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Experimental Evidence from Rio de Janeiro

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Medium-Term Impacts of Access to Daycare on School Outcomes: Experimental Evidence from Rio de Janeiro[1]

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Abstract

In this document we analyze the impacts of a large-scale intervention that provided access to daycare centers for children in low-income neighborhoods in the city of Rio de Janeiro. Our results suggest that the intervention had a positive impact on enrollment rates and on the number of years children were enrolled to daycare during early childhood. We also find that winning the lottery had a positive effect on how regularly children attended primary school during the academic year. Because of the high attrition rates in the sample, we are unable to conclude whether the lottery had a positive impact on medium-term academic outcomes like standardized tests scores and overall grades.

Key words: daycare, mathematics, enrollment
JEL codes: I21, I25, I38

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1. Introduction

The long-lasting consequences that conditions during early childhood have on children's future outcomes has been widely studied (Shonkoff & Phillips, 2000 and Shonkoff et al., 2012). In fact, during early childhood, children's brains are highly plastic and the environment they are exposed to has significant impacts on their development (Nelson and Sheridan, 2011). For instance, negative conditions such as poverty can affect growth and development, and these disadvantages are also likely to have an effect on children's education, employment and health outcomes later in life. The returns that high quality interventions during early childhood have on children's lives have been found to be high (Carneiro & Heckman, 2003). In spite of the evidence of the impact of these type of interventions, there is still much to be learned about them. Previous studies have evaluated the impact of minor scale interventions on education during early childhood with small samples of children. One question that remains is whether those interventions, when done in a large-scale, can have positive impacts on children's development outcomes in the medium and long-term term. However, these large-scaled interventions are expensive and complex to implement. In many middle- and upper-income countries early childhood interventions have focused on the provision of public services for child care such as day care centers. Considering the costs of large-scale interventions, quantifying their effects on children is of great importance for policy makers.

In this technical note we analyze the impact of a large-scale early childhood intervention in the city of Rio de Janeiro, on medium-term academic outcomes during pre-school and primary school (*jardims* and *ensino fundamental* in Brazil) such as test scores, grades and absences. In 2008, through a lottery, the municipal government of Rio de Janeiro gave access to day care centers, which allows us to credibly evaluate[2] the impacts of winning the slots on the different outcomes. The analysis compares children who won the lottery with children who lost it, finding a positive impact of winning the lottery on enrollment in day care centers for every single cohort in the analysis. We also find that on average, children who won the lottery were enrolled in day care for approximately 5 months more than children who lost. These results suggest that winning the lottery had a positive impact on the time they spent enrolled in day care during their early childhood, which is a short-term outcome. We also find a positive impact of winning the lottery on later primary school attendance, which is a medium-term outcome. However, our results are not conclusive on the

[2] Because the slots were assigned randomly it is possible to estimate the impacts of winning a lot without biases.

effect that winning the lottery had on academic longer-term outcomes such as test results and grades in school.

To our knowledge, a few of other knowledge products have already evaluated the effect of this lottery, nevertheless, on different outcomes. First, Paes de Barros et al., 2010 study the impact that the lottery had on female labor participation. They find that access to day care significantly increases household incomes, but the magnitude of those effects is smaller than the costs of actually providing the care. They also find that winning the lottery significantly impacted maternal labor outcomes in the extensive margin. Employment and labor force participation where significantly increased for mothers whose children attended day care as a result of winning the lottery. This effect was particularly important for mothers who started working because they were able to leave their children at the day care centers. Finally, they also find that subsidizing day care in this way crowds out the private day care centers, since lottery winners who had previously enrolled in private day centers never did so again.

On the other hand, Reimão, 2014 evaluates the effect of the lottery on household income and living standards, particularly focusing on households that where initially credit constrained. Like other studies, this article finds that winning the lottery had a significant and positive impact on household's income, but the effect tends to quickly dissipate. Reimão finds that the lottery had a positive and significant effect on the consumption of durable goods of the winners. Enrolling in day care allowed for this increase in consumption, and the effect does not dissipate as quickly. Additionally, they also find that enrolling in daycare could be a way for these households to compensate for credit constraints. Particularly, households that were more likely to be credit constrained before the lottery took place, responded to enrollment by accumulating more durable goods than less credit constrained households. These results suggest that enrolling in day care has an unexcepted positive effect on the quality of life of winner households, through the increase in consumption of durable goods (e.g. computers, telephones or water filters) which also potentially allows for better development of the children.

Attanasio et al., 2017, also assess the impact of this lottery on some outcomes of child development. Primarily, they find that the access to day care had a significant and positive effect on the children's height, weight and BMI up to four years after they first enrolled in day care. They also find that the lottery had a positive impact on household resources and their investments on children, but no impact on the children's cognitive or executive functions. Like all other articles,

they also find that the lottery had a positive impact on households' incomes, which dissipate around four years after the randomization took place.

On a similar note, Silva E lima, 2019 finds that winning the lottery did in fact increase attendance to day care, but they particularly find that winning the lottery had a positive effect on the children's families on a number of dimensions. First, winning the lottery increased household income and labor market outcomes. Despite the effect fading with time, these households were able to temporarily increase their disposable income by sending their children to day care. They also find that home environments were significantly improved for lottery winners and hence, children's cognitive development. The positive effect on cognitive development, was particular to certain dimensions like the TVIP (Peabody picture vocabulary test) and the WISC-Perpetual reasoning index, which seem to change due to having better homes environments and higher household income. Finally, they find that winning the lottery had large gains on children's height and weight.

The research agenda on the impacts of large-scale interventions in middle-income countries, especially in a region like Latin America and the Caribbean is particularly relevant and further studies should be made to learn more about their impacts. This technical note provides further information on the impacts of the lottery in a longer term than previous studies, since we are analyzing academic outcomes up to 10 years after the intervention was done. The document is organized as follows. Section 2 describes the lottery and randomization process and Section 3 describes the data used to measure the outcomes of interest. Section 4 presents the identification strategy, the descriptive statistics and the sample balance tests. The results are described in Section 5 and the conclusions are presented in Section 6.

2. The lottery

In Brazil, municipalities and their local governments are in charge of public services targeted at early childhood. Day care centers in Rio de Janeiro are administered by the local government, particularly by the SME (*Secretaria Municipal de Educação* in Portuguese). These day care centers provide integrated early childhood (0 to 4 years) care in low-income neighborhoods. These centers provide full-time daycare, health services, food, instruction toys and material to enhance children's development. They also include instances of education on positive parenting practices.

The provision of these childcare centers (known as *crèches* in Brazil) has increased in Rio de Janeiro in the past years. However, the demand for these services was still higher than the slots available

for children in 2008. For this reason, between 2008 and 2011, the municipal government decided to use a lottery that randomly assigned the slots available. At the end of 2007 the children interested in enrolling in *crèches* starting January 2008, applied for a slot in a particular daycare center and class. The lottery took place when the number of slots available was smaller than the number of children applying to a particular day care center and age group – *turma*. There were 244 daycare centers located in most of the low-income neighborhoods of the city of Rio de Janeiro. In November 2007, the municipal government selected 10,000 out of 24,000 children that applied for the 2008 period. The remaining children were placed on a waiting list and were considered as losers in the lottery.

Given this set up, we establish that each child was assigned to a group: treatment (winners) or control (losers). There are two important things about the randomization process that are worth mentioning, since they have a direct impact on the identification strategy. First, parents were allowed to apply only to one daycare center of all 244 centers in the city. Once all the parents completed the application process the randomization took place. Second, the lottery only took place in those centers were the number of vacancies for a particular age group (meaning 0, 1, 2 or 3 years old) was lower than the number of applicants[3]. Considering this, only 13,660 children of the total actually participated in the lottery and these are the children we use to estimate the effect of winning the lottery on medium-term outcomes. In this sense, we only used the slots in which an actual randomization took place.

3. Data

Before the lottery took place in 2007 a set of characteristics of the children, their households, their neighborhoods and context were measured. This information is particularly important in order to asses whether the sample was balanced with respect to pre-treatment characteristics. This allows us to evaluate if treatment and control groups where actually similar before the lottery took place, and therefore assess if the children between both groups where comparable.

Our second source of information was provided by the SME of Rio de Janeiro. This dataset includes information for a set of academic outcomes between 2010 and 2018 for each child enrolled in the public education system. Information includes overall, subject and exam grades and

[3] Each of the age groups also represents a classroom since the children from different cohorts are assigned to different classrooms. For example, children 2 years old do no attend the same classroom as the 4 years old. This means that the random assignment is done by daycare center – classroom (*crèche* – *turma* in Portuguese).

absences to school by age of the children and by each quarter of the academic year[4]. First, overall grades were assigned by teachers during each quarter and consider performance of the children in all the subjects that they took. Second, we use subject grades for Math and Portuguese which are also assigned by the teachers based on the children's performance in those specific subjects. Finally, we use Math exam grades which are the results obtained by the children in the test that they took at the end of each quarter. For each of the measures, we calculated the average for all quarters in a school year. For this dataset, 83 percent of the children from the original sample where merged. We calculate the average of each of the grades assigned by the teacher (overall, subject or exam) and the number of absences in each quarter of the academic year. Consequently, we are analyzing the impact of the lottery on the average children's performance during the academic year.

The last source of information was from the Prova Rio test, which is a standardized test applied to all children enrolled in a municipal public school during third grade. Children are tested on their knowledge in different subjects, which include Math and Portuguese. Using the information for the Prova Rio tests that took place between 2012 and 2015 we were able to assign children their test scores, considering the sample contains children who were between 0 and 3 years old in 2007[5]. 64 percent of the children from the original sample were merged to the Prova Rio test results[6]. This is our main source of concern, since the attrition rate is particularly high. Based on those Prova Rio test scores we constructed an Item Response Theory (IRT) score, which was calculated separately for both subjects. Using this type of scores accounts for non-observable characteristics of the test and assigns a discrimination and difficulty parameter for each of the items included in the test. It is useful because is estimates the student's "ability" in each of the subject by considering the fact that certain questions might have a differential weight on children's knowledge. Besides,

[4] Even though the database has information from 2010 to 2018 not all variables are available for every single year. Hence, the results and estimations are done using different ages or grades which allowed us to use as much information as possible for each grade and age group.

[5] Children in our sample were born between 2004 and 2007 and therefore took the Prova Rio test between 2012 and 2015 which is when they were in third grade, respectively. This is important in this context since we work with different cohorts and therefore run estimations on the effect on years where each cohort attended a particular grade, or effects on particular age groups.

[6] Attrition rates between Prova Rio data and SME data are different because in the SME dataset we are able to merge the children with 5 more years of information (2010-2018) while the Prova Rio database is only for years 2012-2015 and for children who actually took the test.

we created a combined measure of Math and Portuguese to test for more general results, in which each individual test weights the same in the final score[7].

4. Identification strategy

The identification strategy allows us to estimate the effect that winning the lottery had on several children outcomes. However, being able to consistently estimate our parameters of interest lies on the assumption of a pre-treatment balanced sample and that attrition rates are uncorrelated with lottery results. First, we need children exposed to the lottery to be very similar regarding their baseline characteristics. Therefore, we would expect treatment and control groups to have means that are statistically speaking, equal. Column three of Table 1 shows estimates from regressions of each baseline characteristic on the treatment. Results suggest that the lottery was indeed random, since no difference is observed between both groups, except for children with special needs, who seem to have been more likely to win the lottery.

Regarding the attrition rates, as discussed in section 3 they are somewhat high in this context. Finding the children's medium-term outcomes in Prova Rio and SME information is a challenge since not all of them took the exam or enrolled in the public education system. In this sense, there are two potential attritors: those without Prova Rio information and those without SME information. Since the first is a bigger group, we define a child as an attritor if no information for him/her is found in the Prova Rio data. First, table 2 shows estimates from regressions of each baseline characteristics on the attrition variable. We found that in general both groups do not seem to be very different except for incomes (for the whole sample and the control group), whether the child has special needs (for the whole sample and control group) and whether there was violence in the are they lived in (for the whole sample). It seems attritors in the control group have higher incomes, and attritors in the treatment group are more likely to have special needs. This suggests that despite the high attrition rates, based on the baseline characteristics the sample is still balanced. However, it is important to consider there might be other aspects (e.g. non-observable characteristics, post-treatment decisions) that might impact the medium-term academic outcomes of the children and hence our results.

On the other hand, it is important to know whether winning the lottery had any effect on the children becoming attritors. Table 3 shows estimates from regressions of each type of attrition:

[7] We estimate the average of the score in both tests to create the combined test score for Math + Portuguese. For this average both tests are assigned the same weight (50%).

Enrollment, Prova Rio test and grades on the treatment variable. For all types, results suggest that winning the lottery made children more likely to drop out of the sample. One possible explanation of this is that those who won the lottery were more likely to enroll in a private school, but we do not have information to confirm this. In particular, we are losing more winners than losers which might also affect our results.

Winning the lottery guaranteed the children could have a slot in the selected daycare center, but parents could decide whether or not to actually enroll their children. One of the concerns about this measure is that lottery losers were not prevented from enrolling elsewhere in that year or applying and actually winning the lottery in later years. Therefore, the lottery was a good indicator of access to daycare but nevertheless it was not a perfect predictor of enrollment. Hence, we estimated and intent to treat (ITT) based on the following equation:

$$y_{igc} = \beta_0 + \beta_{ITT} L_{igc} + \mathbb{X}\theta + \gamma_{gc} + e_{igc} \quad (1)$$

Where y_{igc} represents the outcome of interest of child i in cohort (age group - *turma*) g in daycare center c, L_{igc} is a dummy variable that represents whether the child won or lost the lottery where 1 is for the winners and to 0 for losers, $\mathbb{X}$ are baseline child characteristics like gender, income and parents education used as controls, δ_{gc} represents a set of fixed effects for each combination of age groups g and daycare centers c and e_{igc} is the error term. Our parameter of interest is β_{ITT} and we would expect it to be positive, as winning the lottery should benefit the children.

Aside from learning the impact that winning the lottery had on different outcomes we are also interested on the impact of *actually* attending[8] day care. However, the decision of enrolling children in day care centers is endogenous. For example, parents who found a way to enroll their children despite losing the lottery may have other characteristics and behaviors that can also affect their children's outcomes. In order to address this issue we estimate a Local Average Effect on the Treated (LATE) estimator using an instrumental variables approach. By instrumenting day care attendance with lottery results we address the endogeneity issue, since lottery results were random and they are a good predictor of attendance. We therefore estimate a local effect, which evaluates the impact of attending day care on the outcomes of children whose attendance was induced by lottery results. Attendance to day care is measured by a variable ranging from 0 to 5 which indicates the number of years children spent enrolled to day care. Equations 2.1 and 2.2 describe how we estimate the LATE effect:

[8] We are assuming that children who enrolled in day care actually went.

$$y_{igc} = \beta_0 + \beta_{LATE}\hat{A}_{igc} + \mathbb{X}\theta + \gamma_{gc} + e_{igc} \quad (2.1)$$

$$\hat{A}_{igc} = \delta_0 + \delta_1 L_{igc} + \mathbb{X}\theta + \gamma_{gc} + \varepsilon_{igc} \quad (2.2)$$

Where y_{igc} represents the outcome of interest of child i in cohort (age group - *turma*) g in daycare center c, $\hat{A}_{igc}$ is the instrumented years of enrollment in day care, L_{igc} is the instrumental variable used that represents whether the child won or lost the lottery where 1 is for the winners and to 0 for losers, $\mathbb{X}$ are baseline child characteristics like gender, income and parents education used as controls, δ_{gc} represents a set of fixed effects for each combination of age groups g and daycare centers c and ε_{igc} is the error term. Our parameter of interest is β_{LATE} and we would expect it to be positive, as enrolling in day care should benefit the children.

Besides estimates from equation 1, we also follow Lee (2009) bounds methodology to check the robustness of our results. The Lee bounds estimator allows us to estimate a lower and an upper bound of our estimator (β_{ITT}) on the different outcomes. This estimator considers attrition by making extreme assumptions on the missing data. It relies on the assumptions that the treatment was randomly assigned and that the assignment to the treatment only affects attrition in one direction (which is what we do observe in Table 3).

5. Results

5.1 Enrollment between 0-4 years old

The first outcome of interest is whether winning the lottery influenced parents to enroll children in day care for more years during their early childhood. We used two measures to analyze this enrollment. First, since we have information on different cohorts of children, we evaluated whether the lottery had an impact on the likelihood that children were enrolled in day care for a particular age. Second, we constructed the number of years in which each child was enrolled in day care during their early childhood (0-4 years of age). Table 4 shows the results for the 5 individual enrollment variables by age (Columns 1-5) and for the number of years enrolled (Column 6). The first results show that winning the lottery had a positive and statistically significant impact on the likelihood that children were enrolled in day care for all age groups (0-5). For example, winning the lottery increased this likelihood in 11.6 percentage points for children at age 2. It particularly stands out that the effect of the lottery on these outcomes seems to increase as children become older. Namely, the effect in children with less than 1 year is 7.1 percentage points while it is 12.1 percentage points in children at age 4. These results are relevant since they show

that winning the lottery is indeed a good predictor of actual enrollment to day care. On the other hand, results from Column 6 show that winning the lottery increased the number of years that children spent in day care in 0.40, which is almost half a year. For both outcomes of interest, results are consistent to including a set of control variables (Panel B). This suggests that winning the lottery not only increased enrollment for different age groups, but it also increased the amount of time that children spent at day care.

5.2 Learning outcomes

This section presents the results of the impact of winning the lottery on a series of outcomes regarding the children's school performance. First, we analyze whether winning the lottery had any impact on the children's overall grades[9] at different age groups (6-14). Table 5 suggests that winning the lottery did not have any statistically significant effect on the overall grades of children in school, no matter the age group. However, when analyzing the effect for boys and girls separately, Table 5.1 suggest that boys did benefit from winning the lottery, particularly for ages 7 and 12. Second, we analyzed whether winning the lottery had an effect on grades specific to Math and Portuguese. Table 6 also shows the lottery had no statistically significant effect on this measure. Finally, Table 7 analyzes the effect of winning the lottery on math exam grades to find that the winning lottery has no significant effect. The results on the three outcomes of interest suggest that winning the lottery did not have an impact on the children's academic outcomes. However, these results might also be affected by the high rates of attrition and the problems it generates on the balance of our samples.

Finally, we analyze the effect of winning the lottery on the number of absences of the children during the school year by age groups. Table 8 shows these effects, and results suggest that winning the lottery did have some effect on how much children missed school, for some particular age groups. First, winning the lottery reduced the average yearly absences in 0.76 days per year for 4 year old's. On average, children missed 4.73 days of school per year at this age group, which means that this effect accounts for around 16 percent of average absences. Besides, Panel C shows that this effect is much bigger for children whose attendance to day care was influenced by winning the lottery. In this case, one additional year of attendance to day care meant 1.9 days less of yearly absences at age 4, which represents 40 percent of average absences in this age group. Very similar

[9] As discussed in section 3, the grades variables are available for each quarter of the academic year, but we averaged them to get an image on how winning the lottery affected overall average grades for children.

results are also found for yearly absences to school at age 12. Despite these results being encouraging, they are not conclusive enough about the effectiveness of the lottery on children's attendance to school, since we only observe statistically significant results for specific age groups.

5.3 Standardized tests (Prova Rio)

This section analyzes the impact of the lottery on the IRT test scores that the children obtained for Mathematics, Portuguese and a combined measure of both in the Prova Rio test applied to them in the third grade. Table 9 shows that winning the lottery had no significant impact on these test scores. However, Table 9.1 shows that when comparing boys and girls separately, it seems that boys who won the lottery benefit from with respect to their test scores in Portuguese. Namely, boys that won the lottery increased their test scores in Portuguese in 6.3 percentage points. As with the previous section, our results are not conclusive due to the problems that the high levels of attrition may cause.

5.4 Lee bounds results

As mentioned earlier, Lee bounds estimators provide and upper and lower bound of the effects of the intervention by making some extreme assumptions on the attritors. Considering the high levels of attrition in our sample, we estimate Lee bounds on some of the outcomes from previous sections in order to check the results found. First, Table 10 estimates lower and upper bounds of the effect of winning the lottery on the results for Prova Rio tests. Consistent with the previous section, we do not find statistically significant results. On the other hand, table 11 estimates lower an upper bounds for the effect of winning the lottery on the average absences of children by years of age. Contrasting with the previous results, the bounds contain zero, meaning the effect of winning the lottery is not statistically different than zero. Table 12 shows something very similar when we analyze the effect of winning the lottery on the overall grades for boys, these estimators, unlike previous sections, show that the effect of winning the lottery is not statistically different than zero. Results found in this section point out the mentioned problem of attrition that we have in the sample. Lee bounds estimators consider the missing information, and show that once accounted for, some of the previous results found become statistically insignificant.

6. Conclusion

In general, our results are not conclusive with respect to the effect that winning the lottery had on children's medium term academic outcomes. However, this could be associated to the high levels of attrition in the sample. We are unable to observe the outcomes of a number children who won

the lottery but did not enroll in municipal state schools, and therefore, unable to assess whether winning the lottery left them better off than their counterparts. In this sense, analyzing the medium term academic impact of this lottery requires more data on all the participants.

Despite this, we do find that winning the lottery had a significantly positive impact on day care attendance, which means that the lottery worked to influence parents whose children won the lottery to actually enroll them. Considering the positive effects that attending day care can have on children's early development, this shows that the lottery at least increased attendance to day care for children in Rio de Janeiro. Besides, we find that winning the lottery has a statistically significant effect on how much the children are absent once they are in primary school. This suggests that lottery winners were more likely to attend school on a regular basis, which could leave them better off, considering the positive impacts that attending school has on children's growth and development. We also find that boys benefitted from winning the lottery in their overall grades and Portuguese results in the Prova Rio test.

These results show that the lottery that provided access to day care indeed left the winners better off than their counterparts. However, further research should be done in order to assess if the lottery had an impact on academic outcomes, particularly also considering children who did not enroll in public municipal schools. This is of great importance considering the costs of these types of interventions. Being able to quantify the effect that they have on children's development can help policy makers asses which interventions are more cost-effective. This project is a step in assessing those effects and what challenges might arise when attempting to estimate them. Despite the fact that our results are not conclusive on the long-term effects that this intervention had, this should not be interpreted as if the intervention had no effect at all, especially since attrition rates were important. Without being able to observe the outcomes of all children involved in the study, making a conclusion regarding its effect on medium term academic outcomes is not possible.

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Tables

Table 1. Sample balance (Treatment vs. Control)

	Treatment		Control		Difference
	N	(1)	N	(2)	(3)
Sex (1=M)	5241	0.53	7536	0.517	0.014
		(0.499)		(0.5)	(0.009)
Number of people in household	5456	4.637	7913	4.687	-0.050
		(4.362)		(4.403)	(0.077)
Income	5398	639.002	7849	608.272	30.731
		(2925.293)		(2609.857)	(48.498)
Child caregiver works	5454	0.679	7931	0.685	-0.006
		(0.467)		(0.464)	(0.008)
Child caregiver needs daycare to be able to work	5357	0.986	7738	0.987	-0.001
		(0.118)		(0.115)	(0.002)
Chronic health problems (Child)	5457	0.084	7924	0.081	0.003
		(0.277)		(0.273)	(0.005)
Special needs (Child)	5453	0.032	7926	0.001	0.031***
		(0.175)		(0.032)	(0.002)
Violence in the area where they live	5455	0.075	7924	0.081	-0.006
		(0.264)		(0.273)	(0.005)
Family member abuses alcohol	5456	0.125	7928	0.13	-0.005
		(0.331)		(0.337)	(0.006)
Family member uses drugs	5457	0.091	7917	0.086	0.005
		(0.288)		(0.28)	(0.005)

Table 2. Sample balance (Attritors vs. Non-attritors)

	Whole sample	Treatment group	Control group
	(1)	(2)	(3)
Sex (1 = M)	0.013	0.015	0.009
	(0.009)	(0.014)	(0.012)
Number of people in household	-0.039	-0.010	-0.055
	(0.079)	(0.121)	(0.105)
Income	85.450*	23.887	128.194**
	(49.669)	(81.269)	(62.601)
Child caregiver works	0.009	0.021	0.001
	(0.008)	(0.013)	(0.011)
Child caregiver needs to send child to creche to work	0.001	0.002	0.000
	(0.002)	(0.003)	(0.003)
Chronic health problems (Child)	-0.006	-0.007	-0.006
	(0.005)	(0.008)	(0.007)
Special needs (Child)	0.006***	0.009*	0.000
	(0.002)	(0.005)	(0.001)
Violence in the area where they live	-0.011**	-0.012	-0.009
	(0.005)	(0.007)	(0.007)
Family member abuses alcohol	-0.002	0.003	-0.005
	(0.006)	(0.009)	(0.008)
Family member uses drugs	-0.003	0.000	-0.005
	(0.005)	(0.008)	(0.007)

Notes: A child is considered an attritor if no information for him/her is available for Prova Rio scores (attrition=1). Columns (1), (2) and (3) show the test for differences in baseline variables means by attritors and non-attritors, each cell being one separate regression. Standard errors are reported in parenthesis.

Table 3. Effect of winning the lottery on attrition by type

	Enrolment	Prova Rio score	Overall Grades	Subject Grades	Exam Grades
	(1)	(2)	(3)	(4)	(5)
Lottery (1 = won)	0.064***	0.034***	0.068***	0.039***	0.063***
	(0.009)	(0.010)	(0.008)	(0.010)	(0.009)
Observations	13,660	13,660	13,660	13,660	13,660

Note: Columns (1) to (5) show the effect of winning the lottery on each type of attrition. All regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

Table 4: Effect of winning lottery on enrollment rates for 0-4 year olds

	Enrolment at age					Number of years of enrolment from 0-4
	0	1	2	3	4	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Bivariate regression					
Lottery (1 = won)	0.071***	0.092***	0.116***	0.127***	0.121***	0.402***
	(0.018)	(0.016)	(0.012)	(0.014)	(0.014)	(0.028)
Observations	2,318	6,741	11,930	13,604	13,604	13,660
	Panel B: Multivariate regression					
Lottery (1 = won)	0.091***	0.087***	0.129***	0.130***	0.126***	0.420***
	(0.030)	(0.017)	(0.014)	(0.017)	(0.018)	(0.035)
Observations	1,266	3,842	6,961	7,897	7,897	7,917

Notes: Columns (1) to (5) show the effect of winning the lottery on the enrollment in day care for children of 0, 1, 2, 3 and 4 years of age, respectively. Column (6) shows this effect on the number of years spent in day care for children from 0-4 years of age. Panel A estimates regressions without a set of control variables whilst Panel B controls for gender, whether the families are beneficiaries of social programs, income and parent's education. All regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

Table 5: Effect of winning the lottery on overall grades by age groups

	Overall grades at age								
	6	7	8	9	10	11	12	13	14

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Panel A: Bivariate regressions				
Lottery (1=won)	0.029	0.030	0.007	-0.003	-0.001	-0.012	0.022	-0.017	-0.033
	(0.024)	(0.024)	(0.024)	(0.022)	(0.022)	(0.020)	(0.024)	(0.024)	(0.050)
Observations	6,265	9,537	9,593	9,557	9,528	9,478	7,922	4,770	1,138
					Panel B: Multivariate regressions				
Lottery (1=won)	0.010	-0.002	0.015	-0.026	-0.007	0.006	-0.005	0.005	0.022
	(0.035)	(0.031)	(0.033)	(0.031)	(0.029)	(0.028)	(0.030)	(0.032)	(0.077)
Observations	3,717	5,576	5,583	5,533	5,499	5,473	4,601	2,827	641

Notes: Columns (1) to (9) show the effect of winning the lottery on the overall grades for children aged 4-14 respectively. Panel A estimates regressions without a set of control variables whilst Panel B controls for children's gender, whether his/her household is beneficiary of social programs, household income and parent's education. All regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

					Panel C: IV regressions				
Attendance	0.062	0.064	0.015	-0.006	-0.002	-0.026	0.047	-0.040	-0.178
	(0.049)	(0.050)	(0.051)	(0.047)	(0.045)	(0.041)	(0.051)	(0.055)	(0.252)
Observations	6,265	9,537	9,593	9,557	9,528	9,478	7,922	4,770	1,138

Notes: Columns (1) to (9) show the effect of attendance to day care, instrumented by lottery results, on the overall grades for children aged 6-14 respectively. All regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

Table 5.1: Effect of winning the lottery on overall grades by gender

	Overall grades at age								
	6	7	8	9	10	11	12	13	14
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: Boys								
Lottery (1 = won)	0.014	0.074**	0.015	0.012	0.021	0.012	0.061*	0.007	0.006
	(0.036)	(0.036)	(0.036)	(0.032)	(0.031)	(0.030)	(0.033)	(0.036)	(0.078)
Observations	3,102	4,675	4,685	4,668	4,643	4,638	3,907	2,340	529
	Panel B: Girls								
Lottery (1 = won)	0.021	-0.007	-0.008	-0.029	-0.019	-0.035	-0.027	-0.034	-0.082
	(0.041)	(0.040)	(0.040)	(0.038)	(0.035)	(0.034)	(0.039)	(0.039)	(0.095)
Observations	2,800	4,271	4,301	4,281	4,273	4,243	3,539	2,140	529

Notes: Columns (1) to (9) show the effect of winning the lottery on the overall grades for children aged 6-14 respectively. Regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

Table 6: Effect of winning lottery on subject grades by years of age

	Math	**Portuguese**
	Subject grades at age	

	11	12	13	14	11	12	13	14
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Bivariate regressions				
Lottery (1 = won)	-0.075	-0.076	-0.077	-0.078	-0.079	-0.080	-0.081	-0.082
	(0.085)	(0.062)	(0.062)	(0.142)	(0.079)	(0.061)	(0.063)	(0.142)
Observations	3,020	6,115	4,138	1,036	3,020	6,119	4,158	1,045
				Panel B: Multivariate regressions				
Lottery (1 = won)	-0.040	0.005	-0.062	0.278	0.016	-0.013	0.038	0.127
	(0.106)	(0.086)	(0.082)	(0.192)	(0.107)	(0.079)	(0.080)	(0.200)
Observations	1,836	3,655	2,509	596	1,836	3,657	2,519	600

Notes: Columns (1) to (8) show the effect of winning the lottery on the subject grades in Math and Portuguese for children aged 11-14 respectively. Panel A estimates regressions without a set of control variables whilst Panel B controls for children's gender, whether his/her household is beneficiary of social programs, household income and parent's education. Regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

				Panel C: IV regressions				
Attendance	-0.147	0.078	-0.184	0.036	-0.035	0.049	-0.119	0.233
	(0.156)	(0.126)	(0.141)	(0.793)	(0.144)	(0.123)	(0.146)	(0.809)
Observations	3,020	6,115	4,138	1,036	3,020	6,119	4,158	1,045

Notes: Columns (1) to (8) show the effect of attendance to day care, instrumented by lottery results, on the subject grades for children aged 11-14 respectively. All regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

Table 7: Effect of winning lottery on math exams grades by years of age

	Math exams at age							
	7	8	9	10	11	12	13	14
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Univariate regressions				
Lottery (1 = won)	0.024	0.053	-0.012	-0.029	-0.011	0.002	0.037	0.200
	(0.075)	(0.052)	(0.049)	(0.044)	(0.046)	(0.051)	(0.056)	(0.149)
Observations	4,534	9,213	9,411	9,338	9,342	7,812	4,696	1,121
				Panel B: Multivariate regressions				
Lottery (1 = won)	0.062	0.024	-0.050	-0.067	0.003	-0.015	-0.016	0.130
	(0.097)	(0.069)	(0.065)	(0.055)	(0.059)	(0.071)	(0.083)	(0.208)
Observations	2,691	5,407	5,462	5,405	5,396	4,558	2,789	639

Notes: Columns (1) to (8) show the effect of winning the lottery on math exams grades for children aged 7-14 respectively. Panel A estimates regressions without a set of control variables whilst Panel B controls for children's gender, whether his/her household is beneficiary of social programs, household income and parent's education. Regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

				Panel C: IV regressions				
Attendance	0.051	0.113	-0.026	-0.061	-0.023	0.005	0.087	1.156
	(0.149)	(0.109)	(0.101)	(0.090)	(0.094)	(0.108)	(0.130)	(0.911)
Observations	4,534	9,213	9,411	9,338	9,342	7,812	4,696	1,121

Notes: Columns (1) to (8) show the effect of attendance to day care, instrumented by lottery results, on the math exam grades for children aged 7-14 respectively. All regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

Table 8: Effect of winning the lottery on yearly absences to school by years of age

	Average yearly absences at age										
	4	5	6	7	8	9	10	11	12	13	14

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
						Panel A: Univariate regressions					
Lottery (1 = won)	-0.763**	-0.019	-0.103	-0.177	-0.049	0.042	-0.064	-0.172	-0.736*	0.137	-0.855
	(0.361)	(0.177)	(0.113)	(0.110)	(0.090)	(0.096)	(0.092)	(0.230)	(0.405)	(0.543)	(1.497)
Observations	1,429	4,532	8,784	9,547	9,618	9,589	9,555	9,508	7,943	4,787	1,144
						Panel B: Multivariate regressions					
Lottery (1 = won)	-1.310**	-0.194	-0.229	-0.221*	-0.167	-0.030	-0.102	-0.338	-0.782	0.155	2.018
	(0.518)	(0.276)	(0.150)	(0.128)	-0.111	(0.120)	(0.111)	(0.322)	(0.601)	(0.805)	(2.435)
Observations	839	2,665	5,142	5,578	5,600	5,549	5,515	5,483	4,615	2,834	644

Notes: Columns (1) to (10) show the effect of winning the lottery on average yearly absences for children aged 5-14 respectively. Panel A estimates regressions without a set of control variables whilst Panel B controls for children's gender, whether his/her household is beneficiary of social programs, household income and parent's education. Regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

						Panel C: IV regressions					
Attendance	-1.935*	-0.034	-0.205	-0.376*	-0.104	0.090	-0.136	-0.365	-1.599*	0.324	-4.729
	(1.053)	(0.297)	(0.219)	(0.226)	(0.189)	(0.202)	(0.189)	(0.475)	(0.859)	(1.243)	(7.574)
Observations	1,429	4,532	8,784	9,547	9,618	9,589	9,555	9,508	7,943	4,787	1,144

Notes: Columns (1) to (11) show the effect of attendance to day care, instrumented by lottery results, on the average yearly absences for children aged 4-14 respectively. All regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

Table 9: Effect of winning the lottery on Prova Rio test

	Math	Portuguese	Math + Portuguese
	(1)	(2)	(3)
		Panel A: Bivariate regression	
Lottery (1 = won)	-0.002	0.021	0.010
	(0.023)	(0.025)	(0.022)
Observations	8,734	8,735	8,735
		Panel B: Multivariate regression	
Lottery (1 = won)	-0.017	0.034	0.008
	(0.033)	(0.032)	(0.030)
Observations	5,203	5,203	5,203

Notes: Columns (1) and (2) show effect of winning the lottery on the Prova Rio scores for Math and Portuguese, respectively. Column (3) shows that effect on the average score between Math and Portuguese. Panel A estimates regressions without a set of control variables whilst Panel B controls for gender, age in months when the child took Prova test, whether his/her household is beneficiary of social programs, household income and parent's education. All regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

		Panel C: IV regression	
Year attendance	-0.004	0.047	0.022
	(0.052)	(0.055)	(0.049)
Observations	8,734	8,735	8,735

Notes: Columns (1) and (2) show effect of attendance to day care, instrumented by lottery results, on the Prova Rio scores for Math and Portuguese, respectively. Column (3) shows that effect on the average score between math and Portuguese. All regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

Table 9.1: Effect of winning the lottery on Prova Rio test by gender

	Math		Portuguese		Math + Portuguese	
	(1)	(2)	(3)	(4)	(5)	(6)

	Boys	Girls	Boys	Girls	Boys	Girls
Lottery (1 = won)	0.034	-0.039	0.063*	-0.027	0.049	-0.033
	(0.037)	(0.037)	(0.034)	(0.041)	(0.032)	(0.036)
Observations	4,242	3,950	4,242	3,950	4,242	3,950

Notes: Columns (1) - (4) show the effect of winning the lottery on the Prova Rio scores for math and Portuguese, respectively. Columns (5) - (6) show that effect on the average score between Math and Portuguese. Regressions include lottery fixed effects and lottery clusters. Standard errors reported in parenthesis.

Table 10: Lee bound estimators of effect of winning lottery on Prova Rio Result for boys

		Math	Portuguese	Math + Portuguese
		(1)	(2)	(3)
Lottery (1 = won)	Lower bound	-0.191***	-0.123***	-0.145***
		(0.044)	(0.042)	(0.037)
	Upper bound	0.210***	0.231***	0.212***
		(0.045)	(0.042)	(0.040)
Observations		6,674	6,674	6,674

Notes: Columns (1) and (2) show estimated lower and upper bounds of the effect of winning the lottery on the Prova Rio scores for Math and Portuguese for boys, respectively. Column (3) shows the same effect on the average score between Math and Portuguese. Standard errors reported in parenthesis.

Table 11: Lee bound estimators of effect of winning lottery on yearly absences to school by years of age

		Average yearly absences at year				
		5	6	7	8	9
		(1)	(2)	(3)	(4)	(5)
Lottery (1 = won)	Lower bound	-0.525***	-0.258**	-0.516***	-0.412***	-0.361***
		(0.197)	(0.116)	(0.099)	(0.093)	(0.090)
	Upper bound	1.209***	0.607***	0.752***	0.733***	0.735***
		(0.219)	(0.156)	(0.110)	(0.102)	(0.100)
Observations		13,660	13,660	13,660	13,660	13,660
		Average yearly absences at year				
		10	11	12	13	14
		(6)	(7)	(8)	(9)	(10)
Lottery (1 = won)	Lower bound	-0.329***	-0.508**	-2.680***	-1.380**	-7.670***
		(0.087)	(0.214)	(0.430)	(0.647)	(2.010)
	Upper bound	0.665***	1.963***	5.275***	2.451**	10.108***
		(0.098)	(0.227)	(0.368)	(0.957)	(1.407)
Observations		13,660	13,660	13,660	13,660	13,660

Notes: Columns (1) to (10) show estimated lower and upper bounds of the effect of winning the lottery on average yearly absences for children aged 5-14 respectively. Standard errors reported in parenthesis.

Table 12: Lee bound estimators of effect of winning lottery on boys overall grades by years of age

	Overall grades at age				
	6	7	8	9	10

		(1)	(2)	(3)	(4)	(5)
Lottery (1 = won)	Lower bound	-0.100*	-0.113***	-0.136***	-0.135***	-0.125***
		-0.052	-0.04	-0.041	-0.039	-0.038
	Upper bound	0.087*	0.195***	0.167***	0.154***	0.144***
		-0.05	-0.042	-0.043	-0.042	-0.04
Observations		6,674	6,674	6,674	6,674	6,674
			Overall grades at age			
		11	12	13	14	
		(6)	(7)	(8)	(9)	
Lottery (1 = won)	Lower bound	-0.125***	-0.197***	-0.030	-0.208*	
		(0.037)	(0.034)	(0.046)	(0.122)	
	Upper bound	0.171***	0.349***	0.083	0.341***	
		(0.038)	(0.037)	(0.063)	(0.069)	
Observations		6,674	6,674	6,674	6,674	

Notes: Columns (1) to (9) show estimated lower and upper bounds of the effect of winning the lottery on the overall grades of boys aged 6-14 respectively. Standard errors reported in parenthesis.