DO GOVERNMENT AUDITS AFFECT THE OFFER OF SCHOOL TRANSPORTATION IN BRAZILIAN MUNICIPALITIES?

Ana Carolina de Araújo Cavalcanti Lins

Programa de Pós-graduação em administração e desenvolvimento rural (PADR)

Universidade Federal Rural de Pernambuco

Gisléia Benini Duarte

Departamento de Economia, Universidade Federal Rural de Pernambuco

ABSTRACT: This study examined the relationship between government audits in Brazil and municipal per capita spending on school transportation. The random selection of the audited municipalities allowed the identification of a control group that adequately represented the counterfactual of the treated group. As a result, we did not identify a relationship between the audited municipalities and an increase or decrease in student transportation expenses. Given the supplementary tests performed, the robustness of the estimates was assured, indicating that there is no empirical support for the existence of the investigated effects.

Keywords: Audit; Randomization; School transportation.

Submission area: 10 – Regional and urban economics

JEL Classification: D73; D78; H52; I28.

RESUMO: Este estudo examina a relação entre a auditoria governamental no Brasil e os gastos per capita municipais com o transporte escolar. Como os municípios auditados foram selecionados aleatoriamente, isso permitiu a identificação de um grupo de controle que representou adequadamente o contrafatual do grupo de tratados. Como resultado, não identificamos relação entre os municípios auditados e aumento ou redução dos gastos por aluno com transporte escolar. Diante dos testes suplementares realizados, a robustez das estimativas foi assegurada, indicando que não há suporte empírico para a observação dos efeitos buscados.

Palavras-Chave: Auditoria; Aleatorização; Transporte escolar.

Área de submissão: Área 10 – Economia Regional e Urbana

Classificação JEL: D73; D78; H52; I28.

1. INTRODUCTION

Brazil, as a developing country, faces extremely diverse challenges to advancing and prospering in terms of economic growth, human development, and institution building. The importance of education in the development of countries is very clear and recognized by researchers, governments, and organizations worldwide. It is a known fact that education is the path to economic prosperity, the key to scientific and technological advances, and the basis for social equity. In this context, efforts to improve the quality of schools have been underway for some time in many countries,

with increasing resources being allocated for the purpose; also, many developing countries have made great progress in increasing the number of children and youth attending schools (GANIMIAN AND MURNANE, 2014).

In the Brazilian scenario, the importance of education is embodied in the right of access to a free public-school system guaranteed in the country's Constitution. However, given the differences in the ability to access schools, the Brazilian government acknowledged that simply offering public schools to the population was not sufficient to ensure that the children and youth could get to or would stay in school (FEIJÓ, 2006). Therefore, actions and programs meant to overcome these problems were put into practice.

Emphasizing the need for students to get to school, the Ministry of Education maintains programs to support school transportation, which are the School Pathway (Caminho da escola) and the National School Transportation Support Program (PNATE). The programs' overall goals are to provide safe, quality school transportation, aiming to bolster student success and diminish dropout rates (BRASIL, 2004). More specifically, the School Pathway has as its main objectives the renewal and standardization of the vehicle fleet offered by the public schools of the federative entities. The PNATE, on the other hand, automatically transfers financial resources to the school transportation programs to cover their expenses related to the provision of school transportation for rural students.

Studies on this theme have reinforced that the availability of school transportation can affect students' school attendance, in the sense that students who use school transportation tend to attend more frequently throughout the school year. Ensuring a more student-friendly environment in the schools has benefits for learning, as higher school attendance is associated with better academic performance (GOTTFRIED, 2010; VICENT ET AL., 2014; GOTTFRIED, 2017; STEIN AND GRIGG, 2019). The PNATE[1] data for public schools as a whole showed that in 2004, the year the policy was instituted, a total of 3.219,975 students benefited from the program. In 2014, the number of students served had increased to 4,547,690, which represents an increase of approximately 41% over a 10-year period. Given that PNATE is a program that disburses financial resources from the Union, its administration is subject to inspection by control agencies. Monitoring the use of the resources allocated to this program is important to prevent irregularities from occurring. In this context, Olivieri et al. (2018) highlighted problems associated with the management of school transportation-supply programs such as irregularities in vehicle and fuel purchases and in bidding for transportation services, unsafe vehicles, and overcrowding.

Faced with a scenario in which the misuse of public resources is considered to be one of the main causes of inefficiency in the provision and performance of public programs, the Brazilian government created the random-audit program to monitor the public resources being passed from the Union to the other entities. This measure is part of CGU's tools that aim to ensure the correct application of resources to benefit the population, to inhibit and combat corruption, and to foster social control. Since its creation in 2003, about 2,500 Brazilian municipalities have had their accounts audited (CGU, 2019).

Many studies have examined the effects of monitoring programs and recognized that such actions are effective in reducing the irregularities associated with corruption and the mismanagement of public resources (LITSCHIG AND ZAMBONI, 2014;

AVIS, FERRAZ AND FINAN, 2016; BOBONIS ET AL., 2016). Most studies using the reports issued by the CGU have emphasized the issue of corruption, associating the occurrence of irregularities with variables such as electoral results and the behavior of politicians (FERRAZ AND FINAN, 2008; FERRAZ AND FINAN, 2011), educational performance (FERRAZ, FINAN AND MOREIRA, 2012), and the quality of public health services (LICHAND ET AL., 2017). However, while these studies have helped quantify the direct effects of monitoring the use of public resources, there is still little debate about the indirect effects on the quality of public services management that occur from the impact of monitoring. Cavalcanti and Ramos (2018) and Duarte et al. (2018) have made advances in this direction by assessing the effects of CGU inspections on the provision of school meals and the incidence of dengue cases, respectively. In general, these studies suggest that when federal resources aremonitored, irregular practices decrease, and it causes indirect effects in government programs.

Despite the relevance of programs such as PNATE to public education and the efforts of the public administrators to ensure that all resources are used as intended, empirical research on school transportation is incipient and mostly based on qualitative methodologies or descriptive data analysis that focuses on its impact on student performance, as in Luz (2006) and Martins (2010). Another issue that still has not been resolved by research concerns the indirect effects that enforcement actions can trigger in the government programs. In that sence, we proposed to perform a quantitative analysis of the effects of the inspections by the CGU's Office on variables related with school transportation.

Thus, the objective of our analysis was to evaluate the effects of the CGU audits on two variables of interest: i) the number of students who study in public schools and use the school transportation; and ii) the public expenses associated with the provision of school transportation. Given the randomness guaranteed by the municipal selection method, it was possible to objectively define balanced treatment and control groups in terms of observable and unobservable characteristics. In addition, the availability of data for the period 2014-2017 allowed us to use the difference-in-differences method to estimate the effects we sought to assess.

In general, we did not find any statistically significant effects for the variables of interest. We performed further analyses to ensure the robustness of our estimates and found that, in fact, there was no empirical support for the effects investigated. However, the current discussion in the literature corroborate these findings, highlighting that the indirect effects of inspections could hardly be captured in short analysis periods, as they are not immediately apparent, as shown by Cavalcanti and Ramos (2018). Lastly, this work is divided as follows: section 2 presents the background of school transportation in Brazil, the CGU Inspection Program, and what has been reported in the literature about the effects of monitoring programs. In section 3 we deal with the proposed empirical approach and present the data. Finally, we present the results and a discussion.

2. BACKGROUND

2.1 School transportation

Due to its recognized importance in a successful public school system, the provision of transportation is one of the responsibilities that the State is expected to fulfill, with respect to educating children, along with food, health care, and educational materials. Gottfried (2017), when analyzing the role of school buses in reducing students' absences from school, found that kindergarten students who went to school

using school transportation had fewer days of absence during the school year than students using other transportation options.

Stein and Grigg (2019) examined whether school attendance could be affected by the transportation options available to students, since school attendance is a component of success in school. The results suggested that the unavailability of transportation may result in students being absent from school, affecting their learning opportunities. In this vein, Gottfried (2010) evaluated the hypothesis that the number of days students are present at school affects their learning outcomes. The results indicated a positive and statistically significant relationship between school attendance and academic performance.

In a study about school transportation conducted in the United States by Vicent et al. (2014), it was stated that transportation plays an important role in providing educational opportunities. This is because when adequate school transportation is not available, families may not have ways to cover the cost of transporting their children; then the children may not be able to attend the best school because they don't have a way to get there. In the Brazilian context, Luz (2016) found a positive effect between the provision of school transportation and school performance, and argued that this may be due to a reduction in the time spent commuting to school. In addition, the author emphasized that transportation provides access to school for students who live far away and who would otherwise not be able to get there at all.

Given the positive effects that the provision of school transportation can have on access to education and success in school, the importance of the government's actions in this regard is demonstrated. In Brazil, the National School Transportation Support Program (PNATE) is among the main federal actions in the area of basic education. Its creation took into consideration that the provision of school transportation can facilitate students' access to and continuance in the school environment, and may contribute to the reduction of grade repetitions and dropout rates. The Program is among the responsibilities of the National Fund for the Development of Education (FNDE), and financial support is sent (through automatic transfers) to the states, Federal District, and municipalities.

In general terms, the financial resources are transferred to fund the provision of school transportation for rural public-education students and should be used exclusively to pay the transportation costs of the students. The distribution of PNATE resources is supervised through audits, inspections, and process analyses. In addition, upon finding irregularities in accountability or a use of resources in disagreement with the PNATE implementation criteria, the FNDE may suspend the transfer of resources. As Finan, Olken, and Pande (2015) elucidated, the importance of supervising program activities lies in the fact that monitoring can improve program performance through effects in different dimensions.

2.2 The Federal Inspections of Controladoria Geral da União (CGU) – the random-audit program

The random-audit program is a initiative of the Brazilian Government that was implemented with the objective of inhibiting corruption among the managers in all public-administration spheres and fostering social control, considering the need to give greater transparency and visibility in government management to ensure the correct application of public resources.

When the Program was created in April 2003, it established a public lottery as the mechanism for selecting the municipal units that would be subject to inspection. The lotteries were held monthly at the *Caixa Econômica Federal*, and, in order to ensure the fairness and transparency of the process, representatives of the press, political parties, and other citizens were invited. In addition, the comprehensiveness of the inspection was in accordance with the size of the population of the municipality.

To inspect a municipality, the CGU first collects information about the federal funds transferred to the local government for the period to be monitored. A group of auditors is then sent there to examine bills, documents, public works, and the offer of public services. The definition of the accounts and actions to be monitored is based on the criteria of their relevance, criticality, and materiality to government programs. Following the inspections, the auditors send a report containing detailed descriptions of irregularities to the CGU central unit, Tribunal de Contas da União (TCU), public prosecutors, and municipal lawmakers. In addition, the results for each audited municipality are published on the Internet and posted on the CGU website.

In the inspection cycles carried out in 2016, three actions were denoted to be supervised in all selected entities, and among then was the National School Transportation Support Program (PNATE). The inspections of the school-transportation program were mandatory because of the high priority placed on protecting education resources, as proposed by a working group composed of the Ministry of Education, CGU, Ministry of Justice, and Federal Police (CGU, 2019).

2.3 The effects of the enforcement actions

A large number of studies have examined the effects of inspections on several variables, and have recognized their effectiveness at reducing irregularities in the use of public resources. Bobonis et al. (2016) conducted a study that measured the effect of timely (pre-election) audits on the levels of short- and long-term corruption in municipalities in Puerto Rico, finding that such audits lead to a significant reduction in the short term. However, they also found that the corruption-reducing effect is not sustained in the long run. Opposites results were found by Avis, Ferraz, and Finan (2016) in a study that analyzed to what extent programs that monitor the transfer of public resources from the federal government to local governments are effective in reducing future corruption. They found out that having been audited in the past reduces the level of future corruption, suggesting that the program's effects on corruption persist over the long term. Lichand et al. (2017) estimated the impact of the CGU audit program on incidences of corruption in the use of health resources. The results showed that the program was successful in reducing the incidences of corruption. Similarly, Zamboni, and Litschig (2014), tested whether the increased risk of being audited would discourage the misappropriation of funds earmarked for the procurement and delivery of public services in Brazil. Their results suggested that a temporary increase in the risk of being audited reduced the proportion of acquisitions with evidence of corruption and the share of audited resources involved in corruption.

However, the effects of the monitoring programs go beyond corruption and can be observed in different scenarios. In the electoral context, studies have found that mayors with a reelection incentive are significantly less corrupt than those who do not, and also found that there is an increase in electoral accountability due to reelection incentives and the ability of voters to punish dishonest candidates (FERRAZ AND FINAN, 2008; FERRAZ AND FINAN 2011; BOBONIS ET AL, 2016). In the

educational context, studies have found a negative association between corruption and the academic performance of the students and also found that an anti-corruption campaign can have a positive effect on educational indicators, such as the number of students enrolled in schools (FERRAZ, FINAN AND MOREIRA, 2012; REINIKKA AND SVENSSON, 2005).

The studies cited above have shown advances in quantifying the effects of enforcement on levels of corruption or on variables of interest that are directly related to it. However, there is still a little debate about the indirect effects that can be triggered by monitoring programs on the use of public resources. If, as reported in the literature, the stronger presence of enforcement actions inhibits irregularities and encourages good public management practices, the effect likely occurs similarly to what Baicker and Staiger (2004) have found. They analyzed that additional resources made available to hospitals, when not diverted, were found to be associated with significant declines in child mortality and death resulting from heart attacks. The results suggested that these improvements were due to better hospital care provided by the correct allocation of resources.

Cavalcanti and Ramos (2018) evaluated the impact of CGU audits on the provision of school meals for children and teenagers enrolled in public schools in Brazilian municipalities. The results showed that the audits have a positive effect on the provision of school lunches, suggesting the existence of a spreading mechanism that acts through the indirect effect of irregular mitigation measures for promoting good public program management practices. Duarte et al. (2018) examined the relationship between the audits performed by the CGU and the incidence of dengue cases in Brazilian municipalities. In the results it was possible to identify a negative effect on the cases of dengue by the program. However, when testing with a lagged model, it was observed that the initial impact of the lottery did not persist throughout the inspection year. Overall, the results suggested that when federal resources are monitored, municipalities tend to reduce irregularities, which may have contributed to the reduction in the number of dengue cases.

In view of the above, it is clear that CGU's audit program shows the State's commitment to strengthen the monitoring of federal resources transferred to other entities, and supports its goals of improving the performance of government programs and the supply of public services. That said, the present study proposes to analyze the effects of the audits performed by CGU on the number of students using school transportation and on the public expenses associated with it. The effect we expect to see is that the enforcement actions will result indirectly in more efficient spending and more students provided with school transportation. In the following section, we explain how the analysis was performed.

3. METHOD

3.1 Empirical strategy

The main objective of our analysis was to evaluate the effects of CGU audits on two distinct variables of interest: i) the proportion of students in public schools who use school transportation; and ii) the public expenses, per student, associated with the provision of school transportation. We chose to measure the response variables proportionally to smooth out effects from differences in the sizes of schools and municipalities. To do this, we divided both variables by the total number of students enrolled in each school.

The units observed for analysis were the municipalities classified as selectable in the third cycle of CGU inspections. Given the randomness guaranteed by the Controladoria's process of selection by drawing for the municipalities to be audited, it was possible to divide the observation units into two groups clearly and objectively: the treated units were the municipalities that were selectable and were drawn/audited; and the control group was composed of those municipalities that were selectable but not drawn/audited. Thus, the sample consisted of a total of [1],520 municipalities, of which 70 were drawn; however, only the 67 that were actually audited belong to the treated group. The analysis covered the 4-year period between 2014 and 2017.

For methodological purposes, the period was divided and classified as follows: since 2014 and 2015 were prior to the occurrence of the third inspection cycle, they correspond to the pre-intervention period. The post-intervention period includes 2016 and 2017. The reason for 2016 being considered as post-treatment could be questioned, since the lottery took place in May 2016 and the audits between July and September of the same year. However, as shown by Lichand et al. (2017), the mere expectation of being audited by being within the candidate group generates an announcement effect that is anticipatory and able to influence the behavior of managers even before the lottery takes place. In addition, as the periodicity of the available data is annual, it was not possible to make an accurate division within 2016 between pre-intervention, lottery, and post-intervention. Finally, it was not possible to expand the deadline beyond 2017, as another lottery took place that year, so that no data was available to extend the analysis period using the same methodology.

3.2 The data and descriptive statistics

For the analysis, we used information from five distinct databases, namely: the School Census, Demographic Census, Municipal Gross Domestic Product, RAIS and MEC Panel Control. The data are published annually and, as previously explained, include the municipal information for the period 2014-2017.

The School Census data contains very diverse information pertinent to schools, students, and teachers. Given the availability of disaggregated microdata in this database, we obtained information about the number of students in municipal public schools that use school transportation, teachers' schooling, and characteristics associated with school infrastructures such as Internet access and the presence of computer labs. More educational information is provided by the MEC Panel Control, in which we selected the data on the transfers made on behalf of the National School Support Transportation Program, which we used as representative of the expenses associated with the provision of school transportation.

The IBGE survey of Municipalities' Gross Domestic Product offers the value of the GDP and Gross Added Value (GAV) for all Brazilian municipalities on an annual basis (with 2010 values as the reference). The RAIS database offers records regarding formal employment, with information on companies and employees, such as the number and characteristics of the workers and sector of the firm, among others. We used RAIS to calculate the number of formal bonds in the municipalities. The variables selected from these databases integrated our data set as observable characteristics of the municipalities. Thus, together with the characteristics associated with school infrastructures, they were included in our analysis as control variables.

In order to verify if the treated and untreated groups were balanced, that is, if they had similarities in terms of observable and unobservable characteristics, we

performed a mean difference test on the main socioeconomic indicators of the sample municipalities in 2016. All of the variables were divided by the size of the municipality's population (as presented in the 2010 Population Census) so that they could be tested in per capita terms, to smooth out differences based on the sizes of the municipalities. The results are shown in Table I.

Table I Descriptive statistics for the socioeconomic variables of the treated and untreated municipalities, 2016

Variables	Untreated municipalities, average	Treated municipalities, average	Difference
GDP (*per capita*)	23.546	28.693	-5.147
GAV for farming (*per capita*)	3.892	2.750	1.142
Declared formal jobs (*per capita*)	0.154	0.173	-0.019
Number of teachers in the municipality with higher-education degree (*per capita*)	0.021	0.018	0.003
Demographic density *	247.890	449.776	-201.886
N	1451	67	

Sources: Authors' analysis: Gross Domestic Product of Municipalities – IBGE; 2010 Population Census – IBGE; RAIS; School Census – INEP.

Note: * The variable "Demographic Density" was obtained from the 2010 Census, so it is not from 2016.

The tests performed showed no statistically significant differences between the means of the treatment and control groups for the selected variables. This fact gives strong evidence for the randomness of the lotteries, so that the groups are balanced in terms of the observable and unobservable characteristics. However, still seeking to ensure the absence of selection and balancing bias between the sample groups, we performed mean difference tests for the two variables of interest for the entire analysis period. The results are shown in Table II. Neither did these tests produce statistically significant differences in the group means, suggesting that there is no selection bias in the audited municipalities.

Table II Descriptive statistics for the variables of interest of the treated and untreated municipalities

	Proportion of students using school transportation			Per capita public expenditure associated with the supply of school transportation		
	Untreated municipalities average	Treated municipalities average	Difference	Untreated municipalities average	Treated municipalities average	Difference
Pre-inspection						
2014	0.318	0.304	0.014	121.232	119.126	2.106
2015	0.320	0.306	0.014	40.516	38.245	2.271
N	1,451	67		1,451	67	
Post-inspection						

2016	0.317	0.285	0.032	132.630	132.406	0.224
2017	0.323	0.300	0.023	156.454	156.076	0.379
N	1,451	67		1,451	67	

Source: Authors' analysis: School Census – INEP; SIMEC – MEC Panel Control.

3.3 Model specifications

First, we analyzed the difference in the proportion of students using municipal public school transportation between the municipalities that were drawn and supervised by the CGU and those that were not. We then changed the variable of interest and analyzed the difference in the public expenditure per student associated with the provision of school transportation for the same municipalities as in the initial analysis. For this, we initially used the basic specification of the difference-in-differences method, performing the following regression on Y_{kt} where *k* is the municipality and *t* is the year:

$$Y_{kt} = \propto + \gamma Treatment_k + \lambda P_t + \beta(P_t . Treatment_k) + \varepsilon_{kt} \quad (1)$$

At first, Y_{kt} is the proportion of students using school transportation, and secondly the public expenditure per student for school transportation. $Treatment_k$ is a dummy variable that assumes the value 1 if the municipality is drawn and inspected by the CGU or 0 otherwise. Thus, the parameter γ captures the fixed effect of possible differences between the treatment and control groups. P_t is a dummy variable that assumes the value 1 only in the period after the municipalities are drawn. The parameter λ captures the fixed effect of time or factors that could cause changes in *Y* even if it is not supervised. The parameter of interest in our analysis, β, is multiplied by a variable created from the interaction between $treatment_k$ and P_t. This interaction variable is a dummy that has the value of 1 only after the lottery, if the municipality is drawn. Thus, the β estimate can capture the effects of CGU audits on our variables of interest. Finally, ε_{kt} is the error term.

Such specification was possible given the availability of data for two time periods and the possibility to objectively identify two groups. The first period was classified as pre-intervention and covered the years 2014 and 2015. At first we considered that no municipality had been exposed to the intervention, that is, no municipality in the sample had been drawn and inspected by the CGU. The second period was classified as post-intervention and included the years 2016 and 2017. During this period, some municipalities in the sample had been selected to have their accounts audited by the CGU (composing the treatment group) and some not (forming the control group). In general, the groups were observed before and after the intervention.

The "diff-in-diff" method ensures that if, in the absence of treatment, the treatment and control groups follow a trend of parallel paths over time (the premise of parallel trends), then the average effect of treatment on the treated units can be estimated by comparing the mean change experienced by the treatment group and that experienced by the control group. Thus, bias associated with time trends that are unrelated to intervention are removed (BERTRAND ET AL., 2002; ATHEY AND IMBENS, 2006).

In our analysis, the identification of a control group that adequately represented the counterfactual of the treated group was made possible by the randomized selection mechanism for the audited municipalities. When randomization is well implemented, it becomes possible to find a comparison group that presents, as closely as possible, what would have happened to the group exposed to the intervention if it had not occurred (DUFLO ET AL., 2007). In addition, problems associated with selection bias, which could arise from a potential correlation between the interaction variable (P_t *xtreatment*$_k$) and the error term (ε_{kt}), were also reduced due to randomization, as this mechanism ensures that the treatment and control groups are balanced in terms of observable and unobservable characteristics.

Thus, the addition of control variables to the model would be unnecessary, since the randomizing mechanism used in the selection of the municipalities was well implemented (so that the groups are balanced and the absence of selection bias assured, as shown in the tests). However, in order to provide a more sensitive analysis, we have included in the model proposed in Eq.1 a vector $\bar{X}$ of observable characteristics from the school infrastructure and the socioeconomic structures of the municipalities, to observe how the estimates behave. Thus, for any Y_{kt} result, for municipality k in year t, we estimate the following regression:

$$Y_{kt} = \propto + \gamma treatment_k + \lambda P_t + \beta(P_t . treatment_k) + \delta \bar{X}_j + \varepsilon_{kt} \quad (2)$$

in which the characteristic vector $\bar{X}_j$ contains information on the number of schools that have internet access and a computer lab, teachers with higher-education degrees, GDP *per capita*, Farming Gross Added Value *per capita*, and number of formal jobs *per capita*. Still seeking to provide a more sensitive and robust analysis, we conducted additional analyses to show how our results would behave with changes in the basic specification and functional form. The proposed tests are presented in the following section.

3.4 Supplementary tests

Initially, we studied the event to observe the presence of anticipatory and post-intervention effects, so we replicated the model proposed in Eq.1 with the addition of leads and lags, in order to verify if the intervention actually occurred before its effect, as proposed by the Granger causality test (ANGRIST E PISCHKE, 2008). With this approach, it is possible to verify if there was any coincident change prior to the lottery for CGU's inspections that could have some confounding effect on our estimates. The proposed test is shown formally in equation 3:

$$Y_{kt} = \propto + \gamma treatment_k + \lambda year14 + \mu year15 + \rho year17 + \beta_{-2}(year14. treatment)_{kt} + \beta_{-1}(year15. treatment)_{kt} + \beta_1(year17. treatment)_{kt} + \mu_{kt} \quad (3)$$

where Y_{kt} is, at first, the proportion of students using school transportation and, at a second moment, the public expenditure per student for school transportation, as in Eq.1. The γ parameter captures the fixed effects of municipalities in the treatment and control groups. Unlike what we proposed in Eq.1, the weather effect here is included with a dummy for each year. To capture the effects of the CGU audits in the pre and post-treatment periods, we created an interaction variable similar to the previous one. However, the interaction was performed between dummies specific to each year and the

variable "treatment." Therefore, the parameters β_{-2} and β_{-1} capture the effects of CGU supervision before it happens in 2014 and 2015 respectively. That is, they capture the possible presence of anticipatory effects. Parameter β_1 captures the effect of CGU inspection for the first year after inspection, i.e. 2017. If the trends of the variables of interest (Y_{kt}) between the treatment and control groups are similar, then the estimates of the parameters of the period prior to the intervention should be statistically insignificant.

Given the impossibility of extending the post-intervention deadline beyond 2017 while using the same methodology, we tested the effects for a different period that covered the years 2002 to 2007. As CGU's Inspection Program was initiated in 2003 and that PNATE was established only in 2004, for methodological purposes we considered only the lotteries (and inspections) that occurred after the transportation policy was established. Given the different periodicity of the lottery in the early years, it was not possible to adopt the same identification strategy used for the period from 2014 to 2017, so we used the fixed-effects model (shown in equation 4). As the treatment and control groups are different for each year of the analyzed period, in order to control possible problems associated with different audit-exposure times among the treated municipalities, we included a variable regarding the post-inspection exposure time, which could assume values of 0 (in the case of municipalities that were not exposed to inspections) to 3 years, with 2007 as the reference.

$$Y_{kt} = \propto + \beta Treatment_k + \gamma Exposuretime + \lambda year02 + \mu year03 + \pi year04 + \rho year05 + \sigma year06 + \delta \bar{X}_j + \mu_{kt} \quad (4)$$

where Y_{kt} is the proportion of students using school transportation. Parameter β captures the effect of CGU inspections on our variable of interest. The $treatment_k$ variable is a dummy that assumes the value 1 if the municipality is drawn and the value 0 otherwise. Given that the treatment and control groups are different for each year of the period analyzed, we have added a time-of-audit variable associated with the treated municipalities to control possible problems associated with different exposure times. The range of possible values for this variable reaches from 0 (in the case of municipalities that were not exposed to inspections at any time) to 3 years, considering 2007 as the reference.

In addition, using Eq.1, we performed a falsification test by changing only the variable of interest "Y_{kt}." The response variable considered was the proportion of students that used school transportation in private schools. In this case, we expected the effect of the audits to be null ($\hat{\beta} = 0$), as private-school students should not be affected by the oversight of resources intended for an action exclusively serving public-school students. Finally, to observe the occurrence of a possible spillover effect, we replicated the specifications of Eq.1, but we removed all "neighbor" municipalities (i.e. bordering municipalities) from the database.

4. RESULTS

The results will be presented in two parts. First, we begin by discussing the effects of CGU audits on the number of municipal school students using school transportation. Then we change our variable of interest to the public expense incurred by the provision of school transportation, in order to discuss if the inspections had any effect on the expense. In the second part, we present additional analyses done to ensure that our estimates are sensitive and robust.

4.1 The effects of CGU audits on the students' use of school transportation and spending of public funds on it

Given that CGU's control actions are intended to assess the application of funds allocated to government programs, and that the auditors' findings are publicly disclosed and forwarded to the program managers in a report form, to inform and enable them to implement the recommended measures, we expected that the audits of the municipalities' accounts would overflow the direct effects (such as improvements in management by the disciplining effect[5]) and indirectly interfere with the results of public programs. In this sense, we sought to answer the following questions: i) "Do CGU inspections affect the number of students who benefit from the provision of school transportation?"; and ii) "Do CGU inspections affect the public expenses associated with the provision of school transportation?" To this end, we initially estimated the model presented in Eq. 1, using the proportion of students using school transportation as the variable of interest. Then we re-estimated the same model, only changing the variable of interest to average transportation cost per student.

The results obtained for the analysis of the effect of the CGU inspections on the proportion of students benefiting from the school bus offer are shown in Table III. The estimates generally suggest that the effect we were trying to identify is not statistically significant. As expected, by adding controls regarding the characteristics of schools and municipalities in the model, we did not observe major changes in the estimates, and they were still statistically insignificant. Then we changed the variable of interest in the model to the expenses incurred by the offer of the service. The estimates, shown in Table III, indicated that there is also no statistical significance for the effects of the CGU audits on the expenses for school transportation. In a way, this result did not surprise us either, given that the amounts that are passed on to the School Transportation Support Program are based on the number of students who use school transportation, a figure that is obtained from the School Census of the immediately preceding year. So while transportation spending is, in theory, a variable that is likely to be affected by oversight, it is related to the number of students using school transportation, so it is possibly why we note in our results the similarity in effect (or absence of effect) for the two variables of interest. Despite the absence of a significant effect, the results obtained for the effects of the program are in accordance with what has been presented in recent studies such as those by Linchard et al. (2017) and Duarte et al. (2018).

Table III Effects of CGU enforcement on the proportion of students using school transportation and on public spending per student on school transportation

	Proportion of students using school transportation			Public expenditure per student associated with supply of school transportation		
	(1)	(2)	(3)	(1)	(2)	(3)
	-0.014	-0.017	-0.015	1.989	2.577	2.440
	(0.028)	(0.028)	(0.028)	(4.257)	(4.236)	(4.228)
Fixed group and time effects	Yes	Yes	Yes	Yes	Yes	Yes

School controls	No	Yes	Yes	No	Yes	Yes
Municipal socioeconomic controls	No	No	Yes	No	No	Yes
N	5,827	5,827	5,827	5,778	5,778	5,778

Source: Authors' estimates.

Note: Standard deviations are in parentheses.

The current discussion in the literature corroborates the findings in our study, highlighting that the indirect effects of inspections can hardly be captured in short analysis periods, because they are not immediate, as shown by Cavalcanti and Ramos (2018). Its only after the disclosure of the CGU reports based on the auditors' considerations, that municipal managers have the opportunity to readjust their management. Thus, it is unlikely that the effects of the audits will be captured soon after their occurrence, as the results of management changes take time to become visible. This showns that it is necessary to extend the post-treatment period to increase the possibility of observing whether this effect actually becomes stronger over time. However, it was not possible to make such an extension in this study, given the occurrence of another lottery in 2017, making data unavailable for an extended analysis period using the same methodology.

The lack of observed effects from the CGU enforcement actions on the number of children benefiting from the provision of school transportation and on the public expenses associated with this provision can be further explained by more subjective reasons and related to incentives for deviations that may be perceived by managers, given differences in the degree of punishment for different irregular practices, as pointed out in the study by Zamboni and Litschig (2014). While punishments for more serious infractions may include imprisonment, punishments for irregularities in the provision of services typically range from fines to loss of office; so, even if there is a risk of being punished, misusing resources may be associated with benefits greater than the cost of being punished. Avis, Ferraz, and Finan (2016) raised the possibility of another penalty, though – that the federal government could reduce the resource transfers in response to negative audit results, making it more difficult for managers to engage in corruption schemes. However, the authors did not find support for this hypothesis.

In assessing this possible effect within the reality of PNATE, the legislation governing the School Transportation Policy provides that there should be social monitoring and control over the transfer and application of funds transferred to the program account. FNDE is authorized to suspend transfers if resources are being used in violation of the rules, and to ensure that the perpetrator is held accountable in the civil, criminal, and administrative spheres. However, as stated in the reports of the third cycle of CGU inspections and attested by Gomes (2008), infractions of the program's rules are common. It has also been stated that the committees that should act to ensure the correct administration of the resources allotted to the program are mostly inefficient and weak, and sometimes nonexistent. This situation was also observed by Nascimento (2010) regarding the School Lunch Program.

4.2 Supplementary analyses

In this section we present the results of tests we performed for robustness. First we did an event-study analysis to check if there were any effects prior to performing the CGU audits. We then changed the analysis period to 2002-2007 to see if any effects would be captured in a longer period. Finally, we performed a falsification test and checked for spillover effects.

Initially, we performed an event-study analysis to check whether the premise of parallel trends between groups in the absence of intervention is violated. In addition, we verified whether the effects from subsequent audits remained constant or changed. We performed this test for the two variables of interest of our study: the proportion of beneficiaries of school transportation and the expenses associated with the provision of this public service. The results of the tests are shown in Table IV. The statistical non-significance obtained for the pre-intervention estimates in both cases suggests that there were no statistically significant differences between the groups before the inspections took place. The results indicate that the two groups followed parallel trends in the absence of CGU oversight, so the diff-in-diff estimates captured the program's effects on the proportion of students using the school bus and on the expenses associated with its offer. No new evidence was observable in the post-intervention period in 2017. However, as explained above, it was impossible to capture any changes in the observed effects over time of the variables of interest more sensitively because it was impossible to include the time period after the audits occurred. Figure 1 illustrates the graph obtained from the estimated coefficients for the leads and lags, and their respective confidence intervals, for the variable of interest of the proportion of students using school transportation.

Table IV Effects of CGU audits on the proportion of students using school transportation and public spending per student on the provision of school transportation; estimations were made using the diff-in-diff model with the addition of leads and lags.

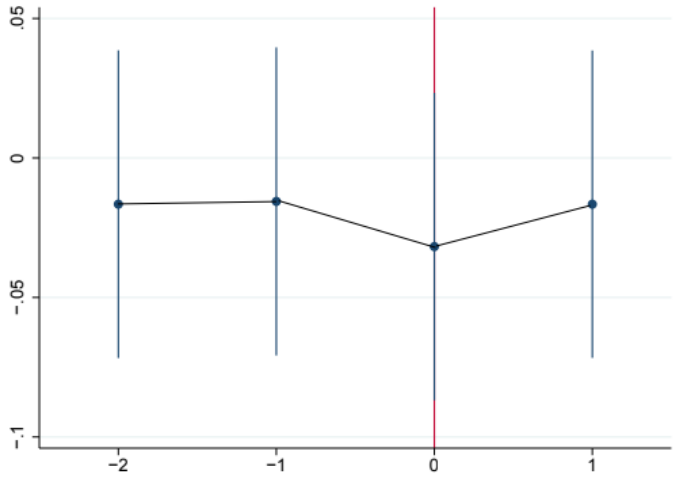
	Proportion of students using school transportation	Public expenditure per student associated with the supply of school transportation
Year14x treatment	0.018	-1.882
	(0.040)	(2.894)
Year15x treatment	0.019	-2.047
	(0.040)	(2.916)
Year17x treatment	0.009	-0.154
	(0.040)	(2.881)
Year dummies	Yes	Yes
School controls	No	No
Municipal socioeconomic controls	No	No
N	5,827	5,827

Source: Authors' estimates.

Notes: Standard deviations are in parentheses. The year 2016 (year of intervention) was omitted to avoid multicollinearity problems.

Given the impossibility of expanding the post-intervention period beyond 2017, we performed a test to observe the effect of CGU audits on the proportion of children using school buses in the early years of the School Transportation Program. The results are shown in Table V. Column (1) of Table V shows the estimates obtained for the basic model described in Eq. 4. Columns (2) and (3) show the results obtained by the addition of controls of the characteristics of schools and municipalities.

Figure 1 - Lead and lags estimation coefficients for the proportion of students using school transportation, 2014-2017



Source: Authors estimate.

In the three test-specification formats, there was no statistical significance observed for the effects of the audits on the variable of interest, or for the exposure time of the municipalities to the intervention. Again, the lack of statistical significance obtained in the estimates suggests that there is really no observed effect of the CGU audits on the number of children benefiting from school transportation, which corroborates the robustness of the results obtained for 2014 to 2017.

Table V Effect of CGU audits on the proportion of students using school transportation; estimations were made with the fixed-effects model for 2002 to 2007.

	(1)	(2)	(3)
Proportion of students using school transportation	-0.002	-0.002	-0.002
	(0.007)	(0.007)	(0.007)
Exposure time	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)
Year dummies	Yes	Yes	Yes
School controls	No	Yes	Yes
Municipal socioeconomic controls	No	No	Yes
N	33,292	33,292	32,966

Source: Authors' estimates.

Note: Standard deviations are in parentheses.

We performed a falsification test using Eq. (1), changing only the variable of interest "Y_{kt}" to the proportion of students using school transportation in private schools. The results are shown in Table VI. The estimates obtained, were statistically insignificant, as expected. This confirmed that there is no confounding effect being captured, and this result supports the reliability of the estimates obtained with our initial specification. Thus, in view of the tests performed and assured robustness of the results, this study suggests that there is no empirical support for the existence of effects from the CGU audits on the proportion of students using school transportation.

Table VI Effect of CGU audits on proportion of private-school students using school transportation

Proportion of private school students using school transportation	0.005 (0.029)
Fixed group and time effects	Yes
School controls	No
Municipal socioeconomic controls	No
N	4,086

Source: Authors' estimates.

Note: Standard deviation is in parentheses.

To finalize the supplementary analyses, we tested two possibilities for spillover effect. In the first, for the variable of interest of the number of students served by school transportation, we removed from the database the municipalities neighboring the treated ones, to observe if there was any effect from children using the school transportation of a treated municipality "*i*," but residing in a control municipality neighboring "*i*." For the variable of interest of the public expenses associated with the provision of school transportation, we used the same approach to verify if the municipalities of the control group were learning from audits performed in neighboring municipalities and were thus becoming more efficient in allocating their resources. To test this, we estimated Eq.1 excluding the control municipalities neighboring treated ones and compared the estimates with those presented in Table III for the basic model. The results are shown in Table VII.

Table VII Comparison of the effects of CGU supervision on the proportion of students using school transportation and on the public spending per student for its provision

	Proportion of students using school transportation	Public expenditure per student associated with the supply of school transportation

	With neighboring municipalities	Without neighboring municipalities	With neighboring municipalities	Without neighboring municipalities
	-0.014	-0.015	1.989	2.320
	(0.028)	(0.029)	(4.257)	(4.278)
Fixed group and time effects	Yes	Yes	Yes	Yes
School controls	No	No	No	No
Municipal socioeconomic controls	No	No	No	No
N	5,778	4,802	5,778	4,777

Source: Authors' estimates.

Note: Standard deviations are in parentheses.

The estimates obtained when excluding the control municipalities bordering the treated ones did not change the statistical significance or magnitude of the coefficients associated with the effects of the CGU audits on either variable of interest. This result suggests that our initial estimates were not interfered by a spillover effect and confirm once again, that even if there is no statistical significance, our estimates are robust. Thus, in view of the tests performed and assured robustness of the results, this study suggests that there is no empirical support for the existence of effects from the CGU audits on the number of students using school transportation or on the public expenses associated with the supply of school transportation.

5. CONCLUSIONS

In this paper, we investigated the effects that government audits performed by CGU have on the number of students in municipal public schools who use school transportation, and on the public expenditures associated with the provision of school transportation, as the effects of monitoring have been much debated in empirical studies. The analysis was performed on the municipalities making up the sample to be selected in the lottery carried out in the third cycle of inspections of the Controladoria Geral da União (CGU). The effect we sought to capture would be indirect and would result from improvements in management efficiency and effectiveness to reduce irregularities. Government actions and programs not directly linked to the objects of oversight could also be affected by these improvements. Thus, we sought to observe if the variables of interest in our study were being affected.

We made estimates using the difference-in-differences approach, whose results showed statistically insignificant relationships. The inclusion of control variables did not change the magnitude or statistical significance for either of the variables of interest. To ensure that our estimates were robust, we performed a number of supplemental tests. First, we tried to capture a possible anticipatory effect of enforcement, so we estimated the diff-in-diff model with the addition of leads and lags, and found that there was no effect on the number of children served by transportation, nor on the public expenditures associated with the provision of transportation, before the audits were carried out. Following those tests, we changed the period of analysis to the initial years of the Inspection Program and the School Transportation Program, so as to be able to observe over a longer term if any effects would be captured. Thus, we used the period

between 2002 and 2007 and the fixed-effects model to estimate the effect of audits on the number of students benefiting from the use of school transportation. Once again, we observed a lack of statistical significance, which corroborated the lack of an effect found in our initial estimation.

We further performed a counterfeit test, changing the variable of interest to the number of students in private schools using school transportation, for which we obtained statistically insignificant estimates, with coefficients close to zero. This result was as expected, considering that students from private schools should not be affected by the supervision of resources intended for an action that only serves students enrolled in the public school system. Finally, we tested whether there would be any spillover effects in municipalities bordering the treated ones by removing the former from the database. The new estimates did not change, either in the magnitude of the coefficients or the statistical significance, suggesting that there was no evidence to confirm the occurrence of spillover effects. With the results of the tests performed, there is evidence that the estimates we obtained with our main estimate are robust.

Thus, the lack of effect of the supervisory actions taken by the CGU expose the need for stronger councils and social controls, as well as the imposition of normative acts and penalties on municipal managers who commit irregularities in the management of municipal school transportation. Although the absence of an effect in the period between 2014 and 2017 may be justified by the short post-treatment period that could be analyzed, we also found no effect in the period between 2002 and 2007. These facts suggest that there is no empirical confirmation of effects from the CGU audits on the number of students using school transportation or on the public spending associated with the provision of school transportation. However, further studies are necessary to verify that supervision has no effect on the variables related to the provision of school transportation in the audited municipalities compared to the unaudited municipalities, given that the indirect effects of these actions are expected to become stronger and more easily capturable over time.

REFERENCES

Angrist, J. D., and Pischke, J. S. (2008). *Mostly harmless econometrics: An empiricist's companion*. Princeton university press.

Athey, S., and Imbens, G. W. (2006). Identification and inference in nonlinear difference-in-differences models. *Econometrica*, 74(2), 431-497.

Avis, E., Ferraz, C., and Finan, F. (2016). Do Government Audits Reduce Corruption? Estimating the Impacts of Exposing Corrupt Politicians. NBER Working Paper, (w22443).

Baicker, K., and Staiger, D. (2005). Fiscal shenanigans, targeted federal health care funds, and patient mortality. *The quarterly journal of economics*, 120(1), 345-386.

Bertrand, M., Duflo, E., and Mullainathan, S. (2002). How much should we trust difference-indifference estimates. NBER working paper series, (8841).

Bobonis, G. J., Cámara Fuertes, L. R., and Schwabe, R. (2016). Monitoring corruptible politicians. *American Economic Review*, 106(8), 2371-2405.

BRASIL. (2004). Lei nº 10.880, de 9 de junho de 2004. Institui o Programa Nacional de Apoio ao Transporte do Escolar - PNATE e o Programa de Apoio aos Sistemas de Ensino para Atendimento à Educação de Jovens e Adultos. Brasília, DF.

Cavalcanti, D.M.; and Ramos, F.S. (2018). O impacto das fiscalizações municipais pela CGU sobre a oferta de merenda escolar, <https://www.anpec.org.br/encontro/2018/submissao/files_I/i5-939758a092d6fd82ff39f94c52c0aff4.pdf>. (Acessed May 27, 2019).

CGU. Programa de Fiscalização em Entes Federativos. https://www.cgu.gov.br/assuntos/auditoria-e-fiscalizacao/programa-de-fiscalizacao-em-entes-federativos>. (Acessed May 28, 2019).

CGU. (2016). Relatório geral do 3º ciclo do Programa de Fiscalização em Entes Federativos, Estados, Distrito Federal e Municípios. http://www.cgu.gov.br/assuntos/auditoria-efiscalizacao/programadefiscalizacao-em-entes-federativos/3ciclo/3ociclo/arquivos/apresentacaoresultado_3ciclo.pdf. (Acessed May 26, 2019).

Duarte, G.B., Melo, A.S., and Silva, D.F.C. (2018). Do government audits reduce dengue? Estimating the impact of federal monitoring lotteries program on dengue incidence. *International Journal of Health Economics and Management*, p. 1-11.

Duflo, E., Glennerster, R., and Kremer, M. (2007). Using randomization in development economics research: A toolkit. Handbook of development economics, 4, 3895-3962.

Feijó, P. C. B. (2006). Transporte escolar: a obrigação do poder público municipal no desenvolvimento do programa. Aspectos jurídicos relevantes. Revista Jus Navigandi, [Teresina, In], 12.

Ferraz, C., and Finan, F. (2008). Exposing corrupt politicians: the effects of Brazil's publicly released audits on electoral outcomes. *The Quarterly journal of economics*, 123(2), 703-745.

Ferraz, C., and Finan, F. (2011). Electoral accountability and corruption: Evidence from the audits of local governments. *American Economic Review*, 101(4), 1274-1311.

Ferraz, C., Finan, F., and Moreira, D. B. (2012). Corrupting learning: Evidence from missing federal education funds in Brazil. *Journal of Public Economics*, 96(9-10), 712-726.

Finan, F., Olken, B. A., and Pande, R. (2015). *The personnel economics of the state*. (No. w21825). National Bureau of Economic Research.

Ganimian, A. J., and Murnane, R. J. (2014). Improving educational outcomes in developing countries: Lessons from rigorous impact evaluations (No. w20284). National Bureau of Economic Research.

Gomes, E. L. T. (2008). Atuação do conselho de acompanhamento e controle social do FUNDEB (CACS-FUNDEB) na execução do Programa Nacional de Apoio ao Transporte Escolar (PNATE).Posts grad monograph, UnB.

Gottfried, M. A. (2010). Evaluating the relationship between student attendance and achievement in urban elementary and middle schools: An instrumental variables approach. *American Educational Research Journal*, 47(2), 434-465.

Gottfried, M. A. (2017). Linking getting to school with going to school. *Educational Evaluation and Policy Analysis*, 39(4), 571-592.

Lichand, G., Lopes, M.F.M., and Medeiros, M.C. (2017). Is corruption good for your health?. edu/glichand/publications/job-market-paper. (Acessed May 25, 2019).

Litschig, S., and Zamboni, Y. (2014). Audit risk and rent extraction: Evidence from a randomized evaluation in Brazil. http://www.iae.csic.es/investigatorsMaterial/a1459113314archivoPdf89737.pdf. (Acessed May 26, 2019).

Luz, L. S. (2016). Os determinantes do desempenho escolar: a estratificação educacional e o efeito valor adicionado. Paper presented at the XV Encontro Nacional de Estudos Populacionais, September 18-22, in Caxambú, Brasil.

Martins, A. P. A. (2010). Análise dos impactos das condições do transporte escolar rural no rendimento escolar dos alunos. PhD diss., UnB.

Nascimento, J.L.R. (2010). A atuação dos Conselhos Municipais de Alimentação Escolar: análise comparativa entre o controle administrativo e o controle público. Graduation monograph, Universidade Federal de Minas Gerais.

Olivieri, C., Martinelli, B., Massucatto, P., and Silva, C. B. (2018). Gestão municipal e corrupção na implementação de programas educacionais federais. *Revista de Administração Pública*, 52(1), 169-179.

Reinikka, R., and Svensson, J. (2005). Fighting corruption to improve schooling: Evidence from a newspaper campaign in Uganda. *Journal of the European economic association*, 3(2-3), 259-267.

Stein, M. L., and Grigg, J. A. (2019). Missing Bus, Missing School: Establishing the Relationship Between Public Transit Use and Student Absenteeism. *American Educational Research Journal*, 56(5), 1834-1860.

Vincent, J. M., Makarewicz, C., Miller, R., Ehrman, J., and McKoy, D. L. (2014). Beyond the Yellow Bus: Promising Practices for Maximizing Access to Opportunity through Innovations in Student Transportation. Center for Cities & Schools.