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EFFECTIVENESS OF PRIVATE SCHOOLS VERSUS PUBLIC SCHOOLS:
A Comparative Analysis in Portugal

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Abstract

This study compares the effects of private versus public school administration on student performance in Portugal, which benefits from the existence of publicly funded private schools (CA schools). We have constructed two measures of students' achievements in order to compare the effectiveness of each type of class. Firstly, a Logit is used to estimate the probability of completing Lower Secondary School (7th to 9th grade) in three years. Secondly, we employ a **Value-Added** approach by OLS, to compare national exam scores at 9th grade. Our findings suggest a positive, but modest, increase in the probability of completing Lower Secondary School with zero retentions, for those students attending a publicly funded private class from 7th grade to 9th grade, when compared to those attending a strictly public class. Additionally, the results suggest that attending a publicly funded private class also increases national exam scores by 1 point in Portuguese subject and 3 points in Mathematics, when compared to strictly public class (0-100 scale). With regard to private classes, in both models, the results move in the same direction as publicly funded private classes, although with higher magnitudes, when compared to public classes.

Keywords: publicly funded private schools; effectiveness; value-added; national exams

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I. Introduction

Despite the motivation for the existence of public-private partnerships in school systems being the improvement of learning outcomes of students (Flaker, 2014), in Portugal the so-called “*Contratos de Associação*” were implemented due to the lack of public school provision in some specific geographic areas, which meant that not all students were given the opportunity to benefit from public government-financed education. Accordingly, instead of creating new infrastructures that would require more time and money, the Portuguese Ministry of Education came up with the following solution: the funding of education in certain private schools to ensure education was available to everyone who had enrolled in the public-school network. However, more recently the Portuguese government has been conducting educational reforms, by reducing the number of classes under these contracts, thus reallocating students to regular public schools¹. Are students in publicly funded private schools getting worse results? If so, is this caused by the different property management schemes? These are some of the questions we will address during this study.

The fundamental advantage, for a researcher, of the coexistence of publicly funded private schools, regular public schools and strictly private schools in Portugal, as mentioned by Rosado and Seabra (2015), is that we have two groups of students - from publicly funded private schools and regular public schools - that are more homogeneous with respect to family income when compared to a third group of students from strictly private schools, who tend to come from wealthier families². Strictly private schools and publicly funded private schools have more freedom in terms of staff hiring decisions, while regular public schools are obliged

¹ “*Contratos de Associação*” are pluriannual contracts signed between the government and private schools at the beginning of each school cycle, meaning that a new class established in the 7th grade in 2009/10 in a publicly funded private school will be financed for at least three years, until the 9th grade, even though the government may choose not to finance new 7th grade classes in 2010/11 in that publicly funded private school

² In this study we use subsidies awarded to families based on aggregate income and family composition as a proxy for family income

to follow centralized state decisions. Therefore, a comparison between regular public school and publicly funded private school students may be the best way to isolate the impact of property management schemes on students' educational outcomes. Hence, this will be the primary goal of this research as both public and publicly funded private schools constitute two freely available educational alternatives. Thus, we will add our contribution to the somewhat scarce literature currently available in Portugal regarding the effectiveness of publicly funded private schools. Nonetheless, we will still look at the differences between studying in strictly private schools, at class level, as compared with studying in public schools, whilst acknowledging the differences in family background between students in both types of schools. For simplicity, henceforth we will refer to strictly private schools, strictly public schools and publicly funded private schools as private schools, public schools and CA schools, respectively, within the Portuguese context.

This study extends the work of Rosado and Seabra (2015) by using a richer dataset. We resort to a cohort of students at the 6th grade in the academic year of 2011/12 and observe their academic achievement both in terms of the time required to finish Lower Secondary School (9th grade) and the Mathematics and Portuguese language standardized test scores obtained in the 9th grade. We then use a Logit Model to estimate the probability of being retained at least once. We also implement a Value-Added approach for the exam scores, using 6th grade national exams as the baseline. This second approach is quite often used in Economics of Education to account for the cumulative effects of prior education inputs on current achievement level (Sass, 2006).

We find a positive contribution from private administration in both models. In particular, *ceteris paribus*, belonging to a CA class, increases the probability of completing 7th – 9th grade with zero retentions by 1.05% relative to belonging to a public class. This effect is much larger when considering private classes, approximately 9.47%. Additionally, the results

suggest that belonging to a CA class or a private class, *ceteris paribus*, also increases national exam scores by 1.3 or 6.75 points in Portuguese subject and 3.2 or 8.4 points in Mathematics, respectively, relative to public class scores.

The structure of this research is organized in the following manner: Section II is devoted to Literature Review; Section III presents some facts about the Portuguese Education System and the nature of *Contratos de Associação* (CA); Section IV describes the data, the variables used throughout the study and the group decomposition of each type of school; Section V reports the methodology used; Section VI is devoted to results obtained and robustness checks; and finally the last Section VII is dedicated to our conclusion and policy implications.

II. Literature review

The debate around educational funding and school administration is quite extensive and comprises decades of research, mainly fostered by attempts to identify whether there are significant differences in the public and private school system management. The challenge of measuring school quality differences under private and public administrations however, lies in separating students' achievement from differences in students' background (Hanushek *et al.*, 2007).

There is a widespread consensus that students who attend strictly private schools tend to come from more privileged socioeconomic backgrounds, since the high tuition fees encountered in these schools impose a financial barrier to many families (Mancebón *et al.*, 2010; Flaker, 2014), thereby generating a self-selection problem that may bias the results of private school attendees. In general, the direction of the selection bias is in favor of private school students. As Hanushek *et al.* (2015) stated, differences in early experiences in childhood (pre-school), which are closely linked to family background, may explain differences in students' achievement at school. Students who are given opportunities and incentives to develop

cognitive and non-cognitive skills earlier in life tend to come from wealthier families. Their parents are also generally more educated and tend to enrol their children in private schools, and thus the direction of the bias will be in favour of private schools.

However, it might be the case that the bias from self-selection into some types of private schools is downwards. Noell (2012) in a reanalysis of the '*Public and Private*' by Coleman et al., corrected self-selection into Catholic schools using an Instrumental Variable of students' religious identification as Catholic. Noell reports a negative bias of the impact of Catholic school attendance on sophomore reading score tests implemented in different states of USA, caused by unmeasured factors which affect both school choice and students' achievement.

Given Noell's findings, it is possible that, despite the extensive controls used for students' backgrounds, there may exist other unmeasured factors in self-selection into the private sector that are correlated with higher achievement (Coleman, Kilgore and Hoffer, 1982), in particular the factor of students' ability. This in fact, sparked many different reactions against the apparent superiority of private school system administration.

Epple and Romano (2002) provide evidence that private schools practice cream-skimming by accepting students based on income and ability stratification, i.e. to retain the most able students and encourage transfer or even drop-out - of low performing students, thus implying that private school results are upwardly biased.

Jimenez, Lockheed and Paqueo, (1991), advocate that since private schools must compete for students to remain financially viable, and given their autonomy and freedom to adjust to the needs of students and parents, the right incentives are in place to manage resources and staff in the most effective and efficient way. Hence, the free market competition promotes efficiency and forces private schools to attain high standards of excellence (Mancebón *et al.*, 2010).

Focusing now on the empirical findings regarding effectiveness of publicly funded private schools, Rosado and Seabra (2015) evaluate the relative performance of public versus private schools in Portugal, using publicly funded private schools to isolate the impact of background from the property and management school schemes. Employing cross-section data to compare students at the 9th grade in 2010, they find a positive effect of private ownership in students' performance in national exams. After controlling for students' individual characteristics e.g. age and gender, and background (the latter mainly district controls), belonging to a publicly funded private school increases the probability of passing the 9th grade national exam by 2.34% for Mathematics and by 2.06% for Portuguese subject, when compared to a public school. However, when considering the impact of school administration on students' consistency over academic years, being in a publicly funded private school decreases by 0.79% the probability of reaching 9th grade without any retention; increases by 0.68% the probability of being retained once; and increases by 0.11% the probability of being retained more than once when compared to public schools. The advantage of the current study is that we have a richer dataset, since it is possible to observe students in different periods, thus controlling for past historical education inputs (prior achievement scores). Nevertheless, the overall results are similar.

Mancebón *et al.* (2010), conduct a non-parametric efficiency analysis (Data Envelopment Analysis) in the context of public and publicly funded private schools in Spain, using microdata from PISA 2006 on science competencies. After controlling for students' background and school resources, and after removing individual management inefficiencies, they find that public schools are more efficient than publicly funded private schools, i.e. students in public schools have better results than publicly funded private schools in science PISA scores, while the former use equal or fewer resources than the latter.

Some countries have Charter schools, another type of school choice program that differs mainly in school administration, given that they can be either privately or publicly owned and managed. Charter schools are publicly funded and foster student learning by promoting educational innovation while allowing more autonomy and freedom with regards to school governance (Robert Bifulco, 2006). Flaker (2014) using data from students in the 8th grade in Massachusetts, reports that Charter schools outperform traditional public schools in schoolwide proficiency scores in both math and reading, whilst being more efficient in doing so, i.e. spending less money per student. Note, however, that even though Flacker disaggregated data by community type to control for variation between urban and non-urban systems, this was an observational study and thus the author did not consider different student characteristics, prior ability nor family background, raising concerns about the results obtained due to selection bias.

Similarly to what Mancebón *et al.* (2010) did in Spain, Grosskopf, Hayes and Taylor (2009) employ a non-parametric approach (DEA) to compare efficiency of Charter schools relative to traditional public schools in Texas, for students in elementary grades at metropolitan or micropolitan areas during the 2001/02 school year. They find that Charter schools are more technically efficient than traditional public schools, i.e. Charter schools produce better outcomes - such as net improvements in math and reading standardized tests - using the same or fewer resources than traditional public schools.

III. Portuguese Education System & *Contratos de Associação*

In Portugal, since 2009³, education is mandatory until the 12th grade and is divided in two different stages: *Ensino Básico* and *Ensino Secundário*. The former comprises three school cycles: *1º Ciclo* – 1st to 4th grade; *2º Ciclo* – 5th and 6th grade; *3º Ciclo* – 7th to 9th grade.

³ Portuguese Law nr.85/2009 of 27th August (Article nr.1 and nr.2)

Ensino Secundário comprises 10th to 12th grade and corresponds to the last school cycle before higher education, which is not compulsory. In the scope period of this study (2011/12-2015/16), students were required to complete national exams for Portuguese and Mathematics subjects at the end of 4th, 6th, 9th and 12th grades, each with different weights for final evaluation of the student. We will use national exams taken in both subjects at the 6th grade as our past achievement control, and those taken at the 9th grade in order to compare scores between students in different types of schools.

Regarding *Contratos de Associação*, these are pluriannual contracts established by the government with private schools to guarantee public education, free of tuition fees, in areas in which the provision of public schools is scarce (or non-existent)⁴. The first law providing the basis for these contracts dates back to 1980⁵, when Portugal experienced a change in the law which extended mandatory schooling until the 9th grade⁶, and established public funding at the individual level which was consistent with the amount spent in public schools with the same level and equivalent degree of education. From 2015/16, the government decided to publicly fund private schools at the class level, allocating 80.500€ per class and per academic year.

Private school students who enrol are subject to the criteria defined by private agents, whilst in both public schools and CA schools, students who apply to benefit from public education are assigned based on their residential area and - subject to the maximum school capacity - are able to rank their school choice preferences⁷.

With regard to teachers' hiring and allocation, private schools and CA schools have freedom to hire teachers in accordance with their own criteria. In public schools the school principal

⁴ In Portugal there are other types of contracts between private schools and the government that are not addressed in this study, namely *Contratos Simples*, *Contratos de Patrocínio*, *Contratos de Desenvolvimento*

⁵ Portuguese Decree-Law nr.553/80 of 21th November (Article nr.14-16)

⁶ Portuguese Law nr.45/86 of 14th October (Article nr.6)

⁷ Interestingly, students who apply to a certain school and whose sibling(s) are already studying there have priority; a possible explanation could be to facilitate transportation among the household

does not exert that function, it being the responsibility of the Ministry of Education's to allocate teachers based on their preferences, experience and grades upon graduation (Ferreira, 2015).

IV. Data, Variables & Group Decomposition

The data used in this study belongs to the DGEEC⁸ (Direção-Geral de Estatísticas da Educação e Ciência) from the Portuguese Ministry of Science and Education (MEC). From this dataset, which contains the entire population in Portugal from the 1st grade up to the 12th grade with respect to students, teachers and schools, we retrieved information distributed among two distinguishable groups of variables, which we will refer to as 'vector regressors' in the Analytical Framework section.

The first group of variables concerns students' individual characteristics including gender, age and nationality. Additionally, we built a proxy for family income, *Familysubsidy*, which is a dummy variable that takes the value 1 if the student's family received social support from the Portuguese Social Security. Regarding the validity of this proxy, we argue that it is closely linked with socio-economic status since social support is awarded on the basis of family aggregate income, family composition (i.e. number of children), and the student's current employment status. Nevertheless, it may not, by itself, be sufficient to control for family background. Hence, in the 'robustness tests' section for the validity of the results obtained, we will add more controls for family background, namely Parent's Secondary Education and Higher Education, and additionally two dummy variables if the student has home access to Computer and Internet⁹.

⁸ DGEEC is the entity responsible for collecting, monitoring, treating, producing and releasing statistics with regards to the Portuguese education system

⁹ Unfortunately, the sample is reduced when we add these variables due to missing variables

The second group of variables include a set of school characteristics, such as school district, county and type of school or class. We separate school from class, since it is possible that one school is not fully financed by the contracts (*Contratos de Associação*), meaning that there will be a mix of CA classes and private classes. Types of school or class, either public, CA or private, are dummy variables and will measure the impact of attending a certain type of school or class. The description of the variables is summarized in **Table A.1** in the Appendix.

Additionally, we use data of Portuguese and Mathematics national exams scores at 6th and 9th grades from JNE¹⁰ (Júri Nacional de Exames) to construct the measure of students' achievement with the Value-Added approach, with 9th grade exam being the output variable, and 6th grade exam the baseline of the student¹¹.

The dataset starts at the academic year 2006/07 and continues until the academic year 2015/16. However, because national exams (Portuguese and Mathematics) taken at the 6th grade only started being reported on a scale from 0-100 in the academic year 2011/12¹², we decided to restrict the sample and take the cohort of students at the 6th grade who performed both Portuguese and Mathematics national exams in the academic year 2011/12, as our starting point. Further, we develop two models to compare the effectiveness of each school regime with respect to students' consistency over the years and students' performance at national exams.

In the analysis, only students from the Portuguese mainland in the regular academic track were considered. In addition, it was necessary to observe, initially, students in the three grades

¹⁰ JNE is integrated into the DGE (Direção-Geral da Educação) and is responsible for coordinating, planning and executing final cycle exams, national final examinations, school-level examinations equivalent to national tests, equivalence tests for the 1st, 2nd and 3rd cycles of basic education (*Básico*) and secondary education (*Secundário*)

¹¹ Notice that there are two phases of national exam scores in the same academic year, and the data collected corresponds to the 1st exam phase taken by the student unless it is missing (in that case it will be the 2nd exam phase taken)

¹² Prior to this school year national exams were classified and reported on a scale 1-5, therefore losing variability

of Lower Secondary School (7th, 8th, and 9th) to record the time required for graduation. However, this was not necessary for students who were retained at least once in 7th or 8th grade, as they would automatically take more than three years to finish 7th to 9th grade. Moreover, for the **Value-Added** approach, we required that each student had both Portuguese and Mathematics national exam at 9th grade. Hence, we start by considering the type of class at 7th grade for the achievement measure of the **Probability of Graduation on Time**, and the type of class at 9th grade for the achievement measure constructed by the **Value-Added** approach. After excluding students for whom we do not observe the 9th grade exam scores, we look at the impact of attending the same class type throughout the three grades (in both models), e.g. studying the impact of attending 7th, 8th and 9th grade in a CA class.

Descriptive Statistics

In this subsection, we compare students from different types of classes.

According to the DGEEC's report for the school year 2011/12, there were 119 758 students enrolled at the 6th grade in mainland Portugal. Of these students, 104 410 were in public schools, 8 323 were in publicly funded private schools (including CA schools) and 7 025 were enrolled in private schools.

Our *Complete Sample* of 89 572 individuals that have both Portuguese and Mathematics national exams at the 6th grade in the school year 2011/12, and that we can follow at 7th grade, represent 74.79% of the total student population. Further ahead, we create a sub-sample of 75 879 individuals which we can follow until the 9th grade. At this point, it is important to point out that the *Restricted Sample* contains only students that completed Lower Secondary School in three or four years, since our dataset's last school year ends at 2015/16, thus caution is necessary when interpreting the results.

From **Table 1** below we confirm Rosado and Seabra's (2015) statement that students from public schools, i.e. those studying in public classes, are closer to their peers in CA classes, in Portugal, with respect to family income, - as measured by our proxy *Familisubsidy* - while students attending private schools tend to come from wealthier families. For instance, considering 7th grade of *Complete Sample*, the families of 36.98% of students in CA class receive social support whereas for students in public class the percentage is 43.67%. On the other hand, the families of students studying in private class barely receive social support at all (1.02%).

Table 1: Group Decomposition – Complete Sample (per type of school at 7th grade)

7TH GRADE				
TYPE OF SCHOOL	CA	PRIVATE	PUBLIC	TOTAL
<i>N</i>	6 195	4 326	79 051	89 572
<i>(% Of Students)</i>	(6,92%)	(4,83%)	(88,25%)	(100%)
<i>Student's Characteristics</i>				
<u>Gender(MALE=1)</u>				
<i>Males</i>	3 169	2 280	39 499	44 948
<i>Females</i>	3 026	2 046	39 552	44 624
<i>(% Of Males)</i>	(51,15%)	(52,70%)	(49,97%)	(50,18%)
<u>Nationality(PT=1)</u>				
<i>Portuguese</i>	6 155	4 290	77 175	87 620
<i>Foreigners</i>	40	36	1 876	1 952
<i>(% Of Portuguese)</i>	(99,35%)	99,17%)	(97,63%)	(97,82%)
<u>Family Subsidies(YES=1)</u>				
<i>6TH Grade: YES</i>	2 810	56	42 338	45 204
<i>NO</i>	3 385	4 270	36 713	44 368
<i>(% Of Receivers)</i>	(45,36%)	(1,29%)	(53,56%)	(50,47%)
<i>7TH Grade: YES</i>	2 291	44	34 525	36 860
<i>NO</i>	3 904	4 282	44 526	52 712
<i>(% Of Receivers)</i>	(36,98%)	(1,02%)	(43,67%)	(41,15%)
<u>Move School (YES=1)</u>				
<i>6TH To 7TH: YES</i>	692	247	21 749	22 688
<i>NO</i>	5 503	4 079	57 302	66 884
<i>(% Of Movers)</i>	(11,17%)	(5,71%)	(27,51%)	(25,33%)

Nevertheless, from 8th grade onwards the percentage of private school students receiving social support increases approximately 13 percentage points (p.p.)¹³. This is a significant increase which reduces the gap between the socio-economic status of private class attendees and that of other students¹⁴.

Moving on to the distribution of schools within mainland Portugal, it is possible to identify some factors that may affect the comparison between schools. Our private schools' sample is mainly located in two districts e.g. Lisbon and Porto, the two wealthiest and most populous districts in Portugal. In **Table A.3** in the Appendix - which shows the distribution of schools by the type of class they offer, per district, at 7th grade in our sample, there are 60 private schools in Lisbon and 36 private schools in Porto, representing 70.6% of all the private schools in the sample. Compared to public schools and CA schools - where Lisbon and Porto amount for 33.17% and 9.33% of the sample, respectively, there are large distributional disparities between the districts. Moreover, with regard to schools' territorial distribution, there are four districts of Portugal in which there are actually no CA schools at all. This is due, not to data limitations, but to the nature of the contract itself.

Regarding pupils' gender, from the *Complete Sample* of 89 572 individuals, 50.18% are males and the proportion remains stable when we disaggregate data by type of class: 51.15%, 52.70% and 49.97% are males in CA class, private class and public class, respectively. Regarding pupils' nationality, 97.82% of students in *Complete Sample* are Portuguese whereas the remainder are foreign.

With regard to students' mobility between 6th and 7th grade, there are some disparities. Considering *Complete Sample*, students from private class tend to remain in the same school;

¹³ See **Table A.2** in the Appendix for the *Restricted Sample*

¹⁴ The increase of family subsidy awarded to private class attendees at the 8th grade onwards may be due to the existence and effects of the financial crisis during the period in analysis (2011/12-2015/16), or may be due simply to a legal change in the way the subsidy was awarded; it is not possible to infer concerning this with total precision

only 5.71% moved to a different school. On the other hand, students from public class are more prone to move between the 6th and 7th grade, with a percentage of 27.51% from the sample moving school, while students in CA class fall between the two above with regard to mobility, with 11.17% moving school¹⁵.

V. Analytical framework

Probability of Graduation on Time

The first measure was constructed to estimate the probability of students completing Lower Secondary School - from the 7th to 9th grade, in three years, and thus to evaluate the student's consistency over an extended period, rather than at a single point in time, i.e. when they take an exam.

Consider:

$$C_i = \alpha X_i + \delta F_i + \gamma S_s + \theta A_i^6 + \beta T_i + \varepsilon_i \quad (1)$$

$$i = 1, \dots, \bar{N};$$

Where C_i is a dummy variable that takes the value one (1) if the student i completes Lower Secondary School (7th to 9th grade) in three years (0 if more than three years). X_i is a vector of student i time-invariant individual characteristics, F_i is our proxy for family income *Familysubsidy* of student's i , S_s is a vector of time-invariant school-characteristics of school s . The baseline achievement measure A_i^6 is a vector of student's i national exam scores at 6th grade at Mathematics and Portuguese subjects, that will account for the cumulative effects of prior education inputs (Sass, 2006).

¹⁵ Changing school is actually moving to another school, not to a different type of school or class, although this may occur

Our variable of interest T_i , is a vector of class type dummies of student i . ε_i is the composite error. \bar{N} is the number of students in the sample.

Achievement Value-Added Measure

Following Todd and Wolpin (2003), who constructed a conceptual framework of children's achievement as a cumulative process of knowledge acquisition, we construct an **Achievement Value-Added** measure of students' performance that uses a baseline achievement measure to allow for unobserved input history as well as unobserved initial ability.

The focus of this model is the standardized exam scores obtained at 9th grade:

$$A_{ij}^9 = \alpha X_i + \delta F_i + \gamma S_s + \theta A_{ij}^6 + \beta T_i + \varepsilon_i \quad (2)$$

$$i = 1, \dots, \bar{N}; j = 1, \dots, \bar{M}$$

Where A_{ij}^9 is the 9th grade national exam score of the student i in subject j and the other explanatory variables were already defined. \bar{M} is the total number of subjects, in this case two, Portuguese and Mathematics.

Similarly, T_i is a vector of class type dummies of student i . The β vector coefficients will measure the impact of attending a certain type of class.

VI. Results

Probability of Graduation on Time

We use a Logit to estimate the probability of graduation on time. The estimation results are shown in **Table 2** below.

Looking at Column 1 (*Complete Sample*) of **Table 2**, we consider students who we have not necessarily observed at 9th grade. The difference between *Complete Sample* and the *Restricted*

Sample is a group of students who took more than four years to complete 7th to 9th grade and would therefore appear in the school years after 2015/16¹⁶. Why is this relevant? Because students that were lost from the *Complete Sample* (Column 1) to the *Restricted Sample* (Column 2) were, in some way, low achievers.

Table 2: Marginal effects of the probability of graduation on time

VARIABLES	(1)	(2)	(3)
SCORE6thMATH	0.00608*** (6.63e-05)	0.00362*** (6.54e-05)	0.00357*** (6.55e-05)
SCORE6thPT	0.00369*** (9.49e-05)	0.00263*** (8.67e-05)	0.00260*** (8.67e-05)
FAMILYSUBSIDY7th	-0.0387*** (0.00233)	-0.0204*** (0.00208)	-0.0209*** (0.00208)
CACCLASS7th	0.00699 (0.00508)	0.00200 (0.00426)	-
PRIVCLASS7th	0.0836*** (0.0102)	0.0488*** (0.00867)	-
CACCLASS7to9th	-	-	0.0105** (0.00446)
PRIVCLASS7to9th	-	-	0.0947*** (0.0122)
MALE(Male=1)	-0.0471*** (0.00226)	-0.0268*** (0.00201)	-0.0265*** (0.00201)
AGE6th	-0.0383*** (0.00203)	-0.0142*** (0.00208)	-0.0135*** (0.00207)
PORTUGUESE(P=1)	-0.0209*** (0.00727)	-0.0198*** (0.00683)	-0.0185*** (0.00677)
MOVESCHOOL6to7th	-0.00607** (0.00264)	0.00142 (0.00240)	0.00150 (0.00239)
School District Dummies	YES	YES	YES
Observations	89,570	75,879	74,638
Pseudo R-squared	0.3259	0.2339	0.237

Robust Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Thus, we evaluate the percentage of students that we lost from each type of class to see whether the reduction of students was evenly distributed having regard to the proportions of students in the sample from each of the three types of class. It is confirmed that the reduction of students was evenly distributed among the three types of class in the 7th grade, as follows: the percentage of students from CA class in the sample increased 0.3 p.p.; from private class increased 0.55 p.p.; and from public class decreased 0.85 p.p., i.e. these changes were not sufficient to alter significantly the composition of the groups.

From Column 1 to 2 of **Table 2**, as we mentioned the difference is merely the sample, as we keep the same specification. It is noticeable that the coefficient from the *CACCLASS7th* dummy

¹⁶ Despite students in the 9th grade in respect of whom information was missing

in Column 1 is not statistically different from zero, suggesting that students from CA class in the 7th grade are neither more nor less likely to complete Lower Secondary School in three years when compared to pupils from public class. The results persist when we remove low achieving students from the sample, given by Column 2. However, in Column 3 we change the specification slightly, in order to capture the effects of studying the entire school cycle in the same class regime (and not only at 7th grade), measured by the dummy *CACCLASS7to9th*. The results change in favor of CA class, suggesting that students from CA class, *ceteris paribus*, are 1.05% more likely to complete 7th to 9th grade in three years when compared to public class students, with a positive coefficient significant at 5% level¹⁷.

Focusing on private class, the dummy *PRIVCLASS7th* has a significant positive effect at a level of 1% both in Column 1 with the *Complete Sample* and in Column 2 with the *Restricted Sample*. Thus, studying in a private class at 7th grade increases the probability by 8.36% and 4.88%, respectively, of completing Lower Secondary School in three years, when compared to studying in a public class. From Column 2 to 3, where the dummy *PRIVCLASS7to9th* captures the effect of studying the three grades in the same class type, belonging to a private class, *ceteris paribus*, increases by 9.47% the probability of reaching 10th grade with zero retentions, when compared to a student studying in a public class, and this effect is significant at 1% level.

Therefore, after excluding low achieving students and controlling for prior achievement test scores, family income, gender, nationality, student mobility and age at 6th grade, there is evidence that both CA class and private class are less likely to retain students once between 7th and 9th grade, for those students who remain in the same regime throughout all three grades, when compared to public class.

¹⁷ Note that the sample from Column 2 to Column 3 was reduced to 74 638 students, as not all students from *Restricted Sample* remained in the same regime administration between 7th and 9th grade

The effects of the control variables are consistent with the literature, namely the impact of family background. Receiving social support at the 7th grade, i.e. belonging to a less wealthy family, decreases the probability of reaching 10th grade with zero retentions. The exception to the direction of the impact according to the literature, is the dummy for nationality. Being Portuguese decreases the probability of completing 7th to 9th grade in three years relative to foreign students, and the effect is always significant at 1% level¹⁸.

Concentrating on student mobility from 6th to 7th grade, the impact of moving school in Column 1 is negative and significant at 5% level, but it fades away when the sample is restricted (Column 2). To conclude, age at 6th grade has a negative impact and is always significant at 1% to the probability of success, suggesting that students that have already been retained prior to 2011/12, are more likely to be retained again.

Achievement Value-Added Measure

The **Achievement Value-Added** measure was estimated by OLS and the results are shown in **Table 3**. We use robust standard errors to account for heteroskedasticity.

Column 1 to 2 (Mathematics Exams) and Column 3 to 4 (Portuguese Exams) from **Table 3** differ in the specification of the time spent in a certain class type. We start by analyzing the impact on national exam scores of contemporaneous class type at 9th grade, and then we extend the effects of administration to the three grades, from 7th to 9th grade. The sample in Column 1 and 3 of **Table 3** is equal to Column 2 (*Restricted Sample*) in **Table 2**, i.e. students who took 9th grade national exams in 2014/15 or 2015/16. As for the sample in Column 2 and 4 of **Table 3** it is equal to Column 3 of **Table 2** as expected.

¹⁸ Note that the percentages of foreign students in the *Complete Sample* (Column 1) and *Restricted Sample* (Column 2) are very low (2.18% and 1.84%, respectively)

Regarding the results, in all specifications, on average, belonging to a CA class either at 9th grade or between 7th and 9th grade, *ceteris paribus*, increases the national exam score by approximately 3.2 points and 1.2 points, for Mathematics and Portuguese subject respectively, on a scale of 0-100, when compared to students in public class. The coefficients reported are all significant at 1%, and the magnitude of the effect from contemporaneous class type attendance (9th grade) is not statistically different from the impact of three school grade class type attendance (7th to 9th grade), for both subjects.

With regard to private class, the results are quite similar in both specifications, although with higher magnitudes. Belonging to a private class in the 9th grade, on average, *ceteris paribus*, increases national exam scores by 8.4 points and 6.4 points, for Mathematics and Portuguese respectively, when compared to public class. Likewise for CA class, differences in the magnitudes of attending private class in three school grades of Lower Secondary School and only at 9th grade are minimal¹⁹.

Table 3: Achievement Value-Added estimation results

VARIABLES	(1) MATH	(2) MATH	(3) PT	(4) PT
SCORE6th	0.858*** (0.00295)	0.859*** (0.00297)	0.594*** (0.00316)	0.595*** (0.00318)
FAMILYSUBSIDY7th	-3.297*** (0.134)	-3.304*** (0.135)	-1.993*** (0.0887)	-1.992*** (0.0893)
CACCLASS9th	3.225*** (0.238)	-	1.152*** (0.163)	-
PRIVCLASS9th	8.367*** (0.249)	-	6.363*** (0.196)	-
CACCLASS7to9th	-	3.225*** (0.247)	-	1.285*** (0.169)
PRIVCLASS7to9th	-	8.375*** (0.256)	-	6.576*** (0.201)
MALE(Male=1)	-2.359*** (0.119)	-2.349*** (0.119)	-2.520*** (0.0826)	-2.513*** (0.0832)
AGE6th	-3.238*** (0.143)	-3.242*** (0.145)	-1.865*** (0.101)	-1.882*** (0.101)
MOVESCHOOL6to7th	0.404*** (0.142)	0.406*** (0.143)	0.0634 (0.0974)	0.0710 (0.0982)
PORTUGUESE(PT=1)	1.025** (0.471)	1.047** (0.474)	0.680** (0.303)	0.683** (0.306)
EXAMYEAR9th (2016=1)	-5.518*** (0.202)	-5.415*** (0.205)	-3.658*** (0.136)	-3.602*** (0.137)
Constant	37.26*** (1.789)	37.30*** (1.804)	43.25*** (1.249)	43.39*** (1.260)
School District Dummies	YES	YES	YES	YES
Observations	75,879	74,638	75,879	74,638
R-squared	0.611	0.611	0.440	0.441

Robust standard errors in parentheses

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

¹⁹ The difference for Mathematics subject is zero, whereas for Portuguese subject it is approximately 0.2 points

Comparing private classes with CA classes, there is evidence that the former outperforms the latter with respect to national exam scores at the 9th grade, in both subjects.

As with to the results obtained for the first measure of students' achievement **Probability of Graduation on Time**, we find that the better the results in prior achievement test scores, the better the results in national exams at 9th grade. Family subsidy contributes negatively to the outcome variable. Additionally, being older at 6th grade or being male also has a negative effect upon scores. With respect to nationality, the coefficients point in a different direction, suggesting that, on average, *ceteris paribus*, being a Portuguese student increases 9th grade national exam scores compared to foreign students, in both subjects. Intermobility between schools from 6th to 7th grade seems to have a positive impact on national exam scores, and is significant at 5% level for both subjects.

Lastly, the dummy variable *EXAMYEAR9th* which controls for the difficulty of the national exams in 2016 compared to 2015, has a negative effect, suggesting that, on average, *ceteris paribus*, national exams in 2016 were more difficult. However, this coefficient also reflects the fact that the group of students taking the exam in 2016 was different from the group of students taking the exam in 2015.

Robustness Tests

In this subsection, we introduce Parents' Education into our specifications to see whether the results are robust. Since Parent's Education in the dataset was only available for students in public schools, we were obliged to search for an alternative to obtain this variable for the remaining students (in CA schools and private schools). Hence, we linked our initial sample, which was not in public schools during the school grades observed in the current study, to other school grades not observed (1st – 5th). Then, we kept only those that were studying in public schools prior to 6th grade, in order to collect data regarding Parent's Education and

resources available at home²⁰. From the *Complete Sample* of 89 572 students, we retained 72 650. In particular, the composition of the sample is now comprised as follows: 6.14% CA class students, 0.88%²¹ private class students and 92.98% public class students.

Because Father's Education and Mother's Education were strongly correlated, we decided to keep Mother's Education as it presented less missing values. Therefore, in total there are four new dummy control variables: *M.SECONDARY*, *M.HIGHEREDUC*, *COMPUTER* and *INTERNET*²², where the prefix "M" stands for Mother.

In **Table A.4** (Appendix), find the results obtained for the **Probability of Graduation on Time**, prior to and after introducing Mother's Education and Home Resources. As with **Table 2**, there are three different estimations, but the number of Columns is multiplied by two, since we first present the old specification with the sample reduction and then we introduce the new variables.

Comparing the old specification after the sample reduction, Columns 1, 3 and 5 of **Table A.4** in the Appendix, which correspond to Column 1, 2 and 3 of **Table 2**, respectively, we can see that the results for the type class dummy coefficients are approximately equal in terms of significance but smaller in magnitude. The smallest and highest coefficient is 0.0361 and 0.0906 for private class respectively, and the only significant coefficient for CA class from the Columns mentioned above is 0.00923, thus below the 0.0105 from Column 3 of **Table 2**. However, when we add Mother's Education, *M.SECONDARY* and *M.HIGHEREDUC*, and student's access to Computer and Internet at Home, Columns 2, 4 and 6 of **Table A.4**, the coefficients of *PRIVCLASS7th* and *PRIVCLASS7to9th* decrease 1.4 p.p. from Column 1 to Column 2; 0.76 p.p. from Column 3 to Column 4; and 0.87 p.p. from Column 5 to Column 6,

²⁰ Students that were already in public schools in our observed school grades (6th to 9th) we collected data for the 7th grade, the first school year of Lower Secondary School

²¹ The majority of private school students were lost after adding Parent's Education and Home Resources

²² Find the description of the variables in **Table A.1: Section C** (Appendix)

whereas the coefficients for *CACCLASS7th* and *CACCLASS7to9th* increase by 0.34 p.p. and become statistically significant at 10% from Column 1 to Column 2; and increases 0.2 p.p. from Column 5 to 6.

The results from **Table A.4** are therefore robust to the introduction of new variables that were not present in prior specifications, and to a smaller sample. Note that *FAMILYSUBSIDY7th*, with the introduction of Mother's Education and Home Resources, loses magnitude (between 0.7 and 1 p.p.).

In **Table A.5** (Appendix), we present new estimations after excluding private class students, as they were a small group of students after the introduction of Mother's Education and Home Resources. Overall results are not altered, with the exception of the coefficient *CACCLASS7th* from Column 1 to Column 2 that remains not statistically different from zero, after the introduction of new variables.

Moving to the **Achievement Value-Added** measure, in **Table A.6** (Appendix) we present the results of the previous specification combined with the reduction of the sample, and the new specification. In Columns 1 and 3 (Mathematics) and Columns 5 and 7 (Portuguese), it is possible to observe for both subjects that the effect of attending either a CA class or private class, compared to public class, upon the 9th grade national exam scores has decreased with the new estimations, i.e. with the reduction of the sample from **Table 3**. However, as with the results obtained for the **Probability of Graduation on Time**, the introduction of Mother's Education and home access to studying resources, increases the impact of attending CA class, compared to public school, and decreases the impact of attending private class compared to public class. The results are the same whether we consider 9th grade attendance or 7th to 9th grade attendance.

Therefore, we can conclude that after introducing Mother's Education and Home Resources, belonging to a CA class during Lower Secondary School, on average, *ceteris paribus*, increases national exam scores by 3.2 points and 1.47 points for Mathematics and Portuguese respectively, compared to a public class. Thus, the results are approximately the same compared to those obtained in **Table 3**, before the robustness checks.

The most important change from the estimations reported in **Table A.6**, is in the impact of attending a private class, after the introduction of Mother's Education and Home Resources. The coefficients from *PRIVCLASS9th* and *PRIVCLASS7to9th* remain positive but decrease by as much as 3 points for both subjects (Columns 2, 4, 6, 9 of **Table A.6**), compared to **Table 3**, and approximately 1.2 points for Mathematics and 0.9 points for Portuguese subject, compared to the old specification with the new sample in **Table A.6**, Columns 1, 3, 5 and 7. These results may suggest that not only can Mother's Education (and Parent's in general) play an important role in the performance of children at school, but also present evidence that after accounting for this factor, the gap between national exam scores of public class students and private class students is substantially reduced.

In **Table A.7** in the Appendix, we present new estimations without private class students, for the same reasons explained above, and the results seem to be unchanged.

VII. Conclusions and Policy Implications

The goal of this research was to compare the effectiveness of private schools, relative to public schools, at class level, in Portugal, with particular interest in separating publicly funded private schools (CA schools in Portugal) from strictly private schools. Considering Rosado and Seabra (2015): whereas in their study, the probability of being retained at least once is higher in CA schools than in public schools, in our study we find a positive effect (9.47% and 1.05%) on the probability of completing Lower Secondary School without any retention, for

those students attending a private class and a CA class respectively, when compared to those attending a public class (7th to 9th grade). An explanation for the difference in our results may be the different set of controls that we employed and the fact that we controlled for the baseline scores (6th grade). After introducing Mother's Education and Home Studying Resources, the coefficients remained positive and changed slightly in favor of CA class relative to public class (1.15%), and to the detriment of private class relative to public class (8.19%).

Regarding students' performance in standardized scores at 9th grade, we corroborate their findings of the positive impact of attending both CA class and private class, when compared to public class. After controlling for Mother's Education and Home Studying Resources, on average, studying in a CA class from the 7th to 9th grade increases national exam score by 3.2 points and 1.47 points, for Mathematics and Portuguese subject respectively, compared to a student in a public class. For a private class, the coefficient is even higher (5.6 and 3.7, respectively for Mathematics and Portuguese subject), suggesting that students in private classes outperform both students in CA classes and public classes.

Despite the results obtained in favor of publicly funded private schools in Portugal compared to public schools in terms of effectiveness, in order to determine the school choice outcome should be publicly funded private schools (CA schools) in preference to public schools, one must also consider the annual average cost of each student at the different types of schools or classes which exist. The report from *Tribunal de Contas*²³, carried out in 2012, calculates the annual average student cost in both CA school and public school for the school year 2009/10 and provides evidence that financing students in publicly funded private schools is cheaper than in public schools. In values, they estimate the annual average cost of a student in a

²³ An independent agency that is responsible for auditing, inspecting and studying expenditures in different areas of the Portuguese government

publicly funded private school to be 4.522€, compared to 4.648€ in a public school. However, this estimate suffers from several limitations due to the lack of available data and the methodologies used. Therefore, we do not infer that the government should choose either to increase or to decrease the investment in CA schools. However, the results of our study, provide evidence that, with respect to effectiveness, students in publicly funded private schools outperform students in public schools. Nevertheless, more studies are required, in particular to estimate the costs of financing a student in each type of class.

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Appendix

Table A.1: General Descriptive Statistics

VARIABLE	DESCRIPTION	OBS	MIN	MAX	MEAN	STD.DEV
SECTION A:						
Achievement Measures						
SCORE9THMATH	9 th grade national exam score (Mathematics)	89 750	0	100	50.77	26.09
SCORE9THPT	9 th grade national exam score (Portuguese)	89 750	3	100	59.12	15.04
COMPLETEIN3YEARS	If the student completed 7 th to 9 th grade in three years	89 750	0	1	0.79	0.41
SECTION B:						
Independent Variables						
SCORE6THMATH	6 th grade national exam score (Mathematics)	89 750	0	100	56.16	23.25
SCORE6THPT	6 th grade national exam score (Portuguese)	89 750	1	100	60.85	15.88
FAMILYSUBSIDY7TH	If student's family received social support in 7 th grade	89 750	0	1	0.41	0.49
PUBCLASS7TH	If the student attends a public class in the 7 th grade	89 750	0	1	0.88	0.32
CACCLASS7TH	If the student attends a publicly funded private class in the 7 th grade	89 750	0	1	0.069	0.25
PRIVCLASS7TH	If the student attends a private class in the 7 th grade	89 750	0	1	0.048	0.21
PUBCLASS7TO9TH	If the student attends a public class between the 7 th and the 9 th grade	74 638	0	1	0.88	0.32
CACCLASS7TO9TH	If the student attends a publicly funded private class between the 7 th and the 9 th grade	74 638	0	1	0.069	0.25
PRIVCLASS7TO9TH	If the student attends a private class between the 7 th and the 9 th grade	74 638	0	1	0.05	0.22
MALE	If the student is male	89 750	0	1	0.5	0.5
AGE6TH	Age of the student at 6 th grade	89 750	9.15	18.54	11.4	0.55
PORTUGUESE	If the student is Portuguese	89 750	0	1	0.98	0.15
MOVESCHOOL6TO7TH	If the student moved school from 6 th to the 7 th grade	89 750	0	1	0.25	0.43
SECTION C:						
Robust Variables						
M.SECONDARY	If the student's Mother has a Secondary School degree	72 650	0	1	0.42	0.49
M.HIGHEREDUC	If the student's Mother has a Higher Education degree	72 650	0	1	0.18	0.39
COMPUTER	If the student has home access to Computer	72 650	0	1	0.73	0.44
INTERNET	If the student has home access to Internet	72 650	0	1	0.59	0.49

Table A.2: Group Decomposition – Restricted Sample (per type of school at 7th grade, 9th grade and 7th to 9th grade)

TYPE OF SCHOOL	7TH GRADE				9TH GRADE				7TH-9TH GRADE			
	CA	PRIV	PUB	TOTAL	CA	PRIV	PUB	TOTAL	CA	PRIV	PUB	TOTAL
<i>N</i>	5 475	4 151	66 253	75 879	5 554	3 949	66 376	75 879	5 115	3 737	65 786	74 638
(% of Students)	(7.22%)	(5.47%)	(87.31%)	(100%)	(7.32%)	(5.20%)	(87.48%)	(100%)	(6.85%)	(5.01%)	(88.14%)	(100%)
Student Characteristics												
Gender(MALE=1)												
<i>Males</i>	2 718	2 178	31 923	36 819	2 766	2 060	31 993	36 819	2 539	1 948	31 686	36 173
<i>Females</i>	2 757	1 973	34 330	39 060	2 788	1 889	34 383	39 060	2 576	1 789	34 100	38 465
(% of Males)	(49.64%)	(52.47%)	(48.18%)	(48.52%)	(49.80%)	(52.17%)	(48.20%)	(48.52%)	(49.64%)	(52.13%)	(48.17%)	(48.46%)
Nationality(PT=1)												
<i>Portuguese</i>	5 442	4 119	64 921	74 482	5 521	3 920	65 041	74 482	5 088	3 710	64 460	73 258
<i>Foreigners</i>	33	32	1 332	1 397	33	29	1 335	1 397	27	27	1 326	1 380
(% of Portuguese)	(99.40%)	(99.23%)	(97.99%)	(98.16%)	(99.41%)	(99.27%)	(97.99%)	(98.16%)	(99.47%)	(99.28%)	(97.98%)	(98.15%)
Family Subsidies(YES=1)												
<i>6TH Grade: YES</i>	2 325	46	33 083	35 454	2 364	81	33 009	35 454	2 188	21	32 896	35 105
<i>NO</i>	3 150	4 105	33 170	40 425	3 190	3 868	33 367	40 425	2 927	3 716	32 890	39 533
(% of Receivers)	(42.47%)	(1.11%)	(49.93%)	(46.72%)	(42.56%)	(2.05%)	(49.73%)	(46.72%)	(42.78%)	(0.56%)	(50.00%)	(47.03%)
<i>7TH Grade: YES</i>	1 876	33	26 355	28 264	1 906	52	26 306	28 264	1 758	8	26 212	27 978
<i>NO</i>	3 599	4 118	39 898	47 615	3 648	3 897	40 070	47 615	3 357	3 729	39 574	46 660
(% of Receivers)	(34.26%)	(0.79%)	(39.78%)	(37.25%)	(34.32%)	(1.32%)	(39.63%)	(37.25%)	(34.37%)	(0.21%)	(39.84%)	(37.48%)
<i>8TH Grade: YES</i>	1 843	577	26 129	28 549	1 867	549	26 133	28 549	1 741	502	25 994	28 237
<i>NO</i>	3 632	3 574	40 124	47 330	3 687	3 400	40 243	47 330	3 374	3 235	39 792	46 401
(% of Receivers)	(33.68%)	(13.90%)	(39.44%)	(37.62%)	(33.62%)	(13.90%)	(39.37%)	(37.62%)	(34.04%)	(13.43%)	(39.51%)	(37.83%)
<i>9TH Grade: YES</i>	1 588	507	25 404	27 499	1 583	496	25 420	27 499	1 479	450	25 290	27 219
<i>NO</i>	3 887	3 644	40 849	48 380	3 971	3 453	40 956	48 380	3 636	3 287	40 496	47 419
(% of Receivers)	(29.00%)	(12.21%)	(38.34%)	(36.24%)	(28.50%)	(12.56%)	(38.30%)	(36.24%)	(28.91%)	(12.04%)	(38.44%)	(36.47%)
Move School (YES=1)												
<i>6TH to 7TH: YES</i>	571	230	18 629	19 430	600	268	18 562	19 430	524	204	18 493	19 221
<i>NO</i>	4 904	3 921	47 624	56 449	4 954	3 681	47 814	56 449	4 591	3 533	47 293	55 417
(% of Movers)	(10.43%)	(5.54%)	(28.12%)	(25.61%)	(10.80%)	(6.79%)	(27.96%)	(25.61%)	(10.24%)	(5.46%)	(28.11%)	(25.75%)

Table A.3: School district per type of school and per school grade

SCHOOL DISTRICT	7TH GRADE				8TH GRADE				9TH GRADE			
	CA	PRIV	PUB	TOTAL	CA	PRIV	PUB	TOTAL	CA	PRIV	PUB	TOTAL
1 - <u>AVEIRO</u>	8	6	79	93	8	6	78	0	8	4	67	79
2 - <u>BEJA</u>	2	1	27	30	2	0	27	30	2	1	26	29
3 - <u>BRAGA</u>	8	8	84	100	8	8	82	100	8	9	84	101
4 - <u>BRAGANÇA</u>	2	0	21	23	2	0	21	23	2	0	21	23
5 - <u>CASTELO BRANCO</u>	4	0	25	29	4	0	25	29	4	0	24	28
6 - <u>COIMBRA</u>	13	4	49	66	12	3	51	66	12	2	45	59
7 - <u>ÉVORA</u>	0	2	23	25	0	2	23	25	0	2	21	23
8 - <u>FARO</u>	0	4	56	60	0	4	57	60	0	4	56	60
9 - <u>GUARDA</u>	4	0	24	28	4	0	23	28	4	0	21	25
10 - <u>LEIRIA</u>	16	0	43	59	16	0	4	59	16	0	43	59
11 - <u>LISBOA</u>	5	60	177	242	5	59	174	242	5	57	159	221
12 - <u>PORTALEGRE</u>	0	1	22	23	0	1	21	23	0	1	21	22
13 - <u>PORTO</u>	2	36	165	203	2	35	164	203	2	34	155	191
14 - <u>SANTARÉM</u>	4	0	52	56	4	0	52	56	4	0	47	51
15 - <u>SETÚBAL</u>	0	9	85	94	0	9	82	94	0	7	79	86
16 - <u>VIANA DO CASTELO</u>	2	2	25	29	2	2	25	29	2	2	23	27
17 - <u>VILA REAL</u>	2	0	25	27	2	0	25	27	2	0	25	27
18 - <u>VISEU</u>	3	2	54	59	3	1	51	59	3	1	46	50
TOTAL SCHOOLS	75	135	1 036	1 246	74	130	1 024	1 246	74	124	963	1 161

Table A.4: Robust Specification - Marginal effects of the probability of graduation on time

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
SCORE6thMATH	0.00614*** (7.41e-05)	0.00587*** (7.52e-05)	0.00366*** (7.33e-05)	0.00352*** (7.39e-05)	0.00362*** (7.33e-05)	0.00348*** (7.39e-05)
SCORE6thPT	0.00380*** (0.000106)	0.00367*** (0.000105)	0.00272*** (9.67e-05)	0.00265*** (9.65e-05)	0.00269*** (9.66e-05)	0.00262*** (9.63e-05)
FAMILYSUBSIDY7th	-0.0387*** (0.00257)	-0.0260*** (0.00264)	-0.0207*** (0.00231)	-0.0139*** (0.00237)	-0.0209*** (0.00230)	-0.0140*** (0.00236)
CACCLASS7th	0.00737 (0.00599)	0.0108* (0.00598)	0.00210 (0.00498)	0.00416 (0.00499)	-	-
PRIVCLASS7th	0.0781*** (0.0236)	0.0641*** (0.0237)	0.0361** (0.0184)	0.0285 (0.0184)	-	-
CACCLASS7to9th	-	-	-	-	0.00923* (0.00521)	0.0115** (0.00521)
PRIVCLASS7to9th	-	-	-	-	0.0906*** (0.0279)	0.0819*** (0.0282)
MALE(Male=1)	-0.0484*** (0.00251)	-0.0500*** (0.00250)	-0.0268*** (0.00224)	-0.0278*** (0.00224)	-0.0267*** (0.00224)	-0.0277*** (0.00223)
AGE6th	-0.0384*** (0.00232)	-0.0346*** (0.00231)	-0.0147*** (0.00238)	-0.0126*** (0.00237)	-0.0143*** (0.00237)	-0.0122*** (0.00237)
PORTUGUESE(Pt=1)	-0.0110 (0.00915)	-0.00848 (0.00921)	-0.0132 (0.00858)	-0.0124 (0.00861)	-0.0126 (0.00851)	-0.0119 (0.00855)
MOVESCHOOL6to7th	-0.00656** (0.00295)	-0.00986*** (0.00295)	0.00227 (0.00269)	0.000415 (0.00269)	0.00230 (0.00268)	0.000403 (0.00268)
+M.SECONDARY	-	0.0344*** (0.00325)	-	0.0185*** (0.00287)	-	0.0195*** (0.00287)
+M.HIGHEREDUC	-	0.0569*** (0.00572)	-	0.0280*** (0.00478)	-	0.0286*** (0.00484)
+COMPUTER	-	0.00922** (0.00379)	-	0.00674** (0.00342)	-	0.00681** (0.00341)
+INTERNET	-	0.00345 (0.00359)	-	-0.000476 (0.00322)	-	-0.000793 (0.00322)
School District Dummies	YES	YES	YES	YES	YES	YES
Observations	72,650	72,650	61,894	61,894	61,183	61,183
Pseudo R-squared	0.3189	0.3244	0.2289	0.2326	0.2303	0.2343

Robust Standard errors in parentheses

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

Table A.5: Robust Specification (without private class students) - Marginal effects of the probability of graduation on time

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
SCORE6thMATH	0.00619*** (7.46e-05)	0.00592*** (7.57e-05)	0.00370*** (7.40e-05)	0.00356*** (7.46e-05)	0.00366*** (7.38e-05)	0.00351*** (7.44e-05)
SCORE6thPT	0.00382*** (0.000107)	0.00368*** (0.000106)	0.00272*** (9.75e-05)	0.00265*** (9.72e-05)	0.00270*** (9.72e-05)	0.00263*** (9.69e-05)
FAMILYSUBSIDY7th	-0.0390*** (0.00259)	-0.0262*** (0.00266)	-0.0211*** (0.00233)	-0.0142*** (0.00239)	-0.0211*** (0.00232)	-0.0141*** (0.00238)
CACCLASS7th	0.00634 (0.00605)	0.00985 (0.00605)	0.00136 (0.00503)	0.00344 (0.00504)	-	-
-PRIVCLASS7th	-	-	-	-	-	-
CACCLASS7to9th	-	-	-	-	0.00927* (0.00524)	0.0116** (0.00525)
-PRIVCLASS7to9th	-	-	-	-	-	-
MALE(Male=1)	-0.0489*** (0.00253)	-0.0505*** (0.00252)	-0.0271*** (0.00226)	-0.0281*** (0.00226)	-0.0270*** (0.00225)	-0.0281*** (0.00225)
AGE6th	-0.0386*** (0.00234)	-0.0348*** (0.00233)	-0.0147*** (0.00240)	-0.0127*** (0.00239)	-0.0141*** (0.00239)	-0.0120*** (0.00238)
PORTUGUESE(PY=1)	-0.0109 (0.00922)	-0.00826 (0.00928)	-0.0133 (0.00864)	-0.0124 (0.00868)	-0.0123 (0.00857)	-0.0116 (0.00860)
MOVESCHOOL6to7th	-0.00677** (0.00297)	-0.0101*** (0.00297)	0.00219 (0.00271)	0.000283 (0.00271)	0.00215 (0.00270)	0.000224 (0.00270)
+M.SECONDARY	-	0.0346*** (0.00328)	-	0.0186*** (0.00289)	-	0.0195*** (0.00289)
+M.HIGHEREDUC	-	0.0583*** (0.00581)	-	0.0289*** (0.00487)	-	0.0292*** (0.00489)
+COMPUTER	-	0.00920** (0.00382)	-	0.00677** (0.00344)	-	0.00689** (0.00344)
+INTERNET	-	0.00344 (0.00361)	-	-0.000547 (0.00325)	-	-0.000823 (0.00324)
School District Dummies	YES	YES	YES	YES	YES	YES
Observations	71,816	71,816	61,112	61,112	60,693	60,693
Pseudo R-squared	0.319	0.3246	0.2289	0.2327	0.2295	0.2336

Robust Standard errors in parentheses

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

Table A.6: Robust Achievement Value-Added estimation results

VARIABLES	(1) MAT	(2) MAT	(3) MAT	(4) MAT	(5) PT	(6) PT	(7) PT	(8) PT
SCORE6th	0.858*** (0.00325)	0.824*** (0.00342)	0.859*** (0.00326)	0.825*** (0.00344)	0.593*** (0.00349)	0.567*** (0.00355)	0.594*** (0.00351)	0.567*** (0.00357)
FAMILYSUBSIDY7th	-3.290*** (0.144)	-1.809*** (0.150)	-3.286*** (0.145)	-1.806*** (0.151)	-2.000*** (0.0958)	-0.927*** (0.100)	-2.003*** (0.0963)	-0.923*** (0.101)
CACCLASS9th	2.590*** (0.276)	3.061*** (0.276)	-	-	1.004*** (0.189)	1.288*** (0.188)	-	-
PRIVCLASS9th	6.825*** (0.624)	5.588*** (0.629)	-	-	3.939*** (0.471)	2.979*** (0.466)	-	-
CACCLASS7to9th	-	-	2.644*** (0.286)	3.176*** (0.286)	-	-	1.145*** (0.196)	1.470*** (0.195)
PRIVCLASS7to9th	-	-	6.728*** (0.714)	5.590*** (0.723)	-	-	4.583*** (0.538)	3.685*** (0.530)
MALE	-2.400*** (0.132)	-2.451*** (0.131)	-2.391*** (0.133)	-2.438*** (0.132)	-2.561*** (0.0915)	-2.730*** (0.0908)	-2.560*** (0.0920)	-2.728*** (0.0913)
AGE6th	-3.239*** (0.162)	-2.947*** (0.161)	-3.220*** (0.163)	-2.929*** (0.162)	-1.817*** (0.114)	-1.566*** (0.113)	-1.831*** (0.115)	-1.578*** (0.114)
MOVESCHOOL6to7th	0.368** (0.156)	-0.0442 (0.155)	0.395** (0.157)	-0.0163 (0.156)	0.0446 (0.107)	-0.244** (0.106)	0.0480 (0.108)	-0.242** (0.107)
PORTUGUESE(PT=1)	1.022* (0.578)	1.067* (0.576)	1.072* (0.581)	1.102* (0.578)	0.523 (0.373)	0.578 (0.371)	0.541 (0.376)	0.584 (0.374)
EXAMYEAR9th (2016=1)	-5.572*** (0.223)	-5.402*** (0.221)	-5.478*** (0.225)	-5.307*** (0.224)	-3.642*** (0.149)	-3.358*** (0.148)	-3.619*** (0.151)	-3.328*** (0.150)
+M.SECONDARY	-	1.912*** (0.171)	-	1.901*** (0.172)	-	1.389*** (0.115)	-	1.413*** (0.115)
+M.HIGHEREDUC	-	4.342*** (0.198)	-	4.379*** (0.199)	-	2.930*** (0.140)	-	2.939*** (0.141)
+COMPUTER	-	0.351 (0.220)	-	0.321 (0.222)	-	0.114 (0.148)	-	0.157 (0.149)
+INTERNET	-	0.864*** (0.202)	-	0.882*** (0.204)	-	0.557*** (0.136)	-	0.540*** (0.136)
Constant	37.53*** (2.023)	33.53*** (2.015)	37.21*** (2.037)	33.26*** (2.029)	43.09*** (1.414)	40.13*** (1.410)	43.19*** (1.425)	40.20*** (1.421)
School District Dummies	YES	YES	YES	YES	YES	YES	YES	YES
Observations	61,894	61,894	61,183	61,183	61,894	61,894	61,183	61,183
R-squared	0.594	0.602	0.594	0.602	0.423	0.434	0.424	0.435

Robust Standard errors in parentheses

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

Table A.7: Robust Achievement Value-Added estimation results (without private class)

VARIABLES	(1) MAT	(2) MAT	(3) MAT	(4) MAT	(5) PT	(6) PT	(7) PT	(8) PT
SCORE6th	0.858*** (0.00326)	0.825*** (0.00344)	0.859*** (0.00327)	0.825*** (0.00345)	0.592*** (0.00351)	0.566*** (0.00357)	0.593*** (0.00352)	0.566*** (0.00358)
FAMILYSUBSIDY7th	-3.299*** (0.145)	-1.805*** (0.151)	-3.291*** (0.145)	-1.796*** (0.151)	-2.002*** (0.0960)	-0.926*** (0.101)	-2.007*** (0.0963)	-0.928*** (0.101)
CACCLASS9th	2.581*** (0.278)	3.072*** (0.278)	-	-	1.021*** (0.190)	1.317*** (0.190)	-	-
-PRIVCLASS9th	-	-	-	-	-	-	-	-
CACCLASS7to9th	-	-	2.639*** (0.286)	3.176*** (0.286)	-	-	1.143*** (0.196)	1.468*** (0.195)
-PRIVCLASS7to9th	-	-	-	-	-	-	-	-
MALE	-2.404*** (0.133)	-2.454*** (0.132)	-2.408*** (0.133)	-2.455*** (0.132)	-2.573*** (0.0920)	-2.743*** (0.0913)	-2.576*** (0.0923)	-2.745*** (0.0916)
AGE6th	-3.221*** (0.163)	-2.925*** (0.162)	-3.192*** (0.164)	-2.896*** (0.163)	-1.808*** (0.114)	-1.555*** (0.114)	-1.822*** (0.115)	-1.569*** (0.114)
MOVESCHOOL6to7th	0.386** (0.157)	-0.0329 (0.155)	0.406*** (0.157)	-0.0108 (0.156)	0.0526 (0.108)	-0.238** (0.107)	0.0591 (0.108)	-0.231** (0.107)
PORTUGUESE(PT=1)	1.020* (0.580)	1.068* (0.578)	1.095* (0.582)	1.127* (0.579)	0.533 (0.374)	0.592 (0.372)	0.534 (0.377)	0.580 (0.374)
EXAMYEAR9th (2016=1)	-5.534*** (0.224)	-5.369*** (0.222)	-5.490*** (0.226)	-5.318*** (0.224)	-3.644*** (0.150)	-3.363*** (0.149)	-3.620*** (0.151)	-3.332*** (0.150)
+M.SECONDARY	-	1.893*** (0.172)	-	1.900*** (0.173)	-	1.405*** (0.115)	-	1.415*** (0.116)
+M.HIGHEREDUC	-	4.431*** (0.200)	-	4.445*** (0.200)	-	2.918*** (0.142)	-	2.926*** (0.142)
+COMPUTER	-	0.321 (0.222)	-	0.314 (0.223)	-	0.113 (0.149)	-	0.150 (0.149)
+INTERNET	-	0.895*** (0.204)	-	0.894*** (0.204)	-	0.568*** (0.136)	-	0.545*** (0.137)
Constant	37.35*** (2.032)	33.32*** (2.025)	36.90*** (2.042)	32.90*** (2.034)	43.07*** (1.421)	40.07*** (1.418)	43.18*** (1.428)	40.18*** (1.424)
School District Dummies	YES	YES	YES	YES	YES	YES	YES	YES
Observations	61,112	61,112	60,693	60,693	61,112	61,112	60,693	60,693
R-squared	0.593	0.600	0.593	0.601	0.422	0.433	0.422	0.434

Robust Standard errors in parentheses

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