



Selection Policies in Education Systems and Educational Achievement

António Maximiano

Dissertation written under the supervision of professor Hugo Reis

Dissertation submitted in partial fulfilment of requirements for the MSc in
Economics, at the Universidade Católica Portuguesa, 1st June 2022.

Abstract

Selection Policies in Education Systems and Educational Achievement

António Maximiano

Keywords: early tracking, grade retention, performance, achievement, inequality

Selection policies in education systems are different across countries, namely tracking and grade retention. Some countries separate students aged 10 into different schools or educational tracks, while others separate students aged 16. Although some countries do not retain students, most countries have grade retention, but with different retention rates during primary and lower secondary schools (from below 1% to above 30%). In order to understand how the differences in grade retention and tracking impact educational achievement, we applied a panel model with year and country fixed effects and difference-in-differences on data from international students' assessment tests. Our results suggest that early tracking raises slightly mathematics and science achievement and achievement inequality with more robust results for boys, high achievers, and science. Early tracking seems to reduce reading achievement of low achievers. Moreover, grade retention decreases educational achievement in all subjects with larger effects in countries with high retention rates and students in European countries whose parents have primary school. Grade retention at lower secondary decreases less educational achievement than grade retention at primary school. Likewise, education achievement of students retained twice or more reduces less than twice as much as of students retained once at primary school and/or lower secondary. Besides, grade retention reduces more schooling performance in late tracking countries than in early tracking countries. Lastly, grade retention and early tracking have, respectively, stronger and more robust effects in European countries.

As políticas de seleção nos sistemas educativos são diferentes entre países, como o *tracking* (idade de separação dos alunos por programa curricular) e a retenção. Alguns países separam os alunos por programa curricular aos 10 anos, enquanto outros fazem-no aos 16 anos. Embora alguns países não retenham os alunos, a maioria dos países retém, mas com diferentes taxas de retenção no ensino básico (de 1% a mais de 30%). Para percebermos os efeitos do *tracking* e retenção no desempenho escolar, aplicámos diferença-nas-diferenças e um modelo de painel com efeitos fixos por país e ano em testes internacionais de avaliação de alunos. Os resultados

sugerem que o *tracking* precoce aumenta ligeiramente o desempenho a matemática e ciências e a desigualdade de desempenho com resultados mais robustos para rapazes, alunos com alto desempenho e ciências. O *tracking* precoce parece diminuir o desempenho a literacia nos alunos com baixo desempenho. Paralelamente, a retenção diminui o desempenho escolar com efeitos maiores nos países com taxas de retenção elevadas e nos alunos de países europeus cujos pais têm o ensino primário a todas as disciplinas. A retenção no ensino preparatório diminui menos o desempenho escolar do que a retenção no ensino primário. Igualmente, o desempenho escolar dos alunos que repetem várias vezes no ensino básico diminui menos do dobro do que dos alunos que repetem uma vez. A retenção também diminui mais o desempenho escolar nos países sem *tracking* precoce do que nos países com *tracking* precoce. Finalmente, os países europeus têm os efeitos maiores.

Table of Contents

1. Introduction.....	6
2. Literature Review.....	8
3. Data and Descriptive Statistics	12
3.1. Data and Descriptive Statistics for Early Tracking	12
3.2. Data and Descriptive Statistics for Grade Retention	17
4. Econometric Model and Methodology	19
4.1. Empirical Approach for Early Tracking	19
4.2. Empirical Approach for Grade Retention.....	22
5. Main Results	23
5.1. Early Tracking and Educational Achievement.....	24
5.1.1. Early Tracking and Mean Achievement.....	24
5.1.2. Early Tracking and Achievement Inequality	25
5.1.3. Early Tracking and Reading Achievement	26
5.2. Grade Retention and Educational Achievement.....	26
5.2.1. Cumulative Grade Retention.....	26
5.2.2. Grade Retention at Primary School and Lower Secondary.....	27
5.2.3. Number of Retention at Primary School and Lower Secondary	28
5.3. Early Tracking, Grade Retention and Educational Achievement.....	30
6. Main Conclusions	31
References	33
Appendix	36

List of Figures

Figure 1 – First Tracking Age by Country	14
Figure 2 – Percentage of Students by Background	14
Figure 3 – Mathematics Achievement by Country	16
Figure 4 – Science Achievement by Country.....	16
Figure 5 – Cumulative Retention Rate by Country.....	17
Figure 6 – Retention Rate at Primary School by Country.....	18
Figure 7 – Retention Rate at Lower Secondary School by Country	18

1. Introduction

Education systems across OECD¹ countries are different regarding selection policies, such as tracking and grade retention.

In most OECD countries, education systems comprise a comprehensive schooling followed by a selective schooling, where students are allocated into different school types, levels within comprehensive schools, or educational programmes according to their academic achievement, ability, or interests. This tracking aims to create homogenous learning environments and takes place in secondary or post-secondary education.

However, the first tracking age is different across countries: most OCDE countries first track students aged 15/16 (after 9th/10th grade), whereas some countries first track students aged 10 (after 4th grade). Likewise, European countries track students into educational programmes or school types, while the USA tracks students into levels within comprehensive schools.

The literature discussion on early tracking's effects on educational performance and equality focuses on the first tracking age, degree of curriculum differentiation and the number of school types. However, we will study the effects of the first tracking age for tracking into educational programmes or school types by revisiting Hanushek and Wößmann (2006).

There are several arguments against and in favour of tracking into different school types or educational programmes, which rest on a perceived trade-off between efficiency and equity in schooling institutions. Therefore, tracking's effects on academic achievement and inequality are not clear and depend on the nature of peer effects.

If students are streamed according to ability, homogenous classes enable tailored curriculum to students' ability level and proper progress. Hence, fast and slow learners can learn at optimal pace, optimising learning for all students. If tailored teaching outweighs the possible negative effect of not having high achievers, then low achievers and disadvantaged students may benefit from tracking. Conversely, if students benefit from being with peers of similar ability, tracking could raise schooling performance and reduce inequality.

If peer effects are not linear, low achievers may benefit from interacting with high achievers who do not lose. Thus, heterogenous classes increase educational achievement through positive spill-over effects from high achievers. By creating homogenous classes, tracking deprives low achievers from these interactions, undermining their performance. Alternatively, if peer effects are linear, tracking would increase educational inequality with an uncertain impact on average educational achievement.

¹OECD – Organisation for Economic Co-operation and Development.

Tracking introduces earlier decision making, which involves parental advice, rising parents' influence. So, students from low socioeconomic background are more likely assigned to lower tracks, reducing their opportunities to earn tertiary educational degrees, and raising educational inequality. Likewise, low achievers may be grouped in lower tracks, reducing their chance of attending university. Thus, tracking causes continuous bias against disadvantaged students and increases inequality of opportunities by reinforcing the impact of educational inheritance.

Earlier tracking raises the risk of misallocating students to tracks, as schooling performance in early education depends more on students' socioeconomic background. Slower learning may raise the skills gap among students in lower and upper tracks, harming students in lower tracks.

Most OECD countries have grade retention. Thus, students with low academic performance, bad behaviour or high absenteeism may be retained. However, countries have different grade retention policies with automatic progression throughout compulsory education in Norway and Japan (retention rate of 0%) and retention rates above 30% in some countries (e.g., Tunisia and Portugal). Therefore, we will study the effects of grade retention during primary and secondary education² on educational achievement and inequality of 15-year-old students.

There are various arguments against and in favour of retaining students who lack basic skills they should master or with academic achievement below expected for promotion, so the effects of grade retention on academic achievement and inequality are not clear.

Retaining low achievers gives them another chance to improve their schooling performance, knowledge, ability, and maturity in order to achieve the human capital needed in the next grade, enrolling on equal terms with their classmates. Therefore, grade retention improves the match of students' ability, leading to more homogenous classes and more efficient teaching.

Repeated instruction gives retained students more time to develop the abilities needed in the next grades, reducing the risk of future failure. Furthermore, grade retention may ensure better accountability and incentive students to learn more.

Conversely, grade retention leads to stigma of being retained, impaired peer relation, greater distancing from schooling, low expectations for academic achievement and self-esteem. These psychological effects may lower schooling performance and rise the dropout probability. Grade retention is also costly, as another year of education must be provided and students' entry into the labour market is delayed.

In this dissertation, we study the impact of early tracking and grade retention on educational achievement using, respectively, difference-in-differences with country level data and a panel

²According to ISCED (International Standard Classification of Education): level 1 – primary education; level 2 – lower secondary education; level 3 – upper secondary education

model with year and country fixed effects using student level data from international students' assessment tests conducted from 1995 to 2018.

Our results suggest that early tracking increases slightly educational achievement inequality. Early tracking also rises mathematics and science achievement and lowers reading achievement for low achievers. Besides, grade retention reduces educational achievement with larger effects in countries with high retention rates and students in European countries whose parents have the primary school. Lastly, grade retention reduces more schooling performance in late tracking countries than in early tracking countries.

However, our analysis has some limitations. As for early tracking, most pairs of assessments do not include Germany and have different countries. Besides, students sampled in the first and second tests may be different and early tracking may be correlated with factors that impact educational achievement. Finally, there is a selection problem that may bias estimates. Retained students are in lower grades, which may reduce their performance in assessment tests.

This dissertation is structured as follows. Section 2 discusses relevant studies on the effects of grade retention and early tracking on educational achievement and inequality. Sections 3 and 4 describe, respectively, data and methodology. Section 5 presents our results on the effects of early tracking and grade retention. Section 6 concludes.

2. Literature Review

We start by discussing some studies of first tracking age's effects on academic achievement.

Hanushek and Wößmann (2006) used international student assessment tests (TIMSS, PISA and PIRLS³) to estimate early tracking's effects on educational achievement. They employed difference-in-differences across countries by regressing educational outcomes (mean, variance, quantiles, or differences among quantiles) at secondary school (after tracking in some countries) on outcomes at primary school (before tracking in any country). Each country's primary school outcome controls for secondary school outcome. They focused on contemporary assessments at both schools to ensure similar education policies, so they used 8 pairs of tests in mathematics, reading, and science with 18 to 26 countries each. Lastly, they used a dummy variable equal to 1 if the country tracks students before the secondary school assessment and to 0 otherwise⁴.

³TIMSS – Trends in International Mathematics and Science Study; PISA – Programme for International Student Assessment; PIRLS – Progress in International Reading Literacy Study.

⁴Students in early tracking countries are tracked by age 14 if TIMSS is the test at secondary school or 15 for PISA.

They found that educational achievement inequality between primary and secondary schools tends to rise in early tracking countries and to decrease in late tracking countries. Early tracking increases standard deviation in test scores and differences among quantiles. However, its effects on mean scores depend on the subject: insignificant and negative for mathematics, insignificant and positive for science, or significant and negative for reading. Besides, early tracking reduces more schooling performance for low achievers than high achievers. They concluded that early tracking increases educational inequality and that there is little evidence of efficiency gains, so countries lose in the level and distribution of educational achievement.

Jakubowski (2010) assessed early tracking's effects on students from different backgrounds and checked the robustness of results of Hanushek and Wöeßmann (2006). He used four pairs of international assessment tests. Hence, he restricted the samples to native students who speak the test's language at home, within 6 months interval around the mean age in each country and from modal grades in order to represent similar populations. Lastly, he controlled for mean age difference among primary and secondary samples in each country. He estimated difference-in-differences at country level on restricted samples and at student level controlling for grade, age, family background and country fixed effects. He found that early tracking does not affect mean, interquartile difference, standard deviation, 10th and 90th deciles of schooling performance and that mean age difference raises educational achievement growth. Besides, growth of schooling performance is smaller in Eastern Europe countries, mostly with early tracking. He concluded that common policies in Eastern Europe countries, different age distribution and surveys design led to previous results of negative early tracking's effects.

Lavrijsen and Nicaise (2016) improved the analysis of Hanushek and Wöeßmann (2006) by controlling for mean age difference between primary and secondary samples in each country, which could bias results as noted by Jakubowski (2010). They estimated early tracking's effects on mean educational achievement, low and high achievers on reading, mathematics and science using 26 pairs of international assessment tests. They found that early tracking decreases mean educational achievement with strong effects for low achievers and no effect for high achievers. Early tracking's effects are larger for reading and lower for mathematics.

Difference-in-differences across countries with controls for features of students, schools and countries may not remove all unobserved heterogeneity amid countries. Therefore, Wöeßmann (2010) studied the different tracking policies in German states (students are tracked after fourth or sixth grade and there are two to four school types according to the state). He used state level data from PISA 2003 to estimate how the first tracking age and number of school types impacts the linkage between students' background and their schooling performance. He found that later

tracking, less school tracks and smaller share of students attending the lowest track reduces the linkage between students' background and their educational achievement and does not impact mean schooling performance. Lastly, early tracking's effects are very similar in German states and OECD countries. Therefore, results of studies that exploit different tracking policies across countries are unlikely to be significantly biased.

Ammermüller (2005) analysed how schooling institutions determine differences in equality of educational opportunities across countries. He used student level data from PIRLS and PISA on reading achievement for twelve countries. He regressed test scores on measures of students' background and controlled for different schooling institutions across grades and countries. He found that in countries with more school types, students' background impacts more educational achievement. Therefore, the number of school types decreases equality of opportunities.

We move to the discussion of studies on grade retention's effects on academic achievement.

Schwerdt and West (2017) used data on all students attending public schools in Florida from third to tenth grades to study third grade retention's effects on schooling performance. If third grade students score below the promotional cut-off in the state reading test are retained, leading to a discontinuous probability of retention around the cut-off. Hence, they applied a regression discontinuity design. They found that third grade retention increases reading and mathematics achievement in the short-term, but these increase fades out over time and becomes insignificant after five years. Besides, third grade retention decreases the probability of retention in the four subsequent grades and its costs are below one year of per pupil spending and foregone earnings.

Jacob and Lefgren (2004) used data on all students attending public schools in Chicago from third to eighth grades to analyse the effects of retention in third and sixth grades on educational achievement. As in Florida, students who score below the promotional cut-off in state reading or mathematics tests in third, sixth and eighth grades are retained. The probability of retention around the cut-off is discontinuous, so they estimated a regression discontinuity design. They found that retention in sixth grade does not affect mathematics achievement and lowers reading achievement, whereas retention in third grade raises schooling performance in the short term. Hence, grade retention has stronger effects in reading than in mathematics and grade retention in third grade has better impact on performance than in sixth grade.

Diris (2012) used PISA 2003 and 2009 to study the effects of grade retention and late starts (retention in kindergarten) on educational achievement. He combined an instrumental variable method with a stepwise estimation method to estimate the effects throughout the achievement distribution, using the percentage of retained students within a month of birth as instrument for retention. He found that late starts and grade retention reduce educational achievement, but late

starts benefits students near the bottom of the achievement distribution. Moreover, early grade retention has weaker effects than late grade retention and might benefit some students. Finally, grade retention harms most retained students and more disadvantaged students and boys.

Mahjoub (2017) used data on results of national tests in mathematics and reading at the end and beginning of lower secondary education of French students to analyse the effects of grade retention in France. He applied an instrumental variables maximum likelihood method, using birth quarter as instrument, and a matching approach based on propensity scores. He found that grade retention increases mathematics and reading achievement in lower secondary education and raises the probability of graduating from lower secondary school and entering the academic track of upper secondary school.

Pereira and Reis (2012) used PISA 2003 and 2009 to study the effects of grade retention at primary school and lower secondary on schooling performance in Portugal compared to other European countries. They estimated a treatment effects model with endogenous selection and found that grade retention at primary school lowers educational achievement in the long term, whereas grade retention at lower secondary school slightly raises schooling performance in the short term. Besides, students most likely to repeat benefit more or lose less from grade retention and European countries have similar effects to Portugal, but with larger positive effect of grade retention at lower secondary school.

Baert *et al.* (2013) used data on Flemish students that reports performance and track choices at secondary school to study the relation among educational achievement, grade retention, track choices, and students' abilities at Flemish secondary schools. They used maximum likelihood techniques to estimate dynamic qualitative choice models. They found that grade retention rises educational achievement in the next grade, may permanently affect schooling performance and harms (benefits) more (less) able students.

Reis (2015) used PISA 2012 to analyse how segregation between schools and inequality in family background and school resources affect inequality of educational achievement in OECD countries. He estimated an education production function and found that inequality in schooling performance increases with early tracking, high retention rates, selective admission procedures and little school autonomy.

Overall, literature on the effects of early tracking and grade retention on inequality and mean of educational achievement has mixed evidence. Thus, their effects are still an open question.

3. Data and Descriptive Statistics

3.1. Data and Descriptive Statistics for Early Tracking

Recent series of international students' assessment provide standardized data on educational achievement in reading, mathematics, and science, which enables us to estimate the effects of early tracking and grade retention on educational achievement.

For early tracking, we use data from three international students' assessment series: PIRLS, TIMSS (fourth and eighth grade) and PISA. PIRLS assesses literacy skills of students in fourth grade, while TIMSS assesses if students in fourth and eighth grades master a mathematics and science curriculum. Test scores in both series are standardized using the mean (500 points) and standard deviation (100 points) of the first edition as reference points, namely PIRLS 2001 and TIMSS 1995. PISA measures 15-year-old students' ability to apply their knowledge of reading, mathematics, and science to solve practical problems, but each edition focuses on one subject. Scores are approximately normal distributed with a mean of 500 points and a standard deviation of 100 points.

Assessment tests of students from the same cohort at primary (before early tracking) and at secondary schools (after early tracking) should be matched in order to estimate early tracking's effects on educational achievement. Thus, we match TIMSS fourth grade in year t with TIMSS eighth grade in year $t+4$ or with PISA in year $t+5$ and PIRLS in year t with PISA in year $t+5$. TIMSS and PISA assess different skills, but their country level scores are strongly correlated⁵.

We use the first tracking age as reported by OECD in 2020⁶ and consider that a country has early tracking if students are tracked by age 14.

Students in PISA are older than in TIMSS eight grade (15.8 vs 14.2 years), so early tracking had more time to affect educational achievement in pairs with PISA, which are likely to provide more reliable estimates of early tracking's effect.

We use 15 pairs of assessments: 10 pairs with TIMSS as second test and 5 pairs with PISA. Each pair has 17 to 34 countries with 4 to 12 early tracking countries. 59 countries are observed across all pairs. Besides, we use a pooled sample of all pairs for mathematics and science with 56 countries and 13 early tracking countries. This sample separates in number of books at home (pairs 1 to 4 and 6 to 11) and in parents' highest education (pairs 12 to 15) in the second model. Lastly, we use a pooled sample of the 25 European countries with 9 early tracking countries in

⁵Rindermann H (2007) found strong correlations between scores of TIMSS eighth grade and PISA in mathematics and science (0.86 to 0.92).

⁶We used the first tracking age reported in the figure V.3.2 of *PISA 2018 Results (Volume V): Effective Policies, Successful Schools* to define the tracking age.

order to check the robustness of results. Table 1 describes all pairs⁷ and table 2 in the appendix presents the countries included in each pair and the first tracking age for all countries.

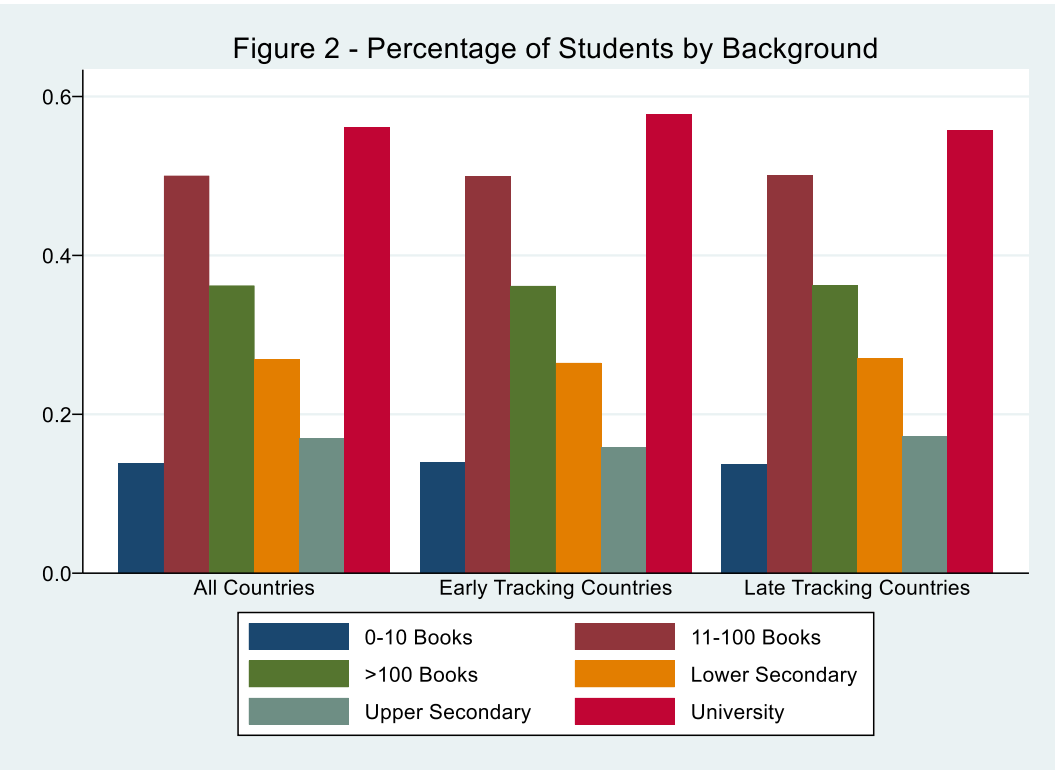
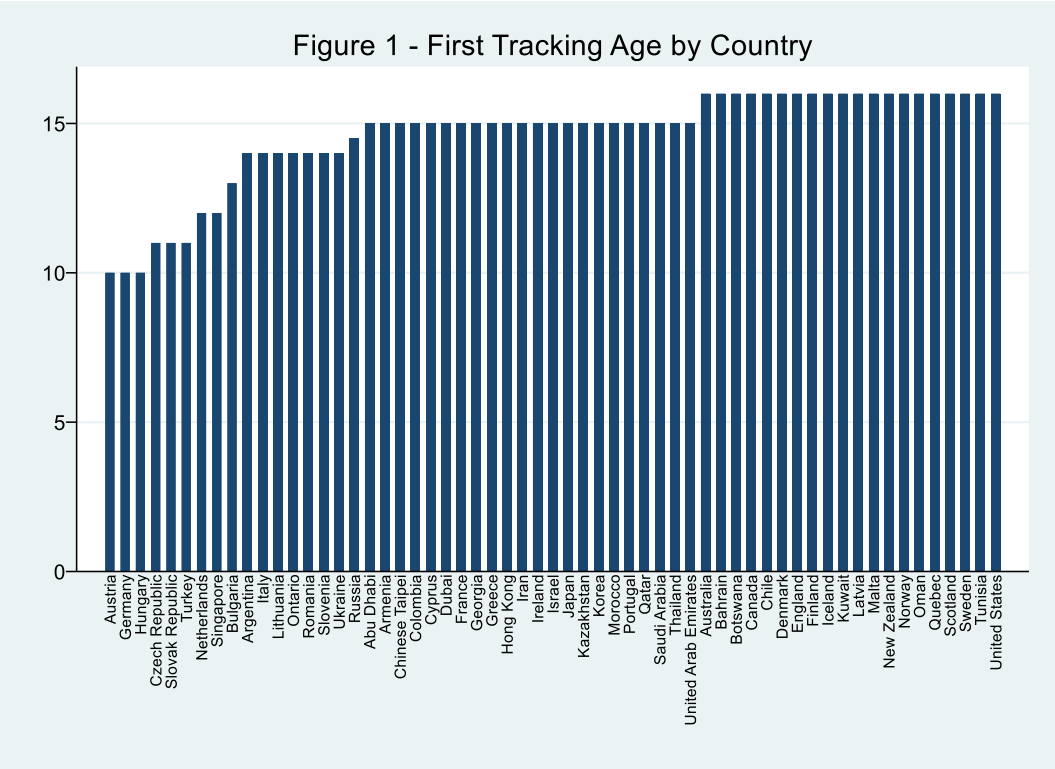
There is only one pair for reading, once it is the only possible pair for the same cohort. Thus, we focus our analysis on mathematics and science.

Pair	Primary School Test		Secondary School Test		Subject	Countries	Early Trackers
1	TIMSS 1995	4 th grade	TIMSS 1999	8 th grade	Mathematics	17	5
2	TIMSS 1995	4 th grade	TIMSS 1999	8 th grade	Science	17	5
3	TIMSS 1995	4 th grade	PISA 2000	15-year-old	Mathematics	17	4
4	TIMSS 1995	4 th grade	PISA 2000	15-year-old	Science	17	4
5	TIMSS 2001	4 th grade	PISA 2006	15-year-old	Reading	23	12
6	TIMSS 2003	4 th grade	TIMSS 2007	8 th grade	Mathematics	21	6
7	TIMSS 2003	4 th grade	TIMSS 2007	8 th grade	Science	21	6
8	TIMSS 2007	4 th grade	TIMSS 2011	8 th grade	Mathematics	26	7
9	TIMSS 2007	4 th grade	TIMSS 2011	8 th grade	Science	26	7
10	TIMSS 2007	4 th grade	PISA 2012	15-year-old	Mathematics	25	10
11	TIMSS 2007	4 th grade	PISA 2012	15-year-old	Science	25	10
12	TIMSS 2011	4 th grade	TIMSS 2015	8 th grade	Mathematics	24	5
13	TIMSS 2011	4 th grade	TIMSS 2015	8 th grade	Science	24	5
14	TIMSS 2015	4 th grade	TIMSS 2019	8 th grade	Mathematics	34	6
15	TIMSS 2015	4 th grade	TIMSS 2019	8 th grade	Science	34	6

Table 1 – Pairs of international students’ assessment tests

The first tracking age is quite different across countries. Figure 1 plots the first tracking age for all countries. Most countries track students at age 15 or 16, namely 23 and 20 countries (39.0 and 33.9%), in our data. Only 3 countries (5.1%) track students at age 10 or 11 and even fewer countries track students at age 12 or 13, respectively 2 and 1 (3.4 and 1.7%). Lastly, only 7 countries (11.9%) track students at age 14. Hence, students are usually tracked into different schools or educational programmes at age 15 or 16 in most countries, but some countries track students between the ages of 10 and 14.

⁷Pairs 1 to 4 may provide less reliable estimates, as methodology is slightly different in TIMSS 1995 for 4th grade.



Students' background is measured by parents' highest education in pairs 5 and 12 to 15 and by the number of books at home in the remaining pairs. Figure 2 presents the percentage of students whose parents have up to lower secondary, upper secondary or tertiary education and

with up to 10 books at home, 11 to 100 books or 101 or more books for all, early tracking, and late tracking countries. Students in early tracking countries have parents slightly more educated and slightly fewer books at home, but the differences between early and late tracking countries are small (the biggest one is 2 percentage points). In either late or early tracking countries, 14% of students has 0 to 10 books, 50% has 11 to 100 books and 36% has 101 or more books at home. In early tracking countries, 26% of parents has up to lower secondary, 16% has upper secondary and 58% has tertiary education, whereas in late tracking countries these percentages are 27%, 17% and 56% respectively.

The country level mean and standard deviation of test scores of PISA and TIMSS at primary and secondary schools and the differences between tests are plotted for all, early tracking, and late tracking countries for mathematics in Figure 3 and for science in Figure 4. Late tracking countries have 490 points on average with a standard deviation of 58 points which rises 1 point and falls 14 points respectively, whereas early tracking countries have a mean of 521 points, a standard deviation of 38 points and respective growths of -6 and 4 points in mathematics. As for science, early tracking countries have 527 points on average and a standard deviation of 29 points that lowers 1 point and rises 4 points respectively, while late tracking countries have on average 493 points with a standard deviation of 47 points and respective growths of 9 and -25 points. Therefore, students in early tracking countries have larger mean achievement in science and mathematics and smaller standard deviation. The differences in schooling performance are significant at the 1% significance level.

As for reading, students in early tracking countries have less educated parents, smaller mean educational achievement, higher standard deviation, larger reduction in mean achievement and bigger increase in standard deviation from primary to secondary education, but the differences are insignificant.

Overall, students in early and late tracking countries have similar backgrounds, but countries with early tracking countries have bigger mean educational achievement and lower inequality. Moreover, descriptive statistics suggests that early tracking decreases slightly mean schooling performance and increases also slightly inequality in educational achievement.

Table 5 in the appendix plots the percentage of students by gender and category of students' background. Tables 6 and 7 present respectively the mathematics and science achievement for all students, by gender and by category of students' background.

Figure 3 - Mathematics Achievement by Country

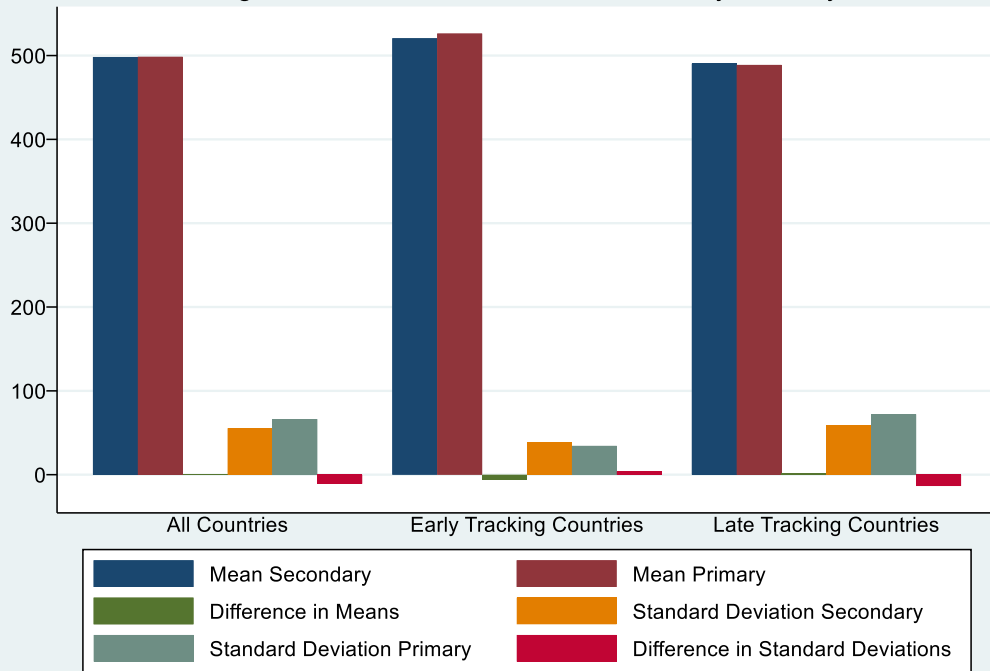
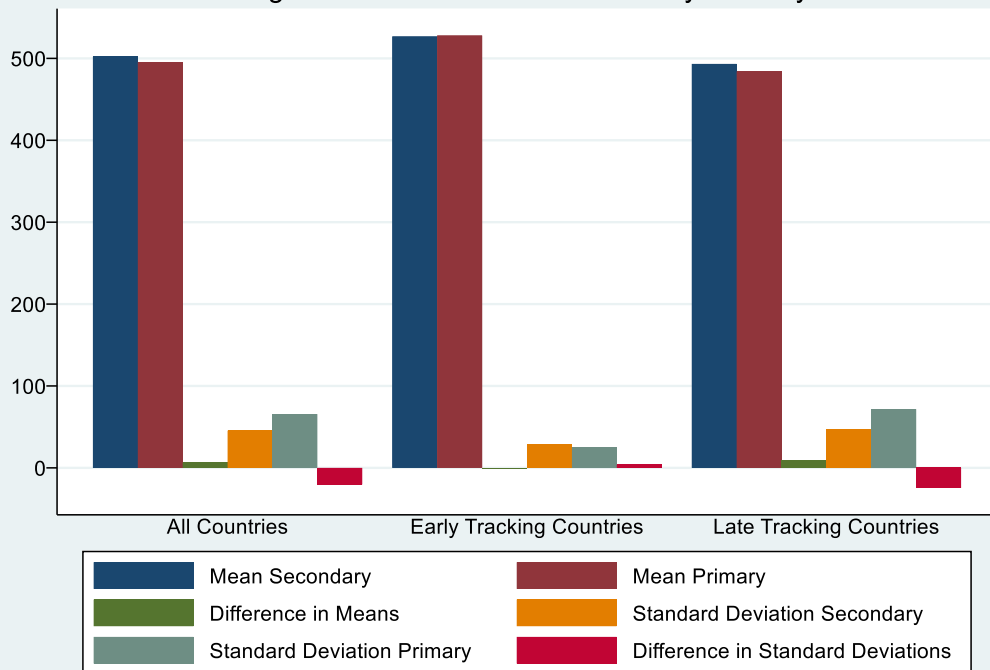


Figure 4 - Science Achievement by Country



3.2. Data and Descriptive Statistics for Grade Retention

For grade retention, we combined student data from 2003, 2009, 2012, 2015 and 2018 waves of PISA for countries that have participated in at least three waves⁸. Our data has 63 countries, 269 country-by-wave observations and 1556714 observed students. We also use the sample of 23 European countries that participated in all surveys to check the robustness of results.

Table 3 in the appendix presents the countries included in each wave and retention rates that range from 0 to 44.5%. Most countries have retention rates between 4 to 20.5%, but 5 countries have retention rates below 2% and 10 countries have retention rates above 30%.

Grade retention rates vary greatly across countries, as some countries do not retain students whereas others have very high retention rates. Figure 5 plots the retention rate by country by the time of PISA. Norway and Japan have the smallest retention rates (0% as they do not retain students), while Macao and Tunisia have the largest retention rates, namely 39.7% and 44.5%. The retention rate by the time of PISA is on average 13.3%.

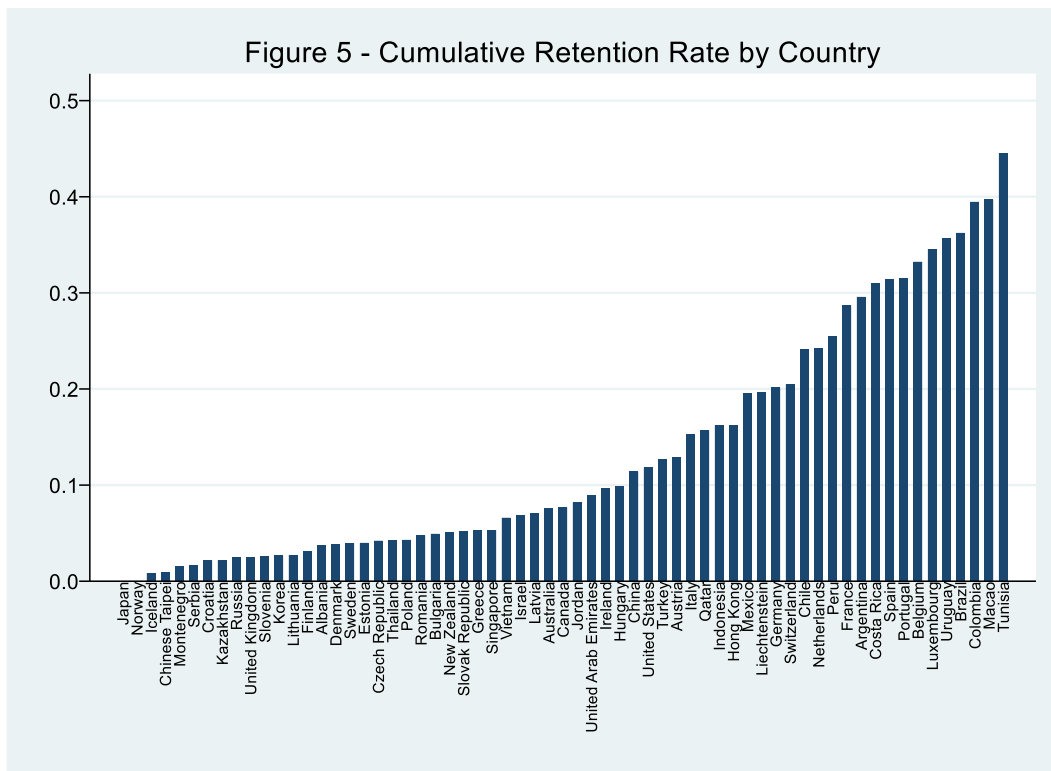


Figure 6 plots the retention rate at primary school by country, which also varies widely by country. Japan and Norway have again a retention rate of 0% and Macao and Tunisia have the biggest retention rates at primary school, respectively 22.8% and 26.7%. The retention rate at

⁸PISA 2000 and 2006 were not used, because they do not provide information on grade retention.

primary school is on average 7.7%. 6.6% of students repeat once whereas 1.1% repeat twice or more.

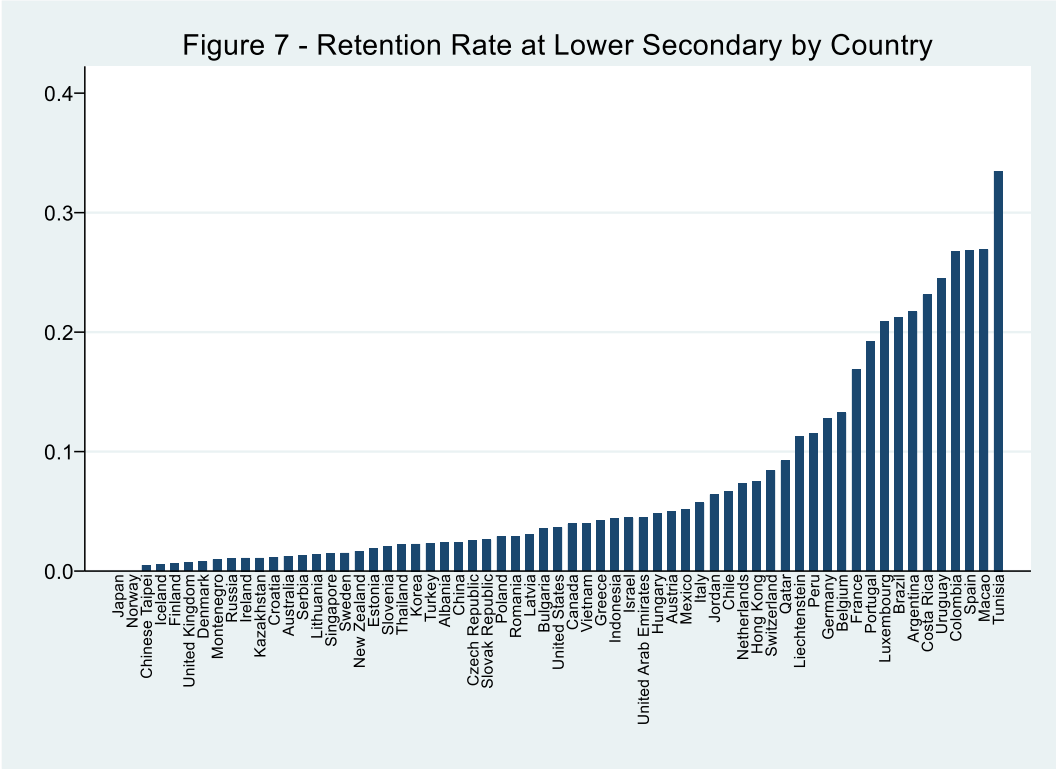
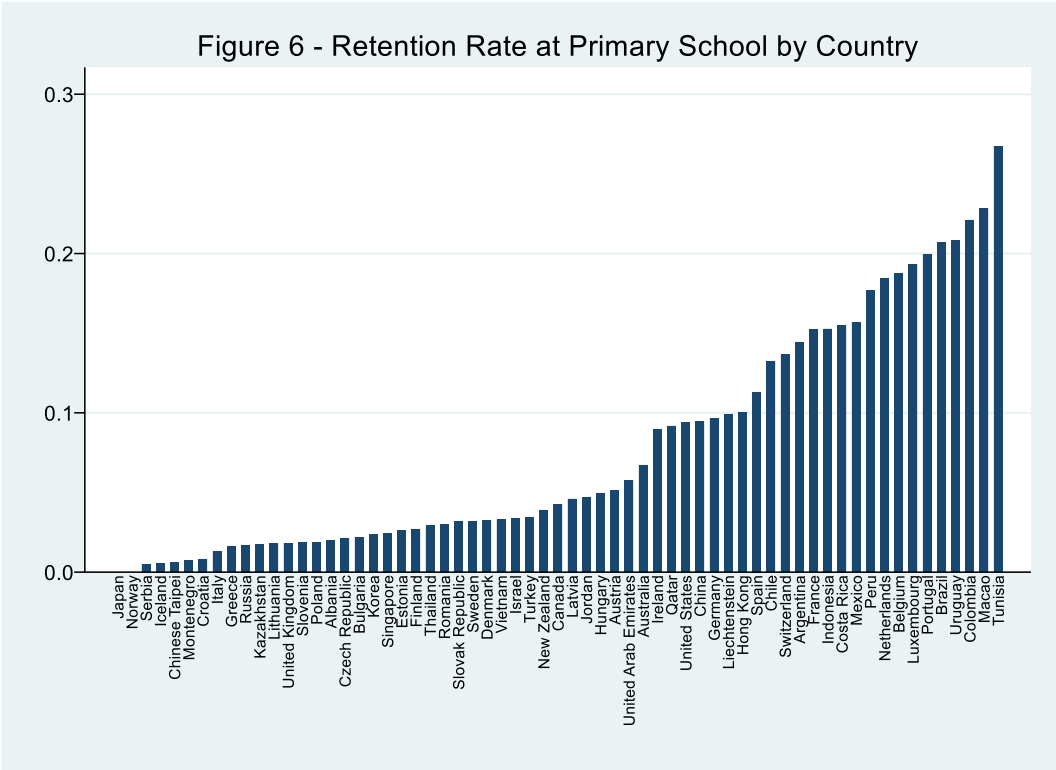


Figure 7 shows the retention rate at lower secondary school by country, which has a large variability across countries. Once again Norway and Japan have the lowest retention rate (0%) and Macao and Tunisia have the largest retention rate, namely 26.9% and 33.5%. The retention rate at lower secondary is on average 7.2%. 6.2% of students repeat once and 1.1% repeat twice or more.

Overall, retention rates vary significantly across countries with a mean of 13.3% by the time of PISA, 7.7% at primary school and 7.2% at lower secondary. Most retained students repeat only one grade. Norway and Japan do not retain students until PISA, while some countries have retention rates below 1% (South Korea and Iceland) and others have retention rates above 30% (Spain and Portugal).

Table 8 in the appendix presents the mean and standard deviation of test scores in PISA for reading, mathematics and science and the retention rates by the time of PISA, at primary school and at lower secondary for all samples used. The mean score for all students is 475 in reading, 469 in mathematics and 479 in science and standard deviations are respectively 96, 98 and 96. Science has the largest mean achievement and mathematics the lowest in most samples, but the differences are always below 24 points. Girls have bigger reading achievement while boys have larger performance in mathematics and science. Mean achievement in all subjects increases as parental education level raises and retention rate decreases. Countries with early tracking have smaller mean educational achievement in all subjects.

Retention rates by the time of PISA are bigger for boys (15.4%) than for girls (11.3%) and fall as parents' highest education raises, being 22.8% if parents have primary school and 10.4% if parents have tertiary education. Retention rate is smaller for high performing students, being 30.4% for students in the first quartile and 3.2% for students in the fourth quartile. Late tracking countries (12.9%) have slightly smaller retention rates than early tracking countries (14.2%).

4. Econometric Model and Methodology

4.1. Empirical Approach for Early Tracking

No country tracks students in early primary grades, so one can estimate the effects of early tracking on educational achievement through the mean achievement growth amid primary and secondary schools (after early tracking) in an early tracking country. This estimation is reliable if students' background and school environment are not significantly different at primary and secondary schools. However, there may be significant differences in students' background and school environment across grades that most likely affect educational achievement. Hence, the usual pattern of mean achievement growth among primary and secondary schools may bias the

estimates of early tracking's effects. Thereby, expected difference in mean achievement growth across grades among early and late tracking countries are computed to estimate early tracking's effects (late tracking countries provide the mean educational achievement gain if there was no early tracking)⁹. This estimation is unbiased if expected errors and existence of early tracking are uncorrelated, that holds if students' background and school environment are similar within cohorts and uncorrelated with early tracking's existence, and if early and late tracking countries do not employ different policies before early tracking that do not impact academic achievement in early primary school¹⁰.

Thus, we estimate difference-in-differences across countries, where early tracking's effects are identified by comparing educational achievement differences among primary school (before early tracking) and secondary school (after early tracking) across countries with early and late tracking. Thereby, differences across countries at primary school educational outcomes correct for differences at secondary schools, so each country's primary school outcome control for its secondary school outcome.

We estimate two econometric models. Hanushek and Wößmann (2006) developed the first model:

$$Y_{g'}^j = \beta_1 + \beta_2 Y_g^j + \beta_3 T^j + \varepsilon^j$$

with $Y_{g'}^j$ (Y_g^j) educational outcome at secondary (primary) education in country j , T^j dummy variable (1 if there is early tracking) or age of tracking in country j and ε^j error term. The second model controls for gender, students' background, and mean age difference among assessments:

$$Y_{g'}^j = \beta_1 + \beta_2 Y_g^j + \beta_3 T^j + \beta_4 C^j + \beta_5 G^j + \beta_6 A^j + \varepsilon^j$$

with $Y_{g'}^j$ (Y_g^j) educational outcome at secondary (primary) education in country j ; T^j dummy variable (1 if there is early tracking) or tracking age in country j ; C^j parents' highest education level in three categories (up to lower secondary, upper secondary, tertiary education) or number of books at home in three categories (0-10 books, 11-100 books, 101 or more books) in country

⁹ $\beta_3 = \overline{\Delta Y_T} - \overline{\Delta Y_U} + (\bar{\varepsilon}_T - \bar{\varepsilon}_U)$: β_3 early tracking's effect; $\overline{\Delta Y_T} - \overline{\Delta Y_U}$ expected difference in mean educational achievement growth across grades among countries with early tracking and late tracking; and $(\bar{\varepsilon}_T - \bar{\varepsilon}_U)$ expected difference in error terms.

¹⁰If anticipatory effects of tracking affect educational achievement growth before the primary school assessment in early tracking countries or other selective education policies, such as grade repetition policies, are correlated with early tracking existence, then differences-in-differences estimates may be biased.

j^{11} ; G^j percentage of girls in country j ; A^j mean difference in age of students amid primary and secondary education in country j^{12} ; and ε^j error term.

β_3 is our coefficient of interest, because it measures early tracking's effects on educational outcomes at secondary education in both models. We consider that a country has early tracking if 14- year-old students are already tracked, whereas Hanushek and Wößmann (2006) used age 14 if TIMSS eighth grade is the assessment at secondary school and age 15 for PISA.

We study the heterogeneous effect of early tracking on educational achievement. This is, to our knowledge, a new contribution to the literature. We estimate early tracking's effects on educational achievement of low and high achievers, the difference between them and on the average in order to estimate early tracking's effects on the mean and inequality of educational achievement¹³. Hence, we use the following educational outcomes: mean, standard deviation, mean of students below 10th and 25th percentiles, mean of students above 75th and 90th percentiles and the difference among students below 10th (25th) and above 90th (75th) percentiles. We estimate both models for all students, by gender and category of parents' highest education or number of books at home for all educational outcomes¹⁴. Both a dummy variable for early tracking and the first tracking age are used to check the robustness of our estimates. The second model attempts to answer the criticism of the mean age difference of students and estimates whether gender and students' background change early tracking's effects.

If students' background and school environments that impact academic outcomes at primary and secondary schools are similar, both models provide unbiased estimates of early tracking's effects on educational achievement. Although students' background may differ among cohorts and school environments may change suddenly, we believe that changes in school environment

¹¹ We use parents' highest education to measure students' background if TIMSS or PISA have information. In the other cases, we use the number of books at home. We use ISCED levels for parents' highest education: level 0 to 2 – up to lower secondary; level 3 – upper secondary; level 4 to 8 – tertiary education.

¹² Jakubowski (2010) noted that students' age distribution in tests is different amid early and late tracking countries. Differences in mean educational achievement and students' age difference amid tests are also strongly correlated. Besides, educational outcomes at secondary school are affected by different time periods among tests. Jakubowski (2010) found that mean age difference is significant. Hence, we include the mean age difference to avoid biased estimates of early tracking's effects.

¹³ Achievement inequality is harder to measure than mean achievement, as test scores are measured more precisely around the mean. Score dispersion also depends on methodology. Sample designs of PISA, PIRLS, and TIMSS and countries' samples are different, so score dispersion is different across pairs and countries. Hence, our results are less significant for educational achievement inequality than for mean educational achievement.

¹⁴ The model becomes $Y_{gr}^j = \beta_1 + \beta_2 Y_g^j + \beta_3 T^j + \beta_4 C^j + \beta_5 A^j + \varepsilon^j$ for boys/girls and $Y_{gr}^j = \beta_1 + \beta_2 Y_g^j + \beta_3 T^j + \beta_4 G^j + \beta_5 A^j + \varepsilon^j$ for parents' highest education or number of books at home.

explain less educational outcomes than changes in students' background¹⁵. Thus, we combine tests that assessed students from the same cohort to ensure similar students' background.

Nonetheless, early and late tracking countries may differ in other selection policies, namely grade retention. If grade retention is correlated with early tracking, it may bias estimates of the effects of early tracking, as students retained between assessments are only included in the first assessment if TIMSS eighth grade is used.

Our analysis has some advantages compared to Hanushek and Wößmann (2006), since we combine assessments of students of the same cohort and study how early tracking impacts the heterogeneity of educational achievement by gender and students' background. Besides, when we use their definition of first tracking age and the same pairs of assessments, we obtain very similar results to Hanushek and Wößmann (2006).

Nonetheless, our analysis has some limitations. Most pairs of assessment tests do not include Germany, which is the largest OECD country with early tracking. Besides, pairs have different countries and students sampled at primary and secondary schools. Finally, early tracking may be correlated with other policies that impact educational achievement, such as grade retention.

4.2. Empirical Approach for Grade Retention

Grade retention policies are different across countries. Besides, omitted variables correlated to grade retention and educational achievement may bias results and there may also be reverse causality if countries with low educational achievement rise grade retention in order to improve educational achievement. Hence, we estimate a panel model with year and country fixed effects to address possible student and country bias:

$$Y^{ijt} = \beta_1 + I^{ijt}\beta_i + S^{ijt}\beta_s + C^{jt}\beta_c + R^{ijt}\beta_r + \mu^j + \mu^t + \varepsilon^{ijt}$$

with Y^{ijt} educational achievement of student i in country j and year t ; I^{ijt} , S^{ijt} and C^{jt} student, school, and country characteristics; R^{ijt} grade retention variables for student i in country j and year t ; μ^j and μ^t country and year fixed effects; ε^{ijt} error term at student level. We estimate this model using as R^{ijt} whether (0 and 1) a student was retained, retained at lower secondary and/or primary school, and retained once or more at primary school and/or lower secondary¹⁶. β_r is our coefficient of interest, as it measures grade retention's effects on educational achievement.

¹⁵School environment may impact educational outcomes through education policies and countries' socioeconomic backgrounds but tracking policies have been stable (four countries have changed the first tracking age from 2003 to 2018 in our sample). Hence, asymmetric changes in students' background across countries may bias estimates, whereas volatile education policies are unlikely to bias estimates.

¹⁶Some countries have no students at upper secondary, so we cannot use grade retention at upper secondary.

This model is estimated for all students, by category of parents' highest education (primary school, lower secondary, upper secondary, tertiary education), gender, quartile of cumulative grade retention rate (e.g., students in countries with grade retention rate in the fourth quartile) and for early and late tracking countries.

Country fixed effects account for possible bias caused by unobserved time-invariant country features that may be correlated with grade retention and educational achievement, whereas year fixed effects account for possible general trends in schooling performance and possible shocks that affect a specific PISA wave.

We control for all student, school and country level features that enable us to use all country-by-wave observations. Student level factors are the number of books at home in six categories (0-10 books, 11-25 books, 26-100 books, 101-200, 201-500 books and 501 books or more), an index of home educational resources provided by PISA, gender, language spoken at home, first and second generation immigration status, parents' highest occupation status in four categories (unskilled blue, skilled blue, unskilled white and skilled white) and parents' highest education level in six categories (none, primary school, lower secondary, upper secondary, postsecondary and university degree)¹⁷. School level factors are mean peers' number of books at home in six categories, mean peers' index of home educational resources, percentage of female peers, mean first and second generation immigration status of peers, mean parents' highest education level of peers in six categories, mean parents' highest occupation status of peers in four categories, admission criteriums, community location with five categories (village, small town, town, city and large city), index of teachers' shortage provided by PISA and how learning is hindered by bullying, misbehaviour, use of alcohol and drugs, absenteeism of students and teachers in four categories (not at all, very little, to some extent, a lot). The country factor is GDP per capita in purchasing power parity measured in 2017 USA dollars.

However, retained students are in lower grades, which may decrease their performance in assessments. This selection issue may bias our results.

Table 4 in the appendix presents summary statistics of all variables.

5. Main Results

In this section, we discuss the results for the effects of early tracking and grade retention on educational achievement and also the results for the interaction among early tracking and grade retention.

¹⁷We used ISCED levels for the categories of parents' highest education: level 0 – none; level 1 – primary school; level 2 – lower secondary; level 3 – upper secondary; level 4 – postsecondary; levels 5 to 8 – university.

5.1. Early Tracking and Educational Achievement

We obtained quite similar results using the first tracking age or the dummy variable for early tracking, so we present the results with the dummy variable for early tracking's effects. Pooled and European samples are likely to provide the most reliable results, so our discussion focuses on these samples.

There is only one pair of assessments for reading, so our results of early tracking's effects on reading achievement are not robust. Hence, we discuss early tracking's effects on the mean and inequality of educational achievement in mathematics and science. Finally, we briefly present our results on early tracking's effects on reading achievement.

5.1.1. Early Tracking and Mean Achievement

Tables 9 to 13 in the appendix present the results of early tracking's effects on mathematics achievement for all students, boys, girls, categories of parents' highest education and of number of books at home from the first model. Moreover, tables 19 to 23 present the same results from the second model. Furthermore, tables 14 to 18 present the results of early tracking's effects on science achievement from the first model and tables 24 to 28 present the same results from the second model.

Early tracking has positive and significant coefficients for all students in mathematics in the European sample for the mean and students above 75th and 90th percentiles. Estimates are also positive and significant in science in the European and pooled samples for students below 10th and 25th percentiles and above the 90th percentile, and for the mean and students above the 75th percentile in the pooled sample.

Early tracking has positive and significant coefficients for boys in mathematics for the mean and students above 75th and 90th percentiles in the European sample and for students below the 10th percentile in the pooled sample. Besides, estimates are positive and significant in science for students below 10th and 25th percentiles and above the 90th percentile in the European and pooled samples and for the mean and students above the 75th percentile in the pooled sample.

As for girls, early tracking has positive and significant coefficients for the mean and students above 75th and 90th percentiles in the European sample in mathematics and in the pooled sample in science.

Early tracking has no significant estimates for all categories of parents' highest education.

As for the number of books at home, early tracking has positive and significant coefficients for students with 11 or more books at home in the European sample in mathematics and science and for students with more than 100 books at home in the pooled sample in science.

The significant coefficients for mean mathematics and science achievement range from 7 to 10 points for all students and by gender and from 9 to 16 points for students with more than 10 books at home. Moreover, significant estimates for high achievers in mathematics range from 15 to 20 points and for low and high achievers in science vary from 8 to 13 points. Besides, the coefficients are significantly larger at the 10% significance level for high achievers than for the mean in mathematics in the European sample for all students and by gender. The estimates for high achievers are also significantly bigger at the 10% significance level in mathematics than in science for all students and by gender.

Overall, early tracking raises slightly mathematics achievement for all students, with similar size by gender, for high achievers and students with 11 or more books at home in the European sample and boys with low performance in the pooled sample. Science achievement also raises for all students, with similar size by gender, in the pooled sample and low performing boys and students with more than 100 books at home in both samples. Therefore, early tracking increases mathematics achievement in the European sample on average and of high achievers and raises science achievement in the pooled sample on average, of low and high achievers. Finally, early tracking has slightly stronger effects on mathematics and high achievers.

5.1.2. Early Tracking and Achievement Inequality

The results for early tracking's effects on achievement inequality are presented in the rows relative to standard deviation and difference between percentiles of the tables that present the results of the previous subsection.

Early tracking has positive and significant estimates in mathematics in the European sample for the standard deviation and the difference among students below the 25th and above the 75th percentiles.

All coefficients of early tracking for educational achievement of boys are insignificant.

As for girls, early tracking has positive and significant coefficients for the standard deviation and differences between percentiles in mathematics in the European sample.

Regarding parents' highest education, early tracking has negative and significant estimates for standard deviation of all categories of parental education in science in the European sample.

Early tracking has no significant estimates for all categories of the number of books at home.

The significant coefficients of the standard deviation and differences amid percentiles range from 4 to 13 points for all students and girls and from -6 to -5 points for the standard deviation by category of parents' highest education. Significant estimates are not statistically different.

Overall, mathematics achievement inequality in the European sample increases for girls and all students and science achievement inequality decreases for all categories of parents' highest education due to early tracking. Hence, early tracking does not impact inequality of educational achievement for boys.

Besides, early tracking's effects on the mean and inequality of educational achievement are always below 0.4 standard deviations of schooling performance.

Finally, some limitations should be considered in the interpretation of our results. First, pairs have different countries. Second, most pairs of assessments do not include Germany, which is the largest early tracking country in OECD. Third, students sampled at primary and secondary assessments may be different due to other education policies (e.g., grade retention).

5.1.3. Early Tracking and Reading Achievement

Tables 29 and 30 present the results for reading achievement. Early tracking reduces reading achievement of students and boys below the 10th percentile (-28 and -30 points) and of students whose parents have up to lower secondary (-39 points) and increases the standard deviation of students whose parents have tertiary education (8 points). The impact of early tracking on the mean and inequality of reading achievement is always smaller than 0.8 standard deviations of schooling performance.

5.2. Grade Retention and Educational Achievement

We discuss how grade retention by the time of PISA (15-year-old students), grade retention at primary and/or lower secondary schools and the number of grade retentions at primary and/or lower secondary schools affect individual educational achievement.

5.2.1. Cumulative Grade Retention

Tables 31 and 32 present our results of cumulative grade retention's effects in the complete sample. Tables 33 and 34 present the same results for the European sample.

Grade retention has negative and significant coefficients in both samples. All students, boys, and girls have similar reductions. Mathematics and science achievement decrease more in the European sample than in the complete sample.

Regarding parents' highest education, grade retention has negative and significant estimates for all categories in both samples. The percentage reduction of educational achievement is quite similar for all categories of parents' highest education in the complete sample and is larger in the European sample for students whose parents have primary school, followed by parents with lower secondary, upper secondary and tertiary education. Lastly, educational achievement has bigger percentage reductions in the European sample.

As for retention rates, grade retention has negative and significant coefficients for students in all quartiles in both samples. The percentage reduction of educational achievement is bigger for students of countries in the fourth quartile, followed by the second, first and third quartiles in both samples. Finally, the percentage decrease is larger in the European sample.

The coefficient of grade retention ranges from -61 to -37 points in the complete sample and from -76 to -38 points in the European sample. Thus, cumulative grade retention's effects vary from 0.4 to 0.8 standard deviations of schooling performance. Lastly, percentage reductions of educational achievement vary from 9.9% to 11.2% in the complete sample and from 11.5% to 13.6% in the European sample.

Overall, grade retention diminishes educational achievement for all students, boys, girls, all categories of parental education and quartiles of retention rates in all subjects. Reductions are similar for boys and girls. The percentage reduction is similar regardless of parental education in the complete sample, decreases as parental education increases in the European sample and is larger in countries with high retention rates. Lastly, grade retention has a stronger impact in the European sample.

5.2.2. Grade Retention at Primary School and Lower Secondary

Tables 35 and 36 presents results of grade retention at primary and lower secondary schools in the complete sample. Tables 37 and 38 present the same results for the European sample.

Grade retention at both schools has negative and significant estimates in both samples. All students, boys, and girls have similar reductions. Grade retention at lower secondary decreases less educational achievement than grade retention at primary school. Lastly, European sample has a larger reduction in educational achievement than the complete sample.

Regarding parental education, grade retention at both schools in both samples has significant and negative coefficients for all categories. Besides, grade retention at lower secondary reduces less educational achievement than grade retention at primary school. The percentage reduction of educational achievement is similar regardless of parental education in the complete sample

and is bigger for students whose parents have primary school in the European sample. Finally, educational achievement decreases more in the European sample.

As for retention rates, grade retention at both schools has negative and significant estimates in both samples. Grade retention at primary school decreases more educational achievement in the third and fourth quartiles, similarly in the second and less in the first quartile in both samples than grade retention at lower secondary. The percentage reduction of educational achievement is larger in the fourth quartile, followed by the third, second and first quartiles in both samples for grade retention at primary school. Besides, grade retention at lower secondary causes bigger percentage reduction of educational achievement in the first and second quartiles, followed by the fourth and third quartiles. Finally, educational achievement decreases more in the European sample.

Coefficients of grade retention at both schools range from -59 to -21 points in the complete sample and from -74 to -25 points in the European sample. Hence, grade retention's effects at both schools vary from 0.2 to 0.8 standard deviations of schooling performance. Furthermore, percentage decreases vary from 6.4% to 10.3% in the complete sample and from 9.2% to 12.8% in the European sample.

Overall, grade retention at both schools diminishes educational achievement in all subjects for all students, boys, girls, all categories of parental education and quartiles of retention rates. Boys and girls have similar reductions. Besides, the percentage reduction is similar regardless of parental education in the complete sample, larger for students whose parents have primary school in the European sample, bigger in countries with high retention rates for grade retention at primary school and higher in countries with low retention rates for grade retention at lower secondary. Lastly, grade retention at both schools has a stronger impact in the European sample and grade retention at primary school also decreases more educational achievement than grade retention at lower secondary.

5.2.3. Number of Retention at Primary School and Lower Secondary

Tables 39 and 40 present results for the number of retentions at primary and lower secondary schools. Tables 41 and 42 present the same results for the European sample.

Grade retention has negative and significant coefficients for all students, boys, and girls in both samples. Boys and girls have similar decreases. Besides, grade retention at primary school decreases more educational achievement than grade retention at lower secondary. Educational achievement of students retained twice or more at primary or lower secondary schools reduces

always less than twice as much as of students retained once in both samples. Lastly, educational achievement decreases more in the European sample.

Regarding parental education, grade retention has negative and significant estimates in both samples for all categories. Besides, grade retention at lower secondary reduces less educational achievement than grade retention at primary school. Educational achievement decreases more in the European sample. The percentage reduction of educational achievement is similar for all categories of parental education in the complete sample but decreases with parental education in the European sample. Lastly, educational achievement of students retained twice or more at primary or lower secondary schools diminishes less than twice as much as of students retained once.

As for retention rates, grade retention has negative and significant estimates in both samples. Grade retention at primary school decreases more educational achievement than grade retention at lower secondary. Moreover, grade retention at lower secondary decreases more educational achievement in the European sample. The percentage reduction of educational achievement is larger in the fourth quartile and smaller in the first quartile for grade retention at primary school in both samples. Likewise, grade retention at lower secondary causes larger relative reductions in the third quartile in both samples. Lastly, educational achievement of students retained twice or more at primary or lower secondary schools decreases less than twice as much as of students retained once, except students in the third quartile in the complete sample.

Coefficients of grade retention range from -20 to -73 points in the complete sample and from -26 to -94 points in the European sample. Hence, grade retention's effects vary from 0.2 to one standard deviation of schooling performance. Finally, percentage reductions range from 5.8% to 12.8% in the complete sample and from 8.5% to 16.5% in the European sample.

Overall, grade retention decreases educational achievement of all students, boys, girls, all categories of parents' highest education and quartiles of retention rates. Besides, boys and girls have similar reductions in educational achievement. The percentage reduction of educational achievement is similar for all categories of parental education in the complete sample, reduces with parental educational in the European sample and is larger in countries with high retention rates in both samples. Furthermore, grade retention at both schools has a stronger impact in the European sample, grade retention at primary school has a stronger effect than grade retention at lower secondary and educational achievement of students retained twice or more decreases less than twice as much as of students retained once at primary school and/or lower secondary.

5.3. Early Tracking, Grade Retention and Educational Achievement

The last two columns of tables 32, 34, 36, 38, 40 and 42 show the results of grade retention's effects on educational achievement in early and late tracking countries.

Grade retention has negative and significant coefficients in early and late tracking countries and decreases more educational achievement in late tracking countries in the European sample than in the complete sample. The percentage reduction of educational achievement is larger in late tracking countries.

Coefficients of grade retention at both schools are negative and significant for early and late tracking countries. Grade retention at primary school decreases more educational achievement than grade retention at lower secondary. Likewise, schooling performance reduces more in the European sample than in the complete sample. Besides, the percentage reduction of educational achievement is larger in late tracking countries in the complete sample due to grade retention at both schools and in late tracking countries in the European sample due to grade retention at lower secondary. On the contrary, grade retention at primary school causes similar percentage reductions in early and late tracking countries in the European sample.

As for the number of grade retentions, coefficients are negative and significant for early and late tracking countries. Grade retention at primary school lowers more educational achievement than grade retention at lower secondary. Besides, schooling performance decreases more in the European sample than in the complete sample. Late tracking countries have bigger percentage reductions of educational achievement, except in mathematics and science for students retained more than once at lower secondary in early tracking countries of the complete sample. Finally, educational achievement of students retained more than once at primary or lower secondary schools decreases less than twice as much as of students retained once.

Coefficients of grade retention range from -76 to -18 points in early tracking countries and from -71 to -35 points in late tracking countries. Hence, grade retention's effects vary from 0.2 to 0.8 standard deviations of schooling performance.

Overall, grade retention decreases more educational achievement in late tracking countries than in early tracking countries and in the European sample than in the complete sample. Grade retention at primary school also reduces more educational achievement than grade retention at lower secondary. Lastly, educational achievement of students retained twice or more decreases less than twice as much as of students retained once at primary or lower secondary schools.

6. Main Conclusions

We applied difference-in-differences and a panel model with country and year fixed effects on data from international students' assessments tests to study, respectively, how early tracking and grade retention impact the mean and inequality of educational achievement.

Early tracking increases slightly mathematics and science achievement for all students, with similar size by gender, high achievers, low performing boys, and non-disadvantaged students. Moreover, early tracking impacts more mathematics achievement in the European sample and more science achievement in the pooled sample. Lastly, early tracking's effects on educational achievement are more consistent for science, boys, and high achievers.

Likewise, early tracking raises mathematics achievement inequality in the European sample for all students and girls and lowers science achievement inequality for all categories of parental education. Thus, early tracking does not impact inequality of educational achievement for boys.

Thus, early tracking increases slightly mathematics and science achievement and inequality of mathematics achievement. These results are different from Hanushek and Wößmann (2006) that suggests early tracking raises educational achievement inequality and does not affect mean schooling performance. However, we obtained very similar results when we used their pairs of assessment tests and definition of first tracking age. They combined contemporary assessments to ensure similar education policies, while we combined assessments of students from the same cohort to ensure similar students' background. Hence, the different combination of assessments explains the difference in results. Therefore, results on the effects of early tracking, when using difference-in-differences at the country level, seem very sample sensitive.

Grade retention decreases educational achievement for all students with stronger impact on countries with high retention rates and students whose parental education is the primary school in European countries. The reduction is similar for boys and girls and all categories of parents' highest education in all countries. Lastly, European countries have the largest reduction.

Educational achievement decreases more in countries with high retention rates due to grade retention at primary school and more in countries with low retention rates due to grade retention at lower secondary. Furthermore, grade retention at primary school decreases more educational achievement than grade retention at lower secondary. Moreover, educational achievement of students retained twice or more at primary school and/or lower secondary diminishes less than twice as much as of students retained once. Therefore, grade retention's effects on educational achievement are not linear

We also estimated grade retention's effects on early and late tracking countries to study how grade retention and early tracking interact. Grade retention reduces less schooling performance

in early tracking countries than in late tracking countries. Therefore, grade retention and early tracking decrease less educational achievement if combined than separately.

However, there is a selection problem that may bias our results on grade retention. Retained students are in lower grades, which may decrease their performance in assessment tests. Thus, results for grade retention should be interpreted with caution.

Lastly, grade retention has larger and stronger effects on educational achievement than early tracking, but their effects are always smaller than one and half standard deviations respectively. Moreover, early tracking and grade retention have stronger and larger effects on the schooling performance of European countries.

Our results for early tracking's effects are different from the literature. Thus, further research on the effects of early tracking and grade retention is needed. This research should also study how early tracking and grade retention interact with school environments and other selective policies in education systems, using students level data from international students' assessment tests.

References

- Alet, Elodie. "Is grade repetition a second chance." manuscript, Toulouse School of (2010).
- Ammermüller, Andreas. "Educational opportunities and the role of institutions." ZEW-Centre for European Economic Research Discussion Paper 05-044 (2005).
- Baenen, Nancy R. "Perspectives after Five Years--Has Grade Retention Passed or Failed?." (1988).
- Baert, Stijn, Bart Cockx, and Matteo Picchio. "On track mobility, grade retention and secondary school completion." Unpublished manuscript, Ghent University, Belgium.[784] (2013).
- Bauer, Philipp, and Regina T. Riphahn. "Timing of school tracking as a determinant of intergenerational transmission of education." *Economics Letters* 91.1 (2006): 90-97.
- Bergbauer, Annika B., Eric A. Hanushek, and Ludger Woessmann. Testing. No. w24836. National Bureau of Economic Research, 2018.
- Brunello, Giorgio, and Daniele Checchi. "Does school tracking affect equality of opportunity? New international evidence." *Economic policy* 22, no. 52 (2007): 782-861.
- Brunello, Giorgio. "Stratified or comprehensive? Some economic considerations on the design of secondary education." CESifo DICE Report 2.4 (2004): 7-10.
- Diris, Ron. "Estimating the impact of grade retention: A heterogenous analysis." Available at SSRN 2026197 (2012).
- Dustmann, Christian. "Parental background, secondary school track choice, and wages." *Oxford Economic Papers* 56.2 (2004): 209-230.
- Hanushek, Eric A. "Dual education: Europe's secret recipe?." CESifo forum. Vol. 13. No. 3. München: ifo Institut-Leibniz-Institut für Wirtschaftsforschung an der Universität München, 2012.
- Hanushek, Eric A., and Ludger Wößmann. "Does educational tracking affect performance and inequality? Differences-in-differences evidence across countries." *The Economic Journal* 116, no. 510 (2006): C63-C76.
- Hanushek, Eric A., et al. "General education, vocational education, and labor-market outcomes over the lifecycle." *Journal of human resources* 52.1 (2017): 48-87.
- Jacob, Brian A., and Lars Lefgren. "Remedial education and student achievement: A regression-discontinuity analysis." *Review of economics and statistics* 86.1 (2004): 226-244.
- Jacob, Brian A., and Lars Lefgren. "The effect of grade retention on high school completion." *American Economic Journal: Applied Economics* 1.3 (2009): 33-58.

Jakubowski, Maciej. "Institutional tracking and achievement growth: Exploring difference-in-differences approach to PIRLS, TIMSS, and PISA data." *Quality and inequality of education*. Springer, Dordrecht, 2010. 41-81.

Lavrijsen, Jeroen, and Ides Nicaise. "Educational tracking, inequality and performance: New evidence from a difference-in-differences technique." *Research in Comparative and International Education* 11, no. 3 (2016): 334-349.

Mahjoub, Mohamed-Badrane. "The treatment effect of grade repetitions." *Education Economics* 25.4 (2017): 418-432.

Meghir, Costas, and Mårten Palme. "Educational reform, ability, and family background." *American Economic Review* 95.1 (2005): 414-424.

Meier, Volker, and Gabriela Schütz. *The economics of tracking and non-tracking*. No. 50. Ifo working paper, 2007.

Ozer, Mahmut, and Matjaž Perc. "Dreams and realities of school tracking and vocational education." *Palgrave Communications* 6, no. 1 (2020): 1-7.

Peña-López, Ismael. "PISA 2018 Results. Effective Policies, Successful Schools." (2020).

Pereira, Manuel Coutinho, and Hugo Reis. "Grade retention during basic education in Portugal: determinants and impact on student achievement." *Economic Bulletin and Financial Stability Report Articles, Lisbon* 1.1 (2014): 61-83.

Peterson, Sarah E., James S. DeGracie, and Carol R. Ayabe. "A longitudinal study of the effects of retention/promotion on academic achievement." *American Educational Research Journal* 24.1 (1987): 107-118.

Reichelt, Malte, Matthias Collischon, and Andreas Eberl. "School tracking and its role in social reproduction: Reinforcing educational inheritance and the direct effects of social origin." *The British Journal of Sociology* 70.4 (2019): 1323-1348.

Reis, Hugo. "Determinantes da desigualdade no desempenho escolar em países da OCDE", *A escola e o desempenho dos alunos*. Organização de Luís Catela Nunes, 1ª ed., Lisboa, Fundação Francisco Manuel dos Santos, outubro 2015, pp. 13-70.

Schütz, Gabriela, Heinrich W. Ursprung, and Ludger Wößmann. "Education policy and equality of opportunity." *Kyklos* 61, no. 2 (2008): 279-308.

Schwerdt, Guido, Martin R. West, and Marcus A. Winters. "The effects of test-based retention on student outcomes over time: Regression discontinuity evidence from Florida." *Journal of Public Economics* 152 (2017): 154-169.

Tomchin, Ellen M., and James C. Impara. "Unraveling teachers' beliefs about grade retention." *American Educational Research Journal* 29.1 (1992): 199-223.

Waldinger, Fabian. "Does tracking affect the importance of family background on students' test scores?" Unpublished manuscript, LSE (2006).

Woessmann, Ludger. "Institutional determinants of school efficiency and equity: German states as a microcosm for OECD countries." *Jahrbücher für Nationalökonomie und Statistik* 230, no. 2 (2010): 234-270.

Appendix

Countries	Tracking		Pairs							
	Age	Dummy	1 and 2	3 and 4	5	6 and 7	8 and 9	10 and 11	12 and 13	14 and 15
Argentina	14	1			X					
Australia	16	0	X	X		X	X	X	X	X
Austria	10	1		X				X		
Bahrain	16	0								X
Armenia	15	0				X	X			
Botswana	16	0							X	
Bulgaria	13	1			X					
Canada	16	0	X	X	X					
Chile	16	0								X
Chinese Taipei	15	0				X	X	X	X	X
Colombia	15	0			X			X		
Cyprus	15	0	X			X				X
Czech Republic	11	1	X	X	X			X		
Denmark	16	0						X		
Finland	16	0								X
France	15	0			X					X
Georgia	15	0					X		X	X
Germany	10	1			X			X		
Greece	15	0		X	X					
Hong Kong	15	0	X	X	X	X	X	X	X	X
Hungary	10	1	X	X	X	X	X	X	X	X
Iceland	16	0		X	X					
Iran	15	0	X			X	X		X	X
Ireland	15	0		X					X	X
Israel	15	0	X		X					
Italy	14	1			X	X	X	X	X	X
Japan	15	0				X	X	X		X
Kazakhstan	15	0					X	X		X
Korea	15	0	X	X						X
Kuwait	16	0								X
Latvia	16	0	X	X	X			X		
Lithuania	14	1			X	X	X	X	X	X
Malta	16	0							X	
Morocco	15	0				X	X		X	X
Oman	16	0							X	X
Netherlands	12	1	X	X	X			X		
New Zealand	16	0	X	X	X		X	X		X
Norway	16	0		X	X	X	X	X	X	X
Portugal	15	0		X						X
Qatar	15	0					X	X	X	X
Romania	14	1			X					
Russia	14.5	0			X	X	X	X	X	X
Saudi Arabia	15	0							X	X
Singapore	12	1	X			X	X	X	X	X
Slovak Republic	11	1			X			X		
Slovenia	14	1	X		X	X	X	X	X	
Sweden	16	0			X		X	X	X	X

Thailand	15	0	X	X						
United Arab Emirates	15	0							X	X
Tunisia	16	0				X	X	X		
Turkey	11	1			X					X
Ukraine	14	1					X			
United States	16	0	X	X		X	X	X		
England	16	0	X			X	X			
Scotland	16	0				X				
Dubai	15	0					X		X	X
Abu Dhabi	15	0							X	X
Ontario	14	1				X	X			X
Quebec	16	0				X	X		X	X

Table 2 – Countries, early tracking variables and pairs of assessments used in the study of early tracking

Country	Ret. Rat.	PISA 2003	PISA 2009	PISA 2012	PISA 2015	PISA 2018
Albania	0.0373		X	X		X
Argentina	0.2958		X	X	X	X
Australia	0.0759	X	X	X	X	X
Austria	0.1286	X	X	X	X	X
Belgium	0.3323	X	X	X	X	X
Brazil	0.3624	X	X	X	X	X
Bulgaria	0.0493		X	X	X	X
Canada	0.0769	X	X	X	X	X
Chile	0.2410		X	X	X	X
China	0.1140		X	X	X	X
Chinese Taipei	0.0094		X	X	X	X
Colombia	0.3947		X	X	X	X
Costa Rica	0.3099			X	X	X
Croatia	0.0213		X	X	X	X
Czech Republic	0.0421	X	X	X	X	X
Denmark	0.0385	X	X	X	X	X
Estonia	0.0399		X	X	X	X
Finland	0.0314	X	X	X	X	X
France	0.2869	X	X	X	X	X
Germany	0.2020	X	X	X	X	X
Greece	0.0526	X	X	X	X	X
Hong Kong	0.1625	X	X	X	X	X
Hungary	0.0990	X	X	X	X	X
Iceland	0.0081	X	X	X	X	X
Indonesia	0.1622	X	X	X	X	X
Ireland	0.0968	X	X	X	X	X
Israel	0.0686		X	X	X	X
Italy	0.1528	X	X	X	X	X
Japan	0.0000	X	X	X	X	X
Jordan	0.0821		X	X	X	X
Kazakhstan	0.0215		X	X		X
Latvia	0.0704	X	X	X	X	X
Liechtenstein	0.1968	X	X	X		
Lithuania	0.0272		X	X	X	X
Luxembourg	0.3455	X	X	X	X	X
Macao	0.3970	X	X	X	X	X

Mexico	0.1951	X	X	X	X	X
Montenegro	0.0157		X	X	X	X
Netherlands	0.2426	X	X	X	X	X
New Zealand	0.0511	X	X	X	X	X
Norway	0.0000	X	X	X	X	X
Peru	0.2548		X	X	X	X
Poland	0.0430	X	X	X	X	X
Portugal	0.3148	X	X	X	X	X
Qatar	0.1566		X	X	X	X
Korea	0.0010	X	X	X	X	X
Romania	0.0475		X	X	X	X
Russia	0.0244	X	X	X	X	X
Serbia	0.0168		X	X		X
Singapore	0.0532		X	X	X	X
Slovak Republic	0.0518	X	X	X	X	X
Slovenia	0.0258		X	X	X	X
Spain	0.3144	X	X	X	X	X
Sweden	0.0392	X	X	X	X	X
Switzerland	0.2045	X	X	X	X	X
Thailand	0.0427	X	X	X	X	X
Tunisia	0.4452	X	X	X	X	
Turkey	0.1269	X	X	X	X	X
United Arab Emirates	0.0893		X	X	X	X
United Kingdom	0.0248	X	X	X	X	X
United States	0.1182	X	X	X	X	X
Uruguay	0.3564	X	X	X	X	X
Vietnam	0.0660			X	X	X

Table 3 – Countries included in each PISA survey and retention rates

Variable	Mean	Std. Dev.
Reading Score	475.1599	95.7596
Mathematics Score	469.0593	97.5097
Science Score	479.3508	96.4309
Percentage Girls	0.5141	0.4998
Language at Home	0.1388	0.3457
Educational Resources	-0.3465	1.1170
11-25 Books	0.2223	0.4158
26-100 Books	0.2892	0.4534
101-200 Books	0.1382	0.3452
201-500 Books	0.0986	0.2981
≥501 Books	0.0536	0.2252
Primary	0.0780	0.2682
Lower Secondary	0.1190	0.3238
Upper Secondary	0.3176	0.4656
Postsecondary	0.1339	0.3405
University	0.3319	0.4709
Skilled Blue	0.1533	0.3602
Unskilled White	0.2350	0.4240
Skilled White	0.4587	0.4983
First Generation Immigrant	0.0262	0.1598
Second Generation Immigrant	0.0422	0.2010

Percentage Girls Peers	0.5041	0.1210
11-25 Books Peers	0.2267	0.0950
26-100 Books Peers	0.2835	0.0908
101-200 Books Peers	0.1328	0.0722
201-500 Books Peers	0.0925	0.0698
≥501 Books Peers	0.0514	0.0479
Primary Peers	0.0856	0.0900
Lower Secondary Peers	0.1264	0.1104
Upper Secondary Peers	0.3140	0.1297
Postsecondary Peers	0.1307	0.0928
University Peers	0.3203	0.1793
Skilled Blue Peers	0.1567	0.1283
Unskilled White Peers	0.2334	0.0939
Skilled White Peers	0.4366	0.1812
First Generation Immigrant Peers	0.0282	0.0502
Second Generation Immigrant Peers	0.0446	0.0769
Educational Resources Peers	-0.3867	0.4991
Teacher shortage	0.0491	1.0688
Smalltown	0.1932	0.3948
Town	0.2792	0.4486
City	0.2560	0.4364
Large City	0.1543	0.3612
Admission Grades	0.6232	0.4846
Admission Feeder	0.5183	0.4997
Admission Religion	0.4464	0.4971
Admission Programme	0.6472	0.4778
Admission Family	0.4245	0.4943
Admission Residence	0.6284	0.4832
Students Absenteeism Little	0.4344	0.4957
Students Absenteeism Some	0.3047	0.4603
Students Absenteeism Lot	0.1171	0.3215
Students Skipping Classes Little	0.4761	0.4994
Students Skipping Classes Some	0.2439	0.4294
Students Skipping Classes Lot	0.0860	0.2804
Students Misbehaviour Little	0.5035	0.5000
Students Misbehaviour Some	0.1736	0.3787
Students Misbehaviour Lot	0.0558	0.2295
Students Alcohol Little	0.3556	0.4787
Students Alcohol Some	0.0870	0.2818
Students Alcohol Lot	0.0515	0.2210
Students Bullying Little	0.5157	0.4998
Students Bullying Some	0.1026	0.3034
Students Bullying Lot	0.0367	0.1880
Teacher Absenteeism Little	0.4594	0.4984
Teacher Absenteeism Some	0.1263	0.3322
Teacher Absenteeism Lot	0.0516	0.2212
GDP	29824.46	17724.95
Repeat	0.0916	0.0706
Repeat at Primary School	0.0625	0.0737
Repeat at Secondary School	0.1385	0.1113

Table 4 – Summary statistics of variables used in the study of grade retention

Subject	Tracking	Boys	Girls	Number of Books			Parental Education		
				[0, 10[[11, 100[≥ 101	Lower	Upper	University
Mathematics and Science	All	0.5052	0.4948	0.1379	0.5002	0.3619	0.2692	0.1695	0.5613
	Early	0.5038	0.4962	0.1392	0.4992	0.3616	0.2647	0.1580	0.5773
	Late	0.5057	0.4943	0.1373	0.5006	0.3620	0.2702	0.1722	0.5576
Reading	All	0.5036	0.4964				0.1432	0.4099	0.4469
	Early	0.5135	0.4865				0.1503	0.4650	0.3848
	Late	0.4937	0.5063				0.1361	0.3547	0.5091

Table 5 – Percentage of students by gender and category of students' background

Students	Tracking	Mean Sec	Std Dev S	Mean Pri	Std Dev P	Diff. Mean	Diff. S.D.
General	All	498.2996	55.4459	498.6754	66.3175	-0.3758	-10.8716
General	Late	490.3591	58.4933	488.8896	72.0437	1.4695	-13.5504
General	Early	520.6437	38.2442	526.2123	34.4507	-5.5686	3.7935
Boys	All	499.4666	56.4760	498.8670	68.6029	0.5996	-12.1269
Boys	Late	491.0456	59.9299	488.3475	74.7726	2.6981	-14.8427
Boys	Early	523.1628	36.5728	528.4685	32.7890	-5.3057	3.7838
Girls	All	497.2367	54.8621	498.4759	64.3742	-1.2392	-9.5121
Girls	Late	489.7900	57.4895	489.4479	69.6425	0.3421	-12.1530
Girls	Early	518.1913	40.3585	523.8801	36.4679	-5.6888	3.8906
Lower	All	464.9315	63.1674	453.1384	69.0464	11.7931	-5.8790
Lower	Late	459.4050	63.9937	445.3011	72.3232	14.1039	-8.3295
Lower	Early	488.5449	56.1147	486.6252	39.8875	1.9197	16.2272
Upper	All	475.3941	61.0146	479.8315	68.3733	-4.4374	-7.3587
Upper	Late	466.9168	61.3765	469.5791	70.8196	-2.6623	-9.4431
Upper	Early	511.6154	45.9387	523.6376	31.1629	-12.0222	14.7758
University	All	515.6566	62.7794	520.9829	63.9733	-5.3263	-1.1939
University	Late	506.6252	63.6442	511.4008	65.3080	-4.7756	-1.6638
University	Early	554.2456	42.5569	561.9246	37.8513	-7.6790	4.7056
0-10 books	All	447.3397	49.1543	457.9459	61.0370	-10.6062	-11.8826
0-10 books	Late	444.9857	50.1833	452.5875	69.2210	-7.6018	-19.0377
0-10 books	Early	452.7832	47.0061	470.3372	33.2914	-17.5540	13.7147
11-100 books	All	491.7121	50.3529	501.2494	58.9066	-9.5373	-8.5537
11-100 books	Late	485.6582	53.5302	492.3852	65.6366	-6.7270	-12.1064
11-100 books	Early	505.7118	39.3716	521.7479	31.4139	-16.0361	7.9577
>100 books	All	531.1387	50.4272	521.9613	64.7133	9.1774	-14.2861
>100 books	Late	522.8321	53.9601	511.0523	71.4865	11.7798	-17.5264
>100 books	Early	550.3477	34.7975	547.1884	34.7779	3.1593	0.0196

Table 6 – Mathematics achievement for all students, by gender and by category of students' background

Students	Tracking	Mean Sec	Std Dev S	Mean Pri	Std Dev P	Diff. Mean	Diff. S.D.
General	All	502.0815	45.4422	495.4957	65.6994	6.5858	-20.2572
General	Late	493.3056	47.1373	483.9681	71.6702	9.3375	-24.5329
General	Early	526.7764	28.6280	527.9338	24.8123	-1.1574	3.8157
Boys	All	501.6633	49.6065	495.2503	69.3964	6.4130	-19.7898
Boys	Late	491.7651	51.5546	482.4998	75.5298	9.2653	-23.9752
Boys	Early	529.5165	29.6618	531.1297	24.5861	-1.6132	5.0757
Girls	All	502.6290	42.3265	495.9518	62.2003	6.6772	-19.8738
Girls	Late	494.9829	43.8848	485.5959	67.9853	9.3870	-24.1005
Girls	Early	524.1447	28.4251	525.0929	25.1166	-0.9482	3.3086
Lower	All	466.5610	51.6683	442.5258	70.5681	24.0352	-18.8998
Lower	Late	460.1432	51.7600	432.2662	73.7134	27.8770	-21.9534
Lower	Early	493.9827	43.2687	486.3624	27.9603	7.6203	15.3084
Upper	All	479.1487	49.3617	472.5500	66.7982	6.5987	-17.4365
Upper	Late	469.8268	47.6819	460.6555	68.1894	9.1713	-20.5075
Upper	Early	518.9788	35.7297	523.3722	23.2002	-4.3934	12.5295
University	All	520.0985	50.0687	515.5824	60.0275	4.5161	-9.9588
University	Late	510.9896	48.9101	504.6738	60.3710	6.3158	-11.4610
University	Early	559.0180	35.0562	562.1922	28.7120	-3.1742	6.3441
0-10 books	All	448.2872	39.3566	454.2219	57.5325	-5.9347	-18.1759
0-10 books	Late	445.0220	40.8087	446.4531	65.6375	-1.4311	-24.8288
0-10 books	Early	455.8381	35.2203	472.1872	24.2631	-16.3491	10.9572
11-100 books	All	495.1901	40.2298	500.4970	54.6992	-5.3069	-14.4694
11-100 books	Late	488.0075	42.6047	490.8204	61.4023	-2.8129	-18.7976
11-100 books	Early	511.7999	28.2745	522.8741	22.7044	-11.0742	5.5702
>100 books	All	536.1361	43.9438	523.6669	62.2044	12.4692	-18.2606
>100 books	Late	526.4641	46.7239	511.8071	69.1205	14.6570	-22.3967
>100 books	Early	558.5026	25.6918	551.0927	27.2616	7.4099	-1.5699

Table 7 – Science achievement for all students, by gender and by category of students’ background

Samples	Reading		Mathematics		Science		Retention Rates		
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	General	Primary	Lower
General	475.18	95.77	469.07	97.52	479.36	96.44	0.1326	0.0769	0.0721
Boys	463.40	98.07	476.11	99.98	482.88	99.67	0.1544	0.0894	0.0875
Girls	486.31	92.17	462.42	94.66	476.04	93.16	0.1125	0.0659	0.0576
Primary	410.52	77.70	397.08	78.87	412.01	77.20	0.2284	0.1564	0.1185
Lower Secondary	438.78	85.36	431.77	90.01	442.98	87.53	0.2073	0.1295	0.1136
Upper Secondary	469.55	89.42	463.42	90.56	473.88	90.04	0.1289	0.0708	0.0716
University	501.85	95.73	497.51	95.81	506.50	95.86	0.1042	0.0558	0.0585
Grades 1 st Quartile	352.06	43.33	347.03	38.10	358.69	36.92	0.3036	0.2190	0.1672
Grades 2 nd Quartile	442.15	19.49	431.58	19.66	441.44	19.64	0.1665	0.0974	0.0888
Grades 3 rd Quartile	508.82	19.85	500.43	20.96	510.99	21.25	0.0844	0.0399	0.0456
Grades 4 th Quartile	597.68	40.59	597.23	45.33	606.32	43.36	0.0319	0.0133	0.0171
Rates 1 st Quartile	499.42	91.93	510.18	90.61	513.88	91.98	0.0191	0.0127	0.0093
Rates 2 nd Quartile	486.58	90.76	485.49	89.75	496.82	91.17	0.0546	0.0322	0.0278
Rates 3 rd Quartile	470.02	96.34	460.00	96.64	471.45	96.26	0.1454	0.0869	0.0600
Rates 4 th Quartile	451.69	95.19	432.26	94.09	446.36	91.00	0.3259	0.1843	0.2001
Early Tracking	451.04	94.09	445.75	98.87	454.56	93.70	0.1423	0.0773	0.0684
Late Tracking	483.70	94.90	477.30	95.69	488.12	95.87	0.1290	0.0774	0.0741

Table 8 – Mean and standard deviation of test scores by subject and retention rates for all

General	1	3	6	8	10	12	14	Pooled	Europe
Mean	6.51	-3.98	-6.59	3.66	11.49	-5.76	9.06	2.68	8.32**
	12.17	16.05	10.61	9.78	9.96	7.44	7.24	4.00	3.71
R²	0.8041	0.3588	0.8413	0.8024	0.7808	0.9071	0.8926	0.7923	0.4571
Std Dev	-2.98	0.04	-2.46	-4.01	4.75	-0.83	2.54	0.65	3.85*
	2.82	2.60	4.90	3.91	3.70	3.05	3.73	1.77	2.23
R²	0.0551	0.3952	0.0956	0.1186	0.1343	0.5248	0.3612	0.0710	0.1923
10th Perc	21.00	-3.67	10.18	9.79	3.73	4.77	13.27**	7.28	4.69
	17.05	14.18	10.36	9.49	5.27	8.26	6.31	4.82	5.80
R²	0.5927	0.3722	0.6958	0.7657	0.8671	0.9005	0.9033	0.7112	0.4051
25th Perc	17.22	-6.40	4.35	9.92	3.59	0.43	11.40*	5.03	3.93
	15.24	14.33	9.62	8.98	5.92	8.20	6.62	4.59	5.20
R²	0.6754	0.3822	0.7738	0.8061	0.8663	0.9110	0.9128	0.7527	0.4047
75th Perc	-0.24	-0.95	-12.16	-0.14	20.51	-10.36	11.42	3.66	15.29***
	9.53	14.94	12.66	11.01	13.43	7.35	9.47	4.35	3.68
R²	0.8615	0.3469	0.8179	0.6791	0.6379	0.8795	0.8488	0.7324	0.4513
90th Perc	0.24	-2.05	-12.33	-1.65	21.77	-10.13	14.08	5.11	18.33***
	9.04	13.48	13.29	11.52	13.84	8.31	11.66	4.69	4.19
R²	0.8545	0.3877	0.7915	0.5987	0.5698	0.8443	0.8088	0.6777	0.4593
Diff 90-10	-9.25	-2.91	-9.81	-12.35	13.08	-5.28	8.57	1.03	11.73
	8.99	8.34	16.22	13.36	12.12	9.56	12.69	5.87	7.48
R²	0.0508	0.3832	0.0816	0.1404	0.0854	0.5627	0.3578	0.0815	0.2195
Diff 75-25	-8.66	0.94	-6.92	-10.76	12.43	-2.61	6.66	1.53	9.89*
	6.95	7.09	12.14	9.72	9.46	7.67	9.50	4.58	5.78
R²	0.0703	0.3645	0.1033	0.1339	0.1470	0.5653	0.3738	0.0742	0.1805

Table 9 – Coefficients of the dummy variable for early tracking in the first model for mathematics achievement of all students. Significance levels: *** 1%, ** 5% and * 10%.

Boys	1	3	6	8	10	12	14	Pooled	Europe
Mean	10.90	-7.36	-5.98	3.08	11.12	-6.47	9.13	2.89	9.86**
	11.98	15.65	11.40	9.96	10.37	7.18	7.00	3.99	4.09
R²	0.8037	0.4742	0.7899	0.7921	0.7721	0.9161	0.8982	0.7940	0.4718
Std Dev	-3.35	-0.40	-2.45	-3.82	4.58	-1.20	2.60	0.61	3.55
	3.18	3.32	5.44	4.26	4.20	3.31	3.80	1.91	2.34
R²	0.0613	0.3161	0.0995	0.1327	0.0887	0.5334	0.3862	0.0869	0.1814
10th Perc	24.66	-1.78	11.01	10.17	5.60	4.79	15.52**	8.73*	6.64
	19.91	14.15	11.20	9.94	5.49	8.24	6.55	4.82	5.91
R²	0.4535	0.3980	0.5682	0.7374	0.8277	0.9006	0.9004	0.6906	0.4090
25th Perc	20.67	-6.21	6.24	9.06	3.94	0.11	12.17*	5.73	5.82
	16.27	14.03	10.31	9.07	6.29	8.15	6.52	4.62	5.43
R²	0.6442	0.4219	0.6715	0.7787	0.8351	0.9154	0.9082	0.7397	0.4138
75th Perc	-1.59	-2.53	-12.00	-1.62	20.99	-9.66	11.82	3.73	16.36***
	9.75	14.91	13.45	11.36	13.59	7.52	8.83	4.43	4.15
R²	0.8403	0.4264	0.7839	0.6739	0.6385	0.8714	0.8576	0.7304	0.4612
90th Perc	-0.46	-3.25	-11.32	-4.32	22.89	-8.52	16.15	5.41	19.55***
	9.81	13.18	14.02	12.07	13.99	9.47	10.80	4.83	4.68
R²	0.8321	0.4260	0.7612	0.5908	0.5632	0.8032	0.8244	0.6686	0.4665
Diff 90-10	-10.01	-5.03	-8.15	-13.17	12.53	-6.43	8.81	0.82	11.44
	10.23	10.81	17.23	14.08	13.44	10.90	12.81	6.21	7.83
R²	0.0514	0.3222	0.0985	0.1587	0.0583	0.5602	0.3995	0.0940	0.2001
Diff 75-25	-9.09	1.03	-6.29	-9.82	12.18	-2.73	6.89	1.79	9.29
	8.46	9.09	13.46	10.65	10.81	8.15	9.53	4.94	6.13
R²	0.0665	0.3063	0.1193	0.1424	0.1058	0.5752	0.3911	0.0844	0.1637

Table 10 – Coefficients of the dummy variable for early tracking in the first model for mathematics achievement of boys. Significance levels: *** 1%, ** 5% and * 10%.

Girls	1	3	6	8	10	12	14	Pooled	Europe
Mean	4.70	-1.58	-7.30	4.43	11.97	-5.15	8.96	2.60	6.72*
	13.02	16.54	10.11	9.74	9.67	7.99	7.82	4.11	3.67
R ²	0.7897	0.2678	0.8775	0.8046	0.7818	0.8936	0.8792	0.7825	0.4287
Std Dev	-1.75	1.71	-2.19	-4.11	5.18	-0.33	2.70	1.03	4.53**
	2.58	2.40	4.34	3.65	3.28	2.94	3.79	1.65	2.08
R ²	0.0195	0.3490	0.0824	0.1023	0.1893	0.4995	0.3067	0.0520	0.2064
10th Perc	16.79	-5.46	8.54	10.68	2.20	4.32	9.90	5.54	1.74
	16.47	15.61	9.55	9.51	5.32	9.21	6.95	4.96	5.92
R ²	0.6241	0.2893	0.7900	0.7889	0.8811	0.8887	0.8959	0.7034	0.3773
25th Perc	13.04	-6.94	2.14	10.63	2.53	0.36	10.06	3.75	1.30
	14.81	15.42	9.07	9.11	5.88	9.33	7.39	4.70	5.17
R ²	0.6967	0.3002	0.8467	0.8220	0.8743	0.8923	0.9088	0.7484	0.3652
75th Perc	-0.77	0.08	-12.39	1.13	20.54	-10.16	9.89	3.34	13.85***
	11.68	15.60	12.23	10.80	13.28	7.71	10.38	4.45	3.60
R ²	0.8098	0.2548	0.8428	0.6833	0.6403	0.8773	0.8309	0.7222	0.4220
90th Perc	1.44	0.25	-13.88	1.11	20.42	-9.81	12.44	4.89	16.71***
	11.12	13.80	13.28	11.28	14.03	8.11	13.00	4.77	4.03
R ²	0.7964	0.3068	0.8129	0.5998	0.5680	0.8643	0.7812	0.6703	0.4252
Diff 90-10	-5.88	0.49	-8.94	-13.11	14.66	-3.42	9.55	1.98	12.76*
	8.47	7.88	15.10	12.62	10.80	8.09	13.34	5.56	7.23
R ²	0.0216	0.3956	0.0633	0.1194	0.1316	0.5733	0.2785	0.0610	0.2239
Diff 75-25	-5.20	1.29	-6.29	-11.67	13.87	-1.58	6.11	2.11	11.25**
	6.29	6.93	10.71	8.86	8.22	7.89	9.73	4.25	5.44
R ²	0.0302	0.4433	0.0761	0.1311	0.2183	0.5233	0.3215	0.0573	0.1874

Table 11 – Coefficients of the dummy variable for early tracking in the first model for mathematics achievement of girls. Significance levels: *** 1%, ** 5% and * 10%.

Lower	12	14	Pooled	Europe
Mean	-16.62	7.51	-3.96	-11.74
	15.73	11.33	11.54	13.84
R ²	0.8491	0.7326	0.7567	0.3452
Std Dev	-4.39	2.92	-0.43	0.46
	3.89	4.34	3.21	3.22
R ²	0.1032	0.0963	0.0780	0.3299
Upper	12	14	Pooled	Europe
Mean	-7.54	3.89	0.22	-1.98
	12.36	9.86	7.93	8.26
R ²	0.8638	0.8470	0.8508	0.5076
Std Dev	-1.64	3.77	1.45	3.10
	3.16	3.98	2.72	2.48
R ²	0.2727	0.1590	0.1798	0.2828
University	12	14	Pooled	Europe
Mean	-6.99	7.42	1.32	6.57
	7.77	8.23	6.41	6.49
R ²	0.8761	0.8853	0.8771	0.6548
Std Dev	-2.30	3.36	1.00	2.75
	3.63	4.91	3.11	2.69
R ²	0.4763	0.3538	0.3934	0.2529

Table 12 – Estimates of the dummy variable for early tracking in the first model for mathematics achievement by category of parents' highest education. Significance levels: *** 1%, ** 5% and * 10%.

0-10	1	3	6	8	10	Pooled	Europe
Mean	15.30	-25.06	-6.67	4.41	1.01	-2.46	-3.23
	19.46	23.54	13.53	13.25	11.58	7.39	7.30
R²	0.5448	0.2832	0.6980	0.0000	0.5271	0.5114	0.1950
Std Dev	-7.24**	-0.24	-1.40	1.64	1.87	-0.46	1.36
	2.90	4.47	5.90	4.70	4.67	2.15	2.84
R²	0.2961	0.0028	0.0296	0.0569	0.0332	0.0006	0.0319
11-100	1	3	6	8	10	Pooled	Europe
Mean	5.65	-11.65	-11.40	2.07	8.15	-0.86	12.83**
	12.69	21.34	11.55	10.05	9.73	5.72	5.80
R²	0.7775	0.2838	0.8277	0.7940	0.7611	0.6916	0.2791
Std Dev	-2.66	-2.50	-2.79	-4.05	0.93	-1.27	1.43
	2.13	2.48	4.35	3.52	3.81	1.82	2.45
R²	0.0765	0.1796	0.0704	0.1751	0.0814	0.0042	0.0224
≥100	1	3	6	8	10	Pooled	Europe
Mean	1.04	-1.24	-8.70	1.51	18.14	3.57	15.75***
	10.41	19.66	10.97	9.16	10.58	5.13	5.11
R²	0.8602	0.2890	0.8319	0.7979	0.7865	0.7384	0.4321
Std Dev	-4.68	-3.70	-3.86	-7.53*	1.17	-2.50	2.05
	2.67	2.36	3.23	3.76	3.13	2.00	2.69
R²	0.0980	0.4722	0.0648	0.3465	0.0436	0.0594	0.0247

Table 13 – Coefficients of the dummy variable for early tracking in the first model for mathematics achievement by category of number of books at home. Significance levels: *** 1%, ** 5% and * 10%.

General	1	3	6	8	10	12	14	Pooled	Europe
Mean	30.86***	-2.83	7.87	7.66	5.18	4.99	13.79	8.52*	7.41
	9.26	7.60	10.05	9.25	11.09	12.34	9.72	4.31	5.25
R²	0.7781	0.8926	0.7203	0.7935	0.6864	0.7853	0.7847	0.7203	0.5319
Std Dev	-0.99	7.93**	-0.58	-0.95	4.89	-1.62	-2.43	1.13	-1.66
	3.54	3.60	5.99	3.39	3.37	1.89	2.41	1.63	2.06
R²	0.3478	0.3612	0.2214	0.2059	0.0645	0.6812	0.5515	0.2214	0.1928
10th Perc	31.27**	-14.19	14.78	9.81	-0.20	13.60	24.21***	10.52**	14.06*
	12.23	8.72	11.59	8.69	8.87	11.86	8.70	5.31	7.56
R²	0.4796	0.9033	0.6175	0.7055	0.7155	0.8169	0.7781	0.6175	0.4379
25th Perc	33.18**	-11.23	12.95	9.74	0.56	9.31	20.98**	9.87*	11.63*
	11.31	7.77	10.27	8.57	9.33	12.36	9.18	5.11	6.94
R²	0.5537	0.9128	0.6540	0.7499	0.7256	0.8147	0.7866	0.6540	0.4672
75th Perc	28.00***	7.23	2.53	6.35	11.10	-0.47	8.60	8.21**	6.55
	7.77	10.03	11.90	11.05	12.88	11.07	9.86	4.10	4.28
R²	0.8853	0.8488	0.6880	0.6703	0.5557	0.7402	0.7331	0.6880	0.5031
90th Perc	29.26***	10.33	-0.85	8.15	13.01	-1.80	9.63	9.44**	7.81*
	8.22	10.51	12.31	12.32	13.05	11.48	10.42	4.28	4.34
R²	0.8844	0.8088	0.6350	0.5634	0.4750	0.7062	0.7023	0.6350	0.4673
Diff 90-10	1.40	24.04*	-3.98	-2.52	14.08	-8.51	-8.85	3.00	-5.74
	11.76	11.40	19.29	10.90	11.04	5.43	8.07	5.22	6.77
R²	0.3437	0.3578	0.2247	0.2281	0.0587	0.6870	0.5422	0.2247	0.2160
Diff 75-25	-23.49	18.40*	-1.26	-2.63	11.45	-3.89	-6.84	-0.17	-6.52
	13.77	9.34	14.84	8.35	8.38	4.48	6.05	4.70	5.85
R²	0.3024	0.3738	0.2044	0.2352	0.0591	0.6908	0.5556	0.2044	0.1639

Table 14 – Coefficients of the dummy variable for early tracking in the first model for science achievement of all students. Significance levels: *** 1%, ** 5% and * 10%.

Boys	1	3	6	8	10	12	14	Pooled	Europe
Mean	30.56***	-4.33	8.06	8.41	3.61	4.69	16.74*	9.15**	8.62
	9.70	7.95	10.18	9.48	11.63	11.44	9.55	4.57	5.85
R²	0.7838	0.8982	0.7251	0.7780	0.6850	0.8225	0.8250	0.7251	0.5449
Std Dev	-2.59	7.31*	-0.95	-1.25	4.42	-1.27	-3.02	0.68	-2.83
	4.14	3.85	6.78	3.89	3.64	2.10	2.71	1.76	2.23
R²	0.2871	0.3862	0.2262	0.1755	0.0464	0.7138	0.5578	0.2262	0.1823
10th Perc	35.09**	-15.15	16.70	13.06	1.88	12.68	30.79***	13.16**	17.87**
	15.01	10.64	12.16	9.03	8.95	10.88	9.18	5.78	8.46
R²	0.4152	0.9004	0.5926	0.6581	0.6922	0.8390	0.7997	0.5926	0.4148
25th Perc	36.99**	-12.20	15.54	11.91	0.94	8.04	25.24**	11.82**	15.39*
	12.96	9.65	11.47	8.78	9.68	11.60	9.43	5.61	7.92
R²	0.5134	0.9082	0.6371	0.7052	0.7004	0.8478	0.8114	0.6371	0.4383
75th Perc	29.65***	5.18	2.19	6.08	10.23	-0.33	11.10	8.56**	6.88
	8.09	9.22	11.48	11.01	13.29	10.41	9.33	4.12	4.46
R²	0.8960	0.8576	0.7137	0.7017	0.5613	0.7657	0.7734	0.7137	0.5504
90th Perc	29.48***	9.93	-0.98	8.04	12.87	0.93	11.27	9.93**	7.95*
	8.67	9.65	11.70	11.95	13.23	10.89	9.99	4.17	4.39
R²	0.8876	0.8244	0.6614	0.6050	0.4775	0.6979	0.7325	0.6614	0.5238
Diff 90-10	0.08	23.93*	-4.92	-3.61	12.13	-7.61	-12.88	1.65	-8.64
	13.71	12.52	20.89	12.39	11.97	5.81	9.19	5.53	7.16
R²	0.2479	0.3995	0.2203	0.1977	0.0442	0.6971	0.5543	0.2203	0.2106
Diff 75-25	-2.90	16.90	-2.34	-3.36	10.46	-3.28	-8.30	1.61	-6.78
	9.98	10.28	17.13	9.67	9.07	4.97	6.59	4.40	5.58
R²	0.2782	0.3911	0.2312	0.2058	0.0424	0.7225	0.5723	0.2312	0.1934

Table 15 – Coefficients of the dummy variable for early tracking in the first model for science achievement of boys. Significance levels: *** 1%, ** 5% and * 10%.

Girls	1	3	6	8	10	12	14	Pooled	Europe
Mean	30.23***	-1.89	7.49	6.84	6.89	4.43	10.29	7.41*	5.02
	8.82	7.60	10.27	9.36	10.67	13.52	10.13	4.15	4.80
R ²	0.7876	0.8792	0.6962	0.7940	0.6785	0.7287	0.7207	0.6962	0.4939
Std Dev	-0.82	8.66**	-0.02	-0.41	5.68*	-1.41	-1.23	1.79	-0.53
	3.42	3.62	5.32	2.94	3.20	2.09	2.34	1.57	2.00
R ²	0.3757	0.3067	0.1802	0.2338	0.0985	0.5770	0.4800	0.1802	0.1636
10th Perc	29.06**	-15.07*	13.46	6.52	-2.81	13.02	16.02*	6.98	8.69
	10.47	7.51	11.15	9.05	8.93	13.11	8.94	4.96	6.76
R ²	0.5450	0.8959	0.6162	0.7432	0.7198	0.7513	0.7061	0.6162	0.4554
25th Perc	30.74**	-11.46	10.40	7.09	0.01	8.35	15.34	6.98	6.96
	10.28	6.85	9.56	9.00	9.35	13.98	9.23	4.78	6.20
R ²	0.5943	0.9088	0.6500	0.7873	0.7235	0.7539	0.7200	0.6500	0.4702
75th Perc	27.97***	9.28	2.39	7.18	12.01	-1.47	5.46	7.89*	5.88
	7.64	10.49	12.53	11.33	12.61	12.51	10.52	4.22	4.38
R ²	0.8712	0.8309	0.6483	0.6271	0.5533	0.6962	0.6836	0.6483	0.4189
90th Perc	27.15***	11.07	0.28	8.60	13.09	-4.24	7.73	8.90*	7.19
	8.19	12.07	13.17	12.52	12.95	13.25	11.22	4.51	4.52
R ²	0.8683	0.7812	0.5864	0.5077	0.4730	0.6624	0.6448	0.5864	0.3644
Diff 90-10	-0.72	26.07**	-2.56	-1.22	16.53	-7.91	-3.38	5.12	-2.22
	10.68	11.64	17.91	9.35	10.19	6.14	7.44	5.02	6.48
R ²	0.4231	0.2785	0.1926	0.2470	0.0881	0.5908	0.4709	0.1926	0.2003
Diff 75-25	-1.49	20.84**	0.42	-0.95	12.82	-2.33	-4.37	4.26	-1.07
	8.40	8.83	12.94	6.81	8.01	5.46	5.86	3.90	4.97
R ²	0.3425	0.3215	0.1932	0.2961	0.0831	0.5987	0.4856	0.1932	0.1875

Table 16 – Coefficients of the dummy variable for early tracking in the first model for science achievement of girls. Significance levels: *** 1%, ** 5% and * 10%.

Lower	13	15	Pooled	Europe
Mean	-6.81	13.18	2.44	-12.48
	17.18	13.37	11.82	14.33
R ²	0.6891	0.6264	0.6379	0.5373
Std Dev	-3.05	-2.49	-2.86	-6.31**
	3.26	2.70	2.12	2.52
R ²	0.3964	0.3616	0.3540	0.7552
Upper	13	15	Pooled	Europe
Mean	5.79	14.02	11.47	-1.93
	15.19	12.36	9.56	11.15
R ²	0.7265	0.7337	0.7251	0.6152
Std Dev	-0.84	-2.12	-1.84	-5.09*
	1.67	3.05	1.93	2.83
R ²	0.6681	0.4396	0.4818	0.5537
University	13	15	Pooled	Europe
Mean	4.53	11.20	7.46	-3.65
	11.70	10.54	7.73	10.49
R ²	0.7599	0.7455	0.7562	0.6785
Std Dev	-2.85	-0.99	-1.73	-5.85**
	2.56	3.14	2.00	2.34
R ²	0.6472	0.5944	0.6152	0.6854

Table 17 – Estimates of the dummy variable for early tracking in the first model for science achievement by category of parents' highest education. Significance levels: * 10%, ** 5%, *** 1%.

0-10	2	4	7	9	11	Pooled	Europe
Mean	34.51**	-28.97*	3.35	3.20	-3.67	0.49	1.43
	14.40	16.09	10.49	11.77	12.67	7.25	9.74
R²	0.3445	0.4304	0.4574	0.5849	0.3675	0.3452	0.1590
Std Dev	-0.25	-0.28	1.89	5.60	3.65	2.91	0.63
	4.12	5.56	7.48	4.46	3.42	2.13	2.29
R²	0.2547	0.0639	0.0071	0.1706	0.0938	0.0618	0.0469
11-100	2	4	7	9	11	Pooled	Europe
Mean	33.24***	-13.65	2.62	7.70	3.60	5.86	14.77*
	10.66	9.71	10.69	10.09	11.17	5.71	8.16
R²	0.6827	0.5428	0.7627	0.7706	0.6316	0.6109	0.3010
Std Dev	0.44	4.32	0.10	-1.11	1.99	1.37	-0.52
	3.69	3.50	5.14	2.82	3.17	1.84	2.10
R²	0.2884	0.2052	0.0003	0.3595	0.0503	0.0892	0.0016
≥100	2	4	7	9	11	Pooled	Europe
Mean	26.71***	1.34	5.42	5.52	10.90	9.24*	12.28*
	8.58	9.34	11.53	9.41	10.76	4.80	7.19
R²	0.8323	0.5831	0.8188	0.7987	0.7335	0.7308	0.4857
Std Dev	-1.18	2.27	-3.13	-3.25	1.37	-0.23	-2.37
	3.47	2.33	4.20	2.51	2.85	1.96	2.70
R²	0.3179	0.3948	0.0681	0.5519	0.2416	0.2022	0.0413

Table 18 – Estimates of the dummy variable for early tracking in the first model for science achievement by category of number of books at home. Significance levels: * 10%, ** 5%, *** 1%.

General	12	14	Pooled E	Europe E	1	3	6	8	10	Pooled B	Europe B
Mean	-4.68	2.64	4.73	9.58*	6.04	14.51	-5.73	2.16	6.96	1.79	12.68**
	8.00	8.24	6.21	5.26	8.19	22.67	11.73	9.66	8.38	5.33	4.93
R²	0.9292	0.8827	0.9036	0.9233	0.9343	0.6081	0.8827	0.8539	0.8492	0.7341	0.4000
Std Dev	-2.57	3.64	0.92	2.62	-2.85	0.19	1.76	-0.54	3.08	0.84	4.38**
	3.47	4.09	2.80	2.12	3.29	4.84	6.02	4.19	4.11	1.81	2.01
R²	0.5996	0.2672	0.4163	0.6503	0.3976	0.4410	0.2672	0.2855	0.3250	0.2694	0.5915
10th Perc	9.46	9.80	10.14	9.91	28.50**	4.72	3.39	8.36	4.94	5.89	7.14
	10.86	7.44	6.31	9.38	10.65	19.88	11.52	10.31	5.18	5.86	5.96
R²	0.9418	0.8524	0.9226	0.8702	0.9140	0.5266	0.8524	0.8149	0.9125	0.6659	0.5017
25th Perc	3.89	8.02	7.07	7.09	19.45*	2.72	0.68	7.95	3.41	3.43	7.91
	10.89	7.76	6.57	8.10	9.70	20.83	10.85	10.27	5.78	5.74	5.59
R²	0.9397	0.8855	0.9278	0.8954	0.9056	0.5541	0.8855	0.8538	0.9071	0.6924	0.4730
75th Perc	-7.81	9.18	3.58	10.39*	1.08	9.14	-9.32	-1.48	6.52	2.60	17.19***
	8.88	9.62	7.32	5.52	5.87	17.12	12.74	12.17	10.84	5.31	4.80
R²	0.9025	0.8810	0.8646	0.8884	0.9674	0.6097	0.8810	0.7382	0.7921	0.6851	0.5668
90th Perc	-7.80	13.63	5.36	13.14*	2.29	8.55	-10.66	-1.69	2.84	3.98	21.68***
	9.24	12.12	8.52	6.53	6.09	15.02	13.48	12.54	11.74	5.46	5.17
R²	0.8706	0.8719	0.8275	0.8706	0.9578	0.6235	0.8719	0.6758	0.7809	0.6379	0.6376
Diff 90-10	-11.22	11.23	2.50	6.99	-13.36*	0.55	-8.50	-8.06	-0.36	-3.20	12.86**
	10.47	12.29	8.10	9.52	6.94	11.10	13.24	14.03	16.59	5.59	6.20
R²	0.6653	0.3386	0.4786	0.6890	0.7547	0.5120	0.3386	0.3775	0.4329	0.3684	0.6548
Diff 75-25	-8.59	7.15	1.76	9.02	-12.05*	0.20	-6.99	-8.46	-0.60	-3.47	8.97*
	7.64	9.18	5.84	5.91	5.56	8.34	9.95	10.06	13.25	4.29	4.53
R²	0.6908	0.3467	0.4961	0.6926	0.7715	0.4777	0.3467	0.2773	0.4619	0.3493	0.6407

Table 19 – Estimates of the dummy variable for early tracking in the second model for mathematics achievement of all students. Significance levels: *** 1%, ** 5% and * 10%. Pooled/Europe E (B) pooled/Europe sample for parents' highest education (number of books at home).

Boys	12	14	Pooled E	Europe E	1	3	6	8	10	Pooled B	Europe B
Mean	-4.19	7.52	4.49	9.73*	10.96	2.87	-6.04	1.81	7.48	1.82	14.21**
	7.80	7.58	5.76	4.75	7.13	18.40	11.81	9.82	8.74	5.31	5.62
R²	0.9284	0.9066	0.9091	0.9262	0.9416	0.6302	0.8454	0.8406	0.8401	0.7315	0.4462
Std Dev	-1.20	1.96	1.03	1.54	-3.54	1.71	1.37	-0.09	2.28	1.10	3.71
	3.35	3.90	2.71	2.18	3.65	4.59	6.69	4.11	4.68	1.96	2.25
R²	0.5357	0.3943	0.4402	0.6830	0.4322	0.3934	0.2012	0.3020	0.2997	0.2344	0.5412
10th Perc	11.60	14.48**	14.71***	15.24**	19.61	7.58	6.21	9.78	6.46	9.55*	12.69
	8.15	5.97	5.04	6.28	13.20	17.81	12.87	8.39	5.50	5.63	7.57
R²	0.9368	0.9083	0.9118	0.8796	0.8098	0.5295	0.7719	0.7802	0.8318	0.5978	0.4376
25th Perc	4.66	10.93*	9.95*	11.88*	18.33	1.06	2.05	8.34	3.76	5.32	11.79
	8.33	5.97	5.14	5.62	11.53	18.98	11.55	8.67	6.40	5.61	7.20
R²	0.9395	0.9168	0.9201	0.9018	0.8819	0.5596	0.8183	0.8166	0.8487	0.6523	0.4357
75th Perc	-7.71	10.14	3.91	11.01*	-1.68	6.94	-11.18	-3.24	7.76	2.31	19.11***
	8.36	10.19	7.05	5.36	7.12	15.87	13.41	12.53	10.27	5.34	4.81
R²	0.8862	0.8631	0.8647	0.8952	0.9369	0.6611	0.8215	0.7410	0.7928	0.6885	0.6464
90th Perc	-5.85	15.19	6.34	13.31*	-0.40	7.26	-9.10	-5.46	6.91	3.41	23.49***
	11.02	11.93	8.56	6.48	7.93	12.69	13.72	13.83	11.19	5.56	4.85
R²	0.8369	0.8273	0.8189	0.8801	0.9195	0.6729	0.7961	0.6703	0.7605	0.6378	0.6972
Diff 90-10	-13.51	7.91	-0.90	-0.34	-15.04*	-5.64	-6.11	-13.74	-2.60	-6.02	9.06
	11.64	12.35	8.66	7.98	7.53	15.73	18.94	14.99	21.07	6.65	7.55
R²	0.6306	0.4003	0.4736	0.6932	0.7210	0.3926	0.1436	0.2263	0.2459	0.2626	0.5581
Diff 75-25	-8.18	5.48	0.49	1.83	-12.85*	-0.92	-4.03	-9.55	-1.09	-3.66	7.08
	9.85	9.69	6.53	5.65	5.99	10.31	14.12	10.93	15.88	5.04	5.71
R²	0.6459	0.3960	0.4828	0.6587	0.7642	0.4659	0.2139	0.1667	0.2917	0.2731	0.5797

Table 20 – Estimates of the dummy variable for early tracking in the second model for mathematics achievement of boys. Significance levels: *** 1%, ** 5% and * 10%. Pooled/Europe E (B) pooled/Europe sample for parents' highest education (number of books at home).

Girls	12	14	Pooled E	Europe E	1	3	6	8	10	Pooled B	Europe B
Mean	-2.80	8.15	5.20	7.10	3.05	8.43	-5.90	3.83	6.38	1.97	9.06*
	8.75	8.34	6.45	4.25	9.88	21.03	10.94	9.62	7.92	5.40	4.54
R ²	0.9126	0.8825	0.8915	0.8658	0.9184	0.4948	0.9070	0.8393	0.8498	0.7287	0.3244
Std Dev	-0.30	1.14	1.10	2.99	-1.33	1.46	2.38	-0.67	4.18	1.57	4.09**
	3.06	3.87	2.59	2.54	2.85	3.55	4.84	3.57	3.33	1.62	1.94
R ²	0.5033	0.3764	0.3684	0.5994	0.2892	0.3511	0.3408	0.2827	0.3506	0.2587	0.5689
10th Perc	10.24	10.76	11.01*	6.82	14.87	6.56	3.61	10.76	3.80	7.16	10.63
	10.61	7.07	5.92	6.45	13.98	20.75	10.07	9.16	4.60	5.67	6.32
R ²	0.9207	0.9001	0.9043	0.8464	0.8473	0.4771	0.8858	0.8067	0.9068	0.6625	0.4653
25th Perc	4.64	9.88	8.66	5.11	11.54	3.88	-0.95	10.36	2.61	3.27	8.60
	10.22	7.59	6.16	5.09	12.50	20.28	10.40	9.36	5.36	5.70	5.71
R ²	0.9160	0.9108	0.9097	0.8724	0.8665	0.5161	0.9049	0.8398	0.9022	0.6936	0.4041
75th Perc	-8.16	8.19	3.17	11.48**	0.27	7.70	-8.94	-0.05	6.07	2.89	15.69***
	8.29	11.04	7.61	4.95	8.72	19.24	12.16	11.44	11.12	5.43	4.59
R ²	0.9060	0.8363	0.8557	0.8632	0.9036	0.5180	0.8853	0.7328	0.7843	0.6697	0.4588
90th Perc	-8.04	11.39	4.53	13.58**	2.84	9.80	-11.36	0.51	3.69	4.43	18.23***
	8.53	14.29	8.97	5.78	8.75	16.43	13.69	12.59	12.21	5.62	4.82
R ²	0.8930	0.7924	0.8216	0.8450	0.8884	0.5202	0.8508	0.6658	0.7666	0.6205	0.5209
Diff 90-10	-11.25	6.72	0.47	7.28	-10.63	-3.30	-7.69	-13.54	-1.62	-5.61	5.88
	8.89	13.20	7.83	7.66	7.27	10.83	16.38	12.79	14.11	5.34	6.09
R ²	0.6540	0.3014	0.3988	0.6280	0.6508	0.4117	0.1082	0.2092	0.4439	0.2941	0.6357
Diff 75-25	-8.35	4.32	0.63	6.36	-8.59	-0.95	-4.91	-11.47	2.80	-2.76	6.50
	7.01	10.20	5.85	6.24	4.83	7.66	11.57	9.19	11.40	4.07	4.51
R ²	0.6917	0.3439	0.4276	0.6092	0.7441	0.4795	0.1558	0.1799	0.4419	0.2626	0.6163

Table 21 – Estimates of the dummy variable for early tracking in the second model for mathematics achievement of girls. Significance levels: *** 1%, ** 5% and * 10%. Pooled/Europe E (B) pooled/Europe sample for parents' highest education (number of books at home).

Lower	12	14	Pooled	Europe
Mean	-14.43	4.16	0.72	2.80
	17.73	13.59	11.08	13.13
R ²	0.8594	0.7572	0.7709	0.5751
Std Dev	-5.36	3.87	-0.77	0.26
	3.96	4.66	3.33	3.32
R ²	0.2388	0.1850	0.1052	0.3592
Upper	12	14	Pooled	Europe
Mean	-5.96	-4.47	-1.09	1.21
	12.93	8.91	7.20	7.69
R ²	0.8916	0.8964	0.8696	0.7506
Std Dev	-2.40	3.49	1.12	3.34
	3.18	4.24	2.78	2.92
R ²	0.3857	0.1631	0.2061	0.2887
University	12	14	Pooled	Europe
Mean	-4.60	5.96	3.61	8.77
	7.88	8.44	6.16	5.72
R ²	0.9200	0.8936	0.8952	0.8793
Std Dev	-1.56	2.96	1.20	4.18*
	3.20	5.30	3.18	2.28
R ²	0.5707	0.3574	0.4033	0.5769

Table 22 – Coefficients of the dummy variable for early tracking in the second model for mathematics achievement by category of parents' highest education. Significance levels: *** 1%, ** 5% and * 10%.

0-10	1	3	6	8	10	Pooled	Europe
Mean	13.62	-15.67	-5.49	6.91	-5.78	-2.21	-2.92
	18.13	28.84	15.46	15.08	14.39	7.54	7.40
R ²	0.7551	0.3799	0.7897	0.7331	0.5748	0.5210	0.2098
Std Dev	-6.28**	-0.61	-0.28	4.68	1.55	0.15	1.79
	2.54	6.83	6.35	4.98	5.06	2.09	2.39
R ²	0.5602	0.1658	0.0595	0.1438	0.1083	0.0704	0.3112
11-100	1	3	6	8	10	Pooled	Europe
Mean	5.61	0.58	-11.59	3.12	4.25	-0.41	13.28**
	8.46	23.44	12.29	9.32	8.03	5.64	5.66
R ²	0.9257	0.4622	0.8603	0.8506	0.8224	0.6948	0.3459
Std Dev	-2.50	-1.41	-3.76	-4.78	-0.96	-2.07	1.08
	2.13	3.03	4.70	3.51	3.47	1.61	1.76
R ²	0.4590	0.2897	0.2965	0.2760	0.3393	0.1810	0.4913
≥100	1	3	6	8	10	Pooled	Europe
Mean	1.50	14.45	-9.33	1.00	19.23	6.23	14.20**
	8.23	19.93	12.38	8.56	11.93	5.34	5.43
R ²	0.9430	0.5152	0.8676	0.8605	0.8419	0.7506	0.4886
Std Dev	-4.64	-3.93	-5.76*	-8.22*	0.19	-3.07*	2.38
	2.66	4.15	3.02	4.41	2.98	1.67	1.97
R ²	0.4194	0.4868	0.5385	0.7214	0.2856	0.2333	0.5055

Table 23 – Coefficients of the dummy variable for early tracking in the second model for mathematics achievement by category of number of books at home. Significance levels: *** 1%, ** 5% and * 10%.

General	13	15	Pooled E	Europe E	2	4	7	9	11	Pooled B	Europe B
Mean	8.51	4.00	11.52	4.56	30.05***	7.96	10.07	6.19	2.09	8.17	13.57**
	12.26	10.32	8.16	11.41	7.95	7.73	10.25	9.47	9.67	5.02	6.51
R ²	0.8199	0.8572	0.8304	0.8465	0.9092	0.7680	0.8191	0.8304	0.7838	0.7033	0.4836
Std Dev	-4.73**	-0.47	-2.85	-4.64*	2.10	5.45	5.70	1.87	1.76	2.84	0.79
	2.21	3.46	1.95	2.39	2.85	4.56	7.06	4.18	3.77	1.74	1.70
R ²	0.8709	0.6432	0.3775	0.7465	0.6286	0.6480	0.3977	0.3775	0.4117	0.3790	0.6954
10th Perc	21.29	24.45**	19.81**	17.56	29.18***	-23.74**	8.54	3.89	2.05	1.56	10.77
	14.54	9.73	7.71	16.83	8.04	8.37	10.37	10.27	9.95	4.93	7.20
R ²	0.8677	0.7949	0.8186	0.8753	0.7749	0.7926	0.8016	0.8186	0.7721	0.6905	0.6447
25th Perc	15.33	22.24**	16.55*	14.40	28.10**	-9.93	12.83	5.86	1.33	3.85	10.12
	15.91	10.53	8.25	15.87	9.40	9.14	10.39	10.56	11.01	4.92	7.25
R ²	0.8697	0.8020	0.8606	0.8707	0.7996	0.7139	0.7928	0.8606	0.7651	0.7134	0.6089
75th Perc	3.60	9.74	6.06	5.11	28.09***	15.84	3.77	5.03	1.53	9.19*	11.97**
	11.06	9.99	7.59	6.75	6.82	11.82	12.42	12.43	10.60	4.80	5.61
R ²	0.7963	0.7388	0.7027	0.8523	0.9412	0.8010	0.8265	0.7027	0.7870	0.6962	0.4975
90th Perc	0.53	9.05	4.89	6.18	29.41***	17.48	-0.33	6.16	-1.84	9.72**	15.47**
	11.33	10.97	8.10	7.29	7.69	12.58	12.94	13.19	11.55	4.87	6.14
R ²	0.7763	0.7034	0.6248	0.8724	0.9273	0.7793	0.8070	0.6248	0.7505	0.6347	0.5063
Diff 90-10	-8.31	-9.66	-8.25	-15.10	0.09	25.87**	1.20	6.07	-2.86	7.16	-2.22
	7.48	10.34	6.03	11.34	14.56	8.30	13.28	13.17	16.94	5.69	6.38
R ²	0.7361	0.5866	0.6478	0.7793	0.7055	0.7669	0.4055	0.6478	0.2833	0.4037	0.7127
Diff 75-25	-3.83	-10.30	-5.80	-8.92	-25.98	15.50*	0.11	4.38	-4.69	0.16	-2.32
	5.40	7.59	4.26	7.75	15.87	7.35	10.95	10.31	13.15	4.40	5.13
R ²	0.7637	0.5951	0.6190	0.7758	0.6411	0.6623	0.3710	0.6190	0.3359	0.4687	0.7285

Table 24 – Estimates of the dummy variable for early tracking in the second model for science achievement of all students. Significance levels: *** 1%, ** 5% and * 10%. Pooled/Europe E (B) pooled/Europe sample for parents' highest education (number of books at home).

Boys	13	15	Pooled E	Europe E	2	4	7	9	11	Pooled B	Europe B
Mean	8.50	17.97*	13.96*	7.66	31.83***	6.36	7.93	6.58	1.05	7.97	14.62*
	11.94	9.84	7.52	8.45	7.16	8.25	10.95	9.78	10.88	5.25	7.45
R²	0.8362	0.8285	0.8318	0.8824	0.9020	0.7533	0.7796	0.8103	0.7619	0.6878	0.5295
Std Dev	-1.15	-2.93	-2.31	-7.60***	0.18	8.22	4.42	2.20	1.66	2.98	-0.75
	2.27	3.62	1.82	2.17	3.29	4.87	7.88	4.43	4.39	1.95	1.91
R²	0.7431	0.6335	0.6045	0.7491	0.6051	0.5295	0.2681	0.3332	0.2653	0.3170	0.6558
10th Perc	20.23	33.78***	28.22***	35.65***	32.50***	-9.00	14.52	11.46	2.25	10.18*	24.73**
	12.12	9.13	7.21	10.87	7.44	14.68	14.90	8.57	10.29	5.68	9.92
R²	0.8583	0.8073	0.8295	0.8704	0.7860	0.5470	0.4937	0.6845	0.7016	0.5374	0.5496
25th Perc	12.90	28.63***	21.79***	24.11**	36.68***	-5.58	13.47	10.76	0.26	9.61*	21.62**
	12.35	9.56	7.45	10.40	6.76	13.41	13.94	8.86	11.30	5.77	9.48
R²	0.8595	0.8233	0.8377	0.8762	0.8128	0.5982	0.5943	0.7391	0.7207	0.5778	0.5252
75th Perc	3.82	10.86	7.35	-2.36	30.2***	16.89*	2.47	4.89	-1.55	9.03*	14.51**
	10.36	10.05	7.35	8.08	7.43	9.35	11.80	12.54	10.56	4.99	6.69
R²	0.8097	0.7751	0.7881	0.8325	0.9341	0.8441	0.8274	0.7383	0.7641	0.6982	0.5250
90th Perc	4.55	10.98	7.42	-3.43	29.95***	22.01*	-1.51	7.97	-0.63	10.44**	17.16**
	11.08	10.65	7.82	9.36	8.45	11.34	11.85	14.02	11.47	4.99	6.97
R²	0.7717	0.7337	0.7421	0.8100	0.9170	0.8407	0.8081	0.6573	0.7083	0.6513	0.5460
Diff 90-10	-10.05	-17.93*	-14.87**	-33.28***	-1.35	13.19	-4.32	-4.36	-0.56	1.65	-5.40
	7.87	10.44	6.50	8.74	12.78	15.33	22.65	12.20	17.38	5.93	6.33
R²	0.7036	0.5867	0.6052	0.7213	0.6733	0.5777	0.0410	0.2820	0.1776	0.3099	0.6742
Diff 75-25	-4.24	-13.65*	-8.88*	-22.95***	-5.08	8.66	-1.20	-3.41	-2.96	0.29	-5.06
	6.72	7.50	4.95	6.44	8.79	12.41	18.17	9.55	12.59	4.63	4.76
R²	0.7333	0.6229	0.6404	0.7271	0.7104	0.5559	0.0829	0.3017	0.2130	0.3305	0.6770

Table 25 – Estimates of the dummy variable for early tracking in the second model for science achievement of boys. Significance levels: *** 1%, ** 5% and * 10%. Pooled/Europe E (B) pooled/Europe sample for parents' highest education (number of books at home).

Girls	13	15	Pooled E	Europe E	2	4	7	9	11	Pooled B	Europe B
Mean	10.28	12.38	10.49	0.22	30.49***	7.07	9.31	6.43	1.52	7.86	10.66*
	14.35	10.35	8.30	9.44	7.49	8.52	10.61	9.49	9.63	4.82	5.90
R ²	0.7648	0.7293	0.7440	0.7896	0.8847	0.6669	0.8326	0.8195	0.7701	0.6958	0.3533
Std Dev	-1.51	-1.54	-1.43	-4.79**	2.47	10.11*	6.44	2.80	3.64	4.08***	1.33
	2.15	3.13	1.64	2.13	2.46	4.83	5.65	3.49	3.35	1.54	1.56
R ²	0.6078	0.5474	0.5001	0.6712	0.6017	0.5493	0.4034	0.3924	0.4206	0.3691	0.7040
10th Perc	21.43	20.53**	19.24**	20.41*	28.79***	-9.56	12.64	5.69	-0.67	5.17	15.35**
	15.01	9.50	7.54	10.88	8.26	9.07	12.23	9.22	8.18	4.93	7.23
R ²	0.7955	0.7258	0.7558	0.8395	0.7473	0.5811	0.6551	0.7488	0.7729	0.6096	0.5356
25th Perc	16.49	18.40*	16.06*	10.68	30.87***	-4.97	9.92	7.81	-0.46	5.40	13.02*
	15.09	9.56	7.99	10.21	8.23	8.02	10.57	9.64	9.01	5.06	7.07
R ²	0.7955	0.7367	0.7590	0.8366	0.7530	0.6314	0.7552	0.8089	0.7728	0.6462	0.4751
75th Perc	3.83	5.62	4.52	-5.83	28.39***	17.64	4.86	5.95	-1.67	9.88**	12.55**
	12.07	10.72	8.25	9.40	5.98	12.23	12.33	12.71	10.69	4.92	5.41
R ²	0.7477	0.6837	0.7110	0.6916	0.9421	0.7267	0.8051	0.6512	0.7377	0.6495	0.4103
90th Perc	-0.14	7.88	4.25	-5.31	27.68***	18.11	2.53	6.24	-3.53	10.65**	14.63**
	12.91	12.08	8.80	10.47	7.01	14.25	13.80	13.90	11.18	5.07	5.55
R ²	0.7292	0.6504	0.6833	0.6392	0.9266	0.6979	0.7694	0.5570	0.7280	0.5856	0.4231
Diff 90-10	-11.25	-6.72	-7.92	-20.70**	-3.86	17.46*	-0.48	-3.92	-1.57	4.25	-0.90
	7.47	8.56	4.99	7.34	12.72	9.28	20.03	9.61	11.99	5.00	4.86
R ²	0.6075	0.5155	0.5164	0.7267	0.7073	0.6461	0.0546	0.3266	0.4190	0.3143	0.7434
Diff 75-25	-4.93	-7.14	-5.11	-13.01**	-2.28	18.09*	1.64	-1.11	-1.65	3.52	0.00
	5.81	7.03	3.87	5.72	10.15	8.67	13.97	7.09	9.95	3.70	3.65
R ²	0.6345	0.5339	0.5304	0.6760	0.6414	0.5681	0.0453	0.3427	0.4113	0.3562	0.7462

Table 26 – Estimates of the dummy variable for early tracking in the second model for science achievement of girls. Significance levels: *** 1%, ** 5% and * 10%. Pooled/Europe E (B) pooled/Europe sample for parents' highest education (number of books at home).

Lower	13	15	Pooled	Europe
Mean	-6.22	9.53	6.03	0.81
	18.79	17.90	11.91	18.21
R ²	0.6915	0.6302	0.6484	0.5835
Std Dev	-4.22	-2.75	-3.26	-6.41**
	3.40	3.39	2.17	2.79
R ²	0.4807	0.4234	0.3843	0.7935
Upper	13	15	Pooled	Europe
Mean	6.98	8.16	9.26	-1.48
	16.11	10.02	8.47	10.41
R ²	0.7592	0.8084	0.7656	0.7343
Std Dev	-1.31	-2.84	-2.13	-5.39
	1.98	3.39	2.00	3.21
R ²	0.6777	0.4581	0.4870	0.5555
University	13	15	Pooled	Europe
Mean	5.83	11.42	10.29	2.21
	12.30	10.79	7.96	10.17
R ²	0.8182	0.7618	0.7887	0.7951
Std Dev	-3.05	-2.78	-2.22	-4.18
	2.87	3.55	2.08	2.86
R ²	0.6484	0.6368	0.6237	0.8099

Table 27 – Coefficients of the dummy variable for early tracking in the second model for science achievement by category of parents' highest education. Significance levels: *** 1%, ** 5% and * 10%.

0-10	2	4	7	9	11	Pooled	Europe
Mean	35.41**	-13.98	10.58	3.45	-11.56	1.74	3.68
	14.21	17.67	11.40	13.63	15.57	6.94	8.88
R²	0.6181	0.5530	0.6468	0.5935	0.4314	0.3902	0.2675
Std Dev	0.37	0.34	2.65	7.85*	2.94	3.24	1.02
	5.00	6.28	7.84	4.17	3.70	2.17	2.04
R²	0.3553	0.3435	0.0349	0.2325	0.2098	0.1224	0.2691
11-100	2	4	7	9	11	Pooled	Europe
Mean	33.17***	-1.75	3.18	8.55	-1.02	6.47	14.97**
	8.35	9.57	11.56	8.74	10.36	5.26	6.62
R²	0.8592	0.6589	0.7753	0.8256	0.6889	0.6395	0.4721
Std Dev	0.42	3.05	-1.54	-1.54	-0.80	0.42	-0.52
	4.29	3.34	5.43	2.75	3.08	1.58	1.45
R²	0.3689	0.4900	0.2045	0.3800	0.3619	0.3034	0.6195
≥100	2	4	7	9	11	Pooled	Europe
Mean	29.43***	9.92	5.41	4.15	14.20	11.96**	11.64*
	7.21	8.94	12.76	10.34	11.48	4.70	6.42
R²	0.9150	0.6624	0.8228	0.8378	0.8103	0.7623	0.5469
Std Dev	-1.25	1.62	-3.94	-4.35	0.36	-0.87	-2.34
	3.75	2.21	4.70	3.02	3.03	1.43	1.48
R²	0.3860	0.5088	0.2481	0.7417	0.3366	0.4512	0.7433

Table 28 – Estimates of the dummy variable for early tracking in the second model for science achievement by category of number of books at home. Significance levels: *** 1%, ** 5% and * 10%.

Reading	Mean	Std Dev	10th Perc	25th Perc	75th Perc	90th Perc	Diff 90-10	Diff 75-25
General 1	-21.07	3.43	-28.21*	-26.39	-16.05	-14.55	12.78	9.68
	14.02	3.87	16.05	15.46	13.46	13.39	13.07	9.50
R²	0.4426	0.2782	0.4955	0.4850	0.3583	0.3217	0.2476	0.2611
General 2	-21.13	2.74	-24.23	-24.21	-8.54	-5.54	14.82	11.93
	14.18	3.93	18.27	16.05	12.14	11.63	14.29	9.70
R²	0.6476	0.3205	0.5786	0.6222	0.5610	0.5073	0.2985	0.3334
Boys 1	-23.75	2.60	-30.14*	-27.16	-19.67	-19.05	9.88	6.82
	14.74	4.14	16.36	16.00	13.64	13.28	13.90	10.66
R²	0.4243	0.2216	0.5080	0.4861	0.3629	0.3422	0.2698	0.2608
Boys 2	-17.96	3.64	-27.60	-23.48	-11.78	-10.36	12.03	7.25
	12.50	4.16	18.36	16.02	11.08	11.03	15.30	11.49
R²	0.6091	0.2734	0.5694	0.5881	0.5718	0.5340	0.3004	0.2930
Girls 1	-16.53	4.71	-26.38	-22.30	-11.63	-9.74	15.62	10.41
	13.61	3.74	15.83	14.93	13.51	13.59	12.84	9.14
R²	0.4635	0.2308	0.5078	0.5035	0.3512	0.3290	0.2628	0.2687
Girls 2	-8.15	4.58	-19.29	-14.28	-2.55	-0.65	17.25	10.63
	11.73	4.17	17.54	14.46	11.56	11.49	15.64	11.44
R²	0.6493	0.2392	0.6228	0.6549	0.5351	0.4986	0.2688	0.2755

Table 29 – Coefficients of the dummy variable for early tracking for reading achievement of all students, boys, and girls. General 1 (2) – all students in the first (second) model. Significance levels: *** 1%, ** 5% and * 10%.

Reading	Mean	Std Dev
Lower 1	-38.97**	5.53
	16.77	6.91
R ²	83.26	0.0313
Lower 2	-24.38*	5.48
	13.87	6.97
R ²	0.6070	0.1698
Upper 1	-21.24	2.73
	15.41	3.81
R ²	0.3371	0.2086
Upper 2	-18.21	3.37
	13.73	3.92
R ²	0.5413	0.2201
University 1	-19.10	7.67*
	16.63	3.88
R ²	0.1927	0.2408
University 2	-6.60	2.04
	19.17	4.07
R ²	0.3629	0.4768

Table 30 – Coefficients of the dummy variable for early tracking for reading achievement by students’ background. Lower 1 (2) – students whose parents have up to lower secondary in the first (second) model. Significance levels: *** 1%, ** 5% and * 10%.

Reading	General	Boys	Girls	Primary	Lower	Upper	University
Retention	-55.10***	-55.13***	-55.43***	-46.61***	-46.29***	-52.86***	-60.25***
	0.55	0.75	0.81	1.22	1.12	1.01	0.97
R ²	0.4452	0.4264	0.4537	0.3669	0.4077	0.3843	0.4077
Students	1556714	754368	802346	87701	147774	504493	816746
Countries	63	63	63	63	63	63	63
Mathematics	General	Boys	Girls	Primary	Lower	Upper	University
Retention	-49.06***	-49.34***	-49.15***	-38.67***	-40.93***	-47.74***	-54.13***
	0.52	0.70	0.76	1.16	1.07	0.94	0.89
R ²	0.4957	0.4887	0.5014	0.4086	0.4930	0.4259	0.4504
Students	1556714	754368	802346	87701	147774	504493	816746
Countries	63	63	63	63	63	63	63
Science	General	Boys	Girls	Primary	Lower	Upper	University
Retention	-49.26***	-49.37***	-49.25***	-40.53***	-41.13***	-47.72***	-53.58***
	0.52	0.71	0.75	1.09	1.07	0.94	0.93
R ²	0.4619	0.4566	0.4694	0.4066	0.4666	0.3894	0.4166
Students	1556714	754368	802346	87701	147774	504493	816746
Countries	63	63	63	63	63	63	63

Table 31 – Results for cumulative grade retention. Samples of all students, by gender and parents’ highest education. Significance levels: *** 1%, ** 5% and * 10%.

Reading	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Retention	-42.80***	-59.04***	-49.24***	-60.68***	-42.19***	-59.45***
	3.54	1.31	0.96	0.62	0.91	0.67
R ²	0.3441	0.4120	0.4794	0.4630	0.5196	0.4052
Students	337847	414288	470332	334247	426148	1130566
Countries	16	16	16	15	20	43
Mathematics	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Retention	-37.43***	-55.15***	-43.86***	-54.61***	-38.85***	-52.36***
	3.53	1.28	0.92	0.52	0.97	0.60
R ²	0.3248	0.3773	0.5155	0.5581	0.5607	0.4603
Students	337847	414288	470332	334247	426148	1130566
Countries	16	16	16	15	20	43
Science	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Retention	-36.49***	-56.87***	-44.58***	-54.02***	-39.26***	-52.28***
	3.52	1.25	0.92	0.54	0.87	0.62
R ²	0.3171	0.3829	0.4867	0.4958	0.5225	0.4273
Students	337847	414288	470332	334247	426148	1130566
Countries	16	16	16	15	20	43

Table 32 – Results for cumulative grade retention. Samples by quartile of retention rates and by early and late tracking countries. Significance levels: *** 1%, ** 5% and * 10%.

Reading	General	Boys	Girls	Primary	Lower	Upper	University
Retention	-55.26***	-55.17***	-55.44***	-66.91***	-54.34***	-52.71***	-55.92***
	0.68	0.96	0.96	2.32	1.70	1.18	1.04
R ²	0.3447	0.3231	0.3403	0.3310	0.3087	0.2719	0.3533
Students	570811	278726	292085	15731	44219	207945	302916
Countries	23	23	23	23	23	23	23
Mathematics	General	Boys	Girls	Primary	Lower	Upper	University
Retention	-58.35***	-58.93***	-57.98***	-69.56***	-55.80***	-56.51***	-59.05***
	0.64	0.88	0.91	2.12	1.59	1.09	0.98
R ²	0.3469	0.3392	0.3489	0.3459	0.3110	0.2646	0.3527
Students	570811	278726	292085	15731	44219	207945	302916
Countries	23	23	23	23	23	23	23
Science	General	Boys	Girls	Primary	Lower	Upper	University
Retention	-53.11***	-53.64***	-52.63***	-67.77***	-50.92***	-51.01***	-53.58***
	0.67	0.94	0.94	2.28	1.69	1.15	1.03
R ²	0.3386	0.3329	0.3466	0.3196	0.2908	0.2551	0.3475
Students	570811	278726	292085	15731	44219	207945	302916
Countries	23	23	23	23	23	23	23

Table 33 – Results of cumulative grade retention in European countries. Samples of all students, by gender and by parents' highest education. Significance levels: *** 1%, ** 5% and * 10%.

Reading	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Retention	-47.95***	-71.97***	-38.38***	-74.91***	-41.56***	-70.58***
	3.99	2.75	1.05	0.95	0.92	0.99
R ²	0.2847	0.3141	0.3820	0.4317	0.3857	0.3272
Students	134030	125727	176178	134876	268002	302809
Countries	6	6	6	5	10	13
Mathematics	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Retention	-46.08***	-71.58***	-44.22***	-76.42***	-47.50***	-70.66***
	3.80	2.37	1.02	0.83	0.89	0.88
R ²	0.2815	0.3014	0.3818	0.4526	0.3842	0.3265
Students	134030	125727	176178	134876	268002	302809
Countries	6	6	6	5	10	13
Science	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Retention	-43.18***	-66.01***	-39.22***	-71.01***	-42.23***	-65.06***
	4.00	2.45	1.08	0.88	0.95	0.93
R ²	0.2846	0.2871	0.3839	0.4216	0.3830	0.3170
Students	134030	125727	176178	134876	268002	302809
Countries	6	6	6	5	10	13

Table 34 – Results of cumulative grade retention in European countries. Samples by quartile of retention rates and by early and late tracking countries. Significance levels: *** 1%, ** 5% and * 10%.

Reading	General	Boys	Girls	Primary	Lower	Upper	University
Primary	-50.44***	-49.44***	-52.00***	-40.75***	-41.83***	-49.47***	-56.71***
	0.73	0.99	1.06	1.42	1.41	1.36	1.38
Lower	-34.59***	-35.21***	-34.03***	-27.98***	-30.24***	-33.01***	-36.88***
	0.75	1.00	1.14	1.79	1.64	1.37	1.26
R ²	0.4452	0.4267	0.4534	0.3670	0.4078	0.3842	0.4077
N	1556714	754368	802346	87701	147774	504493	816746
Countries	63	63	63	63	63	63	63
Mathematics	General	Boys	Girls	Primary	Lower	Upper	University
Primary	-43.84***	-43.07***	-44.55***	-34.05***	-36.92***	-43.73***	-49.49***
	0.68	0.92	1.01	1.28	1.33	1.27	1.26
Lower	-31.29***	-31.95***	-31.46***	-26.18***	-26.42***	-30.39***	-33.38***
	0.71	0.94	1.08	1.58	1.57	1.27	1.17
R ²	0.4953	0.4884	0.5008	0.4063	0.4929	0.4255	0.4499
N	1556714	754368	802346	87701	147774	504493	816746
Countries	63	63	63	63	63	63	63
Science	General	Boys	Girls	Primary	Lower	Upper	University
Primary	-44.14***	-43.55***	-44.72***	-32.50***	-36.53***	-43.61***	-49.53***
	0.68	0.94	0.99	1.36	1.33	1.29	1.33
Lower	-31.23***	-31.70***	-30.90***	-24.54***	-27.42***	-30.51***	-32.15***
	0.70	0.94	1.06	1.67	1.56	1.26	1.21
R ²	0.4615	0.4564	0.4687	0.4079	0.4664	0.3891	0.4160
N	1556714	754368	802346	87701	147774	504493	816746
Countries	63	63	63	63	63	63	63

Table 35 – Results of grade retention at primary and lower secondary. Samples of all students, by gender and by parents' highest education. Significance levels: *** 1%, ** 5% and * 10%.

Reading	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Primary	-28.31***	-45.74***	-45.22***	-59.42***	-38.03***	-55.50***
	4.59	1.83	1.19	0.81	1.22	0.87
Lower	-47.19***	-46.00***	-23.79***	-39.51***	-19.99***	-39.98***
	5.39	1.83	1.68	0.74	1.35	0.86
R ²	0.3444	0.4115	0.4780	0.4678	0.5178	0.4063
N	337847	414288	470332	334247	426148	1130566
Countries	16	16	16	15	20	43
Mathematics	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Primary	-26.53***	-41.14***	-38.81***	-52.45***	-33.94***	-47.81***
	4.67	1.76	1.13	0.66	1.28	0.78
Lower	-38.18***	-43.59***	-22.43***	-35.89***	-18.51***	-36.00***
	5.23	1.81	1.63	0.63	1.45	0.76
R ²	0.3250	0.3766	0.5139	0.5612	0.5589	0.4608
N	337847	414288	470332	334247	426148	1130566
Countries	16	16	16	15	20	43
Science	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Primary	-22.79***	-43.11***	-40.29***	-51.28***	-34.05***	-47.94***
	4.78	1.74	1.14	0.69	1.16	0.82
Lower	-42.36***	-45.00***	-21.44***	-35.91***	-19.90***	-35.28***
	4.95	1.78	1.60	0.66	1.28	0.80
R ²	0.3173	0.3823	0.4852	0.4987	0.5207	0.4277
N	337847	414288	470332	334247	426148	1130566
Countries	16	16	16	15	20	43

Table 36 – Results for grade retention at primary and lower secondary. Samples by quartile of retention rates and by early and late tracking countries. Significance levels: *** 1%, ** 5% and * 10%.

Reading	General	Boys	Girls	Primary	Lower	Upper	University
Primary	-60.23***	-58.00***	-62.79***	-60.15***	-60.14***	-59.52***	-60.21***
	0.96	1.37	1.31	3.08	2.39	1.64	1.49
Lower	-41.28***	-42.33***	-40.15***	-47.78***	-38.97***	-40.14***	-43.39***
	0.87	1.20	1.24	2.51	2.10	1.52	1.36
R ²	0.3473	0.3262	0.3424	0.3460	0.3157	0.2749	0.3546
N	570811	278726	292085	15731	44219	207945	302916
Countries	23	23	23	23	23	23	23
Mathematics	General	Boys	Girls	Primary	Lower	Upper	University
Primary	-63.53***	-62.05***	-65.10***	-63.48***	-61.54***	-63.60***	-63.33***
	0.88	1.23	1.23	2.61	2.17	1.46	1.40
Lower	-43.84***	-44.91***	-43.08***	-48.68***	-41.08***	-43.42***	-46.06***
	0.80	1.09	1.16	2.37	1.93	1.40	1.26
R ²	0.3501	0.3429	0.3514	0.3634	0.3198	0.2682	0.3542
N	570811	278726	292085	15731	44219	207945	302916
Countries	23	23	23	23	23	23	23
Science	General	Boys	Girls	Primary	Lower	Upper	University
Primary	-56.94***	-55.81***	-58.09***	-58.48***	-55.10***	-56.27***	-57.15***
	0.94	1.35	1.28	2.92	2.36	1.60	1.46
Lower	-40.21***	-41.31***	-39.16***	-48.59***	-37.75***	-39.42***	-42.00***
	0.85	1.18	1.22	2.53	2.09	1.47	1.35
R ²	0.3406	0.3355	0.3480	0.3302	0.2967	0.2574	0.3487
N	570811	278726	292085	15731	44219	207945	302916
Countries	23	23	23	23	23	23	23

Table 37 – Results of grade retention at primary and lower secondary in European countries. Samples of all students, by gender and by parents' highest education. Significance levels: *** 1%, ** 5% and * 10%.

Reading	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Primary	-30.41***	-58.81***	-51.14***	-72.53***	-54.15***	-64.85***
	4.34	3.76	1.55	1.34	1.31	1.40
Lower	-72.36***	-59.59***	-25.01***	-53.93***	-26.99***	-53.02***
	7.67	3.45	1.50	1.06	1.32	1.12
R²	0.2858	0.3150	0.3835	0.4369	0.3876	0.3292
N	134030	125727	176178	134876	268002	302809
Countries	6	6	6	5	10	13
Mathematics	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Primary	-32.62***	-53.14***	-58.00***	-74.31***	-60.45***	-65.02***
	4.37	3.14	1.51	1.14	1.26	1.22
Lower	-61.18***	-62.22***	-30.24***	-55.48***	-32.61***	-53.70***
	6.54	3.06	1.47	0.92	1.29	0.98
R²	0.2823	0.3019	0.3838	0.4599	0.3866	0.3292
N	134030	125727	176178	134876	268002	302809
Countries	6	6	6	5	10	13
Science	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Primary	-27.02***	-53.91***	-51.70***	-67.70***	-54.39***	-58.47***
	4.59	3.27	1.62	1.22	1.35	1.31
Lower	-68.12***	-54.13***	-26.65***	-51.57***	-28.49***	-49.93***
	6.57	3.10	1.57	1.00	1.38	1.04
R²	0.2856	0.2877	0.3855	0.4257	0.3849	0.3186
N	134030	125727	176178	134876	268002	302809
Countries	6	6	6	5	10	13

Table 38 – Results for grade retention at primary and lower secondary in European countries. Samples by quartile of retention rates and by early and late tracking countries. Significance levels: *** 1%, ** 5% and * 10%.

Reading	General	Boys	Girls	Primary	Lower	Upper	University
Rep_Pri1	-48.82***	-47.58***	-50.64***	-38.58***	-40.28***	-48.48***	-55.13***
	0.76	1.05	1.11	1.50	1.45	1.43	1.45
Rep_Pri2	-64.90***	-64.33***	-66.59***	-55.83***	-55.98***	-60.54***	-71.15***
	1.94	2.48	3.04	3.39	4.25	4.03	3.42
Rep_Low1	-32.88***	-33.68***	-32.08***	-25.15***	-28.44***	-31.67***	-35.60***
	0.82	1.09	1.22	1.94	1.76	1.48	1.35
Rep_Low2	-41.81***	-40.53***	-44.73***	-38.49***	-38.09***	-39.34***	-41.64***
	1.61	2.02	2.68	3.61	3.59	3.01	2.79
R²	0.4454	0.4269	0.4536	0.3680	0.4082	0.3843	0.4079
N	1556714	754368	802346	87701	147774	504493	816746
Countries	63	63	63	63	63	63	63
Mathematics	General	Boys	Girls	Primary	Lower	Upper	University
Rep_Pri1	-42.60***	-41.42***	-43.80***	-31.09***	-35.67***	-42.65***	-48.38***
	0.72	0.97	1.06	1.46	1.40	1.33	1.33
Rep_Pri2	-54.77***	-56.13***	-52.38***	-42.23***	-48.38***	-55.87***	-58.67***
	1.68	2.15	2.70	2.59	3.48	3.71	3.08
Rep_Low1	-29.61***	-30.23***	-29.78***	-22.56***	-24.75***	-29.06***	-31.72***
	0.77	1.02	1.17	1.85	1.71	1.37	1.27
Rep_Low2	-39.11***	-38.79***	-41.72***	-32.03***	-34.05***	-36.39***	-42.02***
	1.47	1.88	2.32	3.01	3.08	2.77	2.49
R²	0.4954	0.4887	0.5009	0.4084	0.4931	0.4257	0.4500
N	1556714	754368	802346	87701	147774	504493	816746
Countries	63	63	63	63	63	63	63
Science	General	Boys	Girls	Primary	Lower	Upper	University
Rep_Pri1	-42.99***	-42.11***	-43.92***	-32.13***	-35.31***	-42.88***	-48.75***
	0.72	1.00	1.04	1.35	1.38	1.35	1.41
Rep_Pri2	-54.30***	-54.91***	-53.15***	-47.41***	-47.73***	-51.59***	-56.15***
	1.69	2.19	2.65	2.70	3.83	3.37	3.19
Rep_Low1	-29.72***	-30.28***	-29.35***	-24.12***	-25.69***	-29.11***	-31.12***
	0.76	1.02	1.14	1.71	1.70	1.36	1.32
Rep_Low2	-38.16***	-37.22***	-40.08***	-33.41***	-35.40***	-37.97***	-37.31***
	1.40	1.80	2.21	2.94	3.19	2.69	2.39
R²	0.4617	0.4566	0.4688	0.4070	0.4667	0.3892	0.4161
N	1556714	754368	802346	87701	147774	504493	816746
Countries	63	63	63	63	63	63	63

Table 39 – Results of being retained once or more at primary and lower secondary. Samples of all students, by gender, by parents' highest education. Significance levels: *** 1%, ** 5% and * 10%.

Reading	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Rep_Pri1	-26.92***	-45.35***	-44.54***	-57.14***	-37.05***	-53.72***
	4.76	1.88	1.22	0.85	1.25	0.92
Rep_Pri2	-35.08***	-47.18***	-52.31***	-72.97***	-46.49***	-71.10***
	13.37	6.65	4.37	1.99	4.46	2.01
Rep_Low1	-44.32***	-44.78***	-22.15***	-38.50***	-17.87***	-38.68***
	5.86	1.91	1.76	0.80	1.42	0.94
Rep_Low2	-54.63***	-54.27***	-38.75***	-42.92***	-34.43***	-44.08***
	13.09	5.36	5.36	1.61	3.82	1.73
R ²	0.3444	0.4115	0.4781	0.4682	0.5181	0.4065
N	337847	414288	470332	334247	426148	1130566
Countries	16	16	16	15	20	43
Mathematics	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Rep_Pri1	-25.42***	-41.99***	-37.86***	-51.24***	-32.79***	-46.63***
	4.87	1.80	1.16	0.71	1.31	0.83
Rep_Pri2	-30.46**	-29.88***	-48.55***	-59.60***	-43.47***	-58.06***
	13.68	6.49	3.96	1.58	4.26	1.70
Rep_Low1	-35.48***	-42.91***	-19.96***	-35.14***	-15.65***	-35.06***
	5.57	1.90	1.69	0.68	1.51	0.83
Rep_Low2	-46.75***	-52.39***	-45.36***	-38.66***	-38.71***	-39.22***
	14.32	5.22	4.85	1.45	3.84	1.54
R ²	0.3250	0.3766	0.5142	0.5613	0.5593	0.4609
N	337847	414288	470332	334247	426148	1130566
Countries	16	16	16	15	20	43
Science	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Rep_Pri1	-22.21***	-43.29***	-39.86***	-49.54***	-33.42***	-46.65***
	5.08	1.77	1.18	0.73	1.20	0.87
Rep_Pri2	-23.74**	-39.65***	-43.12***	-61.61***	-38.73***	-59.20***
	11.39	6.67	3.74	1.73	3.74	1.83
Rep_Low1	-40.62***	-44.38***	-19.71***	-35.05***	-17.89***	-34.18***
	5.13	1.86	1.67	0.71	1.35	0.88
Rep_Low2	-48.88***	-50.66***	-39.51***	-38.91***	-34.69***	-39.16***
	14.37	5.20	4.80	1.37	3.52	1.51
R ²	0.3173	0.3823	0.4853	0.4990	0.5209	0.4278
N	337847	414288	470332	334247	426148	1130566
Countries	16	16	16	15	20	43

Table 40 – Results of being retained once or more at primary and lower secondary. Samples by quartile of retention rates and by early and late tracking countries. Significance levels: *** 1%, ** 5% and * 10%.

Reading	General	Boys	Girls	Primary	Lower	Upper	University
Rep_Pri1	-58.95***	-56.23***	-62.12***	-58.06***	-58.71***	-58.27***	-59.47***
	0.99	1.41	1.33	3.18	2.47	1.66	1.53
Rep_Pri2	-77.44***	-79.23***	-73.64***	-85.61***	-80.16***	-81.82***	-68.06***
	3.58	4.75	4.98	8.34	6.77	7.17	5.61
Rep_Low1	-40.19***	-41.40***	-38.99***	-46.64***	-36.85***	-38.90***	-42.76***
	0.90	1.23	1.27	2.60	2.17	1.56	1.40
Rep_Low2	-51.82***	-48.01***	-56.82***	-58.94***	-58.36***	-55.39***	-49.29***
	2.97	4.02	4.14	6.48	6.25	5.74	4.85
R²	0.3475	0.3265	0.3425	0.3475	0.3166	0.2751	0.3547
N	570811	278726	292085	15731	44219	207945	302916
Countries	23	23	23	23	23	23	23
Mathematics	General	Boys	Girls	Primary	Lower	Upper	University
Rep_Pri1	-62.78***	-60.98***	-64.79***	-62.61***	-60.77***	-62.56***	-63.18***
	0.89	1.25	1.26	2.72	2.24	1.46	1.43
Rep_Pri2	-72.98***	-74.53***	-68.75***	-73.45***	-71.69***	-81.32***	-64.61***
	3.72	5.01	5.18	6.15	7.21	7.81	5.86
Rep_Low1	-43.06***	-44.27***	-42.19***	-47.60***	-39.61***	-42.21***	-45.88***
	0.82	1.12	1.19	2.46	2.00	1.42	1.29
Rep_Low2	-52.15***	-49.43***	-56.73***	-60.60***	-55.06***	-59.29***	-48.17***
	2.88	3.83	4.28	5.76	5.60	5.80	4.83
R²	0.3502	0.3430	0.3515	0.3640	0.3202	0.2685	0.3542
N	570811	278726	292085	15731	44219	207945	302916
Countries	23	23	23	23	23	23	23
Science	General	Boys	Girls	Primary	Lower	Upper	University
Rep_Pri1	-55.83***	-54.24***	-57.61***	-57.17***	-53.93***	-54.66***	-56.84***
	0.96	1.38	1.31	3.05	2.44	1.59	1.51
Rep_Pri2	-72.60***	-75.58***	-65.54***	-74.58***	-71.24***	-85.70***	-61.22***
	3.66	4.89	5.02	6.07	7.29	8.30	5.40
Rep_Low1	-39.39***	-40.67***	-38.25***	-48.10***	-35.94***	-38.02***	-41.82***
	0.88	1.21	1.25	2.62	2.16	1.49	1.39
Rep_Low2	-47.44***	-43.71***	-52.41***	-52.88***	-54.49***	-55.65***	-42.96***
	3.11	4.19	4.45	6.16	5.86	6.35	5.19
R²	0.3407	0.3357	0.3480	0.3307	0.2974	0.2577	0.3487
N	570811	278726	292085	15731	44219	207945	302916
Countries	23	23	23	23	23	23	23

Table 41 – Results of being retained once or more at primary and lower secondary in European countries. Samples of all students, by gender, by parents' highest education. Significance levels: *** 1%, ** 5% and * 10%.

Reading	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Rep_Pri1	-29.81***	-59.61***	-49.88***	-71.15***	-52.74***	-63.79***
	4.43	3.87	1.59	1.37	1.34	1.43
Rep_Pri2	-28.92**	-55.55***	-73.09***	-92.60***	-75.85***	-78.20***
	15.51	13.19	6.33	4.96	4.47	5.46
Rep_Low1	-68.23***	-60.65***	-23.99***	-52.86***	-26.05***	-52.07***
	8.75	3.52	1.54	1.09	1.36	1.15
Rep_Low2	-93.73***	-53.40***	-35.06***	-66.20***	-35.13***	-61.93***
	14.61	12.21	6.06	3.41	5.16	3.60
R²	0.2858	0.3150	0.3837	0.4374	0.3878	0.3294
N	134030	125727	176178	134876	268002	302809
Countries	6	6	6	5	10	13
Mathematics	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Rep_Pri1	-32.76***	-56.15***	-57.07***	-73.24***	-59.43***	-64.60***
	4.45	3.21	1.53	1.15	1.29	1.24
Rep_Pri2	-17.19	-35.39***	-73.49***	-89.87***	-75.79***	-69.40***
	15.07	10.64	7.06	5.07	4.90	5.54
Rep_Low1	-57.60***	-64.43***	-29.36***	-54.68***	-31.85***	-53.15***
	7.23	3.20	1.50	0.94	1.32	1.00
Rep_Low2	-91.36***	-52.85***	-39.73***	-64.63***	-39.91***	-59.71***
	14.34	9.03	6.67	3.22	5.66	3.20
R²	0.2824	0.3020	0.3839	0.4603	0.3867	0.3292
N	134030	125727	176178	134876	268002	302809
Countries	6	6	6	5	10	13
Science	Rates Q1	Rates Q2	Rates Q3	Rates Q4	Track	Untrack
Rep_Pri1	-26.84***	-55.18***	-50.36***	-66.53***	-53.04***	-57.63***
	4.70	3.42	1.65	1.24	1.38	1.34
Rep_Pri2	-13.99	-47.58***	-76.43***	-85.23***	-75.81***	-69.59***
	14.60	9.95	7.32	4.92	5.07	5.32
Rep_Low1	-63.24***	-55.44***	-25.77***	-50.86***	-27.73***	-49.29***
	7.22	3.29	1.59	1.02	1.40	1.07
Rep_Low2	-102.69***	-47.26***	-33.87***	-59.07***	-34.10***	-55.42***
	14.13	8.55	7.12	3.44	6.07	3.43
R²	0.2857	0.2877	0.3857	0.4261	0.3851	0.3186
N	134030	125727	176178	134876	268002	302809
Countries	6	6	6	5	10	13

Table 42 – Results of being retained once or more at primary and lower secondary in European countries. Samples by quartile of retention rates and by early and late tracking countries. Significance levels: *** 1%, ** 5% and * 10%.