Institut d'Economia de Barcelona

Document de treball de l'IEB 2011/37

DOES GRADE RETENTION AFFECT ACHIEVEMENT? SOME EVIDENCE FROM PISA

J. Ignacio García-Pérez, Marisa Hidalgo-Hidalgo, J. Antonio Robles-Zurita

Documents de Treball de l'IEB 2011/37

DOES GRADE RETENTION AFFECT ACHIEVEMENT? SOME EVIDENCE FROM PISA

J. Ignacio García-Pérez, Marisa Hidalgo-Hidalgo, J. Antonio Robles-Zurita

Postal Address:
Institut d'Economia de Barcelona
Facultat d'Economia i Empresa
Universitat de Barcelona
C/ Tinent Coronel Valenzuela, 1-11
(08034) Barcelona, Spain
Tel.: + 34 93 403 46 46
Fax: + 34 93 403 98 32
ieb@ub.edu
http://www.ieb.ub.edu

Documents de Treball de l'IEB 2011/37

DOES GRADE RETENTION AFFECT ACHIEVEMENT? SOME EVIDENCE FROM PISA [*]

J. Ignacio García-Pérez, Marisa Hidalgo-Hidalgo, J. Antonio Robles-Zurita

ABSTRACT: Grade retention practices are at the forefront of the educational debate. In this paper, we use PISA 2009 data for Spain to measure the effect of grade retention on students'achievement. One important problem when analyzing this question is that school outcomes and the propensity to repeat a grade are likely to be determined simultaneously. We address this problem by estimating a Switching Regression Model. We find that grade retention has a negative impact on educational outcomes, but we confirm the importance of endogenous selection, which makes observed differences between repeaters and non-repeaters appear 14.6% lower than they actually are. The effect on PISA scores of repeating is much smaller (-10% of non-repeaters'average) than the counterfactual reduction that non-repeaters would suffer had they been retained as repeaters (-24% of their average). Furthermore, those who repeated a grade during primary education suffered more than those who repeated a grade of secondary school, although the effect of repeating at both times is, as expected, much larger.

JEL Codes: D63, I28, J24

Keywords: Grade retention, educational scores, PISA

J. Ignacio García-Pérez
Department of Economics
Universidad Pablo de Olavide
E-41013, Sevilla, Spain

Marisa Hidalgo-Hidalgo
Department of Economics
Universidad Pablo de Olavide
E-41013, Sevilla, Spain
E-mail: mhidalgo@upo.es

J. Antonio Robles-Zurita
Department of Economics
Universidad Pablo de Olavide
E-41013, Sevilla, Spain

[*] We are grateful to Giorgio Brunello, Antonio Cabrales, Rajashri Chakrabarti, M. Dolores Collado and Juan J. Dolado for their useful comments and discussion. We also thank seminar participants at the 2010 XREAP Workshop on the Economics of Education. Financial support from the Spanish Ministry of Education and Science (SEJ 2007-67734) and Junta de Andalucía (SEJ-2905, SEJ-426) is gratefully acknowledged.

1 Introduction

In most countries, students are promoted from one grade to the next on the basis of their academic performance. The PISA 2009 Report shows considerable variation in grade retention rates across OECD countries, with the grade retention rate defined as the percentage of 15- year-old pupils who are not in their country's reference grade. The report shows that the Netherlands, Austria and Portugal have relatively high rates of grade retention (with up to 50% of pupils having repeated one year or more) whereas countries such as Denmark, Sweden, Japan, Norway and the UK have no grade retention at all (see Belot and Vandenberghe, 2011). Spain belongs to the first group, with about 40% grade retention on average. These disparities may be due to differences in policies, with some countries allowing students to be promoted to higher grades regardless of their performance and others conditioning promotion on students' educational achievements.

The recent interest in academic performance differences across countries as a result of increased international competition has brought the retention policy to the forefront of the educational debate. The PISA 2009 Report shows important differences in this dimension. In particular, countries such as Spain, Portugal, Italy, France and Greece are clearly below average among the OECD countries and did not show any improvement with respect to the 2000, 2003 and 2006 reports.[1]Moreover, even within a single country, scores vary widely across regions. For example, in Spain, the average math score in southern regions (e.g., the Canary Islands and Andalusia) is between 61 and 34 points below the OECD average whereas the average math score in some northern regions (e.g., Castile Leon or Navarre) is about 18 points above the OECD average. However, students' poor performance on international tests is not the only concern of policy makers and academics. Increasing drop-out rates (see OECD, 2009) are also a major worry.[2] Among a number of policies devised to help reduce school dropout rates and improve academic performance, we focus on grade retention regulation in this paper.

Our objective is to estimate the grade retention effect on educational outcomes for the whole Spanish sample and for each of the Spanish regions with enlarged sample.

There is a great deal of controversy regarding the practice of grade retention. The proponents of retention argue that it may reinforce a student's knowledge, with po-

[1] The average PISA 2009 test scores of Spanish students in math, reading and science are 480, 484 and 488, respectively, which are 13, 12 and 13 points below the respective OECD means and, obviously, much smaller than the scores in the best-performing countries, the Republic of Korea and Finland, where students score above 530 points in all disciplines

[2] See Dearden et al. (2006) for an analysis of policies aimed at reducing drop-out rates in the UK.

tential benefits for his or her subsequent outcomes. Additional exposure to teaching, especially in early grades, may make a student more likely to pursue higher levels of education. Indeed, repetition may also improve the quality of the match between the school and the student if his development makes him more apt to succeed in a certain grade at a later age. The main argument in favor of grade retention is that it provides incentives to increase effort, making it an efficient mechanism to reallocate students. However, this efficiency may come at a cost because retained students take longer to pass through the educational system. The critics of retention argue that it does not lead to improvements in school achievement and, instead, harms those low-achieving students who are most at risk of failure. They base their opinion on a large body of research on education and pedagogy that documents the negative effects of retention, particularly in terms of reducing the high school completion rate.[3]

The challenge in identifying the effect of grade failure on subsequent school outcomes lies in the fact that latent school outcomes (i.e., those that would be observed in the absence of grade failure) and the propensity to repeat a grade are likely to be determined simultaneously. Characteristics of the student (ability or motivation), the socioeconomic background and the school are likely to affect grade retention and attainment simultaneously. Such correlations will likely overestimate the impact of grade failure on subsequent outcomes and compromise the identification of a causal effect of retention on scores. In addition, note that most tests that evaluate students' knowledge in some particular discipline may not be appropriate for studying grade retention. Because repeaters are enrolled in lower grades, they have completed a less advanced curriculum and thus have a lower expected score.

A growing body of literature examines the relationship between grade retention and educational outcomes. Some studies provide quasi-experimental evidence of the effects of grade retention. For example, Manacorda (2008) exploits a discontinuity induced by a rule establishing automatic grade retention for pupils missing more than 25 days of school during a single academic year and shows that grade retention leads to a substantial increase in the drop-out rate and lower educational attainment 4 or 5 years later. Jacob and Lefgren (2004) find no consistent differences in the performance of retained versus promoted students in the short run. However, Jacob and Lefgren (2009), who study the long-run effects of retention on high school completion, find positive effects of grade retention on education attainment for low-achieving third

[3]Some studies have found that retention is associated with increased drop-out rates (see Jimerson et al. (2002) and Roderick (1994), among others). However, as retention decisions are typically made by the teacher or school principal on the basis of a number of unobservable student characteristics (such as maturity or parental involvement), all of these studies are plagued by serious selection concerns.

graders but no significant effect for sixth graders. They use a regression discontinuity design strategy based on promotional decisions tied to performance on standardized tests in the Chicago public schools.

Because PISA exams are aimed not at evaluating students' curricular knowledge but at assessing their general abilities, the score on this test is a more appropriate measure of the impact of grade retention on educational attainment. To circumvent the identification problem noted above, we suggest using a switching regression approach.[4] Our main identification strategy is based on the fact that some variables may affect students' outcome only through their effect on the probability of repeating a grade. In this sense, we use the student's quarter of birth as an instrumental variable. We argue that this variable affects the probability of grade retention but does not directly affect educational outcomes.

Several important results are found. First, if we consider grade retention as exogenous to the individual unobserved heterogeneity, the effect of grade repetition on Spanish students' PISA outcomes is about 80 points out of an average math score of 480. If we take into account the two different educational processes for repeater and non-repeater students, this figure does not change much. However, once endogeneity is properly controlled for, the retention effect is reduced considerably for repeaters. With our model, we are able to measure the predicted effect of grade retention on those who are actually retained: retention reduces their score by about 56 points. However, if we calculate the potential effect of grade retention on non-retained students, the estimated effect is above 125 points. That is, had they been retained as repeaters, their PISA outcomes would have been reduced by more than twice the observed reduction for repeaters.

Estimation of different types of repetition effects at the primary and secondary levels yields some interesting findings. Those students who were held back during their primary education suffered a larger impact on their educational outcomes compared with those who were retained during secondary school. In contrast, for non-repeaters, repeating a grade of secondary school is estimated to have a larger effect. Moreover, we observed that repeating a grade in both primary and secondary school has a much larger negative effect compared with repeating only one grade in either primary or secondary school.

We find that grade retention varies substantially across regions: the retention effect among repeaters is larger in some northern regions (e.g., Castile Leon and Rioja), which have the best educational outcomes, and is much smaller in Baleares (-38.5 points) and Canarias (-46.8).

[4] Many studies use this type of model to analyze different aspects of the labor market. See, among others, García-Pérez and Jimeno (2007), Carrasco (2001) and Prescott and Wilton (1992).

Finally, we decompose the observed difference between repeaters' and non-repeaters' scores into three different components: observed differences in characteristics, differences in the predicted effects of each of these observable characteristics (returns) and differences due to endogenous selection. We find that the observed differences among repeaters and non-repeaters in Spain are essentially explained by different returns to observed individual, socioeconomic, and school characteristics that explain educational outcomes. This component accounts for 89% of the total difference whereas the component due to differences in observed characteristics accounts for only 25%. What is more interesting is that endogenous selection makes observed differences appear 15% smaller than they actually are once we control for self-selection into the groups of repeaters and non-repeaters. Thus, without accounting for such endogeneity in the retaining status, differences between repeaters and non-repeaters would be overestimated. Interestingly, this bias is most important in Catalonia and the Basque Country, the two regions where the percentage of retained students is the lowest among all Spanish regions. Hence, these regions seem to be implementing a slightly different retention policy, although this policy is not reducing the differences between repeaters and non-repeaters. On the contrary, the smaller observed differences in these two regions are due largely to increased larger self-selection into the two student groups. Our final result clearly demonstrates the importance of grade retention and the possibility that it is depressing the Spanish average. We perform a counterfactual exercise that shows that the Spanish average score would increase by about 25 points if grade retention were not considered.

The rest of the paper is structured as follows. Section 2 describes the Spanish education system and presents a descriptive analysis based on our PISA 2009 data. Section 3 explains our methodology and identification strategy. Section 4 presents the results, and finally, Section 5 presents some important concluding comments.

2 Background and Data

We first briefly describe the Spanish education system. The school system is organized into three cycles: primary (grades 1-6), secondary (grades 7-10) and pre-college (grades 11-12). The first two cycles are compulsory (a student can choose to leave school at age 16). In 2009, the reference academic year in our study, the grade retention policy was as follows. At the primary and secondary levels, students could repeat a grade if their performance was deemed insufficient. More specifically, students were required to repeat a grade if they failed three or more subjects. Students can only repeat a grade once during their primary education. In secondary school, they can only repeat the same grade once, and they can only repeat grades twice in total.[5] Rules on grade retention are the same in every region in Spain, and as can be observed in Table 1, retention practices are similar throughout all Spanish regions.

In this paper, we use the PISA 2009 sample for Spain, and in particular the data for the regions with enlarged samples.[6] The PISA 2009 database provides individual-level information on demographics (e.g., gender, immigration status, month of birth), socioeconomic background (parental education), school-level variables and achievement test scores. We use math test score as our dependent variable here, as it shows the most variation between retained and non-retained students.[7]

Every student in the sample was born in 1993 (i.e., they were 15 years old when they took the PISA exams). In Spain, all students born in the same calendar year must enter school in the same academic year, with the 10th grade being the reference grade for 15-year-old students. Thus, we will call "non-repeater" students those enrolled in grade 10 and "repeater" students those enrolled in lower grades (8th or 9th).[8] The total Spanish sample comprises 25,887 students, of whom 8,209 are repeaters. Regional sample sizes are similar to each other, at approximately 1,500 students per region, with the exception of Basque Country, which includes data from almost 5,000 students.[9]

Table 1 presents summary statistics for "non-repeater" students (columns 3 and 4) and "repeater" students (columns 5 and 6). We observe that the Canary Islands and Andalusia have the highest percentages of repeaters, at 45.5% and 42.9%, respectively. In addition, the same two regions present the lowest mean test scores for both repeaters and non-repeaters.[10] However, the best-performing regions, Castile Leon

[5] The prevailing educational law in 2009 was the 2006 Organic Educational Law (LOE). For more statistics and details on the Spanish educational system, visit http://www.educacion.gob.es/ievaluacion/publicaciones/indicadores-educativos/Sistema-Estatal.html.

[6] The regions with a representative sample are Andalusia, Aragon, Asturias, Balearic Islands, Canary Islands, Cantabria, Castile Leon, Catalonia, Galicia, La Rioja, Murcia, Madrid, Navarre, Basque Country and Ceuta-Melilla. We refer to the three regions for which no representative sample is available (Extremadura, Castilla-Mancha and Valencia) as "the rest of Spain".

[7] The PISA program assesses students' performance in three disciplines: science, math and reading. PISA 2009 edition focused on reading. Following the OECD's recommended methodology, we use the 5 plausible values and 80 sampling weights in the PISA Technical Report to calculate each student's educational outcome and the standard errors of the estimated coefficients.

[8] This definition is based on questions 1 and 3 of the PISA Student Questionnaire.

[9] The PISA sample has a stratified two-stage design. First, schools with 15-year-old students are selected, and second, within each school, individual students are selected. See PISA 2009 Technical Report (2011).

[10] Ceuta and Melilla, which participate jointly in PISA, are the cities with the poorest performance (e.g., their average math score is 417). However, because they have small relative dimensions within

and Aragon, do not have the lowest percentage of repeaters (we analyze this result in more detail below).

Regarding individual variables, we observe that the proportion of repeaters is higher among males than among females (41.1% and 31.9%, respectively). Nevertheless, females achieve lower test scores than males do. In addition, the proportion of repeaters is larger among younger students (those born in the 3rd and 4th quarters of 1993). The proportion of repeaters is higher among immigrants compared with native students. Finally, the percentage of repeaters increases with the frequency of PC game use and with decreasing computer use. The socioeconomic variables have the expected relation with grade retention. That is, the number of repeaters is higher among students with low-educated parents.[11] We can also observe that the proportion of repeaters decreases with the number of books at home. In addition, the percentage of repeaters is higher among those students whose parents (especially the mother) do not live at home. Finally, regarding the school-level variables, we find that the number of repeaters is higher in schools with more than 50% female students compared with other schools. School type (ownership) also affects the proportion of repeaters: whereas only 19.5% and 25.6% of students in private schools repeat a grade (in independent and government-dependent schools, respectively), 43.6% of students in public schools do so.[12] We also consider parents' pressure on the school and differentiate between schools with a majority of parents demanding very high academic standards and schools with only a minority of parents doing so (or no parents at all). We observe here that the proportion of repeaters is lower in schools where parents exert significant pressure. Class size is also crucial for grade retention. This variable is categorized into two groups based on the median class size of 21 students. Interestingly, the percentage of repeaters is larger in those schools with smaller class size.[13]

Table 2 shows the distributions of the explanatory variables across regions. With respect to individual-level variables, we observe some differences regarding the per-

Spain, we considered them in our econometric analysis but we do not comment on them when reporting some of our results

[11] A father's education is "high" if he has a secondary or higher education degree and "low" if he has a primary or lower education degree. The same categories hold for mothers' education.

[12] Regarding school ownership, we distinguish between public, government-dependent private (i.e., those with a percentage of public funding above 50%) and independent private (i.e., those with a percentage of public funding less than or equal to 50%).

[13] There is no clear empirical evidence on the impact of class size. Angrist and Lavy (1999) find that reducing class size induces a significant and substantial increase in test scores. However, Hanushek (1998) finds no significant impact of class size reduction on scores. Lazear (2001) argues that the reason why there is no consensus in the literature is because class size is a choice variable: schools adapt class size to students' type and behavior.

centages of immigrants: whereas in Madrid and Baleares more than 15% of students are immigrants, fewer than 6% are immigrants in Andalusia and Galicia. Students from Catalonia use computers more often than students in any other region. However, regional differences in socioeconomic variables are larger. For example, there is a 22.3-percentage-point gap between Madrid, the region with the highest percentage of highly educated mothers, and Andalusia, the region with the lowest percentage. The same gap in fathers' education is 21 percentage points. The region with the fewest students whose parents are highly educated is Andalusia, at only 44.7%. The region with the most parents who are highly educated is Cantabria, at 64%. As we can see in this table, Andalusia has the lowest percentage of students belonging to a household with more than 200 books at home, at only 17.9%, whereas this percentage is 33% in Madrid. The Canary Islands have the highest percentage of students whose mother or father does not live at home (4% and 15.2%, respectively).

Finally, we also observe important differences in the distributions of school-level variables across regions. For example, Spanish regions differ greatly in the percentages of students attending each type of school. The regions with the highest percentages of students in public schools are Canarias and Murcia (between 75% and 80%), whereas in the Basque Country, Catalonia and Madrid this rate is much lower (between 42% and 60%). However, the Basque Country and Catalonia differ significantly in the percentages of students attending private schools: whereas, in the Basque Country, 58% of students attend government-dependent private schools, this percentage in Catalonia is only 21%. The regions with the highest percentage of parents exerting pressure are Catalonia and Madrid (84.5% and 55%, respectively). Finally, Murcia has the largest class size: 66% of students attend classes with 21 students or more. In Asturias, only 30.2% of students attend such large classes.

2.1 Grade retention and scores

In this section, we provide some primary analysis on the relationship between grade retention and PISA test scores. Table 3 shows the mean and several percentiles of the distributions of PISA scores for non-repeater and repeater students. The observed average difference between the two groups is impressive: more than 100 points, not only at the mean level, but also at the three percentiles shown. We distinguish three subgroups within repeater students depending on when they repeated (primary and/or secondary school). Table 3 also displays the means and percentiles for these three types of repeaters: those students who repeated only in primary school (Repeaters_P), those who repeated in both primary and secondary school (Repeaters_PS) and those who repeated only at the secondary level (Repeaters_S).[14] As Table 3 indicates, the worst performers are those who repeated a grade at both educational levels.

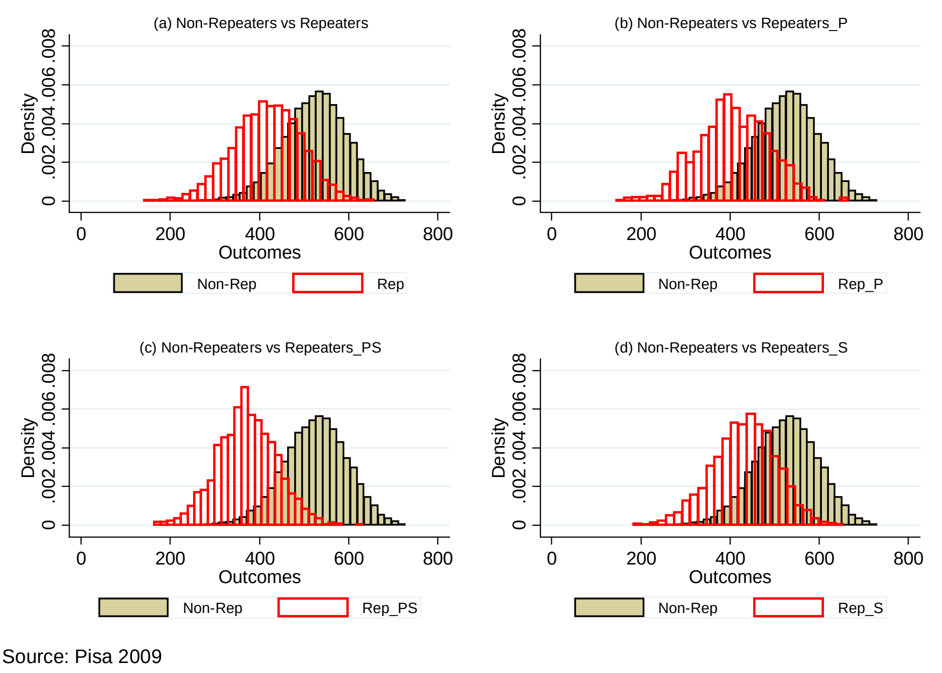

Figure 1: Math score histogram by grade retention in subgroups of repeaters

Figure 1 displays the histogram of PISA 2009 math scores for each group of students. There is heterogeneity within the complete distribution of scores for both repeaters and non-repeaters. However, what is really interesting is that the distribution of PISA scores for repeaters overlaps that of non-repeaters. Hence, there are repeater students in our sample who score better than some non-repeaters, most likely because of the effects of observed or unobserved determinants of their performance. Finally, the distributions of scores for repeaters only at the primary or secondary level seem to be more spread out than the distribution of scores for repeaters at both the primary and secondary levels.

Figure 2 below offers some more evidence about the relationship between grade retention and math score. In this case, we aggregate data at the regional level and

[14] This definition is based on question 7 of the PISA Student Questionnaire. Note that there is a slight difference between the number of repeaters according to the general definition above (that is, based on questions 1 and 3 of the PISA Student Questionnaire) and the total number of repeaters obtained by adding Repeaters_ P, Repeaters_ PS and Repeaters_ S. We assume this difference to be due to measurement error.

compare the percentages of repeaters and their average math scores. We see a negative relationship between these two variables, which is consistent with the descriptive statistics above. The negative slope in panel (a) shows that, in general, those regions with better performance also have fewer repeaters. However, this relationship is not deterministic (e.g., Catalonia has a lower average math score and a lower percentage of repeaters than Castile and Leon). In panels (b), (c) and (d), the percentages of repeaters in the three subgroups are plotted. The negative relationship between scores and percentages of repeaters remains, in particular for those students who repeated a grade only at the secondary level.[15]

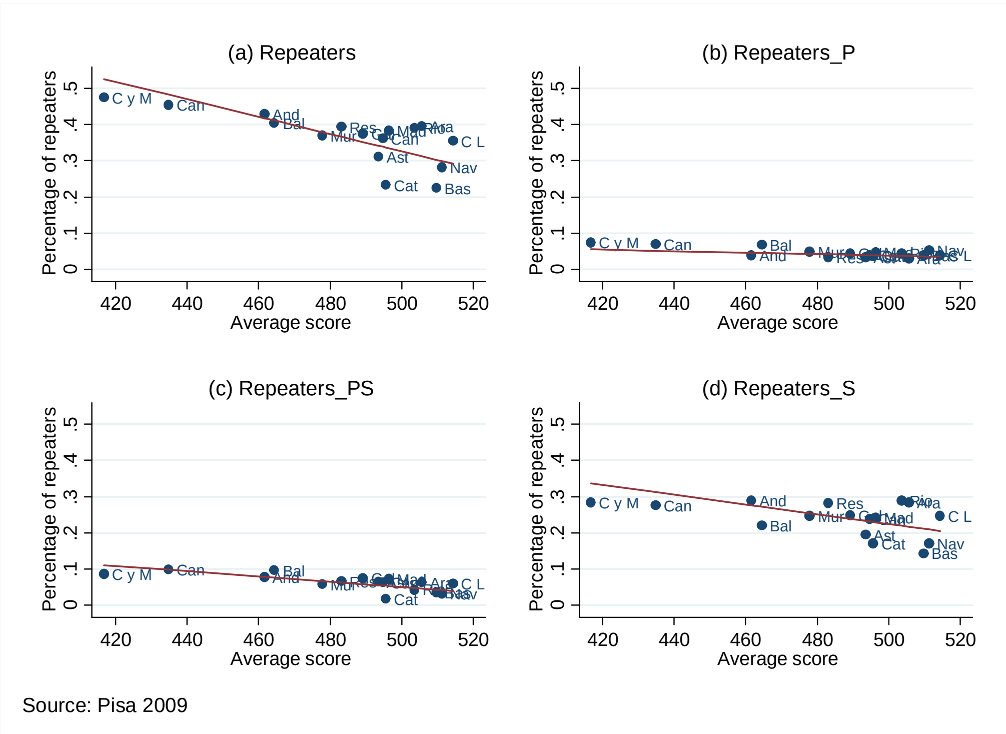

Figure 2: Relation between percentage of repeaters and average math score across Spanish regions

[15]Notice that the percentage of repeaters is the sum of the percentages of repeaters in each subgroup (primary only, primary and secondary, secondary only). Thus, the slope in panel (a) is the sum of the slopes in (b), (c) and (d).

3 Methodology

3.1 The empirical model

In this paper, we study the effect of grade retention on test scores. Prior studies have attempted to study this effect by estimating the following basic model:

$$y_i = \alpha I_i + \Gamma \boldsymbol{X}_i + u_i + \varepsilon_i, \tag{1}$$

where y_i is student achievement, $\boldsymbol{X}_i$ is a vector of individual, socioeconomic and school variables and I_i is a binary variable that takes the value one if the student is retained and zero otherwise; u_i represents unobserved student ability and ε_i is the error term. Several comments can be made here.

First observe that general tests that evaluate students' knowledge in some particular discipline may not be appropriate for studying grade retention. As repeaters are enrolled in lower grades, they have completed a less advanced curriculum and thus have a lower expected score. In this sense, we believe that the PISA test is a proper one, as it does not aim to evaluate students' curricular knowledge but their general abilities.[16]

Second, note that if students are selected into retention on the basis of factors that are unobservable and that influence educational outcomes (e.g., parental effort or a course-specific curriculum), then the estimation of α is likely to be biased. Observe that being a repeater is due to low scores in previous years. Hence, differences between repeaters and non-repeaters are not only due to grade retention. Indeed, repeaters may have different characteristics that influence their own educational attainment. More specifically, our initial hypothesis is that students who do not pass are those with the worst learning characteristics. To the extent that these characteristics are unobservable, estimated differences in educational outcome between repeaters and non-repeaters may be biased under OLS.

The typical approach to dealing with this endogeneity problem is using instrumental variables techniques. Note that this approach implies imposing equal effects on the rest of the regressors in the educational outcome equations (see Equations (4) and (5) below) for both repeaters and non-repeaters. However, we believe that there must be other differences between these two groups besides a change in the levels

[16] PISA assesses the extent to which students near the end of their compulsory education have acquired some of the knowledge and skills that are essential for full participation in modern societies. PISA seeks not only to assess whether students can reproduce knowledge but also to examine how well they can extrapolate from what they have learned and apply it in unfamiliar settings both in and outside of school (see PISA 2009 Report).

of such outcomes. To address this issue, we propose to estimate a switching regression model (SRM) to allow unbiased estimation of the model coefficients, controlling for endogenous selection of repeaters and non-repeaters, and to allow for potentially different effects of the variables included in the model for each group. As usual, we estimate this model by maximum likelihood.[17]

We specify the probability of repeating as a function of student characteristics. This probability acts as the selection equation in the Switching Regression model for repeaters' and non-repeaters' scores. In this model, the selection mechanism is described through a latent variable denoted by I_i^*, with the following process:

$$I_i^* = Z_i\gamma + e_i, \tag{2}$$

where Z_i is a vector of specific explanatory variables that describes the determinants of the selection process, γ is the corresponding vector of unknown parameters, and e_i is the random component of the selection equation, which includes unobservable variables that could be correlated with the observable and unobservable characteristics in the educational outcomes equations below. However, we only observe the realization of this latent variable I_i^* as follows:

$$I_i = \begin{cases} 1 & iff \quad I_i^* > 0 \\ 0 & iff \quad I_i^* \leq 0, \end{cases} \tag{3}$$

that is, I_i is an indicator variable that equals 1 if the student repeats and 0 otherwise. Furthermore, as explained above, we will consider a different equation for each group of students: repeaters, y_{Ri} and non-repeaters y_{NRi}:

$$y_{Ri} = X_i\beta_R + u_{Ri}, \tag{4}$$

$$y_{NRi} = X_i\beta_{NR} + u_{NRi}. \tag{5}$$

We will refer to the previous two equations as the educational outcomes equations. We allow for endogeneity in the selection equation by assuming that e_i, u_{Ri} and u_{NRi} have a normal trivariate distribution with mean zero and a covariance matrix as follows:

$$\Omega = \begin{bmatrix} \sigma_R^2 & & \\ \sigma_{R,NR}^2 & \sigma_{NR}^2 & \\ \sigma_{e,R}^2 & \sigma_{e,NR}^2 & \sigma_e^2 \end{bmatrix}, \tag{6}$$

[17] As the error term of each student's score equation is correlated with the error term of the selection equation, the estimation of the wage equations by OLS would be inconsistent. Furthermore, full maximum likelihood is more efficient than the two-step estimation method proposed by Heckman (1979).

where σ_e^2 denotes the variance of the error term in the selection equation (2) and σ_R^2 and σ_{NR}^2 are the variances of the error terms in the education outcome equations (4) and (5), respectively. Finally, we denote by $\sigma_{e,R}^2$ and $\sigma_{e,NR}^2$ the covariances between u_{Ri} and e_i and between u_{NRi} and e_i, respectively. These terms capture the correlation between the probability of grade retention and the educational attainment of repeaters and non-repeaters, respectively. The interpretation of these terms is as follows. If, for example, $\sigma_{eR}^2 < 0$, then there exists a negative relationship between the unobserved variables that make a student more likely to repeat and the unobserved characteristics that increase a repeating student's test score. That is, those factors that make a student more likely to fail also make a repeater earn a worse test. On the contrary, if $\sigma_{e,R}^2 > 0$, then what makes a student more likely to repeat also make a repeater have a better educational result.[18] Finally, if $\sigma_{e,R}^2 = 0$, then there is no correlation between the errors of the selection equation and the educational attainment of repeaters. The interpretation of $\sigma_{e,NR}^2$ is similar.

We denote by ρ_j for $j = R, NR$ the correlation coefficient between e_i and u_{Ri} for $j = R$ or u_{NRi} for $j = NR$. These two coefficients are jointly estimated with the rest of the parameters in the model, and their interpretation is analogous to that of $\sigma_{e,R}^2$ and $\sigma_{e,NR}^2$. Hence, given the assumption about the distribution of error terms, the log-likelihood function of the equations system (4) and (5) to maximize is:

$$\begin{aligned}\ln L &= \sum_i I_i \left(\ln(\Phi(\frac{(\gamma Z_i + \rho_R u_{Ri}/\sigma_R)}{\sqrt{1-\rho_R^2}}) + \ln(\phi(u_{Ri}/\sigma_R)/\sigma_R) \right) \\ &+ (1-I_i)\left(\ln(1-\Phi(\frac{(\gamma Z_i + \rho_{NR} u_{NRi}/\sigma_{NR})}{\sqrt{1-\rho_{NR}^2}}) + \ln(\phi(u_{NRi}/\sigma_{NR})/\sigma_{NR}) \right), \qquad (7)\end{aligned}$$

where $\Phi(\cdot)$ is the cumulative distribution function of the selection process conditional on educational scores, and $\phi(\cdot)$ is the density function of educational scores.

Now observe that we can obtain unconditional and conditional educational score predictions. The unconditional educational score is defined as the average predicted score for students with average unobserved characteristics, μ_1 and μ_0 for repeaters and non-repeaters, respectively. That is:

$$\mu_1 = \bar{X}^1 \beta_R, \qquad (8)$$

$$\mu_0 = \bar{X}^0 \beta_{NR}, \qquad (9)$$

[18] For example, if the experience of repeating makes the student's subsequent effort increase, we may observe a higher PISA score among repeaters compared with the counterfactual of what would have happened had the student not repeated.

where $\bar{X}^1$ and $\bar{X}^0$ denote the average observed characteristics for repeater and non-repeater students, respectively. The conditional score, $\overline{y}_R^1$ and $\overline{y}_{NR}^0$, represents the mean predicted score for each student type, that is, from Equations (2) to (9):

$$\overline{y}_R^1 = E(y_R \mid I=1) = E\left(y_R \mid I^* \geq 0\right) = \mu_1 + \sigma_{e,R}\frac{\phi(z\gamma)}{\Phi(z\gamma)}, \quad (10)$$

$$\overline{y}_{NR}^0 = E(y_{NR} \mid I=0) = E\left(y_{NR} \mid I^* < 0\right) = \mu_0 - \sigma_{e.NR}\frac{\phi(z\gamma)}{1-\Phi(z\gamma)}, \quad (11)$$

We will use these two expressions when trying to breakdown the educational gap between repeater and non-repeater students. Using Equations (8) to (11), we can decompose the educational gap between repeater and non-repeater students as follows:

$$\overline{y}_{NR}^0 - \overline{y}_R^1 = (\bar{X}^0 - \bar{X}^1)\beta_{NR} + (\beta_{NR} - \beta_R)\bar{X}^1 - [\sigma_{e,NR}\tfrac{\phi(z\gamma)}{1-\Phi(z\gamma)} + \sigma_{e,R}\tfrac{\phi(z\gamma)}{\Phi(z\gamma)}]. \quad (12)$$

The first term on the right-hand side in the equation above corresponds to the observed differences in characteristics, the second term measures differences in the predicted effect of each of these observable characteristics (*returns*) and the third term corresponds to differences due to endogenous selection. In Section 4.2 below, we estimate each of these components.

In addition, we may compute the following conditional scores:

$$\overline{y}_R^0 = E(y_R \mid I=0) = E\left(y_R \mid I^* < 0\right) = \bar{X}^0\beta_R - \sigma_{e.R}\frac{\phi(z\gamma)}{1-\Phi(z\gamma)}, \quad (13)$$

$$\overline{y}_{NR}^1 = E(y_{NR} \mid I=1) = E\left(y_{NR} \mid I^* \geq 0\right) = \bar{X}^1\beta_{NR} + \sigma_{e.NR}\frac{\phi(z\gamma)}{\Phi(z\gamma)}. \quad (14)$$

These counterfactuals allow us to compute the grade retention effect for repeaters, GRE^1, and for non-repeaters, GRE^0, as follows:

$$GRE^1 = \overline{y}_R^1 - \overline{y}_{NR}^1 \quad (15)$$

$$GRE^0 = \overline{y}_R^0 - \overline{y}_{NR}^0 \quad (16)$$

In Section 4, we estimate the grade retention effect as measured by the previous expressions to understand the effects of self-selection into repeaters and non-repeaters.

3.2 Identification

Our model will be identified once we allow for different regressors in each equation of the switching model (see Maddala (1988)). The identification is also possible due to the assumptions about the joint normal distribution of the three error terms (u_{Ni},

u_{NRi} and e_i). Nonetheless, we also identify the model by considering instrumental variables. The assumption now is that these instruments have an impact on the propensity of grade retention, but they do not directly affect a student's PISA score. Hence, our specification will allow identification of the model by introducing variables in the selection equation (2) that are significant for explaining the probability of repeating but are mostly uncorrelated with the student's scores (Equations (4) and (5)).

Following the existing literature, we choose students' quarter of birth as an instrument. The quarter of birth is generally assumed to have an impact on pre-primary and primary test scores and thus on grade retention. Bedard and Dhuey (2006), among others, show that the relative age of a child in his class does not have a significant long-term impact, but most of the effect of relative age comes from programs such as grade retention and selection of pupils into different grades. Indeed, during the very first days of school, relative age is quite important because the oldest students may be much more mature than the youngest ones. As relative maturity is likely to be an important determinant of achievement during the early grades, it may play a crucial role in the decision of grade retention. The remainder of this section is aimed at showing data supporting this instrument. We base our argument on two kinds of analyses. First, we show that unconditional analyses in Table 1 and Figure 3 below give us some reason to choose this variable for the identification of the model. Second, we report conditional analyses that clear up any doubts about the appropriateness of our instrument.

As we can observe in Table 1, the average test score for non-repeater students does not vary significantly with the quarter of birth (it ranges from 518 for those born in Q3 to 522 for those born in Q4). The same can be said for repeater students. However, the probability of repeating varies greatly with the student's quarter of birth (ranging from 30% for those born in Q1 to 43% for those born in Q4). These two results are required for an appropriate instrument.

Figures 3(a) and 3(b) below show the average math score by quarter of birth, with Figure 3(b) differentiating between repeaters and non-repeaters. Figure 3(c) displays the percentage of repeaters by quarter of birth. As can be observed in Figure 3(a), the quarter of birth affects math scores if we do not differentiate according to retention status. Those students who were born in the fourth quarter scored more than 10 points lower than students who were born in the first quarter. However, once we distinguish between repeaters and non-repeaters (see Figure 3(b)), the quarter of birth shows almost no effect on scores. Finally, as can be observed in Figure 3(c), the quarter of birth has an important effect on the propensity to repeat a grade.

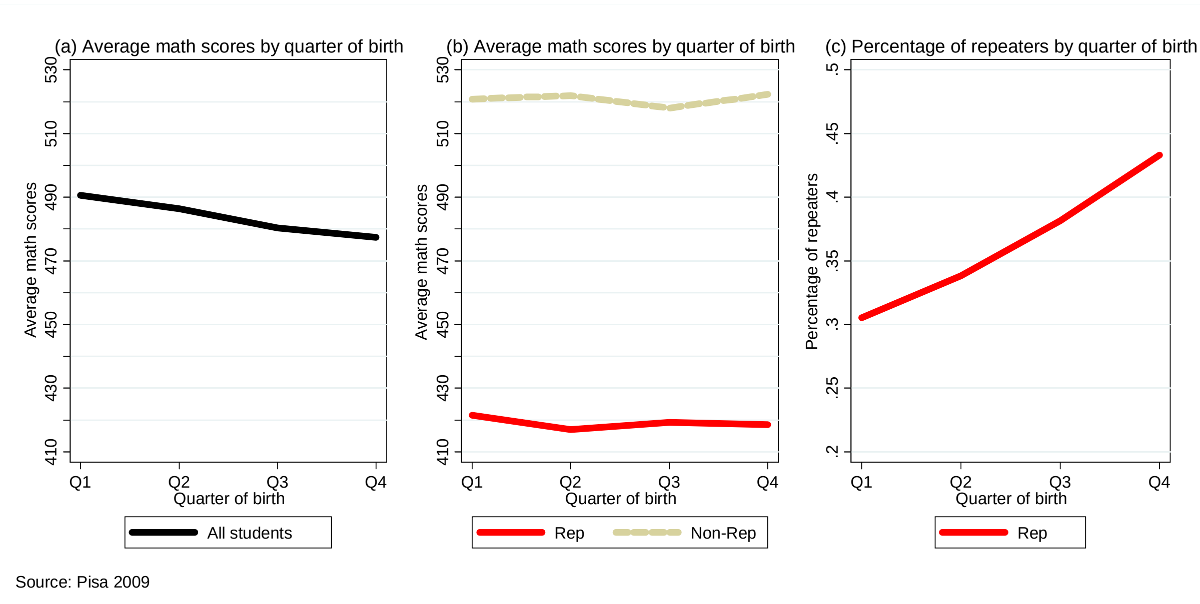

Figure 3: Instrument: Quarter of birth

To further check the robustness of our instrument, we perform an additional conditional analysis. We estimate the impact of the instrumental variable on students' scores once we control for all explanatory variables in our empirical model, joint with an indicator about whether the student is a repeater. Quarter of birth is introduced by two dummy variables that allow us to estimate the effect of being born in the third and fourth quarters with respect to a reference student born in the first or second quarter. Coefficient t-tests indicate that none of these dummies are significant predictors of PISA test scores once we consider in the same equation whether the student is a repeater. The coefficient and standard deviation are -2.02 and 2.19, respectively, for students born in the 3rd quarter and 0.74 and 2.35, respectively, for students born in the 4th quarter. Hence, we can conclude that quarter of birth can be used as an instrument, enabling us to identify our structural model.

4 The results

In this section, we first comment on the results regarding the explanatory variables of the probability of grade retention. Second, we elaborate on the impact of grade retention on PISA test scores, show the educational outcome equations' estimation and decompose differences between repeaters and non-repeaters.

4.1 The probability of grade retention

In this section, we first comment on the results regarding the explanatory variables of the probability of grade retention. Second, we elaborate on the impact of grade retention on PISA test scores, show the educational outcome equations' estimation and decompose differences between repeaters and non-repeaters.[19] With respect to the regional variables, the coefficients of both models are very similar, although some differences emerge in, for example, the significant effect of regions such as Galicia, Catalonia or Basque Country when compared with the Canary Islands in the SRM.

Regarding the individual variables, we find that our instrumental variable proposed above is a significant predictor of the probability of repeating. Observe that the probability of grade retention increases with the student's quarter of birth. Most socioeconomic and school variables in the selection equation are significant. The probability of repeating is negatively related to being female, the frequency of computer use for homework, parental education, the number of books at home and attending a government-dependent private school. A high probability of repeating is also related to being an immigrant, playing PC games very often, having a parent who does not live at home or going to a school with a majority of girls. Regarding class size, we find that increasing class size has a positive impact on the probability of being promoted, but this positive effect diminishes with class size. In particular, we find that the optimum class size in terms of minimizing the probability of repeating is about 30 students. Above that figure, the probability of repeating increases. Finally, observe that the coefficients of the Probit and the SRM models are very similar. Moreover, the negative impacts on the probability of repeating of the frequency of computer use for homework and of attending a private government-dependent school, and the positive effect of being born in the 4th quarter, having a mother who does not live at home or attending a school with a majority of girls become stronger once we control for the endogeneity of grade retention. In contrast, being born in the 3rd quarter and attending a private independent school become a bit less significant.

4.2 The effect of grade retention on scores

The main objective of our study is to estimate the effect of grade retention on educational attainment. Our estimation strategy (SRM) allows us to estimate two different

[19] The reference student in both equations is a male from the Canary Islands, a native of Spain, born in the first or second quarter of the year, with low frequency of using a computer for homework and games, whose mother and father are low educated and living at home, with fewer than 26 books at home. Regarding the school variables, the reference student attends a public school with a minority of boys and low parental pressure.

grade retention effects: one for repeaters and another for non-repeaters. This model takes into account that these two groups of students may have different unobserved characteristics that may bias the estimation if they are not correctly controlled for. In this model, we assume that the educational production functions for the two groups of students differ.

In addition to the SRM, we estimate two models to compare the estimation of the grade retention effect when endogeneity of selection into repeaters and non-repeaters is not considered: OLS(a) and OLS(b). The former consists of OLS estimation of two different educational outcome equations, as in (4) and (5), but without controlling for selection bias. The latter is an OLS estimation of just one educational outcome equation, which is the same for both groups of students as in (1). Finally, we have also estimated an IV model that controls for endogeneity based on the OLS(b) specification.

Before focusing on grade retention effects, we report the main results regarding the explanatory variables in the models. Table 5 shows the effects of individual, family and school variables on educational outcomes according to SRM, OLS(a), OLS(b) and IV. Our SRM results show that high educational achievement in math is found among males, natives, those who frequently use a computer for homework, those with highly educated parents, those with a large number of books at home and those attending a school where a majority of the students are girls. We find that class size has a positive effect on math scores, but with decreasing returns. Specifically, we find that the optimum class size to maximize students' math scores is 25 students for non-repeaters and 22 for repeaters. This finding is consistent with the existing literature on class size (see footnote 12 above). We also find some important differences in the impact of the explanatory variables on educational achievement between repeaters and non-repeaters. For example, being an immigrant is much less favorable for non-repeaters than for repeaters. The impact of the number of books at home is also much larger for non-repeaters. In Table 5, we also compare the SRM estimation with these three models and find similar results. However, we find some important differential effects for variables such as immigrant status, parents' educational status or class size. For example, the optimal class size in both OLS models is about 24 students, for both repeaters and non-repeaters, whereas the SRM, as emphasized above, predicts smaller optimal class size for repeaters than for non-repeaters.

The different results found using these models are not surprising. The SRM implies estimating two correlation coefficients between the unobservable factors that affect each of the two educational outcomes and unobserved variables that affect the probability of repeating a grade. Specifically, we get a positive estimate of ρ_R (0.31) and a negative (and significant) value for ρ_{NR} (-0.22), as can be seen at the button of Table 5.[20] The intuition behind $\rho_{NR} < 0$ could be that potential non-repeaters may have unobservable characteristics that make them perform better than potential repeaters when they are promoted. A consequence of this will be that the negative grade retention effect is bigger for non-repeaters than for repeaters. Thus, this result is capturing the impact of students' unobserved ability. Although not significant in this specification, we consider it useful to interpret the result of $\rho_R > 0$, which has emerged as significant in some of the models explained in footnote 20 above. This sign may mean that repeaters have unobservable characteristics that make them also perform better in case they must repeat a grade. As a result, the negative effect of grade retention will be lower for a repeater than for a non-repeater. The intuition behind this result can be found in parental interest and students' effort. Namely, those students who must repeat recruit greater support from their parents, improving educational attainment.

To estimate the grade retention effect, we use several models. Table 6 shows the results. First, OLS(b) estimates a unique and linear grade retention effect on PISA scores (coefficient α in equation (1)) without allowing for endogenous selection into repeater and non-repeater groups. The estimated effect of repeating is equal to -80.4 points (see column 4 in Table 6). If we control for the endogeneity of repeating in the outcome equation but assume a unique education process for repeaters and non-repeaters (IV), we find that repetition diminishes PISA scores by 73.4 points (see column 5 in Table 6). Next, we relax the hypothesis of one educational equation and instead assume that repeaters and non-repeaters have a different education production process (OLS(a)), finding that the grade retention effect for repeaters (-78.9) is slightly lower than that for non-repeaters (-85.7).

Finally, we comment on the SRM results, which differ greatly from those described above. A huge negative impact of grade retention on scores is estimated for both repeaters and non- repeaters. Nonetheless, the retention effect for the latter (-125.1) is more than double the repetition impact for the former (-56.2). This result is a direct consequence of the correlation between the unobservable factors in the selection

[20]The results regarding ρ_{NR} and ρ_R are robust to other sets of instrumental variables. For example, we explore the validity of adding two instruments to the quarter of birth instrument: whether the student's mother and/or father does not live at home and frequency of playing computer games. We claim here that a student's father or mother may not live at home because of a previous parental death or divorce, which, according to the existing literature, does not negatively affect teenagers' cognitive skills (see Sanz de Galdeano and Vuri (2007)), such as the skills measured in PISA scores. However, parental death or divorce may affect a student's probability of repeating a grade by the time it occurs. Finally, we consider computer games as another instrument, as this instrument is not significant in explaining the PISA test scores (see Table 5), but it has a huge impact on the propensity of repeating a grade (see Table 1 and Table 4).

and the outcome equations. To confirm this connection, suppose that two students, one with the average characteristics of a repeater and another one with the average characteristics of a non-repeater, do not repeat a grade. Then, the negative sign of ρ_{NR} implies that the average non-repeater has better unobservable factors (e.g., ability), which allows her to perform better than the average repeater. Now suppose that these two students have been retained; then the positive sign of ρ_R implies that the student with the repeater characteristics has unobservable factors (e.g., parental effort or support) that lead her to achieve better results than the student with non-repeater characteristics. Thus, both $\rho_{NR} < 0$ and $\rho_R > 0$ imply that a repeater student loses little as a result of being retained in comparison with a non-repeater.

Columns 6-8 of Table 6 show that retention effect estimates depend on the type of repetition to which a student has been subjected. The effect is highly negative regardless of whether repetition occurs at the primary or secondary level. However, two interesting features arise. First, we estimate the impact of repeating at both educational levels, primary and secondary, to be much larger than the effect of repeating only once, at either the primary or secondary level. These differences account for more than 37 and 27 points for repeaters and non-repeaters, respectively. As we find that repeating one grade has a negative impact on scores, this result is not surprising. Second, our results show that the effect of repeating at the secondary level is slightly different than that of repeating at the primary level. In particular, secondary repeaters lose 10 fewer points than primary repeaters because of the repetition. Nonetheless, if a non-repeater were subjected to grade retention, the impact on his or her score would be 9 points larger if the retention happened during secondary school.

Table 7 shows the grade retention effect for students in every region in our sample. Similarly to the pooled sample, in every region the effect of grade retention on scores is highly negative and larger for non-repeaters than for repeaters. However, we note some interesting differences across regions: the Balearic Islands, with a grade retention effect of -39 and -109 points for repeaters and non-repeaters, respectively, shows a much different result with respect to the best performing regions, such as La Rioja, whose corresponding figures are -67 and -139, and the pooled figures for all of Spain (-56 and -125 points for repeaters and non-repeaters, respectively; that is, 10% and 24% of the non-repeating outcome in each case).

Finally, we estimate the three different components in Equation (12) to decompose the estimated differences between repeaters and non-repeaters. Table 7 reports the percentage of observed differences between repeaters and non-repeaters due to each of these three components. This exercise is done for the whole sample and for each separate region. The results are shown in the bottom panel of Table 7. If we analyze this decomposition for the national sample, we can see that the majority of the differences, 89%, is due to differences in the coefficients, that is, in the predicted effect of the observable characteristics for each student group. Hence, repeaters obtain a worse score than non-repeaters because the impact of the observable variables on their outcomes is stronger for non-repeaters. With respect to differences in observable characteristics, we find that they account for about one-fourth of the observed differences. What is more interesting in the context of our analysis is the negative sign of the endogenous selection component (-15%). This finding means that, in case of not allowing for endogenous selection, existing differences between repeaters and non-repeaters would be overestimated. As shown in Table 7, this pattern is the same in every region, although Catalonia and the Basque Country are the two regions whose coefficients of observable characteristics explain the most, almost 100% of the differences, and also the ones with the highest figures for endogenous selection (-26% and -24%, respectively). This finding is interesting given that precisely these two regions have the lowest grade retention rates among Spanish regions. We can conclude from this analysis that their low retention rates are not reducing the grade of self-selection into the repeater and non-repeater student groups. On the contrary, those regions with fewer repeaters seem to have more selection into both groups of students, indicating that it is even more important to control for such selection issues to properly measure the retention effect in these two regions and to compare them with other regions in Spain.

To conclude, we propose the following question: how could the mean score for the whole sample change if there were no grade retention policy at all in Spain? We construct a counterfactual based on SRM estimations to handle this issue. The *actual* average math score $\overline{y}_A$ is computed as the weighted average of actual repeaters' and non-repeaters' scores, that is:

$$\overline{y}_A = E\left(y_R \mid I = 1\right) \cdot P_R + E\left(y_{NR} \mid I = 0\right) \cdot P_{NR}, \tag{17}$$

where P_R and P_{NR} denote the percentages of repeaters and non-repeaters in the sample. Assume now that there is no grade retention policy in place. Then, we can compute a counterfactual for the average math score, the *predicted* average math score $\overline{y}_P$, where we introduce the expected score for repeaters had they not repeated, that is:

$$\overline{y}_P = E\left(y_{NR} \mid I = 1\right) \cdot P_R + \left(y_{NR} \mid I = 0\right) \cdot P_{NR}. \tag{18}$$

The results for Spain are $\overline{y}_A = 491.5$ and $\overline{y}_P = 515.2$. That is, by eliminating the grade retention policy, the PISA score would be almost 25 points higher. Note that we are implicitly assuming that, in the no-grade-retention scenario, students' behavior does not change (for both repeaters and non-repeaters); that is, they exert the same effort, and thus, their score does not diminish. However, we have no clear evidence about the effect of the grade retention policy on student effort. Indeed, it is difficult to believe that this effect could exceed the positive effect of removing the grade retention policy estimated in this study. Nonetheless, this is a strong assumption, and thus, we try to relax it.

Suppose that we could measure students' effort using students' duration of self-study at home.[21] Then, we could try to determine the impact of this variable on educational outcomes and check whether a change in the duration of self-study would be enough to counteract the benefits we estimate. We are able to do this because students were asked about their self-study time in PISA 2006 (unfortunately this variable is not present in PISA 2009). In Figure 4, we can see that scores increase only slightly with weekly hours of self-study. In fact, there is a certain point of self-study frequency above in which the educational outcomes do not vary or even worsen.[22] If we assume this to be the effect of effort, it is difficult to believe that a change in student behavior could balance the benefits of removing the grade retention policy. Hence, we support the idea that if the grade retention policy were eliminated, the Spanish average score would increase, as measured above, for 15-year-old students.

5 Concluding Remarks

Our results show that grade retention has a substantial negative impact on educational outcomes as measured by the PISA program. In addition, we find that this negative effect is bigger for non-repeaters than for repeaters (-24% vs. -10% of the non-repeater average score). That is, had they been retained as repeaters, non-repeaters' PISA outcomes would have been reduced more than by twice the reduction observed for repeaters. In other words, grade retention improves the quality of the match between the school and the student.

Moreover, different types of grade repetition do not change much as the impact is highly negative for both repeaters and non-repeaters, whether it occurs during

[21] Observe that there are two implicit assumptions in this exercise that are worthy of mention: first, the underlying criteria to analyze the optimal grade retention policy is utilitarianism, and second, students' utility is linear in effort.

[22] We think that the inverted-U shape in this graph could demonstrate that students who study frequently are those with more learning difficulties. As students' effort, measured by self-study time, may be endogenous to educational achievement, the impact of this factor should be estimated by the appropriate technique (i.e., Instrumental Variables). However, we will not discuss the impact of students' effort on achievement here as it is not the focus of the paper.

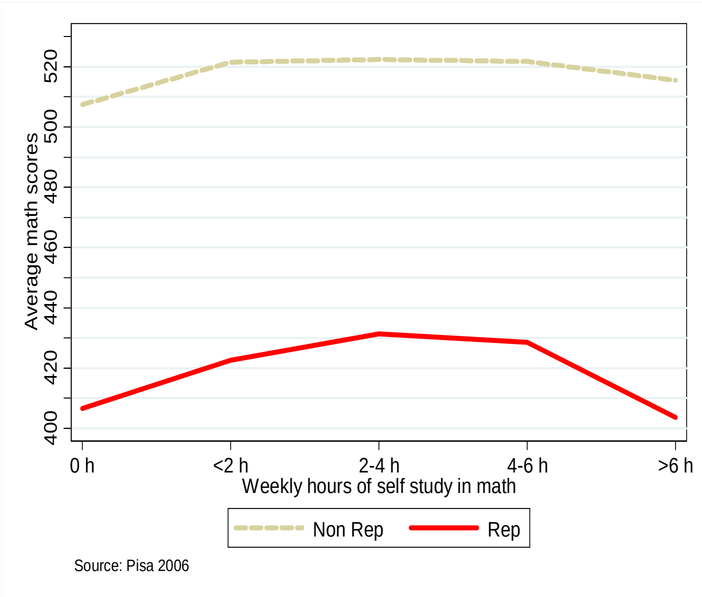

Figure 4: Math scores in PISA 2006 by hours of self study in math

primary or secondary education. Our results show that if a student was retained at the primary level, she will suffer a causal decrease in her performance, but this situation could be even worse if this student was subjected to a second grade retention in secondary school.

Finally, we decompose the observed difference among Spanish repeaters' and non-repeaters' scores. We find that the observed differences among these two groups are essentially explained by the different returns to the observed individual, familiar and school characteristics that explain educational outcomes. This component accounts for about 89% of the total difference whereas the component due to differences in such observed characteristics is only 25%. What is more interesting is that endogenous selection makes observed differences appear 15% lower than they actually are. Thus, if such endogeneity in the retaining status was not considered, differences between repeaters and non-repeaters would be overestimated. Interestingly, this bias is most important in Catalonia and the Basque Country, the two regions where grade retention is the lowest among all Spanish regions. Hence, these regions' slightly different retention policy does not seem to decrease the differences between repeaters and non-repeaters. On the contrary, the smaller observed differences in these two regions are due largely to increased self-selection into both student groups.

Several extensions of this work are possible. An important future study could perform a cost-benefit analysis regarding the grade retention policy. The cost of grade retention includes any additional years of schooling provided to students who are held back.[23] Another interesting extension could be to study the long-run effects of a grade retention policy, for example, by considering its impact on drop-out rates, college attendance and job-market results.

Finally, we believe our results to be of special interest in the actual debate on economics of education and educational policies. First, note that the regional differences we observe may be due to differences in the management of the public educational services at the regional level, as we control for individual and socioeconomic variables. Thus, the worst-performing regions can learn from the best performers regarding the management of retention policies. Second, and more importantly, in a context of increasing interest in academic performance differences across countries (as the importance of human capital accumulation to growth becomes well known), it is important to evaluate the educational policies in place. This is particularly true for those policies that are supposed to serve as a remedial for poor academic performance, as is the case for the grade retention policy.

[23] For example, the average cost of schooling in Spain in 2007, in terms of government and family expenditures, was, at current prices, 4,870€ and 6,508€ per student at the primary and secondary level, respectively. These figures amount to a yearly cost of schooling of 811€ (for six years) and 1627€ (for four years), respectively (see Instituto de Evaluación, 2010).

References

[1] Angrist, J., and Lavy, V. (1999) "Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement" *Quarterly Journal of Economics*, 114 (2): 533-575.

[2] Bedard, K. and E. Dhuey (2006) "The Persistence of Early Childhood Maturity: International Evidence of Long-Run Age Effects", *Quarterly Journal of Economics* 121(4): 1437-1472.

[3] Belot, M. and Vandenberghe, V. (2011) "Evaluating the "Threat" Effects of Grade Repetition" Discussion Papers (IRES - Institut de Recherches Economiques et Sociales) 2011-026.

[4] Carrasco, R. (2001) "Binary Choice with Binary Endogenous Regressors in Panel Data: Estimating the Effect of Fertility on Female Labor Participation" *Journal of Business & Economic Statistics* 19(4): 385-94.

[5] Dearden, L., Emmerson, C., Frayne and Meghir, C. (2006), "Education Subsidies and School Drop-Out Rates", CEE Discussion Papers 0053, Centre for the Economics of Education, LSE.

[6] García-Pérez, J. I., and Jimeno, J. J. (2007). "Public sector wage gaps in Spanish regions" *The Manchester School*, 75(4), 501–531.

[7] Hanushek, E. (1998). "The Evidence on Class Size" Occasional Paper Number 98-1, W. Allen Wallis Institute of Political Economy, University of Rochester.

[8] Heckman, J. (1979). "Sample selection bias as a specification error" *Econometrica* 47 (1), 153–61.

[9] Instituto de Evaluación (2010), "Sistema Estatal de Indicadores de Educación", Ministerio de Educación.

[10] Jacob, B. A. and Lefgren, L. (2004). "Remedial Education and Student Achievement: A Regression-Discontinuity Analysis." *Review of Economics and Statistics*, LXXXVI (1): 226-244:

[11] Jacob, B. A. and Lefgren, L. (2009) "The effect of grade retention on high school completion" *American Economic Journal: Applied Economics* 1:3, 33-58.

[12] Jimerson, S., Ferguson, P., Whipple, A., Anderson, G. and M. Dalton (2002). "Exploring the Association Between Grade Retention and Dropout: A Longitudinal Study Examining Socio-Emotional, Behavioral, and Achievement Characteristics of Retained Students" *The California School Psychologist*, Vol. 7, 51-62.

[13] Lazear, E.P. (2001) "Educational Production" *Quarterly Journal of Economics* 116(3): 777-803.

[14] Maddala, G. (1988). Introduction to econometrics. New York: Macmillan.

[15] Manacorda, M. (2008), "The Cost of Grade Retention", CEP Discussion Papers 0878, Centre for Economic Performance, LSE, forthcoming *Review of Economics and Statistics.*

[16] OECD, (2011), "PISA 2009. Technical Report"

[17] OECD (2010), "PISA 2009 Results: What Students Know and Can Do – Student Performance in Reading, Mathematics and Science (Volume I)". http://dx.doi.org/10.1787/9789264091450-en

[18] OECD, (2009), "Education at a glance 2009. OECD indicators"

[19] Prescott, D. and Wilton, D. (1992) "The Determinants of Wage Changes in Indexed and Nonindexed Contracts: A Switching Model" *Journal of Labor Economics* 10(3): 331-55.

[20] Roderick, M. (1994) "Grade retention and school dropout: Investigating the association" *American Educational Research Journal* 31**:** 729-759.

[21] Sanz de Galdeano, A. and D. Vuri (2007) "Parental Divorce and Students' Performance: Evidence from Longitudinal Data" *Oxford Bulletin of Economics and Statistics*, 69(3): 321-338

Table 1: Descriptive statistics. Grade retention and PISA 2009 Math scores

Variable	N	Non-repeaters		Repeaters	
		%	score	%	score
REGIONS					
Andalusia	1,416	57.1	503.7	42.9	405.8
Aragon	1,514	60.5	548.7	39.5	439.6
Asturias	1,536	68.9	529.4	31.1	414.2
Balearic Islands	1,463	59.6	503.4	40.4	407.2
Canary Islands	1,448	54.5	474.4	45.5	387.6
Cantabria	1,516	63.8	533.7	36.2	425.7
Castile Leon	1,515	64.5	551.6	35.5	446.7
Catalonia	1,381	76.7	517.3	23.3	424
Galicia	1,585	62.5	526.2	37.5	427.4
La Rioja	1,288	60.9	551.3	39.1	429.2
Madrid	1,453	61.7	537.8	38.3	429.8
Murcia	1,321	63	513.4	37.0	417.5
Navarre	1,504	71.8	542.7	28.2	431
Basque Country	4,768	77.6	533.5	22.4	427.1
Ceuta y Melilla	1,370	52.6	471.2	47.4	356.5
Rest of Spain	809	60.7	521.7	39.3	423.5
INDIVIDUAL VARIABLES					
Male	13,141	58.9	535.2	41.1	431.8
Female	12,746	68.1	507.7	31.9	401.8
Born in 1st quarter	6,284	69.5	520.9	30.5	421.5
Born in 2nd quarter	6,558	66.2	521.9	33.8	417
Born in 3th quarter	6,705	61.9	518	38.1	419.2
Born in 4th quarter	6,340	56.7	522.3	43.3	418.5
Native	23,188	66.9	523.5	33.1	423.9
Immigrant	2,227	33.5	483.8	66.5	400
< every week PC use for homework	21,013	60.0	520.3	40.0	421.6
Every week PC use for homework	4,284	71.3	523.1	28.7	418.5
< almost every day play PC games	21,013	66.1	519.4	33.9	420.1
Almost every day play PC games	4,284	54.3	533.5	45.7	421.3

Table 1 (cont.): Descriptive statistics. Grade retention and PISA Math scores

Variable	N	Non-repeaters		Repeaters	
		%	Score	%	Score
SOCIO-ECONOMIC VARIABLES					
Mother low education	8,796	53.3	505.8	46.7	413.1
Mother High education	16,180	71.6	529	28.4	428.1
Father low education	8,987	55.0	506	45.0	416.2
Father high education	15,369	71.5	530.3	28.5	426.6
0-25 books at home	5,331	38.8	471.1	61.2	390.2
26-200 books at home	13,153	66.3	518.5	33.7	434.3
>200 books at home	7,074	80.8	546.3	19.2	451.1
Mother lives at home	24,853	64.6	521.4	35.4	420.8
Mother does not live at home	567	35.0	495	65.0	401.4
Father lives at home	22,224	65.8	521.7	34.2	421.3
Father does not live at home	2,544	51.5	517.5	48.5	416.1
SCHOOL VARIABLES					
Less than 50% girls	12,405	67.3	522.8	32.7	417.7
More than 50% girls	12,349	59.7	518.5	40.3	420.6
Private independent school	885	80.5	535.8	19.5	434.4
Private govern-depend.school	8,154	74.4	525.1	25.6	430.1
Public	15,336	56.4	516.1	43.6	416.2
<=21 students per class	12,778	54.4	515.2	45.6	414.6
> 21 students per class	12,314	72.1	525.1	27.9	428.5

Table 2: Descriptive statistics. Regional distribution of explanatory variables (%)

Variables	And	Ara	Ast	Bal	Cana	Cant	Cast	Cat
INDIVIDUAL VARIABLES								
Females	47.4	49.4	47.4	50	47.6	49.1	51	48.7
Born in 2nd quarter	23.5	23.9	27.1	23.5	22	25.1	26.1	24.4
Born in 3th quarter	25.9	27.7	26.4	25.6	27.1	25.3	25.4	26.4
Born in 4th quarter	27.1	23.9	22.6	26	26.3	26.6	24.4	25.2
Inmigrants	5.8	12.2	5.2	15.3	11.7	7.1	5.3	11.2
Ev. week PC for homework	37.9	37.3	37.1	48.1	44.7	40.5	33.9	60.2
Al. every day play PC	19.6	17.9	22.2	20	15.9	15	16.1	18.8
SOCIO-ECO. VARIABLES								
Mother High education	46.8	65.8	69	58.5	53.7	68.7	66.6	62.9
Father High education	44.7	64.7	65.7	57.8	49.8	64	62.5	61.6
26-200 books at home	51.7	51.6	51.9	51.5	45.2	52.3	53.1	50.9
>200 books at home	17.9	31.3	30.3	26.2	13.8	27.2	35.3	29.4
Mother does not live at home	2.2	2.3	3	2.4	4	2.4	2.2	1.2
Father does not live at home	10.4	9.2	12.9	12.9	15.2	11.6	7.1	10.3
SCHOOL VARIABLES								
More than 50% girls	47	57.7	56.2	34.6	61.4	39.9	55.2	54.4
Private independent school	1.4	4	2.1	4.5	0	3.5	9.2	15.1
Private govern-depend. sch.	24.1	26.4	30.6	29.8	18.2	35.3	23.7	24.1
> 21 students per class	60.3	47.6	30.2	48.1	54.2	35.3	48	63.1

Table 2 (cont.): Descriptive statistics. Regional distribution of explanatory variables (%)

Variables	Gal	Rio	Mad	Mur	Nav	Basq	C y M	Rest	All
INDIVIDUAL VARIABLES									
Females	49.7	48.9	50	50.2	47.6	48.5	50.8	50.8	49.2
Born in 2nd quarter	25	27.7	26.8	25.5	25.8	26.5	23.1	25.1	24.9
Born in 3th quarter	24.9	26.8	25.7	26.7	26.1	24.2	26.6	28	26.3
Born in 4th quarter	26.5	23.7	23.9	22.4	23.1	23.3	26.9	24.7	25.2
Immigrants	4.2	13.1	16.3	12.5	12.7	4.7	10.7	9.2	9.5
Ev. week PC for homework	26.6	41.8	37.4	35.9	44.4	45.3	47.2	36.9	40.9
Al. every day play PC	16.8	16.3	16.7	17.6	15	14.1	20.8	17.4	17.8
SOCIO-ECO. VARIABLES									
Mother High education	59.5	64.8	69.1	52	71.8	77.5	47.8	59.1	59.7
Father High education	57.8	60.7	64.9	55.4	68.8	77	54.4	56.1	57.3
26-200 books at home	54	52.6	50.7	51.4	51	52.6	42.3	54.2	51.8
>200 books at home	26.5	28.4	30.3	20.3	29	33.4	15	25.1	25.5
Mother does not live at home	2.7	2.2	1.9	1.8	2	2	4.3	1.4	2
Father does not live at home	11.7	8.9	11.8	8.7	7.9	9.8	10.8	8.4	10.3
SCHOOL VARIABLES									
More than 50% girls	53.6	55.1	46.9	54.8	55	41.9	49.3	66	53.4
Private independent school	6.3	0	7.3	2.4	2.6	0	2.9	4.3	5.2
Private govern-depend. sch.	25.5	32.7	32.1	22.7	34.7	57.7	17.6	17.5	25.7
> 21 students per class	44	58.6	62.5	66.1	56.7	33.7	65	52.3	55.4

Table 3: Distribution of Math scores

	Number of observations	Mean	P25	P50	P75
Non-repeaters	17,678	520.71	475.94	522.29	568.86
Repeaters	8,209	418.93	369.15	420.17	470.95
Repeaters_P	1,071	422.72	371.95	414.64	483.26
Repeaters_PS	1,406	371.45	326.93	373.90	419.70
Repeaters_S	5,374	442.25	398.04	445.79	487.31

Table 4: Selection equation estimation

	SRM	PROBIT
REGIONS		
Andalusia	0.02 (0.06)	0.01 (0.06)
Aragon	0.08 (0.06)	0.07 (0.06)
Asturias	-0.38^{***} (0.06)	-0.33^{***} (0.06)
Balearic islands	0.03 (0.07)	-0.01 (0.08)
Cantabria	-0.11 (0.07)	-0.03 (0.07)
Castile Leon	0.01 (0.07)	0.08 (0.07)
Catalonia	-0.4^{***} (0.09)	-0.44^{***} (0.09)
Galicia	-0.11^{*} (0.06)	-0.03 (0.06)
La Rioja	0.02 (0.061)	-0.05 (0.06)
Madrid	0.03 (0.06)	0.04 (0.06)
Murcia	-0.12^{**} (0.06)	-0.13^{**} (0.05)
Navarre	-0.32^{***} (0.06)	-0.32^{***} (0.06)
Basque Country	-0.44^{***} (0.06)	-0.4^{***} (0.06)
Ceuta y Melilla	0.06 (0.06)	0.12^{**} (0.06)
Rest of Spain	0.01 (0.07)	0.04 (0.07)
INDIVIDUAL VARIABLES		
Gender (female)	-0.26^{***} (0.03)	-0.23^{***} (0.03)
Born in 3th quarter	0.1^{**} (0.04)	0.13^{***} (0.04)
Born in 4th quarter	0.28^{***} (0.04)	0.19^{***} (0.04)
Immigrant	0.59^{***} (0.06)	0.6^{***} (0.06)
Every week use PC for homework	-0.33^{***} (0.04)	-0.25^{***} (0.04)
Almost every day playing PC games	0.21^{***} (0.05)	0.22^{***} (0.05)

Table 4 (cont.): Selection equation estimation

	SRM	PROBIT
SOCIO-ECONOMIC VARIABLES		
Mother high and father low education	-0.22^{***} (0.05)	-0.26^{***} (0.05)
Mother low and father high education	-0.16^{***} (0.05)	-0.17^{***} (0.05)
Mother and father high education	-0.38^{***} (0.05)	-0.38^{***} (0.05)
26-200 books at home	-0.46^{***} (0.05)	-0.48^{***} (-0.05)
>200 books at home	-0.74^{***} (0.07)	-0.8^{***} (-0.07)
Mother is not at home	0.48^{***} (0.12)	0.39^{***} (0.12)
Father is not at home	0.23^{***} (0.07)	0.24^{***} (0.07)
SCHOOL VARIABLES		
Majority of girls in school	0.1^{**} (0.04)	0.08^{*} (0.047)
Private gov-dependent school	-0.23^{***} (0.04)	-0.16^{***} (0.04)
Private independent school	-0.18^{**} (0.077)	-0.25^{***} (0.08)
Class size	-0.13^{***} (0.02)	-0.13^{***} (0.02)
Class size ^2	0.002^{***} (0.0006)	0.002^{***} (0.0007)
Constant	1.99^{***} (0.23)	1.98^{***} (0.24)
Loglikehood (or pseudo)	$-1,944,306.3$	$-10,628.9$

Note 1: *, ** and *** means that coefficient is significant at 10%, 5% or 1%, respectively.

Note 2: Number of observations is 21,360. Standard errors in brackets

Table 5: Effect of individual, socio-economic and school variables on Math score

	Non-repeaters		Repeaters		All	All
	SRM	**OLS (a)**	**SRM**	**OLS (a)**	**OLS (b)**	**IV**
INDIVIDUAL VARIABLES						
Gender (female)	-27.73^{***} (2.14)	-29.43^{***} (2.053)	-34.64^{***} (4.86)	-31.03^{***} (3.283)	-30.02^{***} (1.82)	-29.48^{***} (2.71)
Immigrant	-26.8^{***} (5.79)	-21.75^{***} (5.51)	-4.68 (8.65)	-12.19^{***} (4.358)	-16.66^{***} (3.302)	-17.97^{***} (6.77)
Every week use PC for homework	4.4^{*} (2.29)	2.27 (1.971)	-5.01 (5.54)	-0.67 (3.215)	1.15 (1.612)	1.87 (3.26)
Almost every day playing PC games	3.64 (3.55)	5.18 (3.213)	-2.4 (5.79)	-5.64 (4.893)	0.32 (2.828)	-0.26 (3.42)
SOCIO-ECO VARIABLES						
Mother high father low educ.	3.81 (4.11)	2.16 (3.935)	10.77^{**} (4.43)	13.56^{***} (4.2)	6.03^{*} (3.21)	6.49^{*} (3.71)
Mother low father high educ.	4.68 (4.26)	3.46 (4.254)	3.26 (7.63)	5.82 (6.559)	3.98 (3.825)	4.42 (4.33)
Mother and father high educ.	17.15^{***} (3.47)	14.58^{***} (3.103)	1.37 (7.51)	6.65 (4.415)	12.42^{***} (2.854)	13.27^{***} (4.40)
26-200 books at home	38.85^{***} (3.52)	34.86^{***} (3.236)	27.34^{***} (7.10)	33.46^{***} (3.803)	33.44^{***} (2.648)	34.51^{***} (5.26)
>200 books at home	63.43^{***} (4.34)	57.93^{***} (3.565)	35.59^{***} (11.83)	46.28^{***} (6.297)	54.75^{***} (3.438)	56.38^{***} (7.38)
Mother is not at home	-21.28^{**} (9.27)	-17.66^{**} (8.863)	4.56 (13.24)	-0.57 (11.244)	-6.5 (7.612)	-7.56 (9.27)
Father is not at home	0 (4.09)	1.77 (4.107)	6.39 (5.38)	3.55 (4.429)	3.09 (3.352)	2.43 (3.62)
SCHOOL VARIABLES						
Majority of girls in school	0 (3.98)	0.6 (3.884)	5.73 (4.71)	4.51 (4.592)	1.88 (3.425)	1.69 (3.57)
Private gov-dependent school	-0.2 (3.9)	-1.61 (3.923)	3.4 (6.05)	6.94 (4.986)	1.08 (3.787)	1.47 (4.19)
Private independent school	2.04 (8.49)	0.91 (8.518)	1.84 (11.23)	4.76 (11.057)	2.59 (8.373)	2.87 (8.58)
Class size	7.38^{***} (1.51)	6.32^{***} (1.56)	2.58 (2.10)	3.93^{***} (1.192)	4.82^{***} (0.91)	5.14^{***} (1.43)
Class size ^2	-0.15^{***} (0.04)	-0.13^{***} (0.037)	-0.06 (0.05)	-0.08^{**} (0.033)	-0.1^{***} (0.024)	-0.10^{***} (0.03)
Constant	354.57^{***} (18.81)	383.01^{***} (17.639)	347.43^{***} (15.77)	341.03^{***} (12.034)	405.17^{***} (9.852)	396.69^{***} (33.00)
Retained					-80.4^{***} (2.03)	-73.41^{***} (26.97)
Correlation coefficients	-0.22^{**} (0.11)		0.31 (0.3)			
R^2		0.21		0.17	0.41	0.46

Note 1: *, ** and *** means that coefficient is significant at 10%, 5% or 1%, respectively.

Note 2: Number of total observations is 21,360, and 14,969 and 6,391 of NR and R respectively. Standard errors in brackets

Note 3: Log pseudolikelihood (SRM) = -1,944,306.3;

Table 6: Grade retention effect on Math scores

	Main model: REP				Repeaters Type		
					REP_S	**REP_P**	**REP_PS**
Predictions	SRM	OLS (a)	OLS (b)	IV	SRM	SRM	SRM
$\overline{y}_R^1$	423.9	424.5	-	-	442.7	425.1	377.1
$\overline{y}_{NR}^1$	480.2	503.4	-	-	489.8	482.9	471.8
$GRE^1 = \overline{y}_R^1 - \overline{y}_{NR}^1$	**-56.2**	**-78.9**	**-80.4**	**-73.4**	**-47.1**	**-57.7**	**-94.7**
$\overline{y}_R^0$	397.2	442.5	-	-	417.6	426.9	391.1
$\overline{y}_{NR}^0$	522.4	528.2	-	-	528.2	528.2	528.6
$GRE^0 = \overline{y}_R^0 - \overline{y}_{NR}^0$	**-125.1**	**-85.7**	**-80.4**	**-73.4**	**-110.5**	**-101.2**	**-137.4**

Note 1: The effects of the four types of repetition is based on different estimations where I=0 if student is Non-Repeater and I=1 if student is repeater of each the four types: Rep, Rep_S, Rep_P and Rep_PS, respectively.

Note 2: The number of observations are 14,969, 6,391, 3,718, 693 and 1,036 for Non-Repeaters, Repeaters, Repeaters_S, Repeaters_P and Repeaters_PS respectively.

Note 3: The equations y_{Ri} and y_{NRi} are the same when estimating by OLS or IV.

Note 4: The estimated SRM correlation coefficient ρ_{NR} for Rep_S and Rep_P estimations is not significant, however for Rep_PS is negative (-0.26) and significant (t-student$= -1.94$) as in the main model estimation (-0.22, significant at 5%). On the contrary, estimated coefficient ρ_R is not significant in any of the models.

Table 7: Grade retention effect. Decomposition of differences between R and NR. By region.

	Spain	And	Ara	Ast	Bal	Cana	Cant	Cast	Cat
SRM									
$GRE^1 = \overline{y}_R^1 - \overline{y}_{NR}^1$	-56.2	-56.7	-61.0	-58.2	-38.5	-46.8	-60.9	-66.9	-48.1
$GRE^0 = \overline{y}_R^0 - \overline{y}_{NR}^0$	-125.1	-123.2	-129.9	-131.9	-108.8	-110.9	-130.8	-135.6	-121.3
$\overline{y}_{NR}^0 - \overline{y}_R^1$ (%)									
Characteristics	25.3	21.2	24.9	29.6	34.0	19.1	26.2	19.6	25.1
Coefficients	89.3	91.5	87.4	86.9	80.1	94.0	88.0	95.6	101.4
Endogenous selec.	-14.6	-12.6	-12.3	-16.6	-14.1	-13.2	-14.2	-15.1	-26.4

Table 7 (cont.): Grade retention effect. Deco. of differences between R and NR. By region.

	Gal	Rio	Mad	Mur	Nav	Basq	C y M	Rest
SRM								
$GRE^1 = \overline{y}_R^1 - \overline{y}_{NR}^1$	-58.3	-67.3	-59.2	-52.7	-55.3	-57.6	-57.4	-56.6
$GRE^0 = \overline{y}_R^0 - \overline{y}_{NR}^0$	-125.6	-138.6	-129.9	-120.7	-130.1	-132.2	-126.9	-124.3
$\overline{y}_{NR}^0 - \overline{y}_R^1$ (%)								
Characteristics	19.4	27.3	27.9	21.6	32.5	24.1	29.0	23.4
Coefficients	97.1	84.2	84.7	95.0	85.7	99.6	80.4	89.1
Endogenous selec.	-16.5	-11.5	-12.6	-16.6	-18.3	-23.7	-9.5	-12.5

2010

2010/1, De Borger, B., Pauwels, W.: "A Nash bargaining solution to models of tax and investment competition: tolls and investment in serial transport corridors"
2010/2, Chirinko, R.; Wilson, D.: "Can Lower Tax Rates Be Bought? Business Rent-Seeking And Tax Competition Among U.S. States"
2010/3, Esteller-Moré, A.; Rizzo, L.: "Politics or mobility? Evidence from us excise taxation"
2010/4, Roehrs, S.; Stadelmann, D.: "Mobility and local income redistribution"
2010/5, Fernández Llera, R.; García Valiñas, M.A.: "Efficiency and elusion: both sides of public enterprises in Spain"
2010/6, González Alegre, J.: "Fiscal decentralization and intergovernmental grants: the European regional policy and Spanish autonomous regions"
2010/7, Jametti, M.; Joanis, M.: "Determinants of fiscal decentralization: political economy aspects"
2010/8, Esteller-Moré, A.; Galmarini, U.; Rizzo, L.: "Should tax bases overlap in a federation with lobbying?"
2010/9, Cubel, M.: "Fiscal equalization and political conflict"
2010/10, Di Paolo, A.; Raymond, J.L.; Calero, J.: "Exploring educational mobility in Europe"
2010/11, Aidt, T.S.; Dutta, J.: "Fiscal federalism and electoral accountability"
2010/12, Arqué Castells, P.: "Venture capital and innovation at the firm level"
2010/13, García-Quevedo, J.; Mas-Verdú, F.; Polo-Otero, J.: "Which firms want PhDS? The effect of the university-industry relationship on the PhD labour market"
2010/14, Calabrese, S.; Epple, D.: "On the political economy of tax limits"
2010/15, Jofre-Monseny, J.: "Is agglomeration taxable?"
2010/16, Dragu, T.; Rodden, J.: "Representation and regional redistribution in federations"
2010/17, Borck, R; Wimbersky, M.: "Political economics of higher education finance"
2010/18, Dohse, D; Walter, S.G.: "The role of entrepreneurship education and regional context in forming entrepreneurial intentions"
2010/19, Åslund, O.; Edin, P-A.; Fredriksson, P.; Grönqvist, H.: "Peers, neighborhoods and immigrant student achievement - Evidence from a placement policy"
2010/20, Pelegrín, A.; Bolance, C.: "International industry migration and firm characteristics: some evidence from the analysis of firm data"
2010/21, Koh, H.; Riedel, N.: "Do governments tax agglomeration rents?"
2010/22, Curto-Grau, M.; Herranz-Loncán, A.; Solé-Ollé, A.: "The political economy of infraestructure construction: The Spanish "Parliamentary Roads" (1880-1914)"
2010/23, Bosch, N.; Espasa, M.; Mora, T.: "Citizens' control and the efficiency of local public services"
2010/24, Ahamdanech-Zarco, I.; García-Pérez, C.; Simón, H.: "Wage inequality in Spain: A regional perspective"
2010/25, Folke, O.: "Shades of brown and green: Party effects in proportional election systems"
2010/26, Falck, O.; Heblich, H.; Lameli, A.; Südekum, J.: "Dialects, cultural identity and economic exchange"
2010/27, Baum-Snow, N.; Pavan, R.: "Understanding the city size wage gap"
2010/28, Molloy, R.; Shan, H.: "The effect of gasoline prices on household location"
2010/29, Koethenbuerger, M.: "How do local governments decide on public policy in fiscal federalism? Tax vs. expenditure optimization"
2010/30, Abel, J.; Dey, I.; Gabe, T.: "Productivity and the density of human capital"
2010/31, Gerritse, M.: "Policy competition and agglomeration: a local government view"
2010/32, Hilber, C.; Lyytikäinen, T.; Vermeulen, W.: "Capitalization of central government grants into local house prices: panel data evidence from England"
2010/33, Hilber, C.; Robert-Nicoud, F.: "On the origins of land use regulations: theory and evidence from us metro areas"
2010/34, Picard, P.; Tabuchi, T.: "City with forward and backward linkages"
2010/35, Bodenhorn, H.; Cuberes, D.: "Financial development and city growth: evidence from Northeastern American cities, 1790-1870"
2010/36, Vulovic, V.: "The effect of sub-national borrowing control on fiscal sustainability: how to regulate?"
2010/37, Flamand, S.: "Interregional transfers, group loyalty and the decentralization of redistribution"
2010/38, Ahlfeldt, G.; Feddersen, A.: "From periphery to core: economic adjustments to high speed rail"
2010/39, González-Val, R.; Pueyo, F.: "First nature vs. second nature causes: industry location and growth in the presence of an open-access renewable resource"
2010/40, Billings, S.; Johnson, E.: "A nonparametric test for industrial specialization"
2010/41, Lee, S.; Li, Q.: "Uneven landscapes and the city size distribution"
2010/42, Ploeckl. F.: "Borders, market access and urban growth; the case of Saxon towns and the Zollverein"
2010/43, Hortas-Rico, M.: "Urban sprawl and municipal budgets in Spain: a dynamic panel data analysis"
2010/44, Koethenbuerger, M.: "Electoral rules and incentive effects of fiscal transfers: evidence from Germany"

2010/45, Solé-Ollé, A.; Viladecans-Marsal, E.: "Lobbying, political competition, and local land supply: recent evidence from Spain"
2010/46, Larcinese, V.; Rizzo; L.; Testa, C.: "Why do small states receive more federal money? Us senate representation and the allocation of federal budget"
2010/47, Patacchini, E.; Zenou, Y.: "Neighborhood effects and parental involvement in the intergenerational transmission of education"
2010/48, Nedelkoska, L.: "Occupations at risk: explicit task content and job security"
2010/49, Jofre-Monseny, J.; Marín-López, R.; Viladecans-Marsal, E.: "The mechanisms of agglomeration: Evidence from the effect of inter-industry relations on the location of new firms"
2010/50, Revelli, F.: "Tax mix corners and other kinks"
2010/51, Duch-Brown, N.; Parellada-Sabata M.; Polo-Otero, J.: "Economies of scale and scope of university research and technology transfer: a flexible multi-product approach"
2010/52, Duch-Brown, N.; Vilalta M.: "Can better governance increase university efficiency?"
2010/53, Cremer, H.; Goulão, C.: "Migration and social insurance"
2010/54, Mittermaier, F; Rincke, J.: "Do countries compensate firms for international wage differentials?"
2010/55, Bogliacino, F; Vivarelli, M.: "The job creation effect or R&D expenditures"
2010/56, Piacenza, M; Turati, G.: "Does fiscal discipline towards sub-national governments affect citizens' well-being? Evidence on health"

2011

2011/1, Oppedisano, V; Turati, G.: "What are the causes of educational inequalities and of their evolution over time in Europe? Evidence from PISA"
2011/2, Dahlberg, M; Edmark, K; Lundqvist, H.: "Ethnic diversity and preferences for redistribution "
2011/3, Canova, L.; Vaglio, A.: "Why do educated mothers matter? A model of parental help"
2011/4, Delgado, F.J.; Lago-Peñas, S.; Mayor, M.: "On the determinants of local tax rates: new evidence from Spain"
2011/5, Piolatto, A.; Schuett, F.: "A model of music piracy with popularity-dependent copying costs"
2011/6, Duch, N.; García-Estévez, J.; Parellada, M.: "Universities and regional economic growth in Spanish regions"
2011/7, Duch, N.; García-Estévez, J.: "Do universities affect firms' location decisions? Evidence from Spain"
2011/8, Dahlberg, M.; Mörk, E.: "Is there an election cycle in public employment? Separating time effects from election year effects"
2011/9, Costas-Pérez, E.; Solé-Ollé, A.; Sorribas-Navarro, P.: "Corruption scandals, press reporting, and accountability. Evidence from Spanish mayors"
2011/10, Choi, A.; Calero, J.; Escardíbul, J.O.: "Hell to touch the sky? private tutoring and academic achievement in Korea"
2011/11, Mira Godinho, M.; Cartaxo, R.: "University patenting, licensing and technology transfer: how organizational context and available resources determine performance"
2011/12, Duch-Brown, N.; García-Quevedo, J.; Montolio, D.: "The link between public support and private R&D effort: What is the optimal subsidy?"
2011/13, Breuillé, M.L.; Duran-Vigneron, P.; Samson, A.L.: "To assemble to resemble? A study of tax disparities among French municipalities"
2011/14, McCann, P.; Ortega-Argilés, R.: "Smart specialisation, regional growth and applications to EU cohesion policy"
2011/15, Montolio, D.; Trillas, F.: "Regulatory federalism and industrial policy in broadband telecommunications"
2011/16, Pelegrín, A.; Bolancé, C.: "Offshoring and company characteristics: some evidence from the analysis of Spanish firm data"
2011/17, Lin, C.: "Give me your wired and your highly skilled: measuring the impact of immigration policy on employers and shareholders"
2011/18, Bianchini, L.; Revelli, F.: "Green polities: urban environmental performance and government popularity"
2011/19, López Real, J.: "Family reunification or point-based immigration system? The case of the U.S. and Mexico"
2011/20, Bogliacino, F.; Piva, M.; Vivarelli, M.: "The impact of R&D on employment in Europe: a firm-level analysis"
2011/21, Tonello, M.: "Mechanisms of peer interactions between native and non-native students: rejection or integration?"
2011/22, García-Quevedo, J.; Mas-Verdú, F.; Montolio, D.: "What type of innovative firms acquire knowledge intensive services and from which suppliers?"

2011/23, Banal-Estañol, A.; Macho-Stadler, I.; Pérez-Castrillo, D.: "Research output from university-industry collaborative projects"
2011/24, Ligthart, J.E.; Van Oudheusden, P.: "In government we trust: the role of fiscal decentralization"
2011/25, Mongrain, S.; Wilson, J.D.: "Tax competition with heterogeneous capital mobility"
2011/26, Caruso, R.; Costa, J.; Ricciuti, R.: "The probability of military rule in Africa, 1970-2007"
2011/27, Solé-Ollé, A.; Viladecans-Marsal, E.: "Local spending and the housing boom"
2011/28, Simón, H.; Ramos, R.; Sanromá, E.: "Occupational mobility of immigrants in a low skilled economy. The Spanish case"
2011/29, Piolatto, A.; Trotin, G.: "Optimal tax enforcement under prospect theory"
2011/30, Montolio, D; Piolatto, A.: "Financing public education when altruistic agents have retirement concerns"
2011/31, García-Quevedo, J.; Pellegrino, G.; Vivarelli, M.: "The determinants of YICs' R&D activity"
2011/32, Goodspeed, T.J.: "Corruption, accountability, and decentralization: theory and evidence from Mexico"
2011/33, Pedraja, F.; Cordero, J.M.: "Analysis of alternative proposals to reform the Spanish intergovernmental transfer system for municipalities"
2011/34, Jofre-Monseny, J.; Sorribas-Navarro, P.; Vázquez-Grenno, J.: "Welfare spending and ethnic heterogeneity: evidence from a massive immigration wave"
2011/35, Brülhart, M.; Schmidheiny, K.: "Estimating the Rivalness of State-Level Inward FDI"
2011/36, García-Pérez, J.I.; Hidalgo-Hidalgo, M.; Robles-Zurita, J.A.: "Does grade retention affect achievement? Some evidence from Pisa"

UNIVERSITAT DE BARCELONA

ieb@ub.edu
www.ieb.ub.edu

Document de treball de l'IEB