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INTERGENERATIONAL MOBILITY IN EDUCATION IN GREECE: AN EXPLORATION INTO SOCIOECONOMIC DETERMINANTS OF STUDENTS' PERFORMANCE

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Intergenerational Mobility in Education in Greece: An Exploration into Socioeconomic Determinants of Students' Performance and Future Career Plans Before, During and After the Crisis

August 2023

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Abstract

Education plays a central role in social mobility. Using data from the OECD's PISA program, this paper sheds light on: (i) the role of socioeconomic status on the cognitive performance and future plans of Greek high-school students, (ii) intertemporal trends in light of the recent economic crisis and, iii) differences with other countries on the effect of socioeconomic and other drivers on intergenerational educational mobility. We find large and significant associations between student outcomes and educational resources at home, cultural possession at home, parental emotional support and private school attendance. Parental education and occupation effects are also important but differ by domain and between parents. The association between basic socioeconomic characteristics and adolescent educational performance is significant and rather stable before, during, and after the Greek economic crisis, which points to the need to produce a coherent strategy against educational disparities according to the socioeconomic status.

Keywords: intergenerational mobility, social mobility, education, inequality, PISA, Greece.

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1 Introduction

Education plays a central role in social mobility. Educational attainment is closely associated with a multiplicity of outcomes including employment status, profession selection, income, living standards and general well-being.

In this research paper we use data from the OECD's Program for International Student Assessment (known as the PISA program) in order to shed light on the role of socioeconomic status and other factors on the cognitive performance and aspirations of Greek high-school students. This work aims to contribute to the public discourse on Greece's educational system and to provide insights on possible ways to improve it, in order to achieve more equal life prospects for all adolescent children in Greece, irrespective of their socioeconomic characteristics and background.

Across the EU, a strong parent-to-child transmission of socioeconomic position is observed which includes the educational aspect. A person with at least one parent having achieved higher education is 43% more likely to reach higher education himself/herself compared to a person whose parents are less educated (d' Hombres et al., 2020). Such statistics help explain widespread negative perceptions about fairness, with 41 percent of European citizens not agreeing that they enjoy equal opportunities in life (European Commission, Eurobarometer 471).

In Greece, both the secondary and tertiary educational systems are believed to have for decades functioned as mechanisms of, mainly upward, intergenerational social mobility, improving social position and living standards across generations. The main reason is that they opened up relatively quickly to students of lower socioeconomic background and supported social mobility for long periods (Tsoukalas, 1977; Frangkoudaki, 1985; IOBE, 2017). For this reason, free-of-charge access to education is broadly considered to be part of the Greek social acquis. But despite these equitable characteristics of the Greek educational system, the intergenerational transmission of social advantage or disadvantage persists, as in most countries around the world.

In fact, evidence suggests that there is a potential tension between the "democratic" and "social reproduction" functions of the Greek educational system (Maloutas et al., 2013). Access to university studies is free-of-charge, but also exams-based. This implies that school-related performance can be a proxy for admission to university faculties, but also for broader capabilities that could affect career trajectories and life chances.

From an equity perspective, problems arise if performance is systematically distributed across the student population according to socioeconomic characteristics, such as household wealth or parental education and occupation. Adolescents from disadvantaged households would then face unequal chances in continuing their education at the tertiary level, in being admitted into prestigious faculties and in their future prospects compared to their more advantaged counterparts. Inequality would then be perpetuated and intergenerational mobility compromised, starting as early as adolescence.

The literature on the various determinants of student performance as captured by PISA scores has been prolific. It mostly examines socioeconomic inequality in student achievement either at the student or at the school level.

Starting from inequality at the student level, authors often focus on the relationship between student socioeconomic status (SES) or background and PISA performance. In the PISA context, the former is measured by the index of Economic, Social and Cultural Status (ESCS) which is

the most used variable in PISA-related analyses and reports, just after student achievement scores (Avvisati, 2020). It is comprised by parental education, parental occupation status, household consumption and the possession of durable goods (which is used as a proxy of household living standards), educational resources and cultural goods. Furthermore, school characteristics (sometimes referred to as "school SES" and reflecting properties such as school type) may also be associated with student performance. Oppedisano & Turati (2011) used data from the 2000 and 2006 surveys and examined inequalities in scores across EU member states. Their decomposition analysis concluded that the inequality reflected both student and school characteristics with inequalities being present in both years and all countries. Fonsecaa et al. (2011) compare Portuguese students' performance in PISA 2006 with that of students from Spain, France, the United Kingdom, Turkey, Greece, and the USA. They find that the school-wide SES effect is superior to that of student SES and is a performance factor for all countries with the exception of Finland.

A more recent study (Sulis et al., 2020) examined inequality in student performance in fifteen EU countries using data from 5 PISA survey years and found a low degree of association between PISA scores and student SES. A possible explanation is that often traditional SES measures are not the most suitable to explain differences in school performance while some non-traditional indicators of SES (such as the home environment) may exhibit a stronger relation to academic achievement (White, 1982). Findings from other studies establish stronger links between school performance and student SES. For example, children from disadvantaged backgrounds have been found to be much less likely to develop the advanced cognitive skills required to enter a high-status university (Jerrim, 2014), while parental education has also been identified as an important determining factor of school performance and access to tertiary education in both OECD and non-OECD countries (Barra & Boccia, 2019; Ermisch & Pronzato 2010). One study suggests that maternal education has a larger effect among less educated parents, while the father's effect is larger among better educated parents and that the effect of maternal education is larger for daughters than for sons (Ermisch & Pronzato 2010).

Another much-cited study (Martins & Veiga, 2010) measures and decomposes socioeconomic-related inequality in mathematics achievement in 15 EU member states using data from the 2003 PISA wave. Findings suggest that there is socioeconomic-related inequality in mathematics achievement, favouring the higher socioeconomic groups in each country. There are important differences among countries. The inequality was higher in Germany, Greece, the UK, Belgium, and Portugal and was lower in Sweden and Finland. Barra & Boccia (2019) find that in both OECD and non-OECD countries, performance at the school level is positively driven by student fees, the presence of girls and computers during 2000-2012. Hippe et al. (2018) use both student and school-level characteristics to explain the variation of performances across regions in Italy and Spain. By employing an Oaxaca-Blinder type decomposition, they find that SES, the students' expected occupation, learning outside school time, truancy and immigrant status matter for within-country differences. Another study (Freeman et al., 2011) uses the PISA mathematics tests from 2000 to 2009 to find that the average test scores are higher in countries with the lowest inequality in scores.

Socioeconomic inequalities in student performance and plans based on student SES should reflect the intergenerational transmission of social advantage or disadvantage, even if these effects are not directly linked to the notion of social mobility in the relevant literature. This is because higher or lower scores can be used as a proxy for higher or lower cognitive performance and skills that inter alia have an effect on access to and choice of tertiary education options. The question is if and how much these outcomes vary with the students'

relative position in the socioeconomic hierarchy based on parental and household characteristics so that the transmission of socioeconomic position can be observed and measured within the context of Greece's educational system. Students' beliefs and aspirations are also very important in terms of their future career path, income and general well-being but this information is rarely exploited in similar studies.

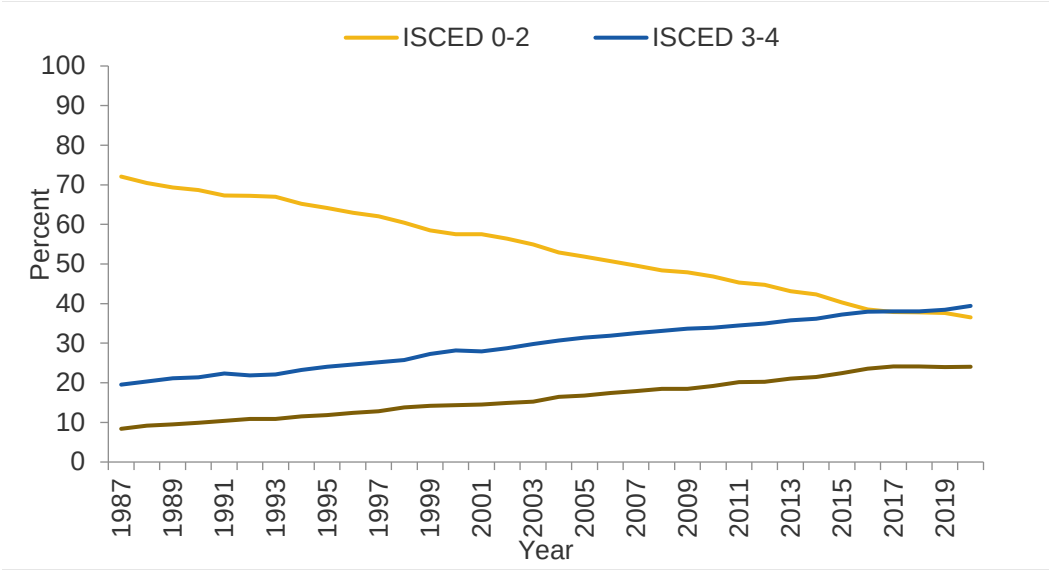
The paper sheds light on these questions by exploring the socioeconomic variation in Greek high-school students' outcomes in a more coherent and systematic way. This is done by assessing effects for a wide range of student outcomes (student performance in all available PISA domains as well as variables on career aspirations) in an intertemporal context covering almost two decades (entire range of available PISA surveys) as well as in comparison with other OECD and EU countries while also controlling for other relevant factors at the individual, household and school level.

Using a series of regression analyses, we document large and significant associations between student outcomes and certain elements of socioeconomic and parental background that seem to matter for children most: educational resources at home, cultural possessions at home and parental emotional support. We find that parental socioeconomic position appears to be channelled to children through such cultural and emotional channels in addition to private school attendance throughout the models examined. Parental education and occupation effects are also important but differ by domain and between parents. Other characteristics that are found to be significantly associated with student outcomes include immigration status, gender, bullying and school type (public versus private). We also find that these correlations are present, statistically significant and broadly stable across PISA survey years and that, while Greek students have been systematically underperforming in PISA tests, Greece is not an outlier in terms of the relationship between ESCC, immigration status, school type on one hand and PISA performance on the other.

2 The Greek education system and social mobility

Since the 1980s, secondary and tertiary education in Greece have expanded considerably. In particular, the share of the population aged 25-74 with less than primary, primary or lower secondary education (ISCED 0-2) fell from 72% in 1987 to 37% in 2020, while correspondingly the share of tertiary education graduates increased from 9% to 24% over the same period (Figure 1). Greece now has the highest enrolment rates in bachelor's programs among individuals aged 19-24 years in the OECD (OECD, 2019). This expansion is believed to have played a key role in boosting upward intergenerational mobility in education and Greece is often perceived as exhibiting a high rate of intergenerational mobility in education compared to peers (defined as the percentage of individuals having achieved a higher level of education than their parents).

Figure 1. Trends in educational attainment for those aged 25-74 in Greece, 1987-2020



Source: ELSTAT Labour Force Survey (authors' calculations).

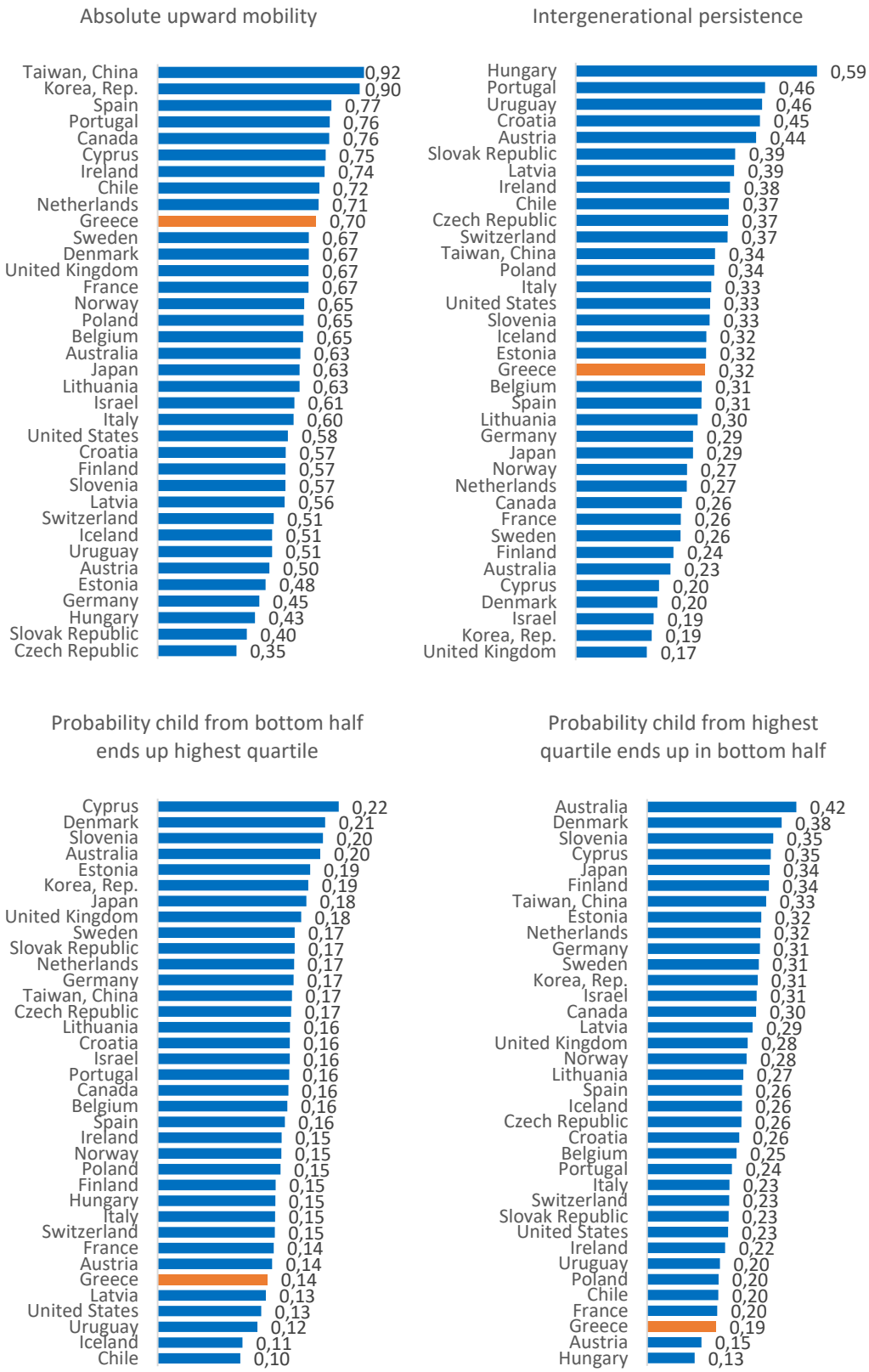
Indeed, the probability that children born in the 1980s in Greece have a higher education attainment level than the highest level of their parents is 70%. Based on this indicator, Greece ranks 10th among 36 high-income economies featured in the Global Database for Intergenerational Mobility (GDIM) of the World Bank (Figure 2).

However, the country's performance is more modest in terms of the intergenerational persistence indicator. The latter measures the estimated impact of one additional year of schooling of parents on the years of schooling of their children. For the 1980s cohort in Greece, an additional year of schooling of the parent adds on average 0.32 years of additional schooling to the child. Based on this indicator, Greece is placed right in the middle of the ranking of high-income economies (18th place).

The better schooling of each generation compared to their parents' generation, due to the expansion of the education system, seems to have had relatively little effect on mobility across the distribution quantiles and by extension on inequality. In particular, the probability that a child with parents from the bottom half of the educational attainment distribution moves to the top quantile for the 1980s cohort is limited to 14% in Greece, while the probability of a child with parents from the top quantile moving to the bottom half is estimated at 19%. Based on these two mobility indicators, Greece ranks 31st and 34th respectively, among the 36 high-income economies featured in GDIM.

Despite successive changes in the procedures ensuring admission to tertiary education in Greece, the main values governing the system have remained broadly unchanged: access to tertiary education is performance-based but typically open with no requirement for tuition fees. However, various barriers to equitable access exist and several studies, using different data and approaches, provide further indications that the transmission of social advantage or disadvantage through the education system is rather persistent in Greece.

Figure 2. Intergenerational education mobility indicators, 1980s child cohort, high-income economies.



Source: Global Database on Intergenerational Mobility (2020), World Bank

To begin with, individuals originating from families of professionals have significantly higher rates of access to higher education (Thanos, 2011; Kontogiannopoulou-Polydorides, 1999). Highly-demanded faculties (such as Medicine, Law and Engineering) have been found to be mostly covered by upper and upper-middle strata and thus procure a higher rate of endogenous reproduction compared to other faculties and occupations. In contrast, faculties with less promising career prospects are mainly attended by students from lower and lower-middle strata, making it harder for them to improve their relative social position within their generation, despite the absolute improvement compared to their parents' educational achievements (Maloutas, 2015; Panayotopoulos, 2000; IOBE, 2019).

In addition to the above, the lengthening of educational trajectories is gradually becoming more of a prerequisite in order to avoid exclusion from the job market (Maloutas, 2015). Hadjiyanni and Valassi (2009) argue that the expansion of tertiary education options in Greece has shifted inequality to higher educational levels such as postgraduate programs (often requiring tuition fees) and doctorates. Also, while earnings and the probability of finding a job increase with the education attainment level, the relation is much stronger in the public sector. In private sector jobs, the difference in the probability of finding a job is limited for education attainment levels lower than a master's degree. In addition, post-secondary non-tertiary education does not appear to improve the chances of employment, compared to the upper secondary level (IOBE, 2018). Last but not least, the Greek educational system operates in a state of isolation from the actual needs of the economy and the labour market (Vettas, 2017).

Other important barriers to equitable access arise from household payments for private education services such as afternoon tutorials preparing students for the final national exams ensuring admission to tertiary education. Private tutorials are also becoming increasingly prevalent amongst younger students (in primary and lower secondary education) as there is a widespread perception that the average quality of lessons offered in public schools does not suffice or that students need additional help in coping with school obligations.[2] In addition, private household expenditure for private foreign language lessons is also very high and prevalent amongst households with children in Greece. As a result of these private arrangements, inequality with respect to educational and career prospects depending on the students' socioeconomic background increases further. At the same time, the public educational system is essentially deprived of incentives to improve the quality of the services it provides.

3 Data, variables and methods

For the purposes of this study, we use the full available range of microdata of the OECD's Program for International Student Assessment (PISA) from 2000 to 2018. The latter is a worldwide survey developed by the OECD in both member and non-member countries. Its main objective is to measure and compare on a cross-country basis 15-year-old student cognitive performance in three fields of literacy: Mathematics, Reading and Science.

[2] It is estimated that households with children in lower and upper secondary education annually spent over EUR 900 million (0.5% of GDP) for private lessons amidst the crisis (in 2016)- excluding private school tuition fees. For students attending primary education the largest share of household expenditure for education services concerns foreign language lessons. For students attending secondary education it concerns afternoon lessons providing supplementary schooling support (IOBE, 2019).

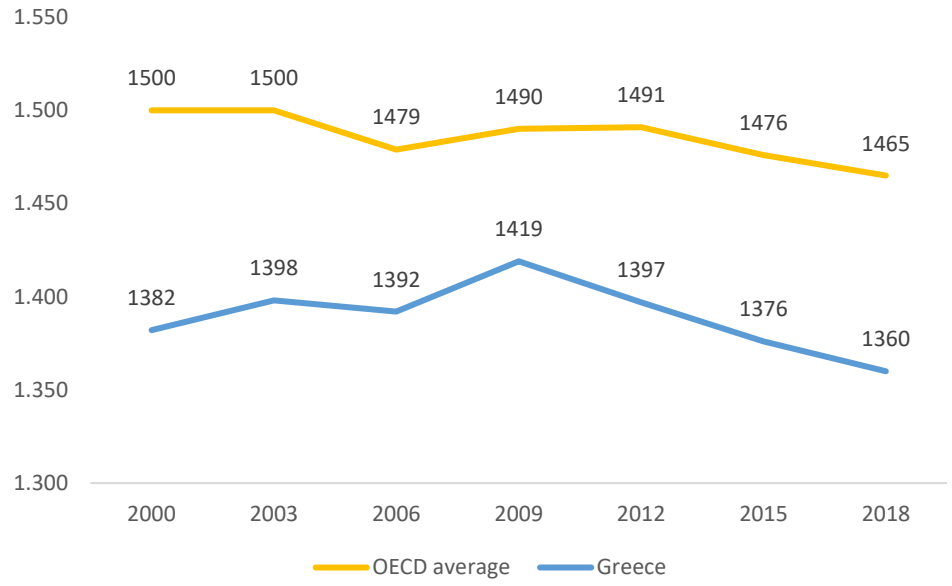
The Program's database also contains rich information at the student, household and school level collected through various questionnaires. It aims at providing policy-makers with comparable data so as to help countries improve their education policies and outcomes, through global cooperation and international benchmarking based on a common measuring scale.

The fist PISA Survey was conducted in 2000 and the survey has been taking place every 3 years ever since. Greece was one of the 43 countries participating in the program from the start. In 2018, the sample contained approximately 600,000 observations from 80 countries, while the Greek sample consisted of 6,403 observations.

The two main sources of the PISA microdata are the Tests and the Questionnaires. The tests are usually computer based and examine the ability of the student in the 3 domains mentioned previously. The Questionnaires seek information about students' attitudes, plans, dispositions and beliefs, their demographic characteristics, their socioeconomic status (SES), their health and well-being, their school learning experiences and expectations for further education. Information is also collected at the school level (filled in by principals and teachers) regarding school characteristics and the broader learning environment. Even though the dataset is very rich, country-specific data gaps can be observed and not all of the variables mentioned above are available for every country participating in the program as not all countries implement all modules of the questionnaires.

Greek students' PISA performance has been systematically lagging the OECD average during the entire 2000-2018 period. Figure 3 compares the sum of Greece's mean scores in the 3 main literacy areas to the OECD average. While some mild convergence was recorded during the first decade, this was offset by some mild divergence of similar magnitude during the second decade. The 2021 scores are uncertain, as the global pandemic and the lockdowns of 2020-2021 affected teaching practices, societies and economies across OECD and non-OECD countries.

Figure 3. Sum of mean PISA scores (Mathematics, Reading and Science), Greece vs. OECD average, 2000-2018.



Source: OECD

PISA findings have challenged deeply embedded educational practices across participating countries. In Greece, policy responses to the PISA outcomes during 2013-2019 included the reduction of the number of substitute adjunct teachers by hiring permanent teaching staff, efforts to increase the quality of education services and the improvement of the criteria for teachers' selection. A more recent policy initiative in response to Greece's poor performance in the 2018 survey,[3] is the design and launch of the "Greek version of PISA" in May 2022.[4]

In terms of methodology, we employ multivariate regression techniques as the main tool for exploring the existence and magnitude of relationships between socioeconomic and other characteristics, on one hand, and educational outcomes and future plans, on the other. In particular, we use Ordinary Least Squares (OLS) to regress plausible values of education performance per student on socioeconomic characteristics, such as household wealth, possession of cultural and educational resources, education and occupation of parents and immigrant status, controlling for demographic (age in months, sex), school (such as class size, computer infrastructure, cultural activities) and other characteristics (such as self-reported support from teachers and parents). Using the same explanatory variables, we use logistic regressions to examine their relations with binary constructs on the students' aspirations to enter university education and work as managers or highly paid professionals (such as doctors, lawyers, architects or engineers). Lastly, we explore the relation between aspirations and student performance through a set of linear regressions.

In greater detail, we estimate the following relation:

$$y_i = \alpha + \beta X_i + \gamma Z_i + \varepsilon_i \quad (1)$$

where y_i is a vector of student outcomes for individual *i* (plausible values of PISA scores or aspiration variables), X_i is a vector of variables for individual *i* that capture socioeconomic characteristics related to social mobility (such as parent education, occupation and wealth), Z_i is a vector of control variables for individual *i* that capture demographic and other characteristics that might be related to student performance (such as age, sex and class size), ε_i is the error term of the regression (i.e. the difference between the actual and the predicted values of the student outcomes), while α, β, γ are the coefficients estimated by the regression.

Starting with student outcomes, we employ two sets of variables (Table 1). The first set includes the students' performance (PISA scores) in the three (3) traditional domains available across all PISA survey years (Reading, Mathematics and Science). In addition, we also use the scores from the Global Competence domain introduced for the first time in the latest (2018) survey. This novel domain is a multi-dimensional construct and, according to the OECD, student scores measure the "students' capacity in examining local, global and intercultural issues, to engage in open, appropriate and effective interactions with people from different cultures, and to act for collective well-being and sustainable development".[5]

[3] Greece ranked 42nd in Reading, 43rd in Math and 44th in Science, amongst 80 countries.

[4] The plan is that the test will be repeated annually with a representative sample of up to 6,000 elementary and up to 6,000 high school students, (12 and 15-year-olds) who will be mandatorily examined in modern Greek and mathematics. Up to 600 school units of all types will participate throughout the country.

[5] Scores on all four domains (Reading, Mathematics, Science and the 2018 Global Competence score) are scaled to account for cross-country differences in the national tests so that the OECD average in each domain is close to 500. Scaling is performed using the Rasch model (an item response theory- IRT model) and are reported in the PISA datasets in the form of so-called plausible values which produce more unbiased estimates for differences between groups. More information on the PISA sampling and methodology can be found in the methodology section.

The second set of outcome variables capture students' aspirations for the future. Specifically, we employ three (3) binary variables measuring (i) whether the student expects to complete ISCED level 6 or above, (ii) whether the student plans to work as a manager or a highly paid professional, such as a medical doctor, a lawyer, an engineer or an architect (as per the International Standard Classification of Occupations) at the age of 30 and, (iii) whether the student plans to be working or studying in 5 years from the time of the interview.

Table 1. Student outcome (dependent) variables employed in the analysis and descriptive statistics for Greece, 2000-2018

Dependent variable	2000	2003	2006	2009	2012	2015	2018
PISA score in Global Competence (GLCM)[1]	-	-	-	-	-	-	487.9
PISA score in Reading (READ)[1]	442.4	444.4	459.2	466.1	453.0	453.6	451.4
PISA score in Mathematics (MATH)[1]	442.4	472.3	459.7	480.5	477.2	467.0	457.4
PISA score in Science (SCIE)[1]	460.6	481.0	473.4	470.1	466.7	454.8	451.6
Student aims to pursue Higher Education (HE)[2]	-	64.5%	-	-	-	76.8%	74.4%
Student aims to be Studying and not Working in 5 years (SW)[2]	-	-	-	-	-	-	59.5%
Student aims to pursue high-level career (HP)[2,3]	17.3%	19.0%	16.9%	-	-	23.3%	23.4%
Total sample of students	4,672	4,627	4,873	4,969	5,125	5,532	6,403

Notes: [1] Mean score. [2] Percentage of respondents.[3] For the purposes of this analysis, we define as "high-level" a career in the following occupations (ISCO codes in parenthesis): managers (1000-1439), engineers (2140-2153), architects, planners, surveyors and designers (2160-2166), medical doctors (2210-2212), veterinarians (2250), dentists (2261) and legal professionals (2610-2619).

Regarding factors that may be associated with the aforementioned student outcomes, the PISA survey includes rich information at the individual (student), household and school level. At the student and household level, our focus is on socioeconomic variation in performance and aspirations as well as on intergenerational mobility and transmission, so variables such as parental occupation, education and household resources are most central to our analysis (vector X_i in equation 1). Results based on these factors should reflect the intergenerational transmission of educational, and thus social, advantage or disadvantage from parents to students participating in the survey while controlling for other potentially important factors. As per the latter, we use school-level variables reflecting their infrastructure and resources (often referred to as "school SES").

We also employ other variables that may exhibit a strong association with student outcomes and aspirations such as gender, residence area/geographic location, immigrant status, bullying and parental emotional support (vector Z_i in equation 1). These variables need to be controlled for, in addition to being quite interesting from an interpretation perspective. The selected set of socioeconomic and other characteristics is summarised in Table 2 along with a selected basic descriptive statistic (mean or frequency) for each for the PISA waves 2000-2018.

Table 2. Student, household and school (independent) variables and descriptive statistics for Greece, 2000-2018.

Independent variable	2000	2003	2006	2009	2012	2015	2018
Demographics							
Sex, male, in % of respondents	50.2%	48.3%	50.3%	49.1%	49.5%	52.0%	50.7%
Age, mean (in years of age)	15.70	15.69	15.72	15.71	15.72	15.71	15.70
Duration of early childhood education (ECEC), % of respondents with less than 3 years	-	-	-	-	-	62.8%	61.3%
ESCS related variables							
Index of Economic, Social and Cultural Status (ESCS), mean	-0.114	-0.150	-0.153	-0.023	-0.065	-0.078	-0.110
Home possessions (HOMEPOS), mean index value	-	-0.097	-0.439	-0.157	-0.215	-0.271	-0.232
Home educational resources (HEDRES), mean index value	-0.365	-0.385	-0.617	0.158	-0.150	-0.157	-0.140
Cultural possessions at home (CULTPOSS), mean index value	0.200	0.234	0.026	0.402	-0.016	0.029	0.125
Family wealth (WEALTH), mean index value	-0.452	-	-0.286	-0.303	-0.257	-0.309	-0.327
Paternal education (FISCED), % of fathers without tertiary education	46.7%	67.1%	65.2%	61.8%	60.0%	56.0%	52.3%
Maternal education (MISCED), % of mothers without tertiary education	45.7%	73.1%	69.2%	63.7%	59.2%	54.8%	49.0%
Highest parent education (HISCED), % of both parents without tertiary education	32.5%	58.5%	55.9%	50.7%	47.4%	42.1%	37.2%
Paternal occupation (ISCOF), % of fathers with high-level occupation[1]	20.5%	18.9%	25.4%	21.1%	10.6%	11.0%	13.8%
Maternal occupation (ISCOM), % of mothers with high-level occupation[1]	8.8%	6.7%	11.5%	10.4%	5.2%	6.9%	7.5%
Immigrant status (IMMIG)							
Native, in % of respondents	95.2%	92.6%	92.5%	91.0%	89.4%	89.3%	88.3%
First generation immigrants, in % of respondents	4.3%	0.6%	6.4%	6.1%	6.3%	3.8%	3.2%
Second generation immigrants, in % of respondents	0.5%	6.9%	1.2%	2.9%	4.3%	7.0%	8.5%
Degree of urbanization (STRATUM)							
Rural areas, % of respondents	4.8%	4.1%	6.4%	5.9%	8.2%	7.3%	7.9%
Suburban areas, % of respondents	16.4%	15.2%	18.4%	25.1%	20.2%	19.5%	22.1%
Urban areas, % of respondents	78.8%	80.7%	75.3%	69.0%	71.6%	73.2%	70.0%
School/educational system							
School type (SCHLTYPE), % of respondents in private school	4.1%	2.6%	5.1%	3.4%	2.3%	4.2%	5.0%
Class size (CLSIZE), % of respondents in class of up to 25 students	-	-	41.8%	-	68.5%	85.0%	80.4%
Creative extra-curricular activities (CREACTIV), % of	-	-	-	-	-	18.6%	17.0%

Independent variable	2000	2003	2006	2009	2012	2015	2018
respondents not following any such activities							
Computer availability/connectivity at school, per students (RATCMP), mean value	0.052	0.085	0.005	0.217	0.244	0.248	0.239
Support variables							
Perceived teacher's interest (TEACHINT), mean value of index	-	-	-	-	-	-	-0.225
Thinking of past two Greek language lessons: The teacher showed enjoyment in teaching, % of respondents who agreed or agreed strongly	-	-	-	-	-	-	65.0%
Perceived parents' emotional support (EMOSUPS), mean value of index	-	-	-	-	-	-0.007	-0.040
Thinking about the current academic year: My parents support my educational efforts and achievements, % of respondents who agreed or agreed strongly	-	-	-	-	-	92.8%	86.6%
Student's experience of being bullied (BEINGBULLIED), mean value of index	-	-	-	-	-	-	0.006
During the past 12 months, how often: Other students made fun of me, % of students responding at least a few times a month	-	-	-	-	-	10.0%	16.9%

Note: [1]For the purposes of this analysis, we define as "high-level" the following occupations (ISCO codes in parenthesis): managers (1000-1439), engineers (2140-2153), architects, planners, surveyors and designers (2160-2166), medical doctors (2210-2212), veterinarians (2250), dentists (2261) and legal professionals (2610-2619).

Regarding the estimation approach, point estimates based on PISA data can be derived with standard statistical and econometric techniques, using the sample weights provided in the dataset. However, the PISA survey has a complex test and sampling design, which complicates the estimation of standard errors and thus the inference when testing for the statistical significance of the results (Caro & Biecek, 2017). In particular, the assumption underlying standard inference techniques that the observations are independent is not substantiated, given first that the student sample is drawn randomly from a sample of schools (two-stage sampling), and second the fact that students within a school tend to have similar socioeconomic and other characteristics. The complex sample design of PISA creates sampling variation that need to be taken into account in the estimations.

In addition, PISA uses a rotated test design where test items are clustered in a way that allows comparability of the results across students, even though each student answers a relatively small subset from the otherwise very extensive pool of test items. While the results are comparable across students, this procedure generates imputation variance around the plausible values that are used as indicators of student performance, which should also be taken into account in the estimation of the standard error.

In order to take into account the sampling and imputation variations that come from the sample and testing design of PISA, in our econometric estimations we employ the **instvy** package (Caro & Biecek, 2017). It is developed with the aim to take explicitly into account the

sampling and imputation variation of PISA and other large international assessment surveys and is recommended by the OECD for users of the R software (R Core Team, 2022). It estimates linear and logistics models, generating the appropriate standard errors, yet a key limitation is that (at the time of preparation of this analysis) it does not extend to other useful for our analysis techniques, such as instrumental variables estimation.

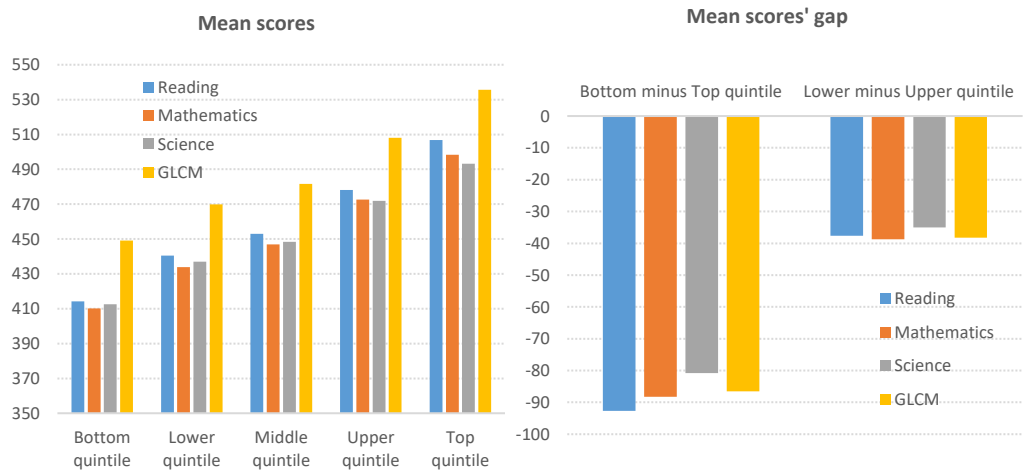
4 Results

4.1 Inequalities in students' outcomes and future life plans (Greece)

In this first section we focus on inequalities in student outcomes and aspirations in Greece based on the results of the latest (2018) PISA survey. After briefly examining some descriptive results, we then proceed to the outputs from the multivariate OLS regressions for PISA scores (4 models) and logistic regressions for students' aspirations (3 models). Intertemporal trends and comparisons with other countries are presented in the sections that follow.

Starting from the available descriptive evidence, socioeconomic gradients can be observed across all PISA domains in 2018. In particular, performance in PISA tests is higher for Greek students stemming from more favourable ESCS backgrounds, across all four subjects (Figure 4). The largest performance gap is recorded in Reading, while the lowest gap is recorded in Science.

Figure 4. PISA scores per subject, by ESCS quintile, Greece 2018



Source: PISA micro data set, authors' calculations

Table 3 presents results from the OLS regressions used to examine associations between student educational outcomes (PISA scores) and a series of individual (student), household and school-level characteristics. Similarly, Table 4 presents results from the logistic regressions used to examine associations between the same set of characteristics and students' aspirations. The explanatory variables selected in all specifications include some of the most commonly-used socioeconomic variables in empirical analyses, not only in the PISA context but from a broader socioeconomic inequality perspective, as well as various other control variables and variables of interest presented in the variables' section.

Table 3. Results from the OLS regressions for PISA scores per domain, Greece (2018).

Coefficient	Global competence	Reading	Math	Science
Intercept	122.75 (1.121)	148.17 (1.427)	153.13 (1.530)	152.04 (1.557)
Age	20.18*** (3.361)	17.05*** (3.104)	15.00*** (2.777)	16.58*** (3.118)
Sex (male)	-22.56*** (-5.611)	-21.71*** (-6.633)	16.41*** (4.413)	5.04 (1.621)
Home educational resources	10.98*** (5.648)	10.72*** (5.977)	10.93*** (5.411)	9.90*** (5.782)
Home cultural possessions	14.12*** (5.305)	14.07*** (5.942)	13.41*** (5.766)	12.46*** (5.608)
Other home possessions	-11.24*** (-3.659)	-8.20*** (-3.294)	-7.52*** (-3.368)	-6.16*** (-2.461)
Mother: university education	10.71*** (2.401)	7.34* (1.769)	9.14** (2.272)	7.11* (1.853)
Father: university education	11.02** (2.214)	10.72*** (4.271)	14.31*** (3.509)	6.97* (1.782)
Mother: high-level occupation *(base: inactive)*	20.16*** (2.876)	17.30*** (2.539)	9.84 (1.445)	11.06* (1.697)
Mother: other occupation *(base: inactive)*	18.11*** (3.832)	21.12*** (4.271)	11.07*** (2.465)	13.47*** (3.044)
Father: high-level occupation *(base: inactive)*	9.04 (0.812)	18.24 (1.347)	19.79 (1.562)	12.95 (1.091)
Father: other occupation *(base: inactive)*	2.27 (0.211)	9.74 (0.746)	9.93 (0.879)	4.02 (0.369)
Student: second-generation immigrant	-29.03*** (-4.497)	-29.98*** (-4.482)	-28.34*** (-3.946)	-27.49*** (-4.244)
Student: first-generation immigrant	-42.40*** (-2.912)	-36.79*** (-3.076)	-27.61** (-2.123)	-35.63*** (-2.987)
Suburban residence *(base: rural)*	10.41 (1.091)	3.17 (0.361)	3.72 (0.427)	5.54 (0.661)
Urban residence *(base: rural)*	13.38 (1.415)	11.39 (1.424)	8.19 (0.962)	8.12 (1.025)
Student: at least 2 years of ECEC	1.69 (0.317)	6.97 (1.510)	8.47* (1.707)	5.54 (1.096)
Student: bullied	-5.59*** (-2.495)	-8.88*** (-4.620)	-3.43 (-1.609)	-5.13*** (-2.656)
Parental emotional support	17.78*** (8.191)	16.64*** (8.851)	12.23*** (5.721)	13.19*** (7.104)
Teacher's interest	2.97* (1.671)	1.24 (0.704)	-2.91 (-1.497)	1.11 (0.598)
School type (public)	-26.11** (-2.225)	-31.05*** (-2.472)	-31.18*** (-3.391)	-25.02*** (-2.364)
School size	0.00 (0.094)	0.00 (-0.058)	0.01 (0.333)	0.01 (0.214)
Class size	2.45*** (3.257)	2.16*** (3.133)	1.61*** (2.496)	1.61*** (2.402)
Computers with internet (%)	-0.20 (-0.005)	-8.33 (-0.219)	14.02 (0.346)	-0.52 (-0.014)
Creative EC activities	1.85 (0.590)	3.53 (1.045)	0.58 (0.175)	1.93 (0.603)
R-squared	21.32%	21.76%	17.12%	

*,**,*** indicates significance at the 90%, 95% and 99% level, respectively. t-values in parenthesis.

Source: PISA micro data set, authors' calculations

We start from the demographic variables of age and gender which are included in the regression as control variables. Regression results indicate that age (in months) is positively correlated with student outcomes across models, which may come as a surprise, given that by design the survey is aimed to test the performance of students that are of the same age in years. The small differences, spanning a few months but less than a year, in the age of the students in the sample, do appear to affect their performance in the test scores, even at the age of 15.

Meanwhile, gender is statistically significant in most of the models estimated but with a different effect (positive or negative) depending on the test domain. Being male is negatively and significantly associated with scores in the Global Competence and Reading domains as well as with aspirations for pursuing tertiary education and a managerial or professional career. By contract, it is positively and significantly associated with scores in the Mathematics domain. These gender-based differences reveal that sectoral segregation effects between genders manifest themselves as early as high school.

In the socioeconomic status (SES) independent variables' panel, we have exploited the ESCS breakdown available in the dataset in order to separately explore the potential effect of household educational resources (a desk and a quiet place to study, a computer and books to help with the student's homework, a dictionary and technical reference books), household cultural possessions (classical literature, books of poetry, works of art), other household possessions (wealth items) in addition to parental education and occupation. For the parental education, we opted a binary split denoting the completion of tertiary education, while for the parental occupation, we employed a factor variable with three levels - managerial/ highly-paid professional occupation, another occupation and inactivity. We used these variables for each parent alone in order to capture maternal and paternal effects separately.

Starting from household educational resources and cultural possessions we observe statistically significant associations across almost all models. Based on the results, these types of household possessions are associated with higher student performance and aspirations with a high level of statistical significance. Effects are more prominent for the variable capturing educational resources at the household level. By contrast, the non-educational, non-cultural component of the aggregate household possessions index is negatively associated with student outcomes with the effect being statistically significant in the PISA scores regressions.

Even though this finding may appear counter-intuitive at first sight, this component should not be interpreted in an isolated manner, considering that other variables included in the model specification capture the effects of overall household living standards and act as channels through which associations between household wealth and student outcomes are manifested. Other things equal, educational and cultural possessions exhibit a positive association and other non-educational, non-cultural home possessions a negative one. In the Appendix (Table A1), we also present findings from running the analysis for the composite household possessions index available in PISA which includes educational resources, cultural and other household possessions in a single variable (HOMEPOS) and we find an overall positive and statistically significant result.

In terms of the parental tertiary education dummies, we find positive and statistically significant associations with student outcomes. Associations between parental occupation (managerial – highly paid professional, another occupation or inactive) and student outcomes are more prominent and statistically significant on the mother's side and in the PISA scores' regressions compared to the aspirations' regressions. In terms of maternal occupation, the

largest effect is observed in the Global Competence score regression and in terms of paternal occupation in the Mathematics score regression (without being statistically significant).

Table 4. Results from the logistic regressions for student aspirations, Greece (2018).

Coefficient	Plans to complete tertiary education	Plans to be high-level professional	Plans to be working in 5 years
Intercept	-8.56*** (-2.800)	-6.37*** (-2.827)	3.08 (1.107)
Age	0.61*** (3.305)	0.37*** (2.693)	-0.20 (-1.245)
Sex (male)	-0.64*** (-6.008)	-0.27*** (-3.100)	0.08 (0.986)
Home educational resources	0.36*** (5.722)	0.08 (1.453)	-0.15*** (-3.563)
Home cultural possessions	0.22** (2.959)	0.15*** (2.551)	-0.22*** (-3.703)
Other home possessions	0.01 (0.135)	0.20*** (2.901)	-0.01 (-0.126)
Mother: university education	0.32*** (2.338)	-0.04 (-0.481)	-0.09 (-0.814)
Father: university education	0.28** (2.154)	0.38*** (3.804)	-0.04 (-0.475)
Mother: high-level occupation *(base: inactive)*	0.55* (1.653)	0.18 (0.978)	-0.45* (-1.898)
Mother: other occupation *(base: inactive)*	0.11 (0.828)	-0.12 (-0.865)	-0.10 (-1.026)
Father: high-level occupation *(base: inactive)*	0.42 (1.256)	0.42 (1.037)	0.20 (0.417)
Father: other occupations *(base: inactive)*	0.05 (0.156)	-0.27 (-0.670)	0.53 (1.205)
Student: second-generation immigrant	-0.41** (-2.218)	0.29** (1.994)	0.07 (0.345)
Student: first-generation immigrant	-0.42 (-1.259)	-0.04 (-0.101)	-0.07 (-0.215)
Suburban residence *(base: rural)*	-0.17 (-0.666)	0.25 (1.080)	-0.21 (-0.784)
Urban residence *(base: rural)*	0.02 (0.090)	0.48*** (2.370)	-0.51* (-1.844)
Student: at least 2 years of ECEC	0.36*** (2.869)	-0.06 (-0.561)	-0.13 (-1.126)
Student: bullied	-0.05 (-0.851)	-0.01 (-0.143)	0.11*** (2.484)
Parental emotional support	0.42*** (7.109)	0.20*** (4.512)	-0.23*** (-4.879)
Teacher's interest	-0.04 (-0.748)	-0.02 (-0.307)	-0.07 (-1.541)
School type (public)	-0.61** (-2.025)	-0.24 (-1.467)	-0.01 (-0.064)
School size	0.00 (-0.432)	0.00 (0.483)	0.00*** (2.652)
Class size	0.06** (2.116)	-0.01 (0.865)	-0.02 (-1.240)
Computers with internet (%)	-0.60 (-0.778)	-0.38 (-0.684)	-0.21 (-0.352)
Creative EC activities	0.11 (1.599)	-0.02 (-0.466)	-0.01 (-0.230)

*,**,*** indicates significance at the 90%, 95% and 99% level, respectively. t-values in parenthesis.

Source: PISA micro data set, authors' calculations

Moving to other background characteristics, a negative and statistically significant relationship is found between immigrant status and PISA scores in all four domains hinting at the presence of inequalities amongst high-school students according to nationality/ citizenship. Negative effects are larger for first-generation immigrant adolescents than for second-generation ones in all domains, except for Mathematics. However, these adverse effects are mostly limited to the PISA scores models and no statistically significant relationships are found between immigrant status and student aspirations (except for a negative association with plans to pursue tertiary education and a positive association with plans to work as a manager or a highly paid professional, significant at the 10% level for the second-generation migrants). We also find no (statistically significant) regional disparities in student outcomes except for a positive association between residence in urban areas and the plan to follow a managerial or highly paid professional career and a negative association with the intention to work in five years. Similarly, the variable denoting that the student had participated for at least two years in early education and care (ECEC) presents a significant relationship only with the aspiration variable on completing tertiary education and not on cognitive performance across domains according to PISA (except for a positive association, significant at the 10% level for the Mathematics domain).

Student experiences with bullying and emotional support and interest expressed on behalf of parents and teachers may also be important factors influencing school performance. Our results indicate that bullying is negatively and statistically significantly associated with scores in 3 out of the 4 PISA domains in 2018 (Global Competence, Reading and Science). It is also associated with a higher probability that the student plans to be working in 5 years from the time of the interview. The effect of parental emotional support is particularly large and statistically significant across models whereas the index variable capturing the perceived teachers' interest does not produce statistically significant results (except for a positive association with Global Competency, statistically significant at the 10% level).

Next, we look at school-level characteristics such as the type (private versus public ownership), school and class size, proportion of computers available connected to the internet and number of creative extra-curricular activities offered. The most important finding is the negative relationship between attending a public school and scores in all four PISA domains (significant at the 5% level) as well as with aspirations for higher education (at the 10% level). Class size is also associated with higher PISA performance whereas the variables on school size, number of creative extra-curricular activities and proportion of computers connected to the internet do not present a statistically significant relationship with the outcome variables in the models (except for a positive and statistically significant association between school size and plans to work in 5 years).

Finally, we explore the relationship between aspirations and student performance. The three aspiration variables have a significant overlap, so to avoid multicollinearity issues, we insert each variable separately in the regressions on the PISA cognitive domains (columns (2) to (4) in Table to A5 in the Appendix). We find that the associations are strong, statistically significant and with the expected sign (positive for the plans to study at university or work as manager or highly paid professional and negative for the plans to work in 5 years). Inserting the aspirations variables in the regressions does not bring substantial changes to the coefficient estimates of the remaining variables.

It is reasonable to expect that in the above associations, aspirations are not exogenous with respect to PISA scores, as it is highly likely that performance at school would influence the students' plans for their future careers. To check for likely endogeneity, instead of the actual aspiration values, we included in the PISA scores regression the predicted values of student

aspirations, obtained from regressing the aspirations on the same set of covariates as those presented in Table 4. As instrumental variables in this setup, we used the categorical variable on urban, suburban and rural residence, which seems unrelated with the PISA scores, but appears to have a statistically significant association with the students' plans to pursue a high-level career or to study in 5 years. Under this setup, the coefficients on aspirations appear substantially lower in size and are not statistically significant,[6] which provides indications that the flow of causality in this association does not run from aspirations to performance.

4.2 Trends and crisis effects

There is descriptive evidence that the performance gap in Greece is more pronounced for certain cases or has been persistent across time. Indicatively, the performance gap by ESCS quintiles within Greece has been rather stable over time (Figure 5). Since 2006, the performance gap by gender and first-generation immigrant status have also been quite stable, while the respective gap by second-generation immigrant status has widened.

Figure 5. PISA performance gap within Greece, 2000-2018

Source: PISA micro data set, authors' calculations.

The relative stability of the relations of various covariates with education performance is also observed in the regression results for Greece across the PISA waves (Table 5). In particular, the coefficients on ESCS in all three domains varies across time within a band of about 4 to 8 points of the plausible values scale (against mean scores of around 440-450).

[6] It should be noted, however, that the consequential two-stage least squares procedure results in biased standard errors (Pokropek, 2016), while the instvy package does not include instrumental variable techniques.

Table 5: Results from regressions per cognitive domain for Greece, 2000-2018

Coefficient	2000	2003	2006	2009	2012	2015	2018
				Reading			
Intercept	246.61**	349.80***	299.23***	428.17***	390.90***	324.42***	201.09***
	(2.162)	(3.702)	(68.166)	(5.547)	(3.904)	(4.214)	(2.813)
ESCS	33.12***	34.65***	35.23***	31.93***	32.05***	34.79***	31.88***
	(8.570)	(17.245)	(13.310)	(11.701)	(15.861)	(13.464)	(14.721)
First-generation migrant	-67.56***	-4.99	-17.28*	-42.55***	-38.38***	-29.94***	-40.61***
	(-3.803)	(-0.247)	(-1.873)	(-2.666)	(-4.582)	(-2.667)	(-4.786)
Second-generation migrant	28.66	-31.53***	-16.31	-14.81*	-19.40**	-15.60*	-21.74***
	(1.461)	(-4.122)	(-0.942)	(-1.770)	(-2.119)	(-1.784)	(-3.485)
Male	-40.45***	-40.90***	-58.32***	-48.90***	-49.88***	-35.69***	-39.43***
	(-3.905)	(-11.045)	(-11.308)	(-6.677)	(-14.916)	(-8.747)	(-12.930)
Age	1.35**	9.63	12.61**	5.17	7.49	10.70**	18.12***
	(2.332)	(1.605)	(2.286)	(1.064)	(1.174)	(2.175)	(3.956)
R-squared	17.5%	15.6%	19.4%	19.1%	19.8%	17.0%	16.2%
				Mathematics			
Intercept	282.88	313.75***	366.50***	329.14***	273.72***	252.19***	173.24**
	(1.518)	(2.970)	(4.630)	(5.963)	(3.400)	(2.982)	(2.431)
ESCS	31.39***	35.79***	36.43***	30.27***	32.75***	28.61***	31.18***
	(5.141)	(8.732)	(15.815)	(12.874)	(17.178)	(13.014)	(15.088)
First-generation migrant	-79.08***	-5.11	-23.79***	-37.70***	-27.99***	-34.80***	-32.21***
	(-3.720)	(-0.166)	(-3.355)	(-3.058)	(-3.411)	(-3.447)	(-3.961)
Second-generation migrant	7.97	-28.84***	-10.46	-14.33	-29.26***	-17.06**	-20.67***
	(0.239)	(-3.632)	(-0.660)	(-1.644)	(-3.906)	(-2.241)	(-3.074)
Male	4.29	16.54***	2.40	12.26***	8.39***	1.47	2.77
	(0.666)	(4.149)	(1.265)	(3.179)	(3.100)	(0.415)	(0.892)
Age	0.87	8.37	6.37	8.62**	11.53**	13.16**	18.11***
	(0.879)	(1.255)	(1.265)	(2.470)	(2.254)	(2.443)	(3.968)
R-squared	10.8%	16.4%	16.2%	14.7%	17.0%	11.7%	13.1%
				Science			
Intercept	19.10	189.87**	245.87***	267.74***	318.56***	212.53***	174.06***
	(0.140)	(2.145)	(3.260)	(3.553)	(3.847)	(2.630)	(2.651)
ESCS	28.99***	34.62***	36.028***	31.27***	30.97***	32.41***	28.23***
	(10.015)	(17.417)	(16.928)	(14.660)	(16.787)	(15.195)	(14.358)
First-generation migrant	-63.71***	43.72**	-28.93***	-32.37**	-28.28***	-29.16***	-42.64***
	(-3.610)	(2.456)	(-3.104)	(-2.154)	(-3.231)	(-3.201)	(-4.737)
Second-generation migrant	30.79	-36.04***	-19.92	-15.73**	-28.17***	-17.82**	-19.66***
	(1.311)	(-5.010)	(-1.360)	(-2.103)	(-3.546)	(-2.368)	(-3.311)
Male	-6.84***	8.47**	-13.55***	-11.47***	-12.87***	-6.78**	-8.87***
	(-1.291)	(2.219)	(-3.242)	(-3.382)	(-4.745)	(-2.105)	(-3.065)
Age	2.40***	18.84***	15.479***	13.50***	10.23*	16.07***	18.45***
	(3.348)	(3.364)	(3.248)	(2.814)	(1.945)	(3.118)	(4.369)
R-squared	12.9%	14.5%	16.7%	14.3%	15.6%	13.8%	12.7%

*,**,*** indicates significance at the 90%, 95% and 99% level, respectively. t-values in parenthesis.

In the migration variables, the variation across waves is considerably larger. For most years and domains, the coefficients are negative and larger for first-generation migrants and less negative for second-generation migrants, which provides indications of a partial integration of the migrant families in the domestic education system. A positive and statistically significant coefficient is observed only in the science domain for first-generation migrants in 2003, but probably this result comes from the relatively low representation of this segment in the Greek sample of that year (only 27 individuals that happen to be exceptionally well-performing). Over time, there does seem to be a tendency for a reduction of the negative coefficient for first-generation migrants up until 2015 (e.g. from -67.6 in 2000 to -29.9 in 2015 in the Reading domain, with corresponding trend in the other two domains), which points to an improved integration of first-generation migrants in the education system across waves, although in 2018 the coefficient points to a significant deterioration in the Reading and Science (but not

Mathematics) domains, which may be the result of the refugee crisis that hit the country after 2015.

The gender differences, controlling for other student characteristics, also appear to be rather persistent across time. Boys underperform in Reading and Science, with the negative coefficient increasing in absolute terms in the earlier waves (until 2006 in the former and until 2012 in the latter domains) and subsiding until 2015, to expand again in 2018. In Mathematics, boys in Greece appear to have a statistically significant advantage in some of the waves (e.g. in 2003, 2009 and 2012), but in the latest two waves, the positive difference appears to be negligible when we do not control for additional variables, such as emotional support, teacher interest, etc. Lastly, age (in months) plays a role in most waves and domains.

4.3 Cross-country comparisons

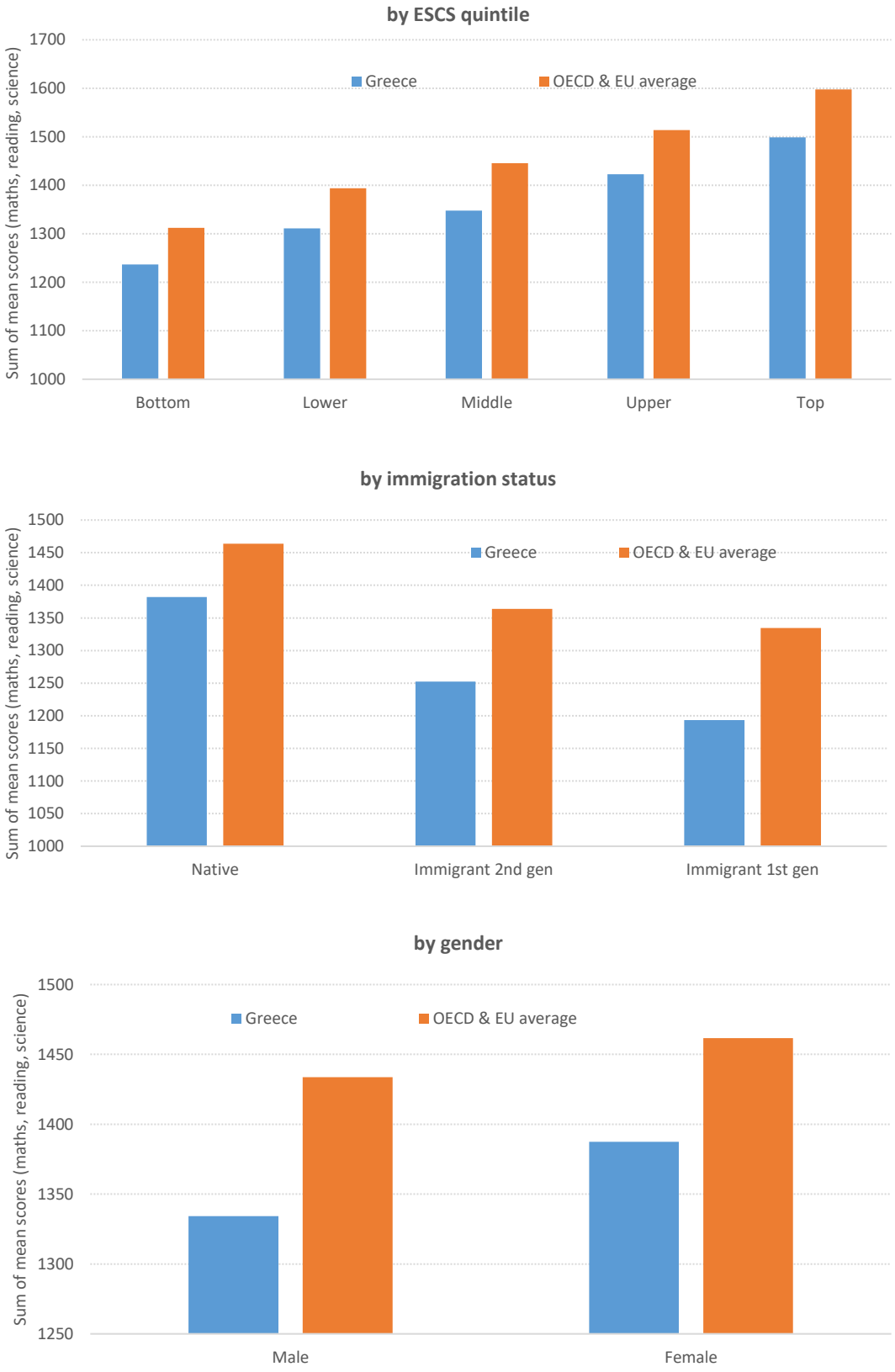
The educational outcomes show variations across socioeconomic and demographic characteristics at the international level. Our sample for descriptive statistics covers 42 countries, which are either members of the OECD or the EU or both ("OECD & EU" sample). The performance gap by ESCS background within Greece, proxied by the difference in performance of students between Bottom (Q5) minus Top (Q1) or Lower (Q4) minus Upper (Q2) ESCS quintiles, has not been larger than the respective gap recorded within the "OECD & EU" average in 2018 (Figure 6).

The performance gap by ESCS background between Greece and the "OECD & EU" average in 2018 has been smaller for the Bottom (Q5) quintile, but larger for middle (Q3) and top (Q1) quintiles. The performance gap by immigration status within Greece, proxied by two distinct variables, has been larger than the respective gap within the "OECD & EU" average in 2018. The gap is proxied by (a) the difference in performance between first generation immigrants and natives, and (b) the difference in performance between second generation immigrants and natives. The performance gap by immigration status between Greece and the "OECD & EU" average in 2018 has been larger for second generation immigrants, followed by first generation immigrants, while it is smaller for natives.

The gender performance gap within Greece, proxied by the difference in performance of male minus female students, has been larger than the respective gap within the "OECD & EU" average in 2018. The gender performance gap stems primarily from performance in Reading, followed by performance in Science. The performance gap between Greece and the "OECD & EU" average in 2018 has been larger for male than for female students.

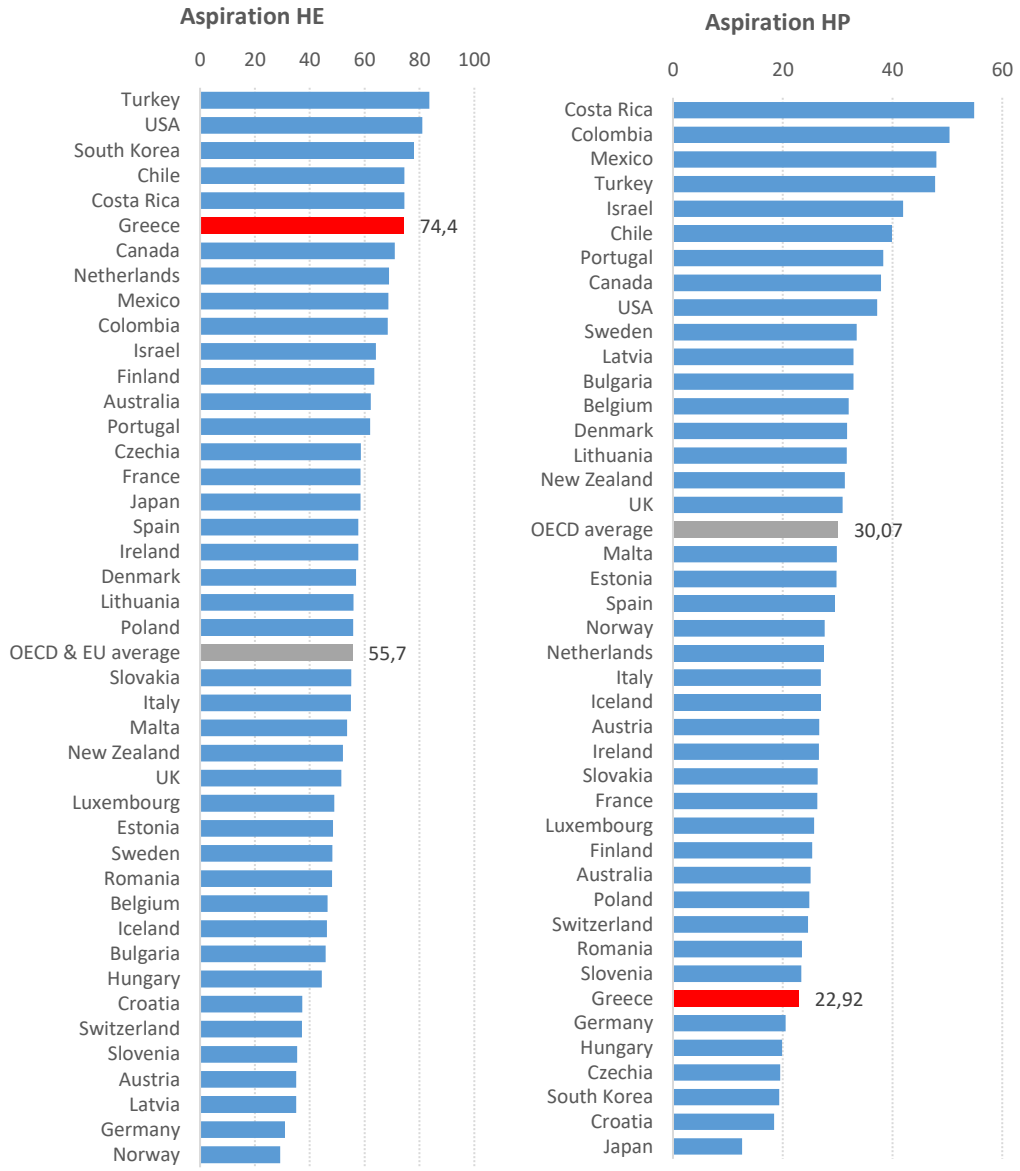
There is descriptive evidence that students' aspirations about their future career plans exhibit variations across countries as well as across socioeconomic and demographic characteristics. Using 2018 data, Greek students exhibit high aspirations with respect to following higher education studies, ranked in the 6th highest position among 42 OECD and/or EU countries (Figure 7). By contrast, the aspirations of Greek students for managerial or highly paid professional careers are recorded significantly below the "OECD & EU" average, which might be indicating that these professions are less open to newcomers in Greece.

Figure 6. PISA performance in Greece versus the OECD & EU average, 2018



Source: PISA micro data set, authors' calculations.

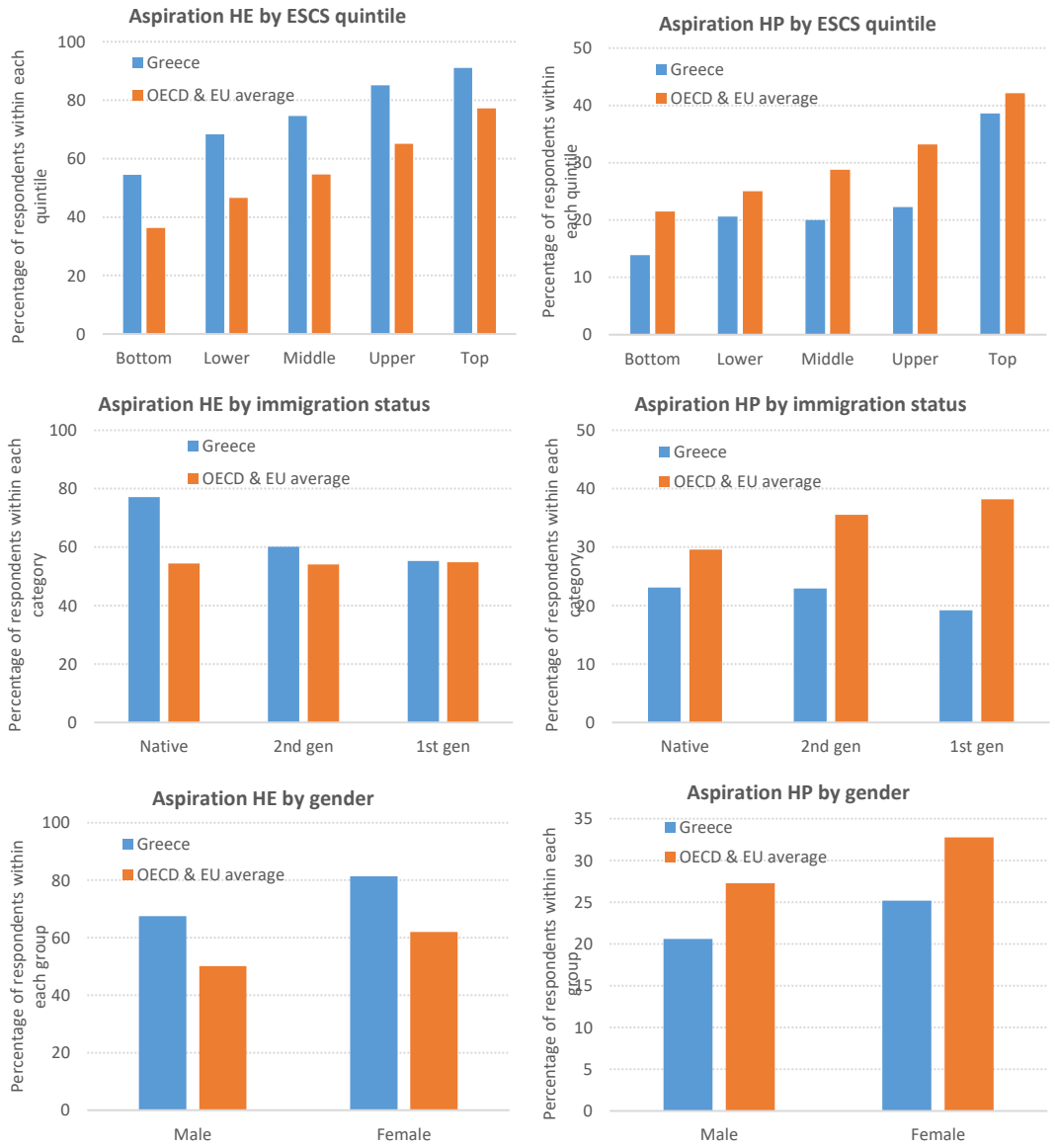
Figure 7. Student aspirations by country, in % of respondents, 2018



Source: PISA micro data set, authors' calculations. Note: Aspiration HE reflects the share of students who responded positively to whether they wish to pursue Higher Education studies. Aspiration HP reflects the share of students who responded that they wish to follow a career as managers, engineers, architects, surveyors, planners, designers, lawyers, judges, other legal professionals, medical doctors, veterinarians or dentists.

The aspirations gap within Greece seems to be affected by gender, immigration status and ESCS background. Greek females, natives and students with higher ESCS ranking expressed in 2018 higher aspirations with respect to both pursuing tertiary education studies and managerial-professional careers, compared to males, immigrants and students with low ESCS ranking (Figure 8). While the high education aspiration gap by ESCS and gender are observed both in Greece and the OECD average, the gap among immigrants is pronounced in Greece, but not in the average OECD country. Furthermore, the managerial-professional aspiration levels are lower in Greece compared to the "OECD & EU" average, and the aspiration gaps by ESCS, gender and immigration status are larger in Greece than in the "OECD & EU" average.

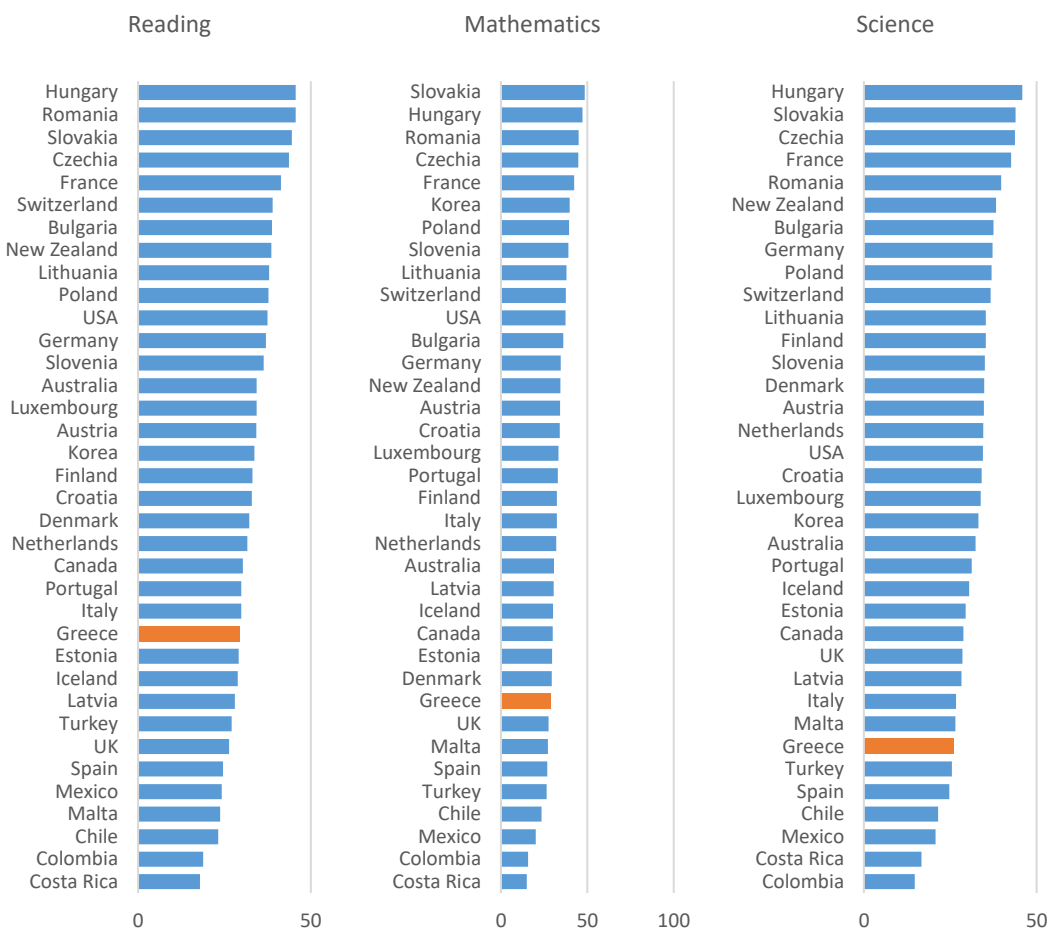
Figure 8. Student aspirations in Greece versus the OECD & EU average, by ESCS, immigration status and gender, 2018



Source: PISA micro data set, authors' calculations. Note: Aspiration HE reflects the share of students who responded positively to whether they wish to pursue Higher Education studies. Aspiration HP reflects the share of students who responded that they wish to follow a career as managers, engineers, architects, surveyors, planners, designers, lawyers, judges, other legal professionals, medical doctors, veterinarians or dentists.

Comparing the relations of a number of covariates with student performance within a sample that includes 36 countries, members of the OECD or the EU, with available relevant data, in a regression model which includes the school type as a variable (tables in the Appendix), we can observe that Greece cannot be characterised as an outlier. In particular, regarding the regression coefficient on the ESCS index, Greece ranks 25th in the Reading domain, 28th in Mathematics and 30th in Science (Figure 9). This implies that there are 24, 27 and 29 countries respectively, where one unit of the ESCS index is associated with a larger boost in the plausible values in the corresponding domains.

Figure 9: Regression coefficients for the ESCS index per OECD and EU country and cognitive domain, 2018



Regarding the performance of second-generation migrant students (compared to natives), Greece ranks closer to the middle position. In particular, the country is placed 18th in the Reading domain, 20th in Mathematics and 15th in Science (Figure 10). At the top of this ranking are countries with a long history of migration integration, such as the USA, Australia, Canada and New Zealand, where the second-generation migrants tend to perform even better than the native students. The largest difference between children born in the country to migrant parents and children of natives is recorded in Korea for the Reading and Mathematics domain, countries in South America (Mexico, Colombia), Eastern Europe (Slovakia in Mathematics, Bulgaria in Science) and Northern Europe (e.g., Finland).

Lastly, regarding school type, in most, but not all countries, students at schools owned and run by the state perform worse compared to private schools that are run independently from the government. Countries for which this difference is particularly large include Luxembourg and the UK, Chile and Colombia. At the other end of the spectrum are Romania, Latvia, the Netherlands, and Switzerland, where the private schools do not seem to provide advantage in terms of student performance, controlling for other student characteristics. In this particular ranking, Greece is placed in the bottom half, ranking 24th in the Reading domain, 25th in Mathematics and again 25th in Science (Figure 11).

Figure 10: Regression coefficients for second-generation migrants compared to native students per OECD and EU country and cognitive domain, 2018

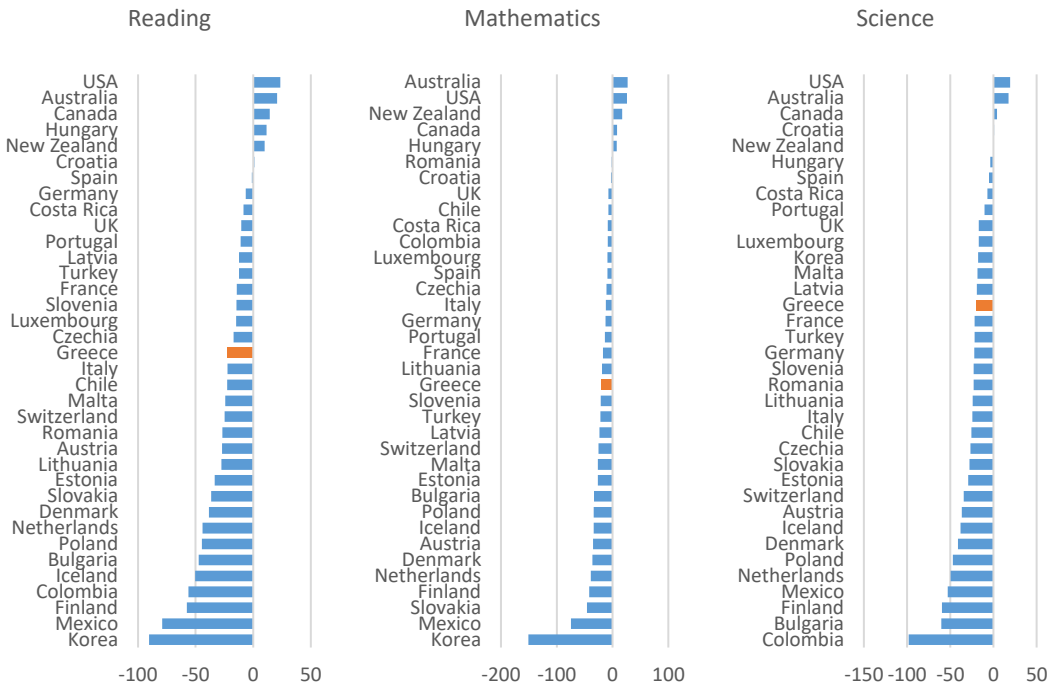
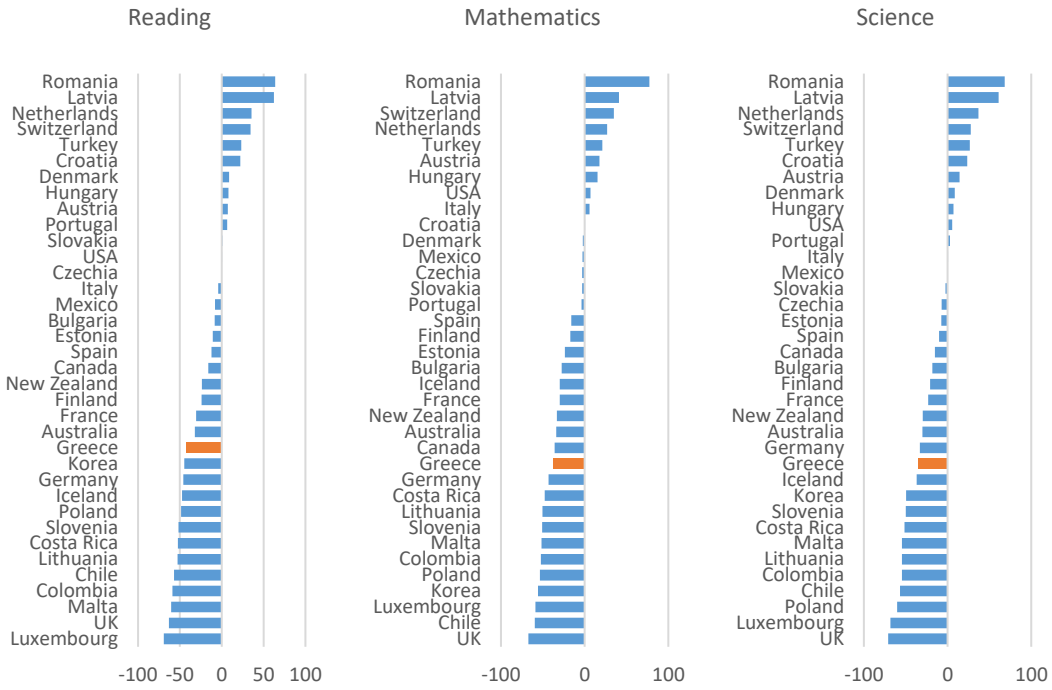


Figure 11: Regression coefficients students of state-run versus private schools per OECD and EU country and cognitive domain, 2018



5 Discussion

This research paper explored intergenerational mobility in education by focusing on PISA performance and future aspirations of high-school students in Greece. Our premise is that cognitive performance and students' perceptions about their future as measured in the context of the PISA program can act as proxies for student performance in the exams for admission to tertiary education, cognitive skills, incentives and life chances in general.

In order to assess the intergenerational transmission of socioeconomic position in education (and, therefore, mobility) PISA score variables per cognitive domain and variables reflecting students' plans for the future were assessed against a diverse but intuitive set of characteristics such as demographic factors, SES, school-level characteristics, emotional support, student bullying and others. While the main aim was to explore the relationship between the different student SES components and student outcomes, the inclusion of other control variables revealed interesting relationships and possible pathways through which student background may affect performance and aspirations.

Out of the characteristics examined, we found large and significant associations between student outcomes and certain elements of socioeconomic and parental background that seem to matter for children most: educational resources at home, cultural possessions at home and parental emotional support. Parental socioeconomic position appears to be channelled to children through such cultural and emotional routes in addition to private school attendance throughout the models examined.

Parental education and occupation effects are also important but differ by domain and between parents.

Another important finding is the negative relationship between non-educational, non-cultural home possessions or wealth which, other things equal, appears to be negatively associated with educational outcomes. This finding suggests that material possessions, as such, that do not have an educational or cultural role do not appear to constitute a channel for the transmission of social advantage as far as children's educational outcomes are concerned, while the effect of wealth depends on how it relates to other parental and household characteristics (e.g. occupation), traits and choices (e.g. to invest in private-school education).

Other student background characteristics like immigrant status and bullying were also found to be negatively and significantly associated with high-school student cognitive outcomes and plans about the future. Student differences in performance and aspirations according to gender were also revealed, pointing, inter alia, to the fact that educational and professional sectoral segregation between men and women starts from a very young age. Last but not least, we found limited associations with school-level characteristics with the exception of class size and the private versus public school split (which may capture geographic location and income effects respectively) while variables on the residence area (e.g. urban or rural) showed no statistically significant associations with student performance and a limited association with aspirations.

The research paper also put the Greek situation into a broader perspective by examining some of these relationships in an intertemporal (2000-2018) and cross-country scale. In the second section of our results, we focused on some simpler specifications in order to examine relationships between the composite socioeconomic status indicator available in PISA (ESCS), immigration, gender and age on one hand and the full set of student outcomes on the other across time. The intertemporal analysis showed that in Greece the relationship between socioeconomic status and student outcomes is evident, statistically significant and broadly

stable across PISA survey years. We also find a negative relationship between performance and immigrant status across PISA waves with consistently larger (in absolute terms) coefficients for first-generation compared to second-generation immigrant status. In terms of international cross-country comparisons, while Greek students have been systematically underperforming in PISA tests, regression analysis revealed that Greece is not an outlier in terms of the relationship between ESCS, immigration status, school type (public versus private) on one hand and PISA performance on the other.

These findings have possible implications for the design of suitable policies aiming to enhance intergenerational mobility in education but also social equity in a broader sense. Based on the evidence, some policies which could have a material impact include migrant integration policies, the provision of incentives to households prioritising educational and cultural possessions, family policies enhancing work-life balance for parents so as to enable them to provide better emotional support towards their children, and psychosocial support services for students (e.g., at the school level) including effective measures to combat bullying. Furthermore, intergenerational mobility in education can be enhanced through measures aimed at supporting youth population such as career guidance programs, with a particular emphasis on students stemming from a disadvantaged background.

The consistent finding across years that students attending private schools have an advantage compared to counterparts attending public schools in Greece, provides evidence that there is a need to upgrade services offered by the pre-tertiary public education system. In addition, we found that basic socioeconomic characteristics and adolescent educational performance had significant and rather stable associations both before and during the Greek crisis. This points to the need to produce a coherent strategy against educational disparities according to socioeconomic status with the aim of enhancing fairness across the student population.

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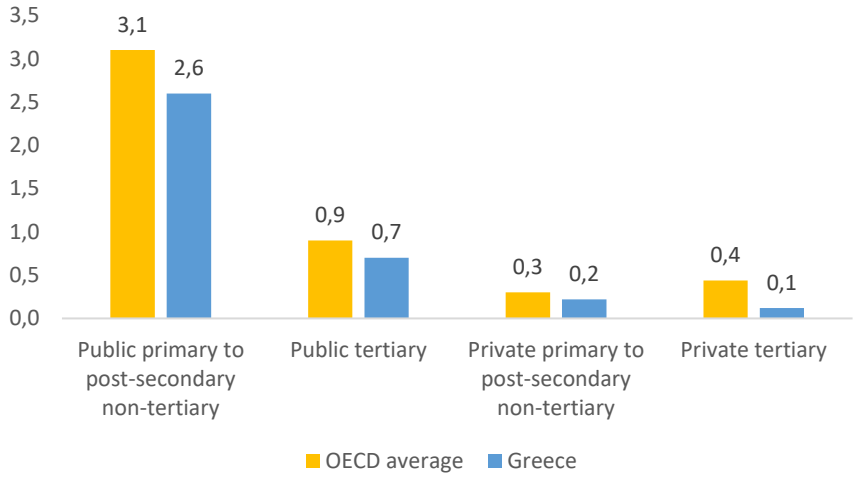
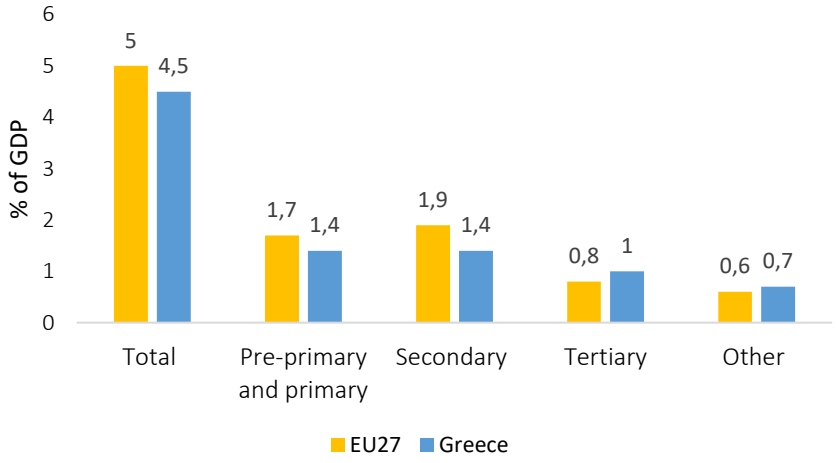
Appendix

Figure A1. Public vs. private expenditure for education (% of GDP) in Greece and the OECD, 2018.



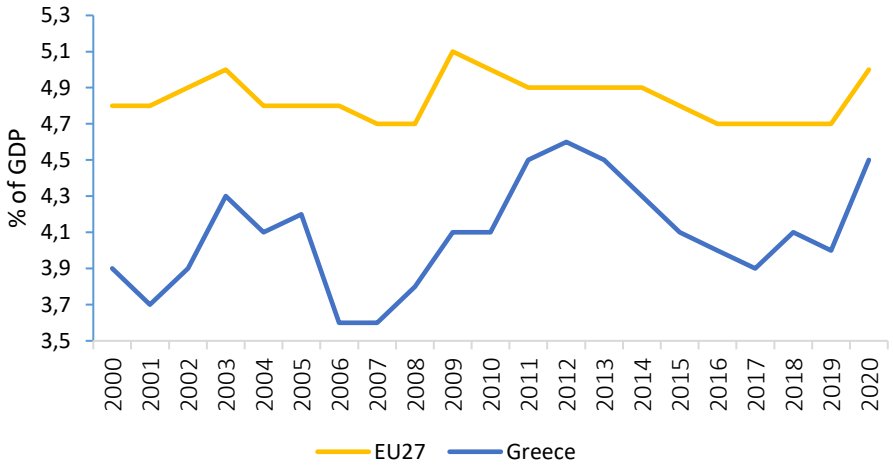
Source: OECD.

Figure A2. Public expenditure for education (total and by level, % of GDP), 2020.



Source: Eurostat, COFOG.

Figure A3. Public expenditure for education (% of GDP), 2009-2020.



Source: Eurostat, COFOG.

Table A1. Results from the OLS regressions for PISA scores per domain with all home possessions combined, Greece (2018).

Coefficient	Global competence	Reading	Math	Science
Intercept	101.44 (0.938)	122.60 (1.198)	120.86 (1.221)	124.12 (1.265)
Age	21.59*** (3.630)	18.63*** (3.432)	16.89*** (3.131)	18.15*** (3.414)
Sex (male)	-25.44*** (-6.236)	-24.39*** (-7.215)	13.78*** (3.653)	2.95 (0.899)
Home possessions	9.10*** (2.960)	11.80*** (5.088)	11.36*** (5.229)	11.93*** (4.657)
Mother: university education	11.86*** (2.601)	8.47** (1.984)	10.61*** (2.524)	8.14** (2.056)
Father: university education	11.22** (2.218)	10.50*** (2.380)	14.03*** (3.412)	6.53 (1.634)
Mother: high-level occupation *(base: inactive)*	20.11*** (2.815)	16.77*** (2.396)	9.80 (1.394)	11.07* (1.649)
Mother: other occupation *(base: inactive)*	19.12*** (3.963)	21.72*** (4.267)	11.93*** (2.574)	14.04*** (3.006)
Father: high-level occupation *(base: inactive)*	7.94 (0.687)	16.13 (1.144)	18.66 (1.431)	11.60 (0.936)
Father: other occupation *(base: inactive)*	2.12 (0.188)	8.34 (0.614)	9.14 (0.787)	3.50 (0.306)
Student: second-generation immigrant	-25.63*** (-3.843)	-26.40*** (-3.870)	-25.43*** (-3.383)	-24.56*** (-3.639)
Student: first-generation immigrant	-39.22*** (-2.615)	-35.89*** (-2.962)	-27.04** (-2.086)	-34.66*** (-2.868)
Suburban residence *(base: rural)*	9.91 (1.026)	3.86 (0.405)	5.05 (0.563)	6.17 (0.695)
Urban residence *(base: rural)*	15.70 (1.630)	14.44 (1.636)	11.76 (1.326)	10.81 (1.286)
Student: at least 2 years of ECEC	0.62 (0.118)	6.07 (1.327)	7.76 (1.573)	4.77 (0.952)
Student: bullied	-5.56*** (-2.511)	-9.14*** (-4.827)	-3.78* (-1.745)	-5.29*** (-2.775)
Parental emotional support	18.37*** (8.315)	16.97*** (8.761)	12.61*** (5.788)	13.56*** (7.132)
Teacher's interest	4.30*** (2.360)	2.41 (1.337)	-1.80 (-0.931)	2.16 (1.130)
School type (public)	-19.87 (-1.624)	-25.07** (-1.964)	-25.86*** (-2.834)	-19.89* (-1.847)
School size	0.00 (-0.002)	0.00 (-0.039)	0.01 (0.218)	0.00 (0.117)
Class size	2.39*** (3.246)	2.13*** (3.034)	1.59*** (2.472)	1.59*** (2.386)
Computers with internet (%)	0.63 (0.016)	-6.55 (-0.170)	15.87 (0.415)	3.03 (0.083)
Creative EC activities	2.25 (0.685)	4.09 (1.158)	1.04 (0.303)	2.28 (0.693)
R-squared	19.10%	20.18%	15.22%	14.62%

*,**,*** indicates significance at the 90%, 95% and 99% level, respectively. t-values in parenthesis.

Source: PISA micro data set, authors' calculations

Table A2. Results from the regressions for student outcomes with aspiration, Global competence domain, Greece (2018)

Coefficient	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	122.75	170.14*	193.42*	142.64	149.75	258.38*	206.34*
	(1.121)	(1.675)	(1.688)	(1.216)	(0.598)	(1.736)	(1.636)
Age	20.18***	14.15***	14.60***	20.09***	18.92	12.55	14.86*
	(3.361)	(2.553)	(2.347)	(3.108)	(1.076)	(1.435)	(1.905)
Sex (male)	-22.6***	-16.1***	-21.1***	-21.7***	-21.03	-16.14**	-20.3***
	(-5.611)	(-4.286)	(-4.953)	(-5.292)	(-1.145)	(-2.194)	(-4.246)
Home educ. resources	10.98***	7.26***	10.96***	9.62***	10.38	9.12***	8.18**
	(5.648)	(3.830)	(5.543)	(4.379)	(1.076)	(3.492)	(2.251)
Home cultural possessions	14.12***	11.60***	13.84***	10.70***	13.75**	10.88***	10.49**
	(5.305)	(4.564)	(5.151)	(3.994)	(2.091)	(2.706)	(2.162)
Other home possessions	-11.2***	-11.6***	-11.6***	-9.88***	-11.5***	-15.7***	-11.2***
	(-3.659)	(-3.876)	(-3.837)	(-3.088)	(-3.596)	(-3.219)	(-3.648)
Mother: univ. education	10.71***	7.92*	9.35*	11.07***	10.46	11.53***	8.80*
	(2.401)	(1.935)	(1.902)	(2.536)	(1.038)	(2.569)	(1.748)
Father: univ. education	11.02**	8.93*	8.43	9.82**	10.70	2.91	10.31**
	(2.214)	(1.868)	(1.592)	(2.049)	(1.097)	(0.320)	(2.043)
Mother: high occupations	20.16***	16.23***	20.81***	19.27***	18.43	15.08*	11.38
	(2.876)	(2.482)	(2.782)	(2.723)	(0.772)	(1.829)	(0.980)
Mother: other occupations	18.11***	16.61***	18.77***	16.85***	18.12***	20.99***	16.64***
	(3.832)	(3.832)	(3.889)	(3.318)	(2.591)	(3.909)	(3.306)
Father: high occupations	9.04	5.75	11.00	5.71	7.23	0.02	9.99
	(0.812)	(0.536)	(0.896)	(0.489)	(0.479)	(0.002)	(0.872)
Father: other occupations	2.27	1.51	5.95	2.88	1.37	7.03	8.98
	(0.211)	(0.144)	(0.516)	(0.247)	(0.128)	(0.567)	(0.639)
Student: 2G immigrant	-29.0***	-23.7***	-28.3***	-28.5***	-28.3***	-34.6***	-29.6***
	(-4.497)	(-4.089)	(-4.011)	(-4.187)	(-2.442)	(-4.859)	(-4.604)
Student: 1G immigrant	-42.40***	-35.72***	-41.41***	-45.8***	-42.66**	-43.02***	-43.5***
	(-2.912)	(-2.633)	(-2.751)	(-2.581)	(-2.152)	(-2.946)	(-2.976)
Suburban residence	10.41	11.70	9.37	12.31			
	(1.091)	(1.387)	(0.920)	(1.385)	-	-	
Urban residence	13.38	12.72	10.19	13.62			
	(1.415)	(1.472)	(1.061)	(1.504)	-	-	
Student: at least 2 years of ECEC	1.69	-2.34	3.84	2.05	0.84	2.59	-0.39
	(0.317)	(-0.460)	(0.740)	(0.369)	(0.073)	(0.496)	(-0.063)
Student: bullied	-5.59***	-4.99**	-4.93**	-3.58	-5.64**	-5.56***	-4.47
	(-2.495)	(-2.301)	(-2.196)	(-1.506)	(-2.162)	(-2.464)	(-1.635)
Parental emot. support	17.78***	13.37***	17.02***	15.66***	16.93	13.85***	13.86***
	(8.191)	(6.833)	(7.772)	(7.008)	(1.447)	(3.253)	(2.841)
Teacher's interest	2.97*	3.38**	2.38	2.10	2.82	3.47*	1.97
	(1.671)	(1.989)	(1.299)	(1.176)	(1.348)	(1.906)	(0.947)
School type (public)	-26.11**	-24.11**	-20.48*	-22.58*	-25.33	-22.74*	-24.40**
	(-2.225)	(-2.090)	(-1.898)	(-1.918)	(-1.197)	(-1.773)	(-1.971)
School size	0.00	0.01	0.00	0.02	0.02	0.00	0.03
	(0.094)	(0.227)	(0.083)	(0.525)	(0.524)	(-0.066)	(0.928)
Class size	2.45***	1.87***	2.32***	2.15***	2.30	2.81***	2.22***
	(3.257)	(2.884)	(3.143)	(3.083)	(1.483)	(3.184)	(2.876)
Computers with internet (%)	-0.20	3.82	3.73	1.02	1.75	4.54	-2.82
	(-0.005)	(0.095)	(0.095)	(0.025)	(0.039)	(0.112)	(-0.070)
Creative EC activities	1.85	0.64	1.94	2.08	1.47	2.05	1.24
	(0.590)	(0.230)	(0.625)	(0.683)	(0.325)	(0.637)	(0.399)
Plans to complete univ.	-	75.25***	-	-	2.14		-
		(16.805)			(0.077)	-	
Plans to be professional	-	-	27.18***	-	-	21.51	-
			(6.463)			(1.079)	
Plans to be working in 5 years	-	-	-	-49.3***	-	-	-17.04
				(-12.669)			(-0.921)
R-squared	21.32%	30.20%	22.34%	27.75%	21.21%	21.29%	21.27%

*,**,*** indicates significance at the 90%, 95% and 99% level, respectively. t-values in parenthesis.

Source: PISA micro data set, authors' calculations

Table A3. Results from the regressions for student outcomes with aspiration, Reading domain, Greece (2018)

Coefficient	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	148.17	196.84**	211.39*	180.11*	375.99	315.84**	262.19**
	(1.427)	(2.108)	(1.958)	(1.745)	(1.443)	(2.210)	(2.132)
Age	17.05***	10.85**	12.21**	16.25***	0.93	7.01	8.99
	(3.104)	(2.225)	(2.142)	(2.896)	(0.051)	(0.854)	(1.214)
Sex (male)	-21.7***	-15.0***	-20.9***	-18.6***	-5.07	-13.27**	-18.3***
	(-6.633)	(-5.103)	(-5.971)	(-5.860)	(-0.271)	(-1.987)	(-4.430)
Home educ. resources	10.72***	6.90***	10.44***	8.94***	2.18	8.40***	6.59**
	(5.977)	(4.002)	(5.838)	(4.515)	(0.220)	(3.215)	(1.807)
Home cultural possessions	14.07***	11.48***	14.25***	10.22***	9.00	9.85***	8.63**
	(5.942)	(5.207)	(6.168)	(4.393)	(1.375)	(2.665)	(1.893)
Other home possessions	-8.20***	-8.62***	-8.46***	-6.43***	-9.32***	-14.2***	-8.30***
	(-3.294)	(-3.571)	(-3.314)	(-2.454)	(-3.567)	(-3.182)	(-3.344)
Mother: univ. education	7.34*	4.47	5.65	7.77*	-0.76	8.27**	4.23
	(1.769)	(1.200)	(1.262)	(1.941)	(-0.074)	(1.974)	(0.898)
Father: univ. education	10.72***	8.57**	8.68*	8.54*	3.03	0.09	9.59**
	(4.271)	(2.090)	(1.903)	(1.944)	(0.306)	(0.011)	(2.150)
Mother: high occupations	17.30***	13.26**	18.22***	17.12***	-3.16	11.12	4.57
	(2.539)	(2.098)	(2.390)	(2.546)	(-0.128)	(1.399)	(0.408)
Mother: other occupations	21.12***	19.57***	21.91***	20.59***	17.34***	25.14***	19.07***
	(4.271)	(4.412)	(4.495)	(3.938)	(2.342)	(4.848)	(3.549)
Father: high occupations	18.24	14.86	18.96	7.63	6.99	6.67	20.11
	(1.347)	(1.211)	(1.269)	(0.661)	(0.392)	(0.442)	(1.472)
Father: other occupations	9.74	8.96	12.96	3.55	7.86	16.14	20.16
	(0.746)	(0.756)	(0.930)	(0.310)	(0.598)	(1.163)	(1.336)
Student: 2G immigrant	-30.0***	-24.3***	-27.4***	-28.9***	-21.82*	-37.0***	-30.5***
	(-4.482)	(-4.023)	(-3.885)	(-4.078)	(-1.823)	(-5.226)	(-4.623)
Student: 1G immigrant	-36.79***	-29.94***	-35.66***	-39.11***	-26.26	-37.3***	-37.9***
	(-3.076)	(-2.841)	(-2.973)	(-2.688)	(-1.562)	(-3.125)	(-3.165)
Suburban residence	3.17	4.50	1.26	6.20	-	-	-
	(0.361)	(0.556)	(0.143)	(0.776)			
Urban residence	11.39	10.72	7.36	11.78*	-	-	-
	(1.424)	(1.416)	(0.951)	(1.665)			
Student: at least 2 years of ECEC	6.97	2.84	9.40**	8.40*	-2.39	7.95*	3.66
	(1.510)	(0.669)	(2.142)	(1.825)	(-0.209)	(1.726)	(0.687)
Student: bullied	-8.88***	-8.26***	-8.39***	-7.01***	-7.88***	-8.75***	-7.08***
	(-4.620)	(-4.455)	(-4.150)	(-3.348)	(-3.311)	(-4.515)	(-2.818)
Parental emot. support	16.64***	12.12***	15.59***	14.66***	6.37	11.41***	10.66**
	(8.851)	(7.406)	(8.111)	(7.465)	(0.532)	(2.752)	(2.222)
Teacher's interest	1.24	1.66	1.26	0.69	1.90	1.91	-0.20
	(0.704)	(1.000)	(0.692)	(0.390)	(0.890)	(1.041)	(-0.105)
School type (public)	-31.05***	-29.00***	-25.10**	-28.77**	-17.38	-26.83**	-28.60**
	(-2.472)	(-2.383)	(-2.248)	(-2.200)	(-0.786)	(-1.980)	(-2.181)
School size	0.00	0.01*	0.00	0.01	0.03	-0.01	0.04
	(-0.058)	(0.191)	(0.075)	(0.423)	(0.856)	(-0.156)	(1.315)
Class size	2.16***	1.56***	2.08***	1.85***	0.80	2.64***	1.83***
	(3.133)	(2.391)	(3.096)	(2.823)	(0.505)	(3.342)	(2.615)
Computers with internet (%)	-8.33	-4.20	-8.77	0.63	11.00	1.53	-8.76
	(-0.219)	(-0.119)	(-0.246)	(0.017)	(0.269)	(0.041)	(-0.233)
Creative EC activities	3.53	2.28	3.41	3.52	0.32	4.08	2.92
	(1.045)	(0.754)	(1.041)	(1.139)	(0.065)	(1.198)	(0.870)
Plans to complete university	-	77.30***	-	-	25.54	-	-
		(19.471)			(0.891)		
Plans to be professional	-	-	26.11***	-	-	28.22	-
			(7.116)			(1.525)	
Plans to be working in 5 years	-	-	-	-50.67***	-	-	-25.65
				(-14.022)			(-1.448)
R-squared	21.76%	31.02%	22.68%	28.01%	21.68%	21.75%	21.75%

*,**,*** indicates significance at the 90%, 95% and 99% level, respectively. t-values in parenthesis.

Source: PISA micro data set, authors' calculations

Table A4. Results from the regressions for student outcomes with aspiration, Mathematics domain, Greece (2018)

Coefficient	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	153.13 (1.530)	194.63** (2.044)	191.00* (1.874)	190.72* (1.725)	264.96 (1.116)	260.41* (1.833)	224.22* (1.847)
Age	15.00*** (2.777)	9.71* (1.919)	11.40** (2.101)	13.37** (2.325)	7.22 (0.441)	8.68 (1.074)	10.10 (1.386)
Sex (male)	16.41*** (4.413)	22.11*** (6.213)	18.31*** (4.601)	19.28*** (5.428)	24.48 (1.454)	21.72*** (3.437)	18.47*** (4.300)
Home educ. resources	10.93*** (5.411)	7.67*** (3.952)	11.33*** (5.566)	9.17*** (4.313)	6.83 (0.786)	9.45*** (3.836)	8.40*** (2.554)
Home cultural possessions	13.41*** (5.766)	11.20*** (5.188)	14.09*** (6.101)	9.97*** (4.244)	10.97* (1.927)	10.75*** (2.926)	10.09** (2.318)
Other home possessions	-7.52*** (-3.368)	-7.88*** (-3.736)	-8.17*** (-3.394)	-5.96*** (-2.674)	-8.1*** (-3.323)	-11.3*** (-2.702)	-7.57*** (-3.371)
Mother: univ. education	9.14** (2.272)	6.70* (1.821)	6.98 (1.580)	8.72** (2.041)	5.32 (0.607)	9.75*** (2.375)	7.28* (1.688)
Father: univ. education	14.31*** (3.509)	12.48*** (3.195)	12.13*** (2.804)	12.69*** (3.147)	10.66 (1.207)	7.61 (0.933)	13.63*** (3.227)
Mother: high occupations	9.84 (1.445)	6.40 (0.978)	9.73 (1.313)	10.07 (1.451)	-0.05 (-0.002)	5.87 (0.751)	2.02 (0.190)
Mother: other occupations	11.07*** (2.465)	9.75*** (2.418)	12.35*** (2.614)	11.59*** (2.415)	9.32 (1.441)	13.57*** (2.803)	9.80** (2.032)
Father: high occupations	19.79 (1.562)	16.91 (1.447)	19.07 (1.340)	15.97 (1.206)	14.16 (0.931)	12.46 (0.893)	20.87 (1.619)
Father: other occupations	9.93 (0.879)	9.26 (0.894)	12.34 (0.965)	9.81 (0.810)	8.86 (0.785)	13.93 (1.130)	16.22 (1.195)
Student: 2G immigrant	-28.3*** (-3.946)	-23.5*** (-3.493)	-27.3*** (-3.758)	-28.7*** (-3.989)	-24.3** (-2.295)	-32.8*** (-4.223)	-28.6*** (-4.003)
Student: 1G immigrant	-27.61** (-2.123)	-21.77* (-1.881)	-27.79** (-2.101)	-26.06* (-1.726)	-22.77 (-1.289)	-28.00** (-2.142)	-28.36** (-2.164)
Suburban residence	3.72 (0.427)	4.85 (0.610)	3.75 (0.431)	4.94 (0.558)	-	-	-
Urban residence	8.19 (0.962)	7.61 (0.962)	7.39 (0.896)	7.67 (0.895)	-	-	-
Student: at least 2 years of ECEC	8.47* (1.707)	4.94 (1.042)	10.18** (2.124)	9.02* (1.818)	3.93 (0.361)	9.12* (1.854)	6.48 (1.135)
Student: bullied	-3.43 (-1.609)	-2.91 (-1.409)	-2.97 (-1.342)	-1.74 (-0.796)	-2.98 (-1.225)	-3.36 (-1.568)	-2.36 (-0.918)
Parental emot. support	12.23*** (5.721)	8.36*** (4.330)	11.64*** (5.642)	10.65*** (4.933)	7.26 (0.686)	8.94** (2.062)	8.60* (1.782)
Teacher's interest	-2.91 (-1.497)	-2.55 (-1.357)	-3.00 (-1.474)	-3.35 (-1.608)	-2.64 (-1.185)	-2.49 (-1.191)	-3.80** (-1.978)
School type (public)	-31.2*** (-3.391)	-29.43*** (-3.238)	-26.26*** (-2.794)	-28.63*** (-3.151)	-24.65 (-1.435)	-28.49*** (-2.876)	-29.68*** (-3.116)
School size	0.01 (0.333)	0.01 (0.489)	0.00 (0.125)	0.02 (0.675)	0.02 (0.853)	0.01 (0.167)	0.03 (1.157)
Class size	1.61*** (2.496)	1.10* (1.831)	1.53*** (2.422)	1.45** (2.303)	0.94 (0.697)	1.91*** (2.557)	1.40** (2.174)
Computers with internet (%)	14.02 (0.346)	17.54 (0.443)	20.50 (0.556)	19.64 (0.463)	23.43 (0.545)	19.63 (0.488)	13.26 (0.327)
Creative EC activities	0.58 (0.175)	-0.49 (-0.161)	0.53 (0.167)	0.14 (0.045)	-1.00 (-0.223)	0.87 (0.264)	0.16 (0.049)
Plans to complete university	-	65.90*** (15.131)	-	-	12.34 (0.502)	-	-
Plans to be professional	-	-	24.84*** (6.563)	-	-	17.77 (1.020)	-
Plans to be working in 5 years	-	-	-	-43.72*** (-10.688)	-	-	-15.61 (-0.968)
R-squared	17.12%	25.13%	18.69%	23.10%	17.06%	17.11%	17.11%

*,**,*** indicates significance at the 90%, 95% and 99% level, respectively. t-values in parenthesis.

Source: PISA micro data set, authors' calculations

Table A5. Results from the regressions for student outcomes with aspiration, Science domain, Greece (2018)

Coefficient	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	152.04	194.99**	213.20**	193.45**	196.32	241.46*	208.60*
	(1.557)	(2.175)	(2.058)	(1.967)	(0.884)	(1.822)	(1.844)
Age	16.58***	11.11**	11.92**	15.15***	13.76	11.47	12.87*
	(3.118)	(2.269)	(2.156)	(2.706)	(0.879)	(1.478)	(1.854)
Sex (male)	5.04	10.94***	6.31*	7.79***	8.06	9.35	6.61*
	(1.621)	(3.760)	(1.872)	(2.551)	(0.498)	(1.605)	(1.807)
Home educ. resources	9.90***	6.53***	9.84***	8.48***	8.45	8.67***	7.97***
	(5.782)	(3.948)	(5.576)	(4.390)	(0.962)	(3.694)	(2.440)
Home cultural possessions	12.46***	10.17***	12.81***	8.94***	11.58**	10.29***	9.93***
	(5.608)	(4.878)	(5.859)	(4.105)	(2.060)	(2.957)	(2.378)
Other home possessions	-6.16***	-6.53***	-6.12***	-4.44*	-6.43***	-9.16**	-6.17***
	(-2.461)	(-2.665)	(-2.434)	(-1.771)	(-2.392)	(-2.030)	(-2.460)
Mother: univ. education	7.11*	4.59	5.43	8.43**	5.89	7.64**	5.76
	(1.853)	(1.320)	(1.305)	(2.146)	(0.657)	(1.994)	(1.315)
Father: univ. education	6.97*	5.07	5.11	4.58	5.76	1.54	6.46*
	(1.782)	(1.370)	(1.254)	(1.106)	(0.688)	(0.210)	(1.645)
Mother: high occupations	11.06*	7.50	11.39	10.73	7.42	7.72	5.01
	(1.697)	(1.186)	(1.608)	(1.603)	(0.343)	(1.044)	(0.491)
Mother: other occupations	13.47***	12.10***	13.99***	12.77***	12.96**	15.43***	12.47***
	(3.044)	(2.967)	(3.067)	(2.711)	(2.078)	(3.210)	(2.637)
Father: high occupations	12.95	9.97	12.85	7.90	10.53	6.95	13.67
	(1.091)	(0.913)	(0.978)	(0.746)	(0.673)	(0.500)	(1.145)
Father: other occupations	4.02	3.33	5.92	3.13	3.32	7.23	8.74
	(0.369)	(0.333)	(0.504)	(0.317)	(0.302)	(0.631)	(0.699)
Student: 2G immigrant	-27.5***	-22.5***	-26.2***	-27.9***	-25.9***	-31.0***	-27.7***
	(-4.244)	(-3.924)	(-3.666)	(-4.092)	(-2.417)	(-4.362)	(-4.310)
Student: 1G immigrant	-35.63***	-29.58***	-35.08***	-36.12***	-34.3***	-36.0***	-36.3***
	(-2.987)	(-2.768)	(-2.829)	(-2.569)	(-2.341)	(-3.010)	(-3.023)
Suburban residence	5.54	6.71	4.23	7.61	-	-	-
	(0.661)	(0.913)	(0.484)	(0.924)			
Urban residence	8.12	7.53	5.12	7.93	-	-	-
	(1.025)	(1.055)	(0.642)	(1.015)			
Student: at least 2 years of ECEC	5.54	1.89	7.44	5.98	3.85	6.11	4.06
	(1.096)	(0.395)	(1.445)	(1.211)	(0.362)	(1.227)	(0.706)
Student: bullied	-5.13***	-4.58***	-4.95***	-3.50*	-5.01**	-5.09***	-4.33*
	(-2.656)	(-2.501)	(-2.373)	(-1.707)	(-2.187)	(-2.612)	(-1.751)
Parental emot. support	13.19***	9.20***	12.61***	11.57***	11.38	10.55***	10.46***
	(7.104)	(5.580)	(6.610)	(5.805)	(1.083)	(2.726)	(2.372)
Teacher's interest	1.11	1.49	0.85	0.62	1.14	1.46	0.43
	(0.598)	(0.822)	(0.427)	(0.316)	(0.529)	(0.741)	(0.222)
School type (public)	-25.02***	-23.21**	-19.37**	-21.73**	-22.78	-22.79**	-23.85**
	(-2.364)	(-2.253)	(-2.088)	(-1.972)	(-1.182)	(-1.944)	(-2.118)
School size	0.01	0.01	0.01	0.02	0.02	0.00	0.03
	(0.214)	(0.363)	(0.221)	(0.684)	(0.632)	(0.080)	(0.972)
Class size	1.61***	1.08*	1.50**	1.22*	1.36	1.86***	1.46**
	(2.402)	(1.776)	(2.212)	(1.892)	(1.019)	(2.398)	(2.176)
Computers with internet (%)	-0.52	3.12	0.93	4.71	3.07	3.15	-1.86
	(-0.014)	(0.090)	(0.027)	(0.135)	(0.077)	(0.086)	(-0.051)
Creative EC activities	1.93	0.83	1.85	1.55	1.31	2.10	1.54
	(0.603)	(0.286)	(0.574)	(0.507)	(0.304)	(0.644)	(0.489)
Plans to complete university	-	68.21***	-	-	4.53	-	-
		(17.611)			(0.182)		
Plans to be professional	-	-	24.24***	-	-	14.40	-
			(7.019)			(0.852)	
Plans to be working in 5 years	-	-		-46.67***	-	-	-11.86
				(-12.760)			(-0.747)
R-squared	16.04%	25.29%	17.41%	23.36%	15.99%	16.03%	16.02%

*,**,*** indicates significance at the 90%, 95% and 99% level, respectively. t-values in parenthesis.

Source: PISA micro data set, authors' calculations

Table A6: Regression results per OECD country, Reading domain, 2018

Country	ESCS	2G migrant	1G migrant	Male	Age	PGD school	State-run school	R^2
Australia	34,36	20,86	0,03	-29,76	14,89	-22,29	-32,01	13,7%
Austria	34,18	-27,19	-57,28	-25,34	25,04	22,61	7,42	18,5%
Bulgaria	38,79	-47,21	-33,23	-39,63	14,45		-8,56	19,6%
Canada	30,30	14,21	-14,70	-26,98	16,67	9,79	-16,21	9,8%
Switzerland	38,98	-24,71	-33,48	-26,06	19,96	88,09	34,51	19,8%
Chile	23,21	-22,61	-6,28	-16,63	9,32	-37,32	-57,09	17,1%
Colombia	18,83	-56,23	-32,88	-14,89	20,12	-64,29	-58,83	21,0%
Costa Rica	17,89	-8,37	-20,98	-16,56	23,87	-47,25	-52,49	21,6%
Czechia	43,70	-17,17	-63,58	-31,97	21,74	-6,66	-0,72	20,1%
Germany	37,02	-6,58	-80,41	-23,42	19,77	-49,10	-45,72	21,7%
Denmark	32,21	-38,43	-50,76	-27,93	8,09	21,86	8,71	14,6%
Spain	24,61	-1,33	-24,07	-24,48	17,61	-5,56	-12,09	12,0%
Estonia	29,10	-33,55	-77,11	-30,14	20,64	-12,59	-10,81	11,2%
Finland	33,15	-57,73	-86,64	-48,84	17,01		-24,24	18,9%
France	41,35	-14,29	-46,04	-21,28	18,32	-41,53	-30,62	20,5%
UK	26,38	-10,36	-17,02	-18,67	18,17	-53,97	-63,12	13,7%
Greece	29,24	-22,23	-39,91	-39,72	18,28		-41,91	16,9%
Croatia	32,94	0,95	-11,10	-33,35	10,54	62,16	22,10	11,9%
Hungary	45,66	11,64	-8,40	-28,50	10,22	16,51	8,03	21,7%
Iceland	28,85	-50,28	-58,62	-39,44	16,28		-47,36	11,6%
Italy	29,83	-22,46	-29,40	-25,81	22,90	-28,56	-4,37	11,8%
Korea	33,67	-90,37	-31,94	-20,80	4,98	-39,43	-44,62	9,7%
Lithuania	37,89	-27,70	-0,06	-38,14	13,72	-15,82	-52,75	18,4%
Luxembourg	34,33	-14,77	-15,62	-30,60	16,02	-78,73	-69,21	20,4%
Latvia	27,98	-12,40	34,42	-34,29	8,45	71,01	62,55	11,0%
Mexico	24,18	-79,16	-103,64	-14,34	21,72		-8,16	16,9%
Malta	23,71	-24,15	-2,12	-50,37	9,47	-19,98	-60,38	16,7%
Netherlands	31,61	-44,04	-70,98	-27,51	26,37	28,99	35,53	14,8%
New Zealand	38,60	9,85	-17,08	-25,54	13,54		-23,79	15,6%
Poland	37,72	-44,66	-71,96	-31,68	14,49	-32,93	-48,46	15,1%
Portugal	29,90	-10,93	-51,00	-23,42	17,88	-9,96	6,39	16,1%
Romania	45,62	-26,82	-6,52	-36,66	10,82	71,39	63,96	23,6%
Slovakia	44,51	-36,40	-45,31	-32,97	33,05	19,23	0,89	21,8%
Slovenia	36,39	-14,42	-45,77	-39,01	17,59		-51,74	19,1%
Turkey	27,07	-12,43	-49,85	-24,29	7,60	-80,61	23,44	16,5%
USA	37,50	23,65	-14,01	-22,53	19,43	10,23	0,58	13,8%

Note: The intercept is not shown in the table for presentation purposes.

Table A76: Regression results per OECD country, Mathematics domain, 2018

Country	ESCS	2G migrant	1G migrant	Male	Age	PGD school	State-run school	R^2
Australia	30,75	27,32	15,24	8,04	15,60	-25,73	-33,87	14,5%
Austria	34,17	-34,71	-46,31	15,41	23,07	29,18	17,57	19,1%
Bulgaria	36,00	-32,92	-43,11	-0,13	8,21		-27,58	14,7%
Canada	29,91	8,27	-4,17	7,15	15,28	0,14	-35,89	9,6%
Switzerland	37,57	-25,05	-26,30	11,57	21,25	81,97	34,82	19,4%
Chile	23,55	-7,52	3,80	10,38	13,64	-39,68	-59,72	20,4%
Colombia	15,61	-8,70	-28,51	15,84	14,83	-61,82	-52,35	19,4%
Costa Rica	15,04	-8,34	-21,54	16,17	19,45	-42,04	-47,65	20,3%
Czechia	44,81	-10,88	-67,93	4,74	13,18	-5,99	-2,81	19,3%
Germany	34,59	-12,47	-52,03	11,61	25,71	-35,36	-42,98	20,1%
Denmark	29,32	-35,89	-22,72	5,87	13,00	17,71	-2,02	13,0%
Spain	26,82	-9,11	-29,37	8,73	20,35	-8,74	-15,92	13,8%
Estonia	29,61	-26,29	-48,14	9,05	28,72	-28,18	-23,58	11,5%
Finland	32,46	-41,78	-48,10	-3,94	15,32		-17,28	13,7%
France	42,45	-17,37	-36,50	9,78	15,49	-32,62	-29,87	23,0%
UK	27,64	-7,37	-3,53	14,86	19,21	-53,46	-67,39	16,6%
Greece	28,89	-21,20	-31,54	2,55	18,17		-37,83	13,8%
Croatia	34,03	-2,57	-1,46	7,75	13,82	35,97	0,47	10,4%
Hungary	47,14	7,73	-22,25	7,69	9,27	24,46	15,43	24,4%
Iceland	30,15	-33,90	-26,62	-8,62	21,50		-29,76	9,8%
Italy	32,30	-12,08	-21,22	14,81	22,30	-8,96	5,72	12,1%
Korea	39,70	-150,97	-52,29	7,00	13,05	-49,90	-55,78	12,9%
Lithuania	38,02	-18,72	5,46	-1,87	10,54	-12,67	-50,33	15,1%
Luxembourg	33,27	-8,85	-7,85	5,09	13,96	-76,37	-58,83	20,1%
Latvia	30,60	-23,40	26,15	6,22	9,81	45,74	41,18	11,2%
Mexico	20,20	-74,72	-97,98	9,99	16,51		-2,39	13,7%
Malta	27,14	-26,22	0,87	-13,68	15,34	-15,22	-51,69	16,0%
Netherlands	32,03	-38,79	-67,35	2,46	24,32	19,62	26,97	16,0%
New Zealand	34,36	17,58	-1,38	11,65	13,18		-32,99	15,5%
Poland	39,34	-33,81	14,66	2,30	8,67	-39,96	-53,51	15,2%
Portugal	32,84	-13,71	-74,28	10,78	15,85	-18,60	-3,59	18,5%
Romania	45,01	-1,67	25,68	4,34	11,00	93,73	77,51	22,2%
Slovakia	48,54	-46,11	-53,08	6,38	22,40	11,05	-2,94	21,8%
Slovenia	38,98	-21,21	-55,58	2,46	15,40		-50,65	18,4%
Turkey	26,52	-21,99	-45,09	5,78	17,95	-93,47	21,03	14,5%
USA	37,39	25,86	-3,80	9,15	16,14	5,01	6,81	17,4%

Table A87: Regression results per OECD country, Science domain, 2018

Country	ESCS	2G migrant	1G migrant	Male	Age	PGD school	State-run school	R^2
Australia	32,33	17,60	-4,92	4,48	10,82	-23,26	-29,87	11,8%
Austria	34,78	-36,78	-53,21	4,84	18,76	30,80	14,42	19,2%
Bulgaria	37,51	-60,20	-25,80	-13,77	15,24		-18,06	17,5%
Canada	28,76	4,10	-14,35	-0,83	17,26	9,37	-15,25	7,5%
Switzerland	36,70	-34,49	-31,93	3,77	15,08	94,19	27,58	19,5%
Chile	21,49	-25,38	-28,77	5,62	14,64	-40,61	-56,92	18,6%
Colombia	14,71	-98,21	-17,07	9,13	16,75	-58,49	-54,69	18,5%
Costa Rica	16,63	-6,80	-17,75	7,62	20,73	-56,99	-51,53	23,6%
Czechia	43,75	-26,64	-51,06	0,06	19,91	-13,11	-7,03	17,9%
Germany	37,24	-22,15	-71,07	3,60	24,38	-30,18	-33,24	21,4%
Denmark	34,86	-40,90	-46,26	-0,67	11,52	20,94	8,60	14,0%
Spain	24,77	-5,23	-25,13	4,41	15,60	-5,18	-10,13	10,7%
Estonia	29,47	-29,15	-56,01	-4,66	20,88	-10,44	-7,50	9,2%
Finland	35,26	-59,48	-68,07	-21,60	20,74		-20,99	14,7%
France	42,63	-21,79	-42,32	2,66	14,85	-33,85	-23,24	21,7%
UK	28,56	-16,84	-7,15	3,66	18,15	-55,12	-71,02	15,3%
Greece	25,96	-20,50	-42,41	-9,17	18,59		-35,49	13,3%
Croatia	34,09	0,80	-6,56	-4,82	6,85	65,61	23,67	9,1%
Hungary	45,83	-3,71	-7,30	4,78	4,12	17,02	7,13	21,4%
Iceland	30,47	-38,04	-36,53	-7,10	13,64		-37,02	9,9%
Italy	26,65	-24,52	-29,59	2,04	18,31	-23,89	0,52	9,6%
Korea	33,13	-17,67	36,27	6,43	7,50	-43,03	-49,55	9,3%
Lithuania	35,27	-23,90	-11,47	-5,25	19,05	-15,82	-54,56	13,9%
Luxembourg	33,83	-17,01	-16,98	-5,58	6,88	-80,68	-68,17	22,3%
Latvia	28,26	-19,14	31,78	-9,35	2,90	84,20	60,85	9,0%
Mexico	20,71	-52,80	-75,30	7,29	22,96		-0,71	14,4%
Malta	26,47	-18,53	10,22	-22,08	8,04	-17,95	-54,47	15,0%
Netherlands	34,54	-49,69	-73,16	-7,17	30,59	29,17	37,02	16,0%
New Zealand	38,30	-0,18	-11,39	5,14	9,69		-29,62	14,9%
Poland	37,00	-47,04	-75,46	0,50	12,05	-45,53	-60,18	13,6%
Portugal	31,18	-10,16	-49,87	6,29	11,98	-10,75	3,03	16,8%
Romania	39,71	-22,88	-33,38	-2,55	5,05	71,43	68,27	19,1%
Slovakia	43,91	-27,68	-45,70	-3,78	27,85	12,77	-2,32	19,7%
Slovenia	35,02	-22,88	-55,02	-6,87	13,74		-49,94	16,4%
Turkey	25,50	-21,81	-19,58	-6,25	11,62	-74,92	26,61	14,4%
USA	34,43	19,39	-14,83	1,65	13,01	3,52	5,73	12,9%