for this possibility by estimating the following equation:

$$A_{sm} = \alpha + \beta c_m + \eta_1 p_m + \theta(p_m \times c_m) + Z'_{sm} \delta + X'_m \gamma + \epsilon$$

where p_m is an indicator for whether a private school exists in the municipality. If in corrupt municipalities more able students are sorting into private schools, then we would expect the interaction effect between corruption and the existence of a private school to be negative, i.e. $\theta < 0$.

4 Data

Our empirical analysis combines three different data sources. First, we use information contained in the audit reports of Brazil's anti-corruption program to construct our measures of corruption and mismanagement in the education sector. Second, we collect information on various schooling outcomes and student characteristics, which we aggregate to the school

level. The third data source contains information about the socio-economic characteristics of the municipality. Because the identifying variation is at the level of the municipality, accounting for differences across municipalities will be important for our analysis.

4.1 Building Measures of Corruption and Mismanagement of Educational Funds

Widespread corruption scandals in municipalities have led to a growing concern over the misuse of federal funds. In May 2003, the federal government started an unprecedented anti-corruption program based on the random auditing of municipal government's expenditures. The program, which is implemented through the *Controladoria Geral da União* (CGU), aims at discouraging misuse of public funds among public administrators and fostering civil society participation in the control of public expenditures. The program started with the audit of 26 randomly selected municipalities, one in each state of Brazil. It has since expanded to auditing 50 and later 60 municipalities per lottery, from a sample of all Brazilian municipalities with less than 450,000 inhabitants. The lotteries, which are held on a monthly basis at the Caixa Econômica Federal in Brasilia, are drawn in conjunction with the national lotteries. To assure a fair and transparent process, representatives of the press, political parties, and members of the civil society are all invited witness the lottery.

Once a municipality is chosen, the CGU gathers information on all federal funds transferred to the municipal government from 2001 onwards. Approximately 10 to 15 CGU auditors are then sent to the municipality to examine accounts and documents, to inspect for the existence and quality of public work construction, and delivery of public services. Auditors also meet members of the local community, as well as municipal councils in order to get direct complaints about any malfeasance.²⁶ After approximately one week of inspections, the auditors submit a report containing, for each inspected area (i.e education, health, urban infrastructure), a list of government programs audited, the total amount of federal funds transferred, and a detailed list describing each irregularity found.²⁷ At the time of this study, audit reports were available for approximately 790 municipalities randomly selected across the first 16 lotteries of the anti-corruption program. From these 16 lotteries, we randomly selected the municipalities from 10 lotteries to measure corruption and mismanagement in

²⁶These auditors are hired based on a public examination, and prior to visiting the municipality receive extensive training on the specificities of the sampled municipality. Also, there is a supervisor for each team of auditors.

²⁷For some irregularities, the amount of resources diverted are estimated by the auditors.

education, health, and urban infrastructure, the three largest sources of federal transfers for municipalities.²⁸ Thus, in total, we construct indicators of corruption and mismanagement for 365 municipalities.

In order to build our measures of corruption and mismanagement, we read the report for each municipality and classify the irregularities listed by the auditors into several pre-established categories. We define three types of irregularities as acts of corruption: *diversion of public funds*, *over-invoicing*, and *irregular public procurements*. We classify *diversion of resources* as any irregularity involving the embezzlement of public funds. This typically occurs in two situations: 1) federally-transferred resources simply “disappear” from municipal bank accounts; and 2) the municipality claimed to have purchased goods and services that were never provided, which is determined when there is no proof of purchase and community members confirm that the goods were in fact not delivered. We classify *over-invoicing* as any irregularity in which auditors determined that the goods and services were purchased at a value above market price. We classify the irregularity as an *irregular public procurement* when there is an illegal call-for-bids and the contract is awarded to a “friendly firm”. These firms are usually connected directly to the mayor and/or his family or some cases do not physically exist. Most cases of corruption involving illegal public procurements include any combination of: i) use of non-existing firms in the bidding process; ii) use of fake receipts to pay for goods and services; iii) over-invoicing of prices to increase the amount paid for the goods and services.

In addition to cases of corruption, we also construct measures of mismanagement. These are irregularities that are uncovered by the auditors, but do not involve any incidence of fraud. Administrative irregularities, however, may still affect the quality of education if they create inefficiencies in the allocation of school inputs. Some examples are useful to illustrate this measure. Municipalities that receive funds from the FUNDEF program are required to establish an active and independent community council to monitor the use of these funds. Auditors uncovered several cases where the council simply did not function. It either never met or was led by a mayor’s family member. Although this irregularity is not an act of corruption, the lack of a well functioning council prevents the effective use and monitoring of resources by civil society. Another common form of mismanagement is the use of resources that are mandated for other purposes. For instance, mayors have to spend at least 60 percent of resources from FUNDEF on teacher salaries. In some municipalities, auditors discovered that these resources were used to pay the salaries of other public servants or the purchase

²⁸As a result, we do not have data from lotteries 8, 11-13, and 15.

of gasoline for municipal cars. Again, even though this does not constitute the diversion of resources for private gains, it may affect the allocation of resources intended for education. Finally, public procurements require at least three firms to participate in the call-for-bids. Even in the case where the public good or service was provided (and is thus not considered corruption) the lack of competition in the bidding process might have led the government to overspend, thus creating distortions in the allocation of resources.

Using the classifications described above, we define three measures of corruption. First, an indicator for whether auditors detected any corruption in education. Second, we count the number of irregularities associated with corruption and divide by the number of service items audited. Third, we estimate the value of resources diverted (when information is available) and divide by the amount of resources transferred to the municipality from educational grants.²⁹ While the second and third measures capture the extent of corruption, corruption in education was only detected in 35 percent of municipalities, suggesting that the extensive margin may capture most of the relevant variation in the data. So while we present results using all three measure of corruption, most of our analysis will focus on the corruption indicator. For mismanagement, most irregularities are not associated with values (e.g. lack of a council to monitor the use of funds) and virtually every municipality has some incident of mismanagement. Thus, we can only build measures counting the total number of irregularities.

Table 1 presents summary statistics of the corruption measures. Corruption in the area of education was discovered in 35 percent of municipalities. Among these municipalities, 35 percent of services items in education were found to be corruption and 8 percent of resources were diverted. Corruption in other sectors were also discovered in 50 percent of the municipalities, and on average 2 irregularities per service item were found to associated with some type of mismanagement.

With the richness of the audit data, we are also able to distinguish in what types of programs the irregularities occur. To this end, we classify the corruption in education into three broad categories: i) school feeding programs; ii) infrastructure and payments for teachers; iii) others. A large number of irregularities occur in block grants that the central government transfers to municipal governments to provide school lunches for children. The second category includes infrastructure, materials, and teachers' salaries. Examples include the construction of classrooms and purchase of textbooks, purchase of school buses, and payments

²⁹Because some of the irregularities associated with corruption have missing values, the share of corruption is underestimated.

for teachers with the FUNDEF funds.

4.2 Data on Schooling Outcomes and Municipal Characteristics

We have two main sources of schooling data, both of which are aggregated at the school level. The data on test scores and student characteristics come from a program called *Prova Brasil*. *Prova Brasil* is a federal program designed to measure student performance among 4th and 8th graders. In 2005, the program conducted a standardized exam in the subjects of Mathematics and Portuguese given to all 4th graders enrolled in a public school with at least 20 students. In addition to the exam, the program conducted a survey designed to measure the child's socio-economic conditions. The survey includes not only information about the child: such as, gender, age, and race, but also information about the parents and home environment: such as, the education of the parents, whether the child lives with both parents, size of the family, whether the household owns a computer, and other assets. The wealth of information contained in the survey allows us to control for a host of characteristics that are likely to affect student achievement.

Our second principal data source comes from the 2006 school census, referring to information from the 2005 school year. The census measures the basic conditions of schools in Brazil. Contained in the census is information about approval rates, dropout rates, and failure rates by school. There is also information regarding school conditions: such as whether the school has sanitation, or computer and science labs, as well as information about teachers: such as, years of experience and what proportion have a degree or are credentialed.

Table 2 provides summary statistics based on information from these surveys, as well as, basic socio-economic information about the municipality. In panel A, we see that the proportion of children with parents with at least high school degree is on average 16 percent. And on average 15 percent of children have a computer at home. The average dropout rate for schools in our sample is 4 percent, while failure rates are at 10 percent. Only 19 percent of schools have a computer lab and 4 percent of schools have a science lab.

From *Prova Brasil*, we also have responses from a director's survey and a teacher's survey. These surveys, which were conducted separately, asked whether the following four items were a serious concern at school: 1) lack of financial resources 2) lack of school supplies 3) lack of teachers to teach the courses 4) disciplinary problems among the student body. In both the teacher's and director's survey, 55 percent of the schools cite a lack resources and school supplies as serious concerns. Only 23 percent cited a lack of teachers as an important concern.

Combining the test score data with the information from the audit reports, Figure 4 plots

the distribution of test scores by whether or not corruption in education was detected in the municipality. Consistent with the cross-country evidence, we find that the distributions of scores for both math and language in corrupt municipalities is to the left of the distributions of scores in municipalities where corruption was not found. On average, test scores are 15 points lower in municipalities where some corruption in education was detected. In the next sections, we investigate the robustness of this relationship.

5 Results

In this section we present the main empirical results of the paper. We begin by presenting estimates of the relationship between schooling outcomes and corruption in education. We then show that our estimates are robust across various specifications, including ones that control for the effects of mismanagement and corruption in other sectors. In the final part of the section, we explore the mechanisms that link corruption to poor schooling achievement, and whether school elections for principals reduce corruption.

5.1 The effects of corruption practices on educational outcomes

Table 3 reports estimates of the association between corruption and various schooling outcomes measured in 2005. The results are OLS estimates of a series of regression models based on equation 3. Our base specification, which is reported in the odd columns for various educational outcomes, adjusts for several key school characteristics (e.g. gender, race, age, parent's education, household wealth, student-teacher ratio, etc) which are likely to affect the education production function. In the even columns, we augment this base specification to also include various characteristics of the municipalities (e.g. GDP per capita, population, Gini, etc).

Panel A presents estimates using as our measure of corruption: the proportion of education items audited found to involve corruption. Across the various schooling measures, the negative effects of corruption are substantive. For instance, a 30 percentage point (or approximately one standard deviation) increase in corruption is associated with a 0.10 standard deviation decrease in test scores (columns 2 and 4), and a 0.6 percentage point increase in both dropout and failure rates (columns 6 and 8). These point estimates, while economically meaningful, are also highly robust to the inclusion of important controls, such as GDP per capita and urbanization rates, that control for differences in labor market opportunities.

In Panel B, we present estimates using the share of resources in education found to be corrupt as an alternative measure of corruption. In reading the audit reports, it is difficult to calculate a dollar amount for every irregularity. Yet despite the imprecision associated with this measure, the results in Panel B tell a similar story. In columns 2 and 4 of Panel B, the estimates imply that a 5 percentage point increase in corruption is associated with a 0.04 standard deviation decrease in test scores. The share of audited resources found to be corrupt is also positively associated with both dropout and failure rates.

In Panel C, we present a third alternative measure of corruption: an indicator for whether or not corruption in education was detected. The results suggests that children residing in municipalities where corruption was detected fare much worse on the standardized exams than those with similar observable characteristics but residing in municipalities where no corruption was revealed. Based on the estimates presented in column 1, corruption in education is associated with a significant decrease of 0.35 standard deviations in test scores (robust standard error = 0.076).

While columns 1-4 suggest that corruption may have affect learning, the results in columns 5-8 indicate that corruption may also affect a child's education attainment. Dropout rates are 2.9 percentage points higher in municipalities where corruption was detected, which represents almost a 65 percent increase from the average. Failure rates are also higher in corrupt municipalities (see column 7 and 8), which is consistent with the effects on test scores. Again, these results are robust to controlling for differences in observable characteristics of the municipalities.

While all three alternative measures of corruption produce similar results, the measures presented in panels A and B have the potential advantage of capturing the effects of corruption along the intensive margin. However, given that only 35 percent of municipalities committed some act of corruption in education, extensive margin might capture the relevant variation in the data. In panel D, we test for this explicitly by re-estimating the model with two indicators indicating low versus high corruption. Low corruption municipalities have engaged in some corruption but below the median amount in the proportion of items audited associated with corruption. High corruption municipalities are defined as those that have corruption levels above the median amount. The excluded category in the regression is no corruption. As we see in Panel D, the effects for low versus high corruption are the same and statistically significantly different from zero. For this reason, we use in the remainder of the analysis, an indicator for whether or not corruption in education was detected as our main measure of corruption.

Overall, the results presented in Table 3 suggest that the effects of corruption on education outcomes are quite severe. These estimates represent reduced-form effects of several channels. Thus, it is difficult to compare them with the previous literature. Relative to other studies, however, the estimated effects of corruption on test scores are large but not unreasonably so. For instance, Banerjee et al. (2007) find that a remedial education program increased average test scores by 0.28 standard deviation, and a computer-assisted learning program focusing on math increased math scores by 0.47 standard deviation. Muralidharan and Sundararaman (2008) randomly assigns bonus payments to teachers based on the average improvement of their students' test scores and finds that math scores increased by 0.28 standard deviations among students in incentive schools.

5.2 Accounting for institutional differences

The results presented in Table 3 suggest that corruption in education may have adverse effects on the educational outcomes of primary school children. An obvious concern with this interpretation is that our estimates may be capturing the effects of the overall quality of institutions in the municipality, rather than the effects of corruption in education per se. If municipalities with less corruption have better institutions and provide better public goods, which may also attract families who value education more, then our estimates will be biased upwards.

To address this set of concerns, in Table 4 we re-estimate our main specification controlling for corruption in other sectors. This specification is useful for two reasons. First, it identifies the effects of corruption specifically in education, rather than potentially estimating a proxy for more general corruption. Second, by controlling for corruption in other sectors, we are in effect accounting for many of the unobserved differences between municipalities that do and do not engage in corruption more generally. For instance, returns to education are often lower in places that are more prone to corruption, since these areas tend to be economically depressed and more reliant on local patronage practices. With this specification, we are, for example, able to capture any potential differences in the returns to education that were not necessarily accounted for by controlling for just differences in income across municipalities.

Our findings suggest that corruption in other sectors do not adversely affect educational outcomes. If anything, the correlation is positive although not statistically significant. Moreover, even after controlling for whether corruption in other sectors was detected, our estimates remain both economically and statistically meaningful. Overall these results suggest

that our estimates are robust to unobservable factors that affect both schooling outcomes and a municipality’s propensity to engage in corruption more generally.

In Table 5, we present an alternative test for whether unobserved differences between corrupt and non-corrupt municipalities are affecting our results. In columns 1 and 2, we estimate the effects of corruption in education on the dropout and failure rates of children attending private schools.³⁰ Because our measure of corruption is based on the misuse of funds intended for public schools, we should not expect the measure to predict educational outcomes of private-school children. The results in columns 1 and 2 do in fact show that the effects of corruption on private schooling outcomes are small and statistically insignificant.

The remaining columns of Table 5 report the estimated coefficients from the model based on equation 3, which in addition to the standard set of controls includes an indicator for whether a private school exists in the municipality and an interaction term between having a private school and our corruption measure. This model is then estimated for each of the four educational outcomes for sample of children attending public school. Under this specification, we can test whether selection across municipal and private schools could potentially explain the correlation between corruption and schooling outcomes. If in municipalities without corruption, more able students are more likely to attend private schools, then we should expect the effects of corruption to be more pronounced among municipalities with a private school. But as we see in columns 3-6, for each educational outcome, the coefficient on the interaction term is both small in magnitude and statistically insignificant, suggesting that differential sorting does not explain our findings.

5.3 Controlling for school organizations and community involvement

Even after controlling for institutional differences across municipalities, our results still suggest that test scores and other educational outcomes are substantially lower in municipalities with more corruption in education. While encouraging, our specifications do not rule out the possibility that differences in educational systems and institutions across municipalities are confounding the results. For instance, it could be the case that parent-teacher associations, and other school/parent organizations, operate more effectively in municipalities where corruption was not detected. If these organizations also hold government officials more accountable then we would be overestimating the effects of corruption on student achievement.

³⁰Unfortunately, standardized math and Portuguese exams are only conducted on students attending public schools.

Also, it could be the case that municipalities where communities are more active exert more control over corruption and school quality.

In columns 1-4 of Table 6, we re-estimate the main regression model controlling for several measures of community participation and differences in education systems and institutions: 1) whether the school principal is elected; 2) whether the school has an active PTA; 3) whether the municipality has an education council, which are intended to provide oversight on spending; 4) whether the municipality receives private or community financial support; 5) whether the municipality participates in any intergovernmental consortiums; and 6) whether the municipality uses participatory budgeting - whereby local communities actively participate in the budgeting process. These variables either directly capture the efficacy of local schools and parent organizations (e.g. active PTA, existence of school council) or serve as proxies for the general level of civic engagement in the municipality (e.g. principal is elected, municipality uses participatory budgeting).³¹

In columns 1 and 2, we find that whether the principal is elected and whether the municipality participates in any intergovernmental consortiums are both positively associated with test scores. Yet controlling for these characteristics, as well as the other proxies, does not affect any of our original estimates. Even accounting for participatory budgeting and principal elections, both of which are negatively correlated with corruption in education, (e.g. point estimate on participatory budgeting = -0.212 with robust standard errors = 0.105) has no effect on our estimates.

Differences in community involvement in schools also do not drive our results. In columns 5-8, we control for whether the community helps in school maintenance, which is positively associated with test scores, and whether in the last year, the school participated in an awareness campaign for the community. Once again, accounting for these differences leaves our point estimates unaffected.

5.4 Robustness Checks

Corruption or mismanagement? Another possible concern is that our estimates capture the effects of not only the diversion but also the mismanagement of educational resources. If corruption and mismanagement of educational funds are positively correlated, then our estimates are overstated. Table 7 shows this is not the case. In columns 1-4, we re-estimate

³¹Intergovernmental consortiums are entities managed by the civil society. They group municipalities to implement a certain action that individual municipalities are not capable of doing alone. They have autonomous management and financing and are usually used to provide public services, e.g. management of a public hospital, irrigation project, public transportation, etc.

the full specifications presented in Table 3, controlling for the share of audited items in education associated with mismanagement practices. Our findings in columns 1 and 2 suggest that test scores are in fact negatively correlated with the incidence of mismanagement. A one standard deviation increase in the incidence of mismanagement is associated with a 0.14 standard deviation decrease in math scores. Yet despite this negative correlation, the magnitude of the effect is small relative to the size of the effects of corruption. The incidence of mismanagement in a municipality would have to increase from the 1st percentile to the 99th percentile of the distribution in order to achieve the same effects as those of corruption. Overall, the estimated coefficients across the various educational outcomes suggest substantive effects of corruption, even after accounting for the negative effects of mismanagement.

Functional form Table A1 presents additional specification checks that relax our functional form assumptions. In Panel A, we estimate the effects of corruption in education on our various educational outcomes using propensity score, and in Panel B we estimate the effects by propensity score matching. To compute the propensity score, we estimate the probability that corruption in education was detected in the municipality using a logit regression on the entire set of school and municipal controls. For the regression, we use a highly flexible specification that included a full set of second-order polynomials and interactions.³² The propensity score is the predicted values from this regression. In Figure A1 in the appendix, we plot the distribution of the propensity score for municipalities with corruption versus municipalities without corruption. Overall, municipalities where corruption was detected have a much higher propensity, and although there does appear to be substantial common support, 20 percent of the corrupt municipalities have a propensity score above the maximum propensity score for non-corrupt municipalities. In the estimates presented in both panels A and B, we drop these municipalities that are off the common support. Table A2 of the appendix demonstrates how accounting for the propensity score eliminates almost all of the differences in covariates between corrupt and non-corrupt municipalities. Only the number of household members above the age of 6 is statistically different between the two groups, at less than the 10 percent level.

Panel A of Table A1 reports the estimated effects of corruption on education outcomes using a propensity score approach (Rosenbaum and Rubin 1983). Specifically, we regress the outcomes indicated in each column on an indicator for whether or not corruption in education was detected in the municipality, the propensity score, the corruption indicator

³²Using a higher order structure does not change the estimates of the effects of corruption on schooling outcomes.

interacted with the propensity score demeaned. While specifications presented in Panel A are regression based, the estimates presented in Panel B are computed using a bias-adjusted matching estimator (Abadie and Imbens 2006) on the propensity score.

Overall, the findings presented in Table A1 support the conclusion that corruption has a negative effect on education outcomes of children in 4th grade of primary school. In both set of specifications, the point estimates are similar to those presented in Table 3. Although compared to the previous regression analysis the identification assumptions are similar, the estimators presented here have the advantage that they neither assume an additive linear functional form nor extrapolate over areas of uncommon support in the observable characteristics.

5.5 Mechanisms linking corruption to educational outcomes

Thus far, we have presented estimates of a reduced-form relationship between corruption in education and student achievement. As discussed in Section 3, corruption can affect student performance through various channels. One possible channel is the reduction of schooling inputs or infrastructure. In Table 8, we explore whether schooling inputs are lower in municipalities where corruption was detected using data from the 2006 school census.

Column 1 examines whether corrupt municipalities are less likely to have received pedagogical training. One common form of corruption uncovered in the audits was the diversion of funds intended for teacher training. The results in column 1 confirm this. In municipalities where corruption was detected, the percentage of teachers who are trained is 10.7 percentage points (standard error 0.061) lower compared to non-corrupt municipalities. Given that 43 percent of teachers receive training, this estimate represents a 25 percent decline. Schools in corrupt municipalities are also less likely to have a computer lab (coefficient=-0.068; standard error =0.027) or a science lab (coefficient=-0.020; standard error =0.009). We do not find any evidence that schools in corrupt municipalities have less access to sanitation, but this might be a margin where corruption is harder to hide.

Table 9 provides further evidence that schools have fewer resources in municipalities where corruption in education was detected. Table 9 presents estimates based on a series of linear probability models, where the dependent variable is specified at the top of each column. Each dependent variable is constructed based on a series of questions asking whether the school faced the following non-mutually exclusive problems: 1) insufficient resources; 2) insufficient teaching supplies; 3) lack of teachers; 4) disciplinary problems among the students. In columns 1-4, we present estimates based on information from a teacher's survey, whereas the

estimates presented in columns 5-8 are based on responses for the same question, but asked separately to the school principal.

Despite the fact that the two surveys were conducted separately, both teachers and principals of schools in municipalities where corruption was detected are much more likely to report a lack of resources is a serious problem. For instance, in corrupt municipalities, teachers are 7.5 percentage points (standard error=0.031) more likely to indicate a lack of teaching supplies (see column 2); whereas, school directors are 11.4 percentage points (standard error=0.034) more likely to complain about a lack of teaching supplies (see column 6). While corruption would expectedly lead to fewer resources, one would not necessarily expect corruption to affect disciplinary problems among students or even a lack of teachers (at least in the short run). The data do in fact bear this out. In columns 3-4 and 7-8, we do not find any association between corruption in education and whether the school faces disciplinary problems amongst its students or a lack of teachers. Using information from the principal's survey, we investigate whether schools in corrupt municipalities are less likely to offer pedagogical training. As reported in column 9, we find that schools in corrupt municipalities are 11.3 percentage points less likely to have gone through teacher training. This result is consistent with the finding presented in Table 8.

The audit data provide further insights into potential mechanisms. As discussed in Section 4, corruption in education assumes several forms. The effects of corruption may vary depending on whether it occurred through the reduction of school supplies, or perhaps during the course of a school feeding program. In Table 10, we separate the irregularities into three categories: 1) corruption involving a school feeding program; 2) corruption involving schooling inputs, including teachers; 3) other violations associated with corruption in education.³³

Test scores in municipalities where corruption was detected in either schooling inputs or teacher salaries are 0.18 standard deviations lower than in municipalities where no corruption was found. The effects on test scores for the other categories of corruption are similar in magnitude, but are measured with much less precision. Corruption in schooling inputs is also associated with a 2 percentage point increase in dropout rates.

³³Unfortunately, the data do not allow us to separate the various forms of corruption into finer categories. Because certain programs were selected at random for audit, information does not exist for each municipality. Thus, as we disaggregate our corruption measure into separate categories, we lose observations.

5.6 Electing principals, accountability, and corruption

Given the negative costs associated with corruption in education, the question naturally becomes how to reduce it. Recently, much of the policy focus has been on enhancing accountability in service delivery, both through increased citizens' access to information or shifting the responsibility and decision-making power to end users that have better incentives to manage public funds (Bjorkman and Svensson (2009), Gertler, Patrinos, and Rubio-Codina (2008)).

In Brazil, a different accountability mechanism has emerged. During the 1990's, as Brazil underwent its democratic transition, some states began to experiment with democratization of state schools by making the choice of school principals a democratic process where teachers, parents and students can vote. This movement was predicated on the idea that the election of principals would empower both teachers and parents with more decision-making power to enhance accountability. Currently, 16 out of Brazil's 26 states have some form of elections for school principals of state-run schools. This form of school governance has also been adopted by municipalities, where 30 percent of municipal school principals are currently elected.

In Table 11, we investigate the relationship between the election of school principals in municipal schools and our measures of corruption in education. Panel A presents the OLS estimates of regressing corruption on an indicator for whether or the not the municipality holds elections for its school principals, controlling for the full set of student and municipal characteristics. As seen in column 1, municipalities where the principal is elected are associated with less corruption in education. For instance, an elected principal is associated with a 17 percentage point decline in the likelihood of detecting corruption in education. Even though principal elections and corruption in education are negatively correlated, this does not necessarily imply that the effects of elections on corruption are causal. For instance, individuals in municipalities that chose to elect their principals may value education more, which may lead them to elect a mayor that is more likely to adopt election of principals and less likely to engage in corruption.

In Panel B, we use an instrumental variable approach to overcome some of the issues associated with omitted characteristics that determine the choice of elections. We use as an instrument for the election indicator, the number of state schools in the municipality that have an elected principal. Municipalities should be more likely to adopt school policies if there are other schools administered by the state that adopt such policies. Moreover, because the state government makes statewide decisions about whether or not to elect its principals,

it's unlikely to have a direct effect on municipal corruption in education.³⁴ We find that school elections have a negative effect on corruption in education, although the IV estimate is larger and less precisely estimated than the OLS estimate.³⁵

As a further test of robustness, we estimate the effects of elections on whether corruption was detected in other sectors (e.g. health and infrastructure). If elections had a significant negative effect on corruption in sectors other than education, then one might be concerned that our indicator for elections is also capturing other unobserved municipal characteristic. But as we see in column 2, both the OLS and IV estimates are positive and statistically insignificant.

Traditionally, school principals in Brazil's public schools have been nominated by politicians which constituted an important source of patronage to distribute to their electoral supporters (Plank 1996). Moreover, with politically-appointed principals, school administration is typically centralized and under the influence of local mayors (Myers 2008). While admittedly suggestive, our estimates of the effects of holding elections for school principals point towards the importance of making school principal accountable to parents and teachers, instead of dependent on local politicians.

6 Conclusions

While there is a general consensus that corruption undermines economic and social development, empirical evidence on the consequences of corruption remains limited. In this paper, we present evidence that corruption has important consequences for learning and school attainment. Using a novel dataset of corruption in education and schooling outcomes across public schools in Brazil, we find that student test scores on a national standardized exam are 0.35 standard deviations lower in municipalities where corruption was detected. We also find that corruption is associated with higher dropout and failure rates.

Given the richness of the data, we are able to rule out several alternative explanations for our findings. We reject that the effects of corruption in education are capturing overall corruption in the municipality or inefficiencies related to public sector management. We also reject the possibility that more able children in corrupt areas are sorting out of municipal schools and into private schools. Our data also provide insights into some of the mechanisms that link corruption and mismanagement to schooling outcomes. Consistent with the idea

³⁴In the IV specifications, we also control for the total number of state schools in the municipality. Whether we control for the number of state schools does not affect the results in the slightest.

³⁵These results are robust to using the other measures of corruption.

that corruption reduces and/or distorts schooling inputs, we find that schools in municipalities found to be corrupt are much less likely to have school infrastructure and high quality teachers. Moreover, both teachers and directors are more likely to cite a lack of resources as a principal concern in corrupt municipalities. Finally, we show that using elections for school principals as a mechanism for accountability can reduce resource diversion.

Overall, our results suggest that not only corruption, but also the mismanagement of resources have detrimental effects on schooling outcomes. These findings complement the work of Bandiera, Prat, and Valletti (2008) who show that passive waste in public service might be as important as active waste (i.e. corruption) in generating public sectors inefficiencies. Moreover, to the extent that the quality of education affects long-run economic performance, our results suggest a direct channel through which corruption affects long-run economic development (Hanushek and Woessmann (2009)). Our study provides micro-evidence for why the large increases in educational spending in developing countries have had such a disappointing effect on economic growth.

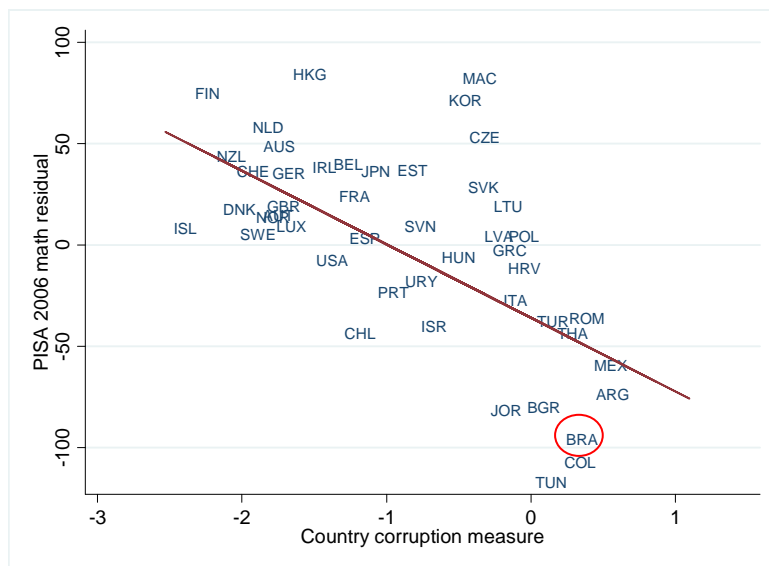
Improving school performance remains a challenge facing most countries (Filmer, Hasan, and Pritchett 2006). Our results suggest that policies aimed at increasing resources to schools may not be effective in an environment of high corruption and poor management. In such contexts, policies that enhance transparency and accountability may be more effective in improving school performance.

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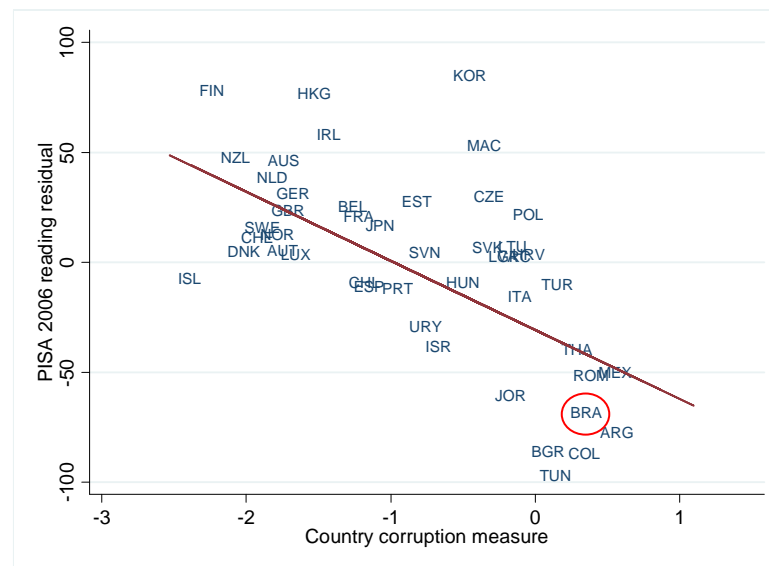
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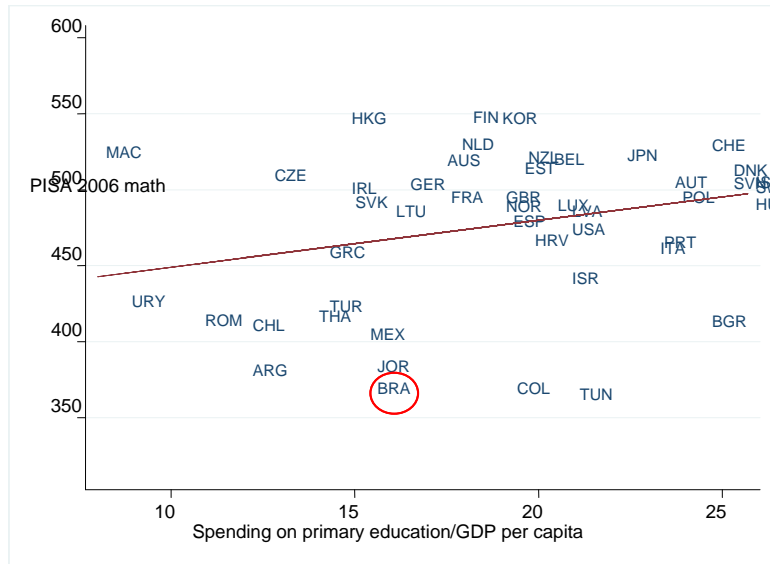
PANEL A: MATH



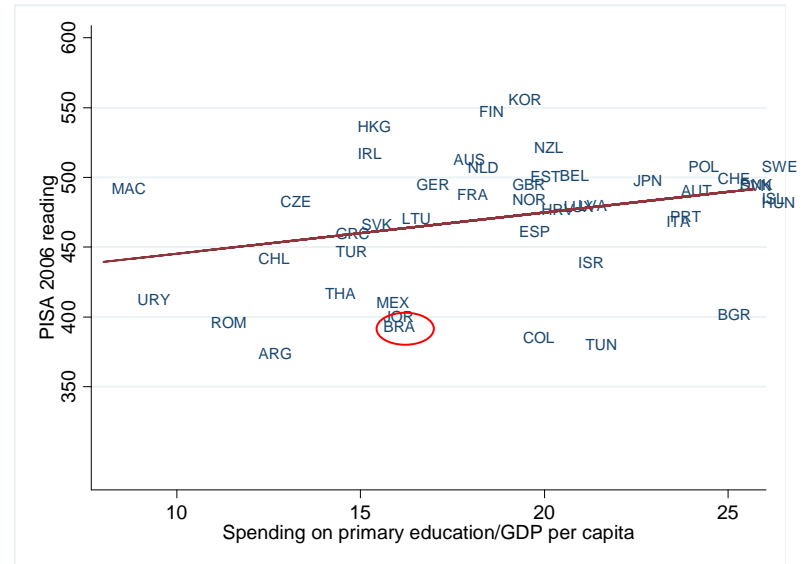
PANEL B: READING

FIGURE 1: TEST SCORES AND CORRUPTION

Notes: The scatter plots in panels A and B depict the relationship between the residuals from a regression of performance on the PISA exams in 2006 on expenditure on primary education per capita as a share of 2005 GDP per capita, and the World Bank corruption index (Kaufmann, Kraay, and Mastruzzi (2005)). The data used for these graphs can be found: <http://www.pisa.oecd.org>.



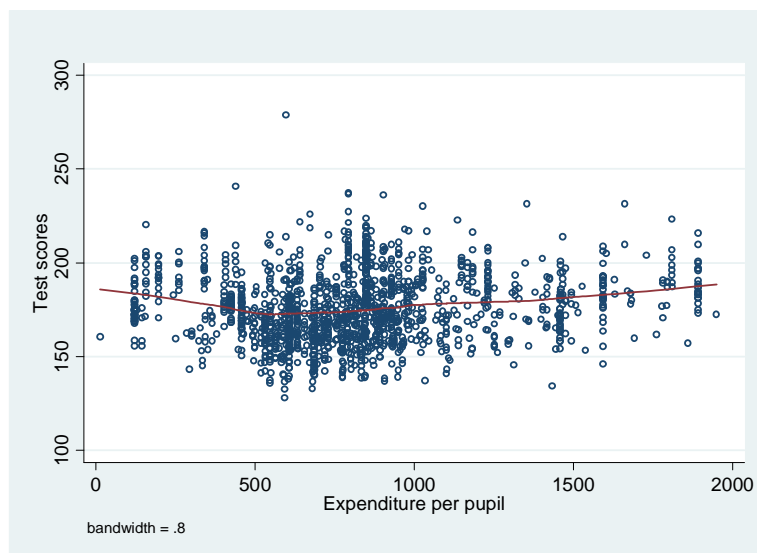
PANEL A: MATH



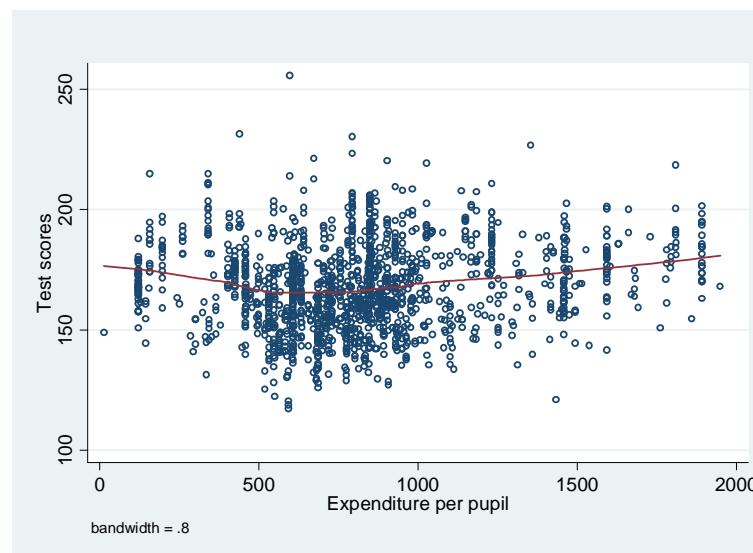
PANEL B

FIGURE 2: TEST SCORES AND SPENDING IN PRIMARY SCHOOL PER PUPIL IN 2005

Notes: The scatter plots in panels A and B depict the relationship between a country's performance on the PISA exams in 2006 and its expenditure on primary education per capita as a share of GDP per capita in 2005. The data used for these graphs can be found: <http://www.pisa.oecd.org>.



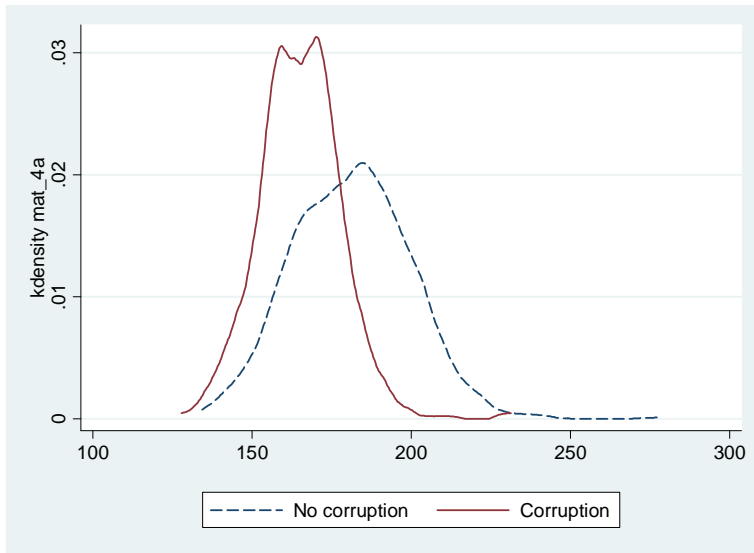
Panel A: Mathematics



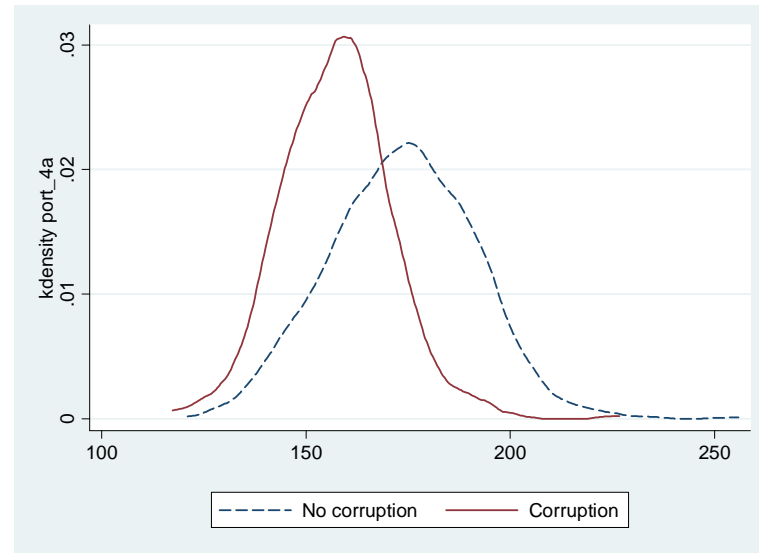
Panel B: Portuguese

FIGURE 3: TEST SCORES AND SPENDING IN PRIMARY SCHOOL PER PUPIL WITHIN BRAZIL

Notes: : The scatter plots in panels A and B depict the relationship between 2005 test scores on a national standardized exam for 4th graders in Brazil and municipal expenditure on primary education per pupil in 2005. The line represents a nonparametric estimate of the relationship, with a bandwidth of 0.8. The data on test scores come from Prova Brasil and the data on expenditures come from Brazil's national treasury. See the data appendix for more details.



Panel A: Mathematics



Panel B: Portuguese

FIGURE 4: DISTRIBUTION OF TEST SCORES FOR MATHEMATICS AND PORTUGUESE BY CORRUPTION

Notes: Panels A and B display kernel densities of 2005 test scores aggregated at the school-level by subject matter. The densities were estimated separately depending on whether the school resided in municipality where corruption was detected in education. The densities were estimated using the Epanechnikov kernel, with an optimally computed bandwidth.

	N	mean	sd	p25	p50	p75
Proportion of municipalities with corruption in education	365	0.35	0.48	0.00	0.00	1.00
Proportion of items in education found to be corrupt	365	0.12	0.25	0.00	0.00	0.15
Proportion of items in education found to be corrupt conditional on some corruption	128	0.35	0.32	0.13	0.25	0.50
Share of resources audited in education that were found to be corrupt	365	0.03	0.12	0.00	0.00	0.01
Share of resources audited in education found to be corrupt conditional on some corruption	128	0.08	0.19	0.00	0.03	0.07
Proportion of municipalities with corruption in some area other than education	365	0.50	0.50	0.00	1.00	1.00
Proportion of items audited found to be associated with mismanagement	365	2.00	1.83	0.75	1.46	2.71
Proportion of municipalities with corruption involving a school feeding program	343	0.15	0.36	0.00	0.00	0.00
Proportion of municipalities with corruption involving teachers and school supplies	305	0.28	0.45	0.00	0.00	1.00
Proportion of municipalities with corruption involving other aspects of education	364	0.03	0.18	0.00	0.00	0.00

TABLE 1: CORRUPTION IN THE EDUCATION SECTOR

Notes: This table reports descriptive statistics on the various measures of corruption. Column 1 reports the sample size. Column 2 reports the mean and column 3 reports the standard deviation. Columns 4-6 report the 25th, 50th, and 75th percentiles of the distribution. The data used to compute these statistics come from the audit reports.

	N	mean	sd	p25	p50	p75
Panel A: Student characteristics						
Standardized exam in Mathematics - 4th grade	1488	175.80	18.25	162.23	174.01	188.22
Standardized exam in Portuguese - 4th grade	1488	168.09	18.07	155.41	167.10	180.15
% males	1488	0.50	0.09	0.45	0.50	0.56
% white	1488	0.31	0.15	0.21	0.29	0.39
% of mothers with a high school degree	1488	0.17	0.09	0.10	0.15	0.21
% of fathers with a high school degree	1488	0.15	0.08	0.09	0.14	0.19
% children that live with both parents	1488	0.61	0.12	0.54	0.62	0.70
Family size	1488	0.26	0.13	0.17	0.24	0.34
% families with a home computer	1488	0.15	0.10	0.08	0.13	0.20
% families with electricity at home	1488	0.92	0.09	0.89	0.94	0.97
% families with running water at home	1488	0.84	0.14	0.79	0.88	0.93
% of children who are 8 years old or younger	1488	0.01	0.02	0.00	0.00	0.02
% of children who are 9 years old	1488	0.05	0.05	0.01	0.04	0.07
% of children who are 10 years old	1488	0.36	0.18	0.22	0.35	0.49
% of children who are 11 years old	1488	0.25	0.10	0.18	0.24	0.31
% of children who are 12 years old	1488	0.12	0.07	0.07	0.11	0.16
Panel B: School Characteristics						
Dropout rates	1488	0.04	0.07	0.00	0.02	0.06
Failure rates	1488	0.10	0.09	0.03	0.09	0.16
% of teachers with a teaching credentials	1488	0.43	0.36	0.05	0.42	0.75
School has a computer lab	1488	0.19	0.39	0.00	0.00	0.00
School has a science lab	1488	0.04	0.19	0.00	0.00	0.00
School has sanitation	1488	0.03	0.17	0.00	0.00	0.00
<i>Director's survey</i>						
Lack of financial resources is a serious concern	1488	0.55	0.50	0.00	1.00	1.00
Lack of schooling supplies is a serious concern	1488	0.40	0.49	0.00	0.00	1.00
Lack of teachers is a serious concern	1488	0.23	0.42	0.00	0.00	0.00
Disciplinary problems is a serious concern	1488	0.63	0.48	0.00	1.00	1.00
Training courses are provided to teachers	1488	0.49	0.50	0.00	0.00	1.00
<i>Teacher's survey</i>						
Lack of financial resources is a serious concern	1488	0.56	0.50	0.00	1.00	1.00
Lack of schooling supplies is a serious concern	1488	0.51	0.50	0.00	1.00	1.00
Lack of teachers is a serious concern	1488	0.26	0.44	0.00	0.00	1.00
Disciplinary problems is a serious concern	1488	0.63	0.48	0.00	1.00	1.00

TABLE 2: SUMMARY STATISTICS

Notes: This table reports descriptive statistics for the variables used in the analysis. Column 1 reports the sample size. Column 2 reports the mean and column 3 reports the standard deviation. Columns 4-6 report the 25th, 50th, and 75th percentiles of the distribution. The variables presented in Panels A and B are computed for the 1488 schools that reside in the 365 municipalities for which information on corruption exists.

	N	mean	sd	p25	p50	p75
<u>Panel C: Municipal Characteristics</u>						
% population urban	365	0.61	0.23	0.44	0.62	0.80
Gini	365	0.57	0.06	0.54	0.57	0.61
GDP per capita	365	8707.74	22821.08	2545.43	4678.03	8544.47
Expenditure in primary school per child	365	942.20	487.67	656.48	856.68	1106.40
Dropout rates among private schools	188	0.01	0.03	0.00	0.00	0.00
Failure rates among private schools	188	0.02	0.04	0.00	0.00	0.02
Election is held for principal	365	0.10	0.30	0.00	0.00	0.00
Average number of state schools that elect its principal	365	0.43	1.25	0.00	0.00	0.00
Average number of state schools in the municipality	365	1.68	3.31	0.00	1.00	2.00
PTA is active in the municipality	365	0.48	0.50	0.00	0.00	1.00
Municipality has a intergovernmental consortium	365	0.26	0.44	0.00	0.00	1.00
Municipality has an education council	365	0.69	0.46	0.00	1.00	1.00
Schools receive support from private sector	365	0.07	0.25	0.00	0.00	0.00
Municipality uses participatory budgeting	365	0.71	0.45	0.00	1.00	1.00
The community helps in the maintenance of the school	365	0.15	0.36	0.00	0.00	0.00
The school participated in an awareness campaign for the community	365	0.41	0.49	0.00	0.00	1.00

TABLE 2: SUMMARY STATISTICS (CONTINUED...)

Notes: This table reports descriptive statistics for the variables used in the analysis. Column 1 reports the sample size. Column 2 reports the mean and column 3 reports the standard deviation. Columns 4-6 report the 25th, 50th, and 75th percentiles of the distribution. The variables presented in Panels A and B are computed for the 1488 schools that reside in the 365 municipalities for which information on corruption exists.

Dependent variable:	Mathematics		Portuguese		Dropout rates		Failure rates	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A:								
Proportion of items with corruption in education	-0.323 [0.069]***	-0.321 [0.073]***	-0.356 [0.068]***	-0.357 [0.072]***	0.021 [0.010]**	0.02 [0.010]**	0.019 [0.006]***	0.017 [0.006]***
R-squared	0.49	0.5	0.55	0.57	0.26	0.29	0.15	0.17
Panel B:								
Share of audited resources with corruption in education	-0.722 [0.372]*	-0.6 [0.352]*	-0.9 [0.413]**	-0.731 [0.388]*	0.048 [0.016]***	0.034 [0.017]*	0.029 [0.023]	0.024 [0.024]
R-squared	0.49	0.49	0.54	0.56	0.26	0.28	0.15	0.16
Panel C:								
Corruption in education	-0.356 [0.076]***	-0.33 [0.078]***	-0.357 [0.070]***	-0.317 [0.074]***	0.029 [0.005]***	0.026 [0.005]***	0.019 [0.008]**	0.019 [0.008]**
R-squared	0.51	0.51	0.56	0.57	0.29	0.31	0.16	0.17
Panel D:								
Low corruption in education	-0.373 [0.074]***	-0.328 [0.079]***	-0.377 [0.083]***	-0.35 [0.085]***	0.028 [0.006]***	0.025 [0.006]***	0.018 [0.009]**	0.019 [0.009]**
High corruption in education	-0.321 [0.122]***	-0.287 [0.131]**	-0.304 [0.115]***	-0.282 [0.120]**	0.03 [0.008]***	0.027 [0.008]***	0.019 [0.010]**	0.018 [0.009]**
R-squared	0.56	0.57	0.51	0.51	0.29	0.31	0.16	0.17
F-test: low corruption = high corruption	0.17	0.09	0.38	0.29	0.02	0.05	0.00	0.01
Student characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipal characteristics	No	Yes	No	Yes	No	Yes	No	Yes

TABLE 3: THE EFFECTS OF CORRUPTION ON SCHOOLING OUTCOMES

Notes: This table reports the effects of corruption on various education outcomes. Each column presents the results of an OLS regression where the dependent variable is listed at the top of each column. For the results reported in Panels A, C, and D, the number of observations is 1488 schools. Whereas, for Panel B, the number of observations is 1479, due to missing values in the amount of resources audited. Student characteristics included proportion of male children, proportion of white children, the schooling of the mother, schooling of the father, the proportion of kids with both parents living at home, family size, proportion of households with a computer, proportion of families with running water, proportion of families with electricity, age dummies. Municipal characteristics included share of population that resides in urban areas, Gini coefficient, GDP per capita in 2004, expenditure per child in primary school. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Dependent variable:	Mathematics	Portuguese	Dropout rates	Failure rates
	(1)	(2)	(3)	(4)
Corruption in education	-0.28 [0.120]**	-0.279 [0.100]***	0.034 [0.011]***	0.027 [0.012]**
Corruption in other sectors	0.023 [0.116]	0.014 [0.096]	0.011 [0.010]	0.012 [0.011]
Student characteristics	Yes	Yes	Yes	Yes
Municipal characteristics	Yes	Yes	Yes	Yes
Number of schools	1251	1251	1251	1251
R-squared	0.48	0.54	0.29	0.17

TABLE 4: THE EFFECTS OF CORRUPTION ON SCHOOLING OUTCOMES CONTROLLING FOR INSTITUTIONAL QUALITY

Notes: This table reports the effects of corruption on various education outcomes. Each column presents the results of an OLS regression where the dependent variable is listed at the top of each column. Our measure of corruption is an indicator for whether corruption was detected in education. Our measure of other corruption is an indicator for whether corruption was detected in sectors other than education. Student characteristics included proportion of male children, proportion of white children, the schooling of the mother, schooling of the father, the proportion of kids with both parents living at home, family size, proportion of households with a computer, proportion of families with running water, proportion of families with electricity, age dummies. Municipal characteristics included share of population that resides in urban areas, Gini coefficient, GDP per capita in 2004, expenditure per child in primary school. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***) , 95 (**), 90 (*) percent confidence.

Dependent variable:	Dropout rates for	Failure rates for				
	private schools	private schools	Mathematics	Portuguese	Dropout rates	Failure rates
	(1)	(2)	(3)	(4)	(5)	(6)
Corruption in education	-0.005 [0.004]	-0.001 [0.005]	-0.308 [0.091]***	-0.28 [0.086]***	0.023 [0.005]***	0.014 [0.008]*
Corruption in education × Municipality has a private school			-0.007 [0.012]	-0.019 [0.015]	0.001 [0.001]	0 [0.002]
Student characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Municipal characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Number of schools	1185	1185	1488	1488	1488	1488
R-squared	0.04	0.01	0.53	0.59	0.31	0.19

TABLE 5: PRIVATE SCHOOLS

Notes: This table reports whether there is a differential effects of corruption in municipalities with a private school. Each column presents the results of an OLS regression where the dependent variable is listed at the top of each column. In columns 1 and 2, the dependent variables are dropout and failure rates of children in private schools. In columns 3-6, the dependent variables are the education outcomes for children attending municipal schools (as in the previous tables). Our measure of corruption is an indicator for whether corruption was detected in education. Student characteristics included proportion of male children, proportion of white children, the schooling of the mother, schooling of the father, the proportion of kids with both parents living at home, family size, proportion of households with a computer, proportion of families with running water, proportion of families with electricity, age dummies. Municipal characteristics included share of population that resides in urban areas, Gini coefficient, GDP per capita in 2004, expenditure per child in primary school. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***) , 95 (**), 90 (*) percent confidence.

	Dependent variable:							
	Mathematics (1)	Portuguese (2)	Dropout rates (3)	Failure rates (4)	Mathematics (5)	Portuguese (6)	Dropout rates (7)	Failure rates (8)
Corruption in education	-0.351 [0.078]***	-0.328 [0.073]***	0.028 [0.005]***	0.017 [0.008]**	-0.325 [0.079]***	-0.312 [0.075]***	0.025 [0.005]***	0.019 [0.008]**
Principal is elected	0.173 [0.090]*	0.115 [0.068]*	0.002 [0.005]	0.004 [0.007]				
Active PTA	0.017 [0.048]	0.057 [0.040]	-0.004 [0.003]	-0.003 [0.005]				
Intergovernment consortium	0.142 [0.084]*	0.152 [0.075]**	-0.006 [0.005]	0.007 [0.008]				
Education council	-0.077 [0.087]	-0.052 [0.074]	0 [0.004]	0.007 [0.007]				
Schools receive support from private sector	-0.141 [0.113]	-0.093 [0.110]	0.004 [0.005]	-0.025 [0.013]*				
Participatory Budgeting	0.004 [0.082]	0.056 [0.076]	0.009 [0.005]*	-0.007 [0.009]				
The community helps in the maintenance of the school					0.099 [0.056]*	0.075 [0.044]*	-0.005 [0.003]	-0.003 [0.006]
The school participated in an awareness campaign for the community					0.021 [0.037]	0.012 [0.037]	-0.002 [0.003]	0.007 [0.005]
Student characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of schools	1488	1488	1488	1488	1488	1488	1488	1488
R-squared	0.52	0.58	0.31	0.18	0.51	0.57	0.31	0.17

TABLE 6: EFFECTS OF CORRUPTION ON SCHOOLING OUTCOMES ACCOUNTING FOR SCHOOL ORGANIZATIONS AND COMMUNITY INVOLVEMENT

Notes: This table reports the effects of corruption on various education outcomes, controlling for the existence and efficacy of school organizations and the degree of community involvement in education. Each column presents the results of an OLS regression where the dependent variable is listed at the top of each column. Our measure of corruption is an indicator for whether corruption was detected in education. Student characteristics included proportion of male children, proportion of white children, the schooling of the mother, schooling of the father, the proportion of kids with both parents living at home, family size, proportion of households with a computer, proportion of families with running water, proportion of families with electricity, age dummies. Municipal characteristics included share of population that resides in urban areas, Gini coefficient, GDP per capita in 2004, expenditure per child in primary school. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Dependent variable:	Mathematics	Portuguese	Dropout rates	Failure rates
	(1)	(2)	(3)	(4)
Corruption in education	-0.304 [0.082]***	-0.289 [0.078]***	0.025 [0.005]***	0.02 [0.008]**
Mismanagement	-0.044 [0.018]***	-0.048 [0.018]***	0.001 [0.001]	-0.003 [0.003]
Student characteristics	Yes	Yes	Yes	Yes
Municipal characteristics	Yes	Yes	Yes	Yes
Number of schools	1486	1486	1486	1486
R-squared	0.52	0.59	0.31	0.19

TABLE 7: EFFECTS OF CORRUPTION ON SCHOOLING OUTCOMES ACCOUNTING FOR MISMANAGEMENT

Notes: This table reports the effects of corruption on various education outcomes, controlling for mismanagement and corruption in other sectors. Each column presents the results of an OLS regression where the dependent variable is listed at the top of each column. Our measure of corruption is an indicator for whether corruption was detected in education. Our measure of mismanagement is the share of audited service items that found to be associated with poor management practices. Student characteristics included proportion of male children, proportion of white children, the schooling of the mother, schooling of the father, the proportion of kids with both parents living at home, family size, proportion of households with a computer, proportion of families with running water, proportion of families with electricity, age dummies. Municipal characteristics included share of population that resides in urban areas, Gini coefficient, GDP per capita in 2004, expenditure per child in primary school. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Dependent variable:	Percentage of teachers with a teaching credential (1)	Proportion of schools with a computer lab (2)	Proportion of schools with a science lab (3)	Proportion of school with sanitation (3)
Corruption in education	-0.107 [0.061]*	-0.068 [0.027]**	-0.02 [0.009]**	-0.003 [0.016]
Student characteristics	Yes	Yes	Yes	Yes
Municipal characteristics	No	Yes	No	No
Number of schools	1488	1488	1488	1488
R-squared	0.25	0.13	0.08	0.02

TABLE 8: THE EFFECTS OF CORRUPTION ON SCHOOLING INPUTS

Notes: This table reports the effects of corruption on various schooling inputs. Each column presents the results of an OLS regression where the dependent variable is listed at the top of each column. Our measure of corruption is an indicator for whether corruption was detected in education. Student characteristics included proportion of male children, proportion of white children, the schooling of the mother, schooling of the father, the proportion of kids with both parents living at home, family size, proportion of households with a computer, proportion of families with running water, proportion of families with electricity, age dummies. Municipal characteristics included share of population that resides in urban areas, Gini coefficient, GDP per capita in 2004, expenditure per child in primary school. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***) , 95 (**), 90 (*) percent confidence.

Survey respondent:	Teacher				Principal				
	Insufficient resources (1)	Insufficient teaching supplies (2)	Lack of teachers (3)	Disciplinary problems among students (4)	Insufficient resources (5)	Insufficient teaching supplies (6)	Lack of teachers (7)	Disciplinary problems among students (8)	Provided teacher training (9)
Corruption in education	0.08 [0.037]**	0.075 [0.031]**	0.002 [0.033]	0.012 [0.028]	0.051 [0.033]	0.114 [0.034]***	-0.009 [0.030]	-0.03 [0.030]	-0.113 [0.045]**
Student characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of schools	1488	1488	1488	1488	1488	1488	1488	1488	1488
R-squared	0.02	0.05	0.03	0.01	0.05	0.08	0.02	0.02	0.03

TABLE 9: PROBLEMS THAT SCHOOLS FACE BASED ON TEACHER AND PRINCIPAL SURVEYS

Notes: Each column presents the results of an OLS regression where the dependent variable is listed at the top of each column. Our measure of corruption is an indicator for whether corruption was detected in education. In columns 1-4, the data come from a survey conducted with a teacher. In columns 5-9, the data come from a survey conducted with the principal. Student characteristics included proportion of male children, proportion of white children, the schooling of the mother, schooling of the father, the proportion of kids with both parents living at home, family size, proportion of households with a computer, proportion of families with running water, proportion of families with electricity, age dummies. Municipal characteristics included share of population that resides in urban areas, Gini coefficient, GDP per capita in 2004, expenditure per child in primary school. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***) , 95 (**), 90 (*) percent confidence.

Dependent variable:	Mathematics (1)	Portuguese (2)	Dropout rates (3)	Failure rates (4)
Corruption involving a school feeding program	-0.163 [0.116]	-0.125 [0.117]	0.01 [0.009]	0.007 [0.011]
Corruption involving teachers and schooling inputs	-0.186 [0.092]**	-0.171 [0.090]*	0.02 [0.006]***	0.01 [0.010]
Corruption involving other aspects of education	-0.272 [0.226]	-0.305 [0.186]	0.006 [0.012]	0.024 [0.016]
Student characteristics	Yes	Yes	Yes	Yes
Municipal characteristics	Yes	Yes	Yes	Yes
Number of schools	1230	1230	1230	1230
R-squared	0.49	0.56	0.3	0.15

TABLE 10: THE EFFECTS OF CORRUPTION BY TYPE OF IRREGULARITY

Notes: Each column presents the results of an OLS regression where the dependent variable is listed at the top of each column. Corruption involving a school feeding program is an indicator for whether corruption was detected in a school feeding program. Corruption involving teachers and schooling inputs is an indicator for whether corruption was detected in delivery of school supplies or teachers' salaries. Corruption involving other aspects of education is an indicator for whether corruption was detected in an area of education other than school feeding or schooling inputs. Student characteristics included proportion of male children, proportion of white children, the schooling of the mother, schooling of the father, the proportion of kids with both parents living at home, family size, proportion of households with a computer, proportion of families with running water, proportion of families with electricity, age dummies. Municipal characteristics included share of population that resides in urban areas, Gini coefficient, GDP per capita in 2004, expenditure per child in primary school. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***) , 95 (**), 90 (*) percent confidence.

Dependent variable:	Corruption in education	Corruption in other sectors
	(1)	(4)
<u>Panel A: OLS</u>		
Principal is elected	-0.169 [0.066]**	0.019 [0.086]
<u>Panel B: IV</u>		
Principal is elected	-0.835 [0.437]*	0.403 [0.438]
Municipal characteristics	Yes	Yes
Number of observation	365	365
F-test on excluded instrument	13.9	13.9

TABLE 11: THE EFFECTS OF PRINCIPAL ELECTIONS ON CORRUPTION IN EDUCATION

Notes: In Panel A, each column presents the results of an OLS regression estimated at the level of the municipality where the dependent variable is listed at the top of each column. Panel B presents IV estimates, where the excluded instrument is the number of state schools with elected principals. Principal is elected is an indicator for whether the principal of the municipal school is elected. Municipal characteristics included share of population that resides in urban areas, Gini coefficient, GDP per capita in 2004, expenditure per child in primary school. Robust standard errors are displayed in brackets. Significantly different than zero at 99 (***) , 95 (**), 90 (*) percent confidence.

Dependent variable:	Mathematics (1)	Portuguese (2)	Dropout rates (3)	Failure rates (4)
<u>Panel A: Propensity score</u>				
Corruption in education	-0.332 [0.101]***	-0.331 [0.095]***	0.019 [0.007]**	0.017 [0.010]*
<u>Panel B: Propensity score matching</u>				
Corruption in education	-0.592 [0.103]***	-0.588 [0.112]***	0.019 [0.006]***	0.018 [0.012]
Number of schools	1449	1449	1449	1449

TABLE A1: THE EFFECTS OF CORRUPTION ON SCHOOLING OUTCOMES USING PROPENSITY SCORE MATCHING

Notes: This table reports the effects of corruption on various educational outcomes. Each column in Panel A presents the results of an OLS regression where the dependent variable is listed at the top of each column, whereas Panel B presents estimates from the Abadie and Imbens (2004) matching estimator. Our measure of corruption is an indicator for whether corruption was detected in education. The propensity score is estimated from a logit regression based on a 3rd order polynomial approximation of the student and municipal characteristics. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***) , 95 (**), 90 (*) percent confidence. The sample has been restricted to areas of common support based on the estimated propensity score.

Dependent variable:	Unadjusted difference (1)	Propensity-score adjusted difference (2)
Share of male students	-0.001 [0.005]	0.004 [0.007]
Share of white students	-0.072 [0.015]***	-0.01 [0.020]
Share of mothers with a high school degree	-0.026 [0.008]***	0 [0.009]
Share of fathers with a high school degree	-0.028 [0.009]***	-0.003 [0.009]
Both parents reside in the household	-0.024 [0.013]*	0.011 [0.012]
Household size	0.094 [0.014]***	0.026 [0.013]*
Proportion of households with electricity	-0.021 [0.008]***	0.004 [0.009]
Proportion of households with running water	-0.052 [0.013]***	-0.005 [0.015]
Age 3	-0.079 [0.023]***	0 [0.022]
Age 4	0.002 [0.012]	-0.007 [0.015]
Age 5	0.031 [0.006]***	0.01 [0.009]
Gini coefficient	0.023 [0.006]***	-0.001 [0.009]
Per capita income	-3,510.11 [785.241]***	-1,385.72 [993.955]
Share of expenditures in education per child	-0.153 [0.062]**	-0.116 [0.107]

TABLE A2: DIFFERENCE IN MEANS BEFORE AND AFTER ADJUSTING FOR THE PROPENSITY SCORE

Notes: This table reports differences in student and municipal characteristics between municipalities where corruption in education was detected and those where corruption in education was not detected. Column 1 reports the unadjusted differences, whereas column 2 reports the differences conditional on the propensity score. The propensity score is estimated from a logit regression based on a 3rd order polynomial approximation of the student and municipal characteristics. Robust standard errors clustered at the municipality are displayed in brackets. Significantly different than zero at 99 (***) , 95 (**), 90 (*) percent confidence. The sample has been restricted to areas of common support based on the estimated propensity score.

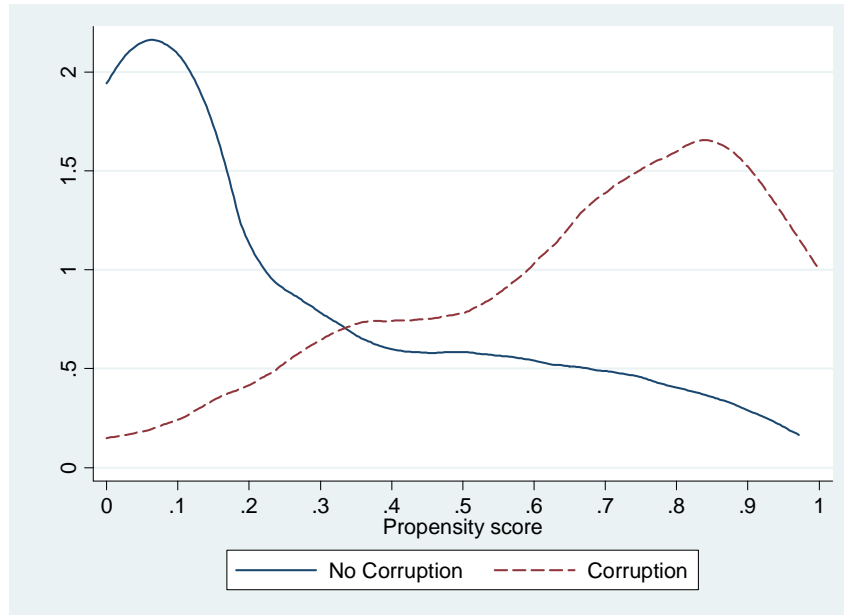


FIGURE A1: OVERLAP IN THE DISTRIBUTION OF THE ESTIMATED PROPENSITY OF BEING CORRUPT

Notes: Figure A1 displays the distribution of the propensity score for detecting corruption in education. The propensity score is estimated from a logit regression based on a 3rd order polynomial approximation of the student and municipal characteristics. The densities were estimated using the Epanechnikov kernel, with an optimally computed bandwidth.

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