The importance of self-confidence in explaining subject choices in high school*

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Abstract

Educational choices remain incredibly gendered. This paper investigates whether the subject choices of Australian students in high school are influenced by gender differences in test scores and beliefs about abilities. We use the 2009 cohort of the Longitudinal Surveys of Australian Youth (LSAY), which contains both students' PISA test scores and rich information about their self-perceptions in their own abilities compared with other students in English/literacy, mathematics, and science. This allows us to build a measure of over/under-confidence in all three subjects. Our analysis also controls for the efforts exerted by the students in each subject. We show that girls slightly under-estimate themselves in English compared to boys, however this is not the case in mathematics or science. But when choosing their set of subjects, girls are more sensitive than boys to their confidence in English. Failing to control for self-confidence leads to biased coefficients of the PISA scores. On the contrary, omitting effort does not change the results, suggesting that it is not an important source of endogeneity with respect to test scores.

Keywords: study choices, self-assessment, confidence, ability, gender

JEL classification: I21, J16, J24

1. Introduction

Educational choices remain incredibly gendered even though boys and girls seem equally free to choose their field of study, at least this is true in developed countries. Girls choose more often humanities and boys are more likely to select mathematics, physical science and computing. The underlying puzzle is that girls' study choices lead more often to lower-paid jobs and less prestigious careers than boys, even though they perform as well at school, if not better, than boys[1]. As such, young people's educational choices contribute to the gender wage gap and gendered life later on. Understanding the reasons of gendered study choices is crucial if one aim to reduce the gender wage gap and find the best tools to do so.

This paper helps to better understand these gendered study choices by adding self-confidence into the analysis. We investigate to what extent confidence in one's abilities is a factor driving subject choices in high school, beyond cognitive abilities. We first test whether there exist gendered biases in perception of abilities in the different subjects. We then study whether those biases lead boys towards choosing STEM[2] subjects and girls towards choosing humanities' subjects. We use the 2009 cohort of the Longitudinal Surveys of Australian Youth (LSAY), which contains information about students' self-perceptions of their own abilities compared with the students of the same year level at the same school in the following domains: English/literacy; mathematics; science; and overall. The survey also contains the PISA scores which allows us to identify whether students are over/under-confident by comparing the students' beliefs with the "objective" measures of ability.

The literature that looked at the determinants of educational choices is quite large and has explored several channels. At first sight, the reasons behind these choices remain somewhat a mystery for economists because according to the standard human capital models (Becker, 1964; Ben-Porath, 1967; Mincer, 1974), pupils should make educational decisions that maximize their lifetime incomes but it does not seem to be the case for girls. In particular, some studies from several countries have found that students' comparative advantages in the different subjects is not the explanation for these gendered study choices, among other regarding subject choices in Australian high school (Justman & Méndez, 2016). Other possible explanations may come from gender differences in preferences and interests, possibly shaped by social norms and gender identity (Eccles & Hoffman, 1984; Huston, 1983; Akerlof & Kranton, 2000). Those social rules may specify the (different) fields of study that should be followed by boys and by girls respectively. Recent evidence also suggests that women are less likely to compete than men (Niederle & Vesterlund, 2007)[3] so that we expect to find fewer girls in the most competitive fields of study. Girls may also make these study choices because they anticipate future children and family responsibilities[4] or discrimination in hiring or placement (Graham & Smith, 2005; Reskin, 1998; Reskin & Roos, 1990). Finally, girls and boys may value differently their test scores when

[1] For instance, across OECD countries in 2012, 14% of boys and 9% of girls did not attain the PISA baseline level of proficiency in any of the three core subjects. Source: OECD (2015), *The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence*, PISA, OECD Publishing. http://dx.doi.org/10.1787/9789264229945-en

[2] STEM: science, technology, engineering and mathematics.

[3] Actually, most of those differences seem to be cultural rather than innate (Booth & Nolen, 2012).

[4] Women may choose jobs, and therefore fields of study, with a low depreciation of human capital during years away from the job (England, 1982, 1984; Polachek, 1981, 1984; Sofer, 1990).

making their choices, and this is the factor we will be particularly interested in throughout this paper. As pupils generally have a rudimentary idea of their true skills, girls and boys may use differently the signals they receive about their abilities. This may be due to gender difference in self-confidence. Indeed, experimental studies have shown that men tend to be more confident than women (for instance, Reuben, Wiswall and Zafar, 2017; Kamas & Preston, 2012), such that girls may under-evaluate their real skills compared to boys. This may be also due to gender stereotypes maintaining that girls are less able than boys in certain areas (Ruble, Cohen, & Ruble, 2001), such as Mathematics (Good, Aronson, & Harder, 2008). Boys and girls may then believe that they are better or worse in a given field of study than their real skills indicate. Previous studies looking at valuation of test scores find some gender differences. For instance, Bartolj and Polanec (2012) find that, among students enrolled in four-year business and economics programs in the largest Slovenian university, both genders are more responsive to measured major-specific ability in majors that are traditionally more popular among them (e.g. Business Informatics for males). In Israel, Friedman-Sokuler and Justman (2016) find that girls and boys in high school react differently to early signals of mathematical and verbal ability. In France, Rapoport and Thibout (2018) find that gender differences in high school choices are largely due to differences in marginal impact of test scores, which are lower for girls. In higher education however, while partly driven by test scores, they find that choices largely depend on other gender differences (tastes, norms). Compared to previous studies looking at study choices in high school and using only "objective" measures of ability (Rapoport & Thibout, 2018; Friedman-Sokuler & Justman, 2016; Justman & Méndez, 2016; Favara, 2012; Van de Werfhorst, Sullivan, & Cheung, 2003), our contribution is to add measures of self-confidence into the analysis.

Introducing beliefs about abilities is not new in economics. Some recent studies have shown that self-perceptions about abilities explain various educational and labour market outcomes such as: expectation to continue to higher education (Chevalier, Gibbons, Thorpe, Snell, & Hoskins, 2009); earnings (Chen, Grove, & Hussey, 2017); and also willingness to compete (Kamas & Preston, 2012; Niederle & Vesterlund, 2007). More closely related to our paper, perceptions of one's own abilities have been found to affect college major choices (Arcidiacono, Hotz, & Kang, 2012; Wiswall & Zafar, 2015), though Zafar (2013) finds that the gender gap in college majors is not due to females' under-confidence in their academic ability. Moreover, Reuben, Wiswall and Zafar (2017) show that an experimental measure of overconfidence is not related with college major choices. These somewhat contradictory results might be due to the fact that they are generally limited to a specific school or university. One advantage of our study is that we use a large nationally representative survey.

To our knowledge however, though the economic literature has looked at the role of abilities' beliefs in explaining study choices at other levels of education, it has paid no attention to the secondary level, high school. Some of the only research that has does so comes from the psychology literature, which uses "self-concept" measures describing students' belief in their own academic abilities (typically, this is an index constructed from a range of subjective questions). In this strand of literature, ability beliefs have been shown to influence high school course choices (e.g., Guo et al. 2015, using the 2003 cohort of LSAY; Nagy et al., 2006; Wang, 2012). Our paper uses a different measure that we directly compare to objective abilities.

Investigating further the impact of beliefs about ability on educational choices appears important, because if gender differences in self-confidence occur early and are partly responsible for the observed gender segregation into the different high school courses, then it means that the allocation of students into the various subjects is inefficient. In terms of policy implications, it also means that acting early on beliefs about abilities is likely to help reduce this persistent gender gap in fields of study already prevalent in year 11, which could in turn contribute to reduce the gender wage gap.

This paper seeks to extend the current understanding of the effects of self-confidence on educational outcomes by focusing on the choice of subjects in high school in the Australian context. Compared with previous literature, our framework has some advantages. First, the LSAY is a large nationally representative sample survey while previous studies often suffer from small scale samples, in particular the cited papers about expectations and college major choices that are limited to a specific school or university.

Second, the measure of self-perception about abilities we use, which to the best of our knowledge has only been considered by Parker et al. (2017)[5] before, has some major advantages in our context when compared to other ability beliefs measures: i) it elicits beliefs about academic ability in three different subjects as well as overall academic ability by making a comparison with other fellow students in a simple way ("Compared with most of the students in your year level at school, how well are you doing in *this subject*? 1 Very well / 2 Better than average / 3 About average / 4 Not very well / 5 Very poorly / 6 Not studying this subject"); ii) it refers to a familiar situation and does not concern confidence in one specific and ad hoc test (as in the studies about willingness to compete); iii) it does not use several selected and subjective questions about abilities (as is the case for the self-concept measure[6]); and iv) it does not refer to hypothetical situations as do the studies about college major choices that ask students to provide their expected abilities if they were majoring in each of the possible majors. Our measure seems to be closer to what high school students have in mind when they think about their skills compared to their actual peers.

Last but not least, it is difficult to construct measures of abilities that are both objective and reliable. Test scores not only mix "pure" skills with the effort exerted, but they also carry other effects such as family influences. The PISA scores on the other hand are good quality measures in our context because they remove some of the endogeneity concerns which arise from unobserved factors that may influence both measures of abilities and subject choices. The PISA test has no consequence for the students' future thereby removing some concern related to gender differences in response to competition and pressure. This also weakens the possibility that girls' performances are negatively

[5] Using all five LSAY cohorts, pre-PISA and PISA based, and controlling for ability in math, literacy, and generally, Parker et al (2017) find that significant gender differences in self-belief still exist between equally able boys and girls.

[6] For instance, science self-concept can be measured using these questions: "Learning advanced school science topics would be easy for me"; "I can usually give good answers to test questions on school science topics"; "I learn school science topics quickly"; "School science topics are easy for me"; "When I am being taught school science, I can understand the concepts very well"; "I can easily understand new ideas in school science". Source: OECD, PISA 2006 Database, Table 3.3a.
See also OECD (2015), *The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence*, PISA, OECD Publishing. http://dx.doi.org/10.1787/9789264229945-en

affected by a stereotype threat in mathematics and science (Good, Aronson, & Harder, 2008). In addition, recent studies have shown that teachers' grading practices are biased by the gender stereotypes they have in mind (e.g., Lavy, 2008; Cornwell, Mustard, & Van Parys, 2013), while PISA scores are unlikely to suffer from such a bias given that their purpose is not to provide information to either the teacher or the student about performances. Finally, the PISA tests have been designed to assess the key competencies of students in reading, mathematics, and science, and not to test them in a more specific area within the domain, involving a particular study program beforehand. So the PISA scores appear to be better than a school semester score for instance. Our estimations also control for the student's efforts separately in science, mathematics, and other subjects, which are an important source of endogeneity of the test scores[7] but also related to self-perceptions about abilities[8]. Effort is usually not included in previous works due to data limitation, and this is another important contribution of the present work. Even if our analysis does not allow us to draw rigorous causal interpretations, the positive characteristics of the PISA scores mentioned above together with the fact that we control for the effort in different subjects allow us to at least remove several sources of endogeneity.

Results based on the 2009 cohort show that girls choose more often foreign languages, humanities, art, and home economics, while boys choose more frequently STEM and health & physical education. There is no gender difference in the choice of science subjects. Girls slightly under-estimate themselves in English compared to boys but there are no gender differences in the other subjects. However, when choosing their whole set of subjects, girls are more sensitive than boys to their confidence in English. Omitting to control for self-confidence leads to biased coefficients of the PISA scores. However, omitting the effort does not change the results, suggesting that the effort is not an important source of endogeneity with respect to test scores.

2. The Australian educational system[9]

There are six year levels in the secondary level of schooling within the Australian educational system, years 7 to 12. Generally, the first crucial educational choice takes place in year 10, at which time students are for the first time able to choose their subjects (or study) for the following two years, years 11 and 12. Each of the chosen subjects consists of learning goals and assessment criteria that are split over these last two years of high school. Most of the subjects are 'elective' (a subject that students

[7] By increasing their effort in a subject, a pupil will probably get higher test scores, and choose this field of study accordingly (Rapoport and Thibout, 2017).

[8] Pupils might provide different levels of effort because they might underestimate their skill in a given subject, leading them to under-invest in terms of effort (Rapoport and Thibout, 2017).

[9] As each Australian state has some particularities regarding their educational system, this Section has been constituted using a vast range of sources, from the internet or by directly contacting some Tertiary Admissions Centres. For instance: http://www.education.vic.gov.au/school/parents/learning/Pages/vce.aspx
https://senior-secondary.scsa.wa.edu.au/the-wace
https://www.sace.sa.edu.au/
https://www.qcaa.qld.edu.au/senior/certificates-qualifications/qce

can choose), while a small number of subjects are core/compulsory subjects (like English in some states; see below) i.e. a subject students must do. Not only does year 10 represent an important period of a student's life, enabling them, for the first time, to branch away from the compulsory subjects imposed throughout all of their previous schooling experience, but it also directly impacts their tertiary rank, which will be used by the universities to select students into their programs. The various state-specific tertiary ranks, ranging from 0 to 99.95 in intervals of 0.05, represent a student's rank relative to all other year 12 students who have completed their certificate of education in the same state.

Below are described some particularities of the Australian context and the different states, which are important for understanding how Australian high school students choose their subjects.
In June 2009, the Federal Minister of Education, Julia Gillard, announced the removal of the Universities Admission Index (UAI), then utilised in the states of New South Wales (NSW) and Australian Capital Territory (ACT) as the primary criterion for admission into undergraduate university programs. In its stead, the Australian Tertiary Admission Rank (ATAR) was introduced to bring uniformity to the university entrance system in Australia. In 2010, with the exception of Queensland (QLD), the ATAR replaced the Equivalent National Tertiary Entrance Rank (ENTER) in Victoria (VIC), and the Tertiary Entrance Rank (TER) in South Australia (SA), Northern Territory (NT), Western Australia (WA), and Tasmania (TAS). QLD will implement the ATAR for year 10 subjects in 2018 for year 12 students graduating in 2020, which will replace their current Overall Position (OP) system. Although the various tertiary ranks could be directly compared nationally, each state determined the calculation of its own rank to account for differences in their education systems.

The following rule applies to all states: a student cannot receive a tertiary rank without completing the certificate of education in its state. Each certificate of education sets rules for compulsory subjects and other technical pre-requisites.

Here are some particularities of each state. This information applies to both pre-ATAR and post-ATAR.

NSW

Up until June 2009 with the introduction of ATAR in NSW, a student had to complete the year 12 certification called the Higher School Certificate (HSC) in order to receive a tertiary rank (UAI). English was the only mandatory subject for the HSC.
With the introduction of the ATAR in June 2009, English is still the only mandatory subject for the HSC.

ACT

English is the only compulsory subject for the certificate of education in ACT. Prior to 2015 this certificate was called the 'ACT Year 12 Certificate' and from 2015 it is now called the 'ACT Senior Secondary Certificate and Record of Achievement'.

SA

In SA, English and mathematics are compulsory subjects to obtain the South Australia Certificate of Education (SACE).

NT

English and mathematics are also compulsory because they have the same curriculum as in SA. The certificate in NT is called the Northern Territory Certificate of Education and Training (NTCET).

VIC

Only English is compulsory in VIC to obtain the Victorian Certificate of Education (VCE).

WA

In WA, English is compulsory to complete the Western Australian Certificate of Education (WACE).

QLD

In QLD you need to meet minimum standards in numeracy and literacy to complete the Queensland Certificate of Education (QCE). One way to do that is to choose an English subject and a mathematics subject. Though there are others ways to meet those minimum standards, most students choose a subject in both English and maths.

TA

No requirements.

With regards to how the ATAR is calculated, it is similar across all the Australian states with some subtle differences between them. In VIC for example,[10] the ATAR is calculated by VTAC (Victorian Tertiary Admissions Centre) based on up to six VCE (Victorian Certificate of Education) scaled study scores. Study scores are scaled up or down by VTAC according to the performance of students in a study in a particular year – which means scores change each year, making ATARs difficult to predict. The ATAR is calculated from an aggregate, produced by adding together:

- the highest scaled study score in one of the English studies (English, English Language, English as an Additional Language (EAL), Literature),
- highest scaled study scores for three additional permissible studies, and
- 10% of the scaled study scores for the fifth and sixth permissible studies.

Students are then ranked in order of their aggregate and a percentage rank is assigned to distribute students as evenly as possible over a 100-point scale. Finally, the percentage rank is converted to an ATAR score. The ATAR is an estimate of the percentage of the population that the student outperformed. So if he/she receives an ATAR of 60, it means he/she performed better than 60% of students that year. The ATAR is a number from 0 and 99.95 in intervals of 0.05. The highest rank is 99.95, the next highest 99.90, and so on. The lowest automatically reported rank is 30.00, with ranks below 30.00 being reported as ‘less than 30’.

[10] Source: http://atar-calculator.deakin.edu.au/how-it-works

Regarding the number of subjects[11], typically, students in Year 12 study five (47 % of students) or six (38 % of students) subjects. Nationally the average was 5.4 subjects, and while there are some state variations, students in most states study between five and six subjects. The exceptions to this are in Queensland where around 70 % of students study six subjects, and in Tasmania where around 40 % of students study only four subjects. These apparent anomalies, however, do not reflect actual differences in overall workload or teaching time. Where the average number of full-year equivalent subjects is fewer it usually corresponds to those subjects having more teaching time per week. Where the number is greater each subject usually has proportionally less instructional time than in those states where students generally take five subjects.

Regarding scaling, although the actual methodology for scaling year 12 subjects varies across the states, conceptually it serves the same purpose, that being to rank students for university admissions. Universities fill their various courses with students from many secondary schools, for example 200 schools and colleges in Western Australia offer the Western Australian Certificate of Education (WACE) to year 12 students, a pre-requisite to attain a tertiary rank. Although a subject has its own curriculum, learning goals, and assessment criteria, each school teaches it differently. To account for this, for each subject within a particular state, scaling is required to bring uniformity across the various secondary education institutions so that state-specific results can be directly comparable. Once results of similar subjects can be compared, scaling is then required so that results in different subjects are also comparable. In Victoria for example, students can choose from one of three VCE mathematics subjects, which are, from most difficult to least difficult, Specialist Mathematics, Mathematical Methods, and Further Mathematics. To ensure that students who enrol into a harder mathematics subject are not disadvantaged when compared to those students undertaking an easier class, all three are scaled against each other so that their distributions of results have a similar mean and standard deviation. Once this scaling process has been implemented, the results of all of the subjects offered in year 12 to the many students of the various schools of the state that contribute to the calculation of the tertiary rank can be compared in a straightforward manner. These scores, often referred to as scaled study scores, are then combined in some way specific to the state to determine the tertiary rank, for example the ENTER in VIC prior to 2010 or the ATAR thereafter.

In our main analysis, we focus on subjects that students study in year 12. We will relax this in sensitivity analyses, because in some specific circumstances it is possible to validate a subject before year 12[12]. Available to students of above-average ability, accelerated learning refers to the process of altering the otherwise nationally uniform high-school program. Although this process includes various variations, subject acceleration, relevant to our study, allows gifted students to join older peers to

[11] Information for 1998.
https://research.acer.edu.au/cgi/viewcontent.cgi?article=1012&context=lsay_research

[12] https://spectrumtuition.com/why-you-should-take-a-vce-subject-early/
https://atarnotes.com/forum/index.php?topic=134820.0
http://www.theage.com.au/victoria/more-students-take-on-vce-subjects-early-20141024-11b4rv.html
http://blog.duxcollege.com.au/accelerating-a-hsc-subject/

undertake a subject one or two years in advance of schedule. The most common way to accelerate a subject is to do so by one year, that is, to commence a year 11 subject in year 10 and to finish it in year 11 instead of year 12. The major advantage of doing so is to increase the number of subjects taken into account when calculating the tertiary rank. In Victoria for example, the ATAR is calculated by adding the four best scaled study scores with an added bonus of 10% for each of the next two highest scaled study scores. Although most Victorian schools allow students to complete five subjects in year 12, the only way to acquire the added bonus for the sixth subject is to accelerate a subject. Becoming an increasingly more popular option among students according to the Victorian Curriculum and Assessment Authority (VCAA), the number of students accelerating a subject by one year has increased by 22 percent from 2003 to 2014, while over the same period, the number of students accelerating a subject by two years (completing a year 12 subject in year 10) has almost tripled (from 726 to 2,194). Although subject acceleration can be extremely advantageous, as to not mistakenly overburden a student with added stress and pressure, schools and parents are recommended to work together effectively to allow only those students possessing enough emotional, intellectual, and social maturity to undertake such advances in their curriculum.

Finally, it is important to note that only the students intending to attend the university apply for an ATAR, meaning that some of the rules mentioned above may not concern the students who do not plan to do so. 83% of students who completed the certificate of education in NSW in 2017 have also received their tertiary rank[13]. For the same year, this is 93% in VIC[14], 48% in WA[15], and in 2016, 69% in ACT[16]. So a quite large proportion of students receive a tertiary rank, but it varies from state to state.

3. Data

3.1. The Longitudinal Surveys of Australian Youth (LSAY)

The Longitudinal Surveys of Australian Youth (LSAY) follow young Australians in their mid-teens through to their mid-twenties, throughout which time information is collected about education and training, work, and social development. It consists of six cohorts (Y95, Y98, Y03, Y06, Y09, Y15) of approximately 11-12 waves. Since 2003, the initial survey wave has been integrated with the OECD Programme for International Student Assessment (PISA). Basically, information contained in wave 1 of LSAY is collected as part of PISA, and subsequent waves include data from the LSAY interviews.

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[13] http://www.smh.com.au/national/education/hsc-2017-78000-nsw-high-school-students-receive-their-marks-20171213-h0492m.html
[14] http://www.theage.com.au/national/secondary-education-victoria/vce--atar-results-2017-the-wait-is-over-for-thousands-of-students-20171214-h04oin.html
[15] http://www.watoday.com.au/wa-news/wa-students-flock-online-as-atar-results-released-a-day-early-20171218-h06tst.html
[16] http://www.abc.net.au/news/2016-12-14/atar-results-most-canberra-students-in-top-35-per-cent/8118916

Since the self-perception variables required for our analysis are only available in the PISA questionnaire, our chosen sample is constructed from the most recent cohort for which we observe subject choices in Year 12, that is the Y09 cohort. Y09 students were aged 15 in 2009 when they participated in PISA. As a sensitivity analysis, we will also use the Y03 and Y06 cohorts [forthcoming; not in this version]. These three cohorts are nationally representative of 15-year-old students who were selected to participate in PISA from a sample of schools designed to represent all states and sectors. The Y09 cohort consists of 14,251 students from 353 schools while the Y06 cohort consists of 14,170 students from 356 schools.

3.2. The choice variables

In a first analysis, we are interested about the determinants of choosing at least one subject in one field of study. We consider the 12 fields of study defined by LSAY: English; LOTE (language other than English); Maths; Science; Business; Humanities/Social Science; Arts; Health/physical education; Computing; Home economics; Technology; Other. Each field of study includes a collection of subjects of different level of difficulty and/or dealing with different topics.

In a second analysis, we focus on the composition of the whole set of subjects chosen by a student, in order to define whether the selection of subjects is more STEM-oriented, Humanities-oriented, or neutral/diversified.

In a separate paper, we will focus on the degree of competition of the subjects chosen. In this objective, we will use the official scales study scores (or scaling) that depict differences in competition between the different subjects. This will allow us to investigate whether self-confidence influences the choice of competitive subjects.

In a main specification, we consider the subjects that students are studying in Year 12, i.e. the last year of high school. In our sample, 75.9 % of the students are in Year 12 in 2011 and 24,1 % in 2010. Students in Year 12 in 2011 have made their choices at the end of 2009 (end Year 10, if they have not repeated a class) meaning that they should have provided their self-assessments about abilities before they make their choices. However, students in Year 12 in 2010 should have made their choices at the end of 2008, meaning that they asses their beliefs about abilities after they made their choices. For them, the ex-post rationalization issue may be at play, meaning that students report expectations that rationalize their choice (e.g., Zafar, 2013; Bertrand and Mullainathan 2001). We cannot remove this issue as we do not have longitudinal information about self-assessment. However, some studies have shown that non-cognitive skills are relatively stable over the time, especially Elkins, Kassenboehmer and Schurer (2017), who focus on the period of adolescence and very young adulthood, using nationally representative panel data from Australia.

3.3. The self-perception of own abilities and self-confidence variables

Self-perception (or self-assessment) of abilities corresponds to the “original” variable in LSAY.
Self-confidence corresponds to the comparison between self-perception (“original” variable in LSAY) and “objective ability” (PISA scores).

3.3.1. How do previous studies measure self-perception of abilities and self-confidence?

Some of the earliest measures to capture self-confidence in a general sense are those constructed by Rotter (1966) and Rosenberg (1965). Rotter ’s locus of control scale captures the extent to which an individual believes his actions matter in achieving a desired outcome. An individual who believes that the desired outcome is “controlled by forces outside of himself and may occur independently of his own actions” (pp. 1) is thought of as believing in *external control*, whereas an individual who believes the desired outcome “follows from, or is contingent upon, his own behaviour or attributes” (pp.1) is thought of as believing in *internal control*. On the other hand, the Rosenberg’s self-esteem scale, originally constructed by asking questions about the current feelings of high-school students, captures the extent of an individual’s general self-esteem. For example, questions include: “I am able to do things as well as most other people”; “I certainly feel useless at times”; “I wish I could have more respect for myself”; and “I feel that I'm a person of worth, at least on an equal plane with others”.

In their recent and critical review of the literature pertaining to confidence in the field of psychology, however, Oney and Oksuzoglu-Guven (2015) strongly argue for the importance in distinguishing between general confidence and task-specific confidence. They first review some of the varying definitions of confidence used in the literature, such as “a person’s judgment of certainty about a future event or outcome” (Barbalet, 1998 , p. 83), “a degree of certainty individuals possess about their abilities” (Vealey, 1986 , p. 222), “a subjective sense of conviction or validity regarding oneself” (Petty et al, 2002 , p. 724), “the conviction that everything is under control and uncertainty is low” (Siegrist et al, 2005, p. 148), and “an evaluative process based on the evidence collected from the past and the present … that a chosen course of action will lead to a desired outcome” (Stankov et al, 2009, p. 123). They next make the claim that beliefs about one’s ability to do well in life differ from beliefs in one’s ability to complete a specific task, and in doing so, reference Lampert and Rosenberg (1975), who themselves define specific self-confidence as one’s self-stated confidence in abilities in a specified context at a given point in time, as opposed to general self-confidence which they define as one’s self-stated confidence irrespective of any specific context. One of Oney and Oksuzoglu-Guven’s concluding remarks then supports the idea that general self-confidence is comprised of various ‘specific self-confidences’ (Shavelson et al, 1977; Suh, 2000).

Such specific types of self-confidence, relevant to our study because they relate to self-beliefs in an academic context but differ from our and other measures of academic self-confidence that use both objective and subjective measures of ability, are referred to as, by PISA (2013): mathematic *self-efficacy* — a constructed index based on students’ responses about their perceived ability to solve a range of pure and applied mathematics problems; mathematic *self-concept* — a constructed index based on students' responses about their perceived competence in mathematics; and mathematic *anxiety* — a constructed index based on students' responses about feelings of stress and helplessness when dealing with mathematics. These types of self-beliefs are important because they not only influence how students respond when faced with solving mathematical problems, but also because they influence students' perceptions of themselves as mathematical learners which will directly affect their educational pathway choices and subsequent careers (Bong and Skaalvik, 2003; Wang et al., 2013). Various recent studies to analyse these PISA self-beliefs in mathematics in various parts of the world include Lee (2006) who focuses on 15-year-old students in 41 countries, Ferla et al. (2009) who focus on the Belgian sample, Stankov (2012) who focuses on the Singaporean sample, Chevalier et al (2009) who focus on the 2003 PISA sample for England and Wales and Parker et al. (2014; 2017) and Guo et al. (2015) who focus on the Australian sample. Another study to look only at subjective ability is that of Zafar (2013), who, looking at determinants of college major choices in the United States, elicits beliefs about ability in any one major from the following question: "If you were majoring in [*X*], what do you think is the percent chance that you will graduate with a GPA of at least 3.5 (on a scale of 4)?" (pp. 558). Lastly, using data from the Graduate Management Admission Test (GMAT) Registrant Survey, Chen et al. (2017) create two measures of confidence from participants' subjective expected performances on both the quantitative and verbal sections of the GMAT. Also having access to the actual quantitative and verbal scores of the GMAT and by controlling for them in the analysis, they claim being able to capture the "noncognitive mental state of confidence in these areas, beyond their actual abilities embodied in subsequent realized scores" (pp. 13).

Other studies have constructed a measure of subjective ability that allows for a comparison relative to peers, thereby creating a measure of academic rank. Arcidiacono et al. (2012) ask a small sample of 173 male students at Duke University in the United States to rate their competitiveness relative to their peers in each of the majors in Science, Humanities, Engineering, Social Sciences, Economics, and Policy using a 5-point scale of much worse, worse, average, better, and much better. In Wiswall and Zafar (2015), beliefs about ability were elicited from the following scenario: "Consider the situation where either you graduate with a Bachelor's degree in each of the following major categories or you never graduate/drop out. Think about the other individuals (at NYU and other universities) who will graduate in each of these categories or never graduate/drop out. On a ranking scale of 1-100, where do you think you would rank in terms of ability when compared to all individuals in that category?" (pp. 805).

More closely related to our analysis because they utilise both subjective and objective measures of ability to construct a measure of self-confidence (as the difference between the two measures), some studies run their own experiments and ad hoc tests. Kamas and Preston (2012), just as did Moore and Healy (2008), estimate three types of confidence: i) Estimation — one's predicted score; ii) Precision — the certainty of the accuracy of one's belief of the predicted score; and iii) Placement — the predicted score relative to others. They are then able to create an indicator for overconfidence in estimation, calculated as the difference between the predicted score and actual score, and another indicator for confidence in placement, calculated as the difference between the predicted rank and actual rank. In the experiment carried out by Reuben et al. (2017), students are assigned randomly into groups of four to participate in various tasks, including the computation of sums of four two-digit numbers for four minutes. Reuben et al. measure confidence by subtracting a student's true probability of being ranked first at the computing task from a student's subjective probability of being ranked first at the same task. Positive (negative) values of this confidence variable indicate overconfidence (underconfidence). Their experimental design is an adaptation of an earlier design implemented by Niederle and Vesterlund (2007).

Chevalier et al. (2009) investigate whether the persistent gap in higher education participation across different socioeconomic groups can be explained by students' misperceptions of their own ability as well as their own ability relative to their peers. Their second dataset comes from first-year students at two British universities and captures both subjective and objective measures of numeracy and literacy. The numeric test includes ten mental arithmetic problems which must be completed within twenty seconds each. The literacy test is comprised of problems in spelling, grammar, and comprehension which must be completed within five minutes. After completing the test, students provide a subjective evaluation of their absolute performance as well as their performance relative to the other students. Unlike Reuben et al (2017) however, they refer to the situation in which expected ability is higher (lower) than actual ability as over-estimation (under-estimation) as opposed to overconfidence (underconfidence).

The measure we are using in the present study is also a difference between objective and subjective abilities. Our subjective (or self-assessment) variable is measured in comparison with other students. Our "objective" measure of ability is a student's absolute score, but we calculate the placement of the student within his/her school. This allows us to construct a measure of self-confidence in rank. By contrast with previous studies, our measure is taken from a large sample size survey, using actual students' PISA scores as well as students' beliefs about their own abilities compared with their actual peers at school.

To the best of our knowledge, the only study to use the same subjective measure of academic ability as ours is that of Parker et al. (2017), using also the LSAY survey. Using all five LSAY cohorts, pre-PISA and PISA based, and controlling for ability in math, literacy, and generally, Parker et al. find that significant gender differences in self-belief still exist between equally able boys and girls.

3.3.2. Our measure of self-perception of abilities and self-confidence

In this section we describe how we compare "objective" measures of abilities, the PISA scores, with the subjective measures, the self-assessment variables, in order to construct a self-confidence variable that compare both.

Self-perception of abilities

Similarly to Parker et al. (2017), we measure students' self-perceptions of their own abilities in English, mathematics and science using the following question asked to the participants of the 2009 cohort of the LSAY: "Compared with most of the students in your year level at school, how well are you doing in…your English/literacy subject(s)…your mathematics/numeracy subject(s)…your science subject(s)…your subjects overall…?", which is assessed on a five-point Likert scale of *very well*, *better than average*, *about average*, *not very well*, and *very poorly*. This measure of rank is consistent with the rest of the literature that looks at subjective predictions of relative rankings within a particular group of interest.

The PISA scores in Reading, Math and Science

We describe here the specificities of the PISA scores and why they appear to be good quality measures of ability in our context.

The Programme for International Student Assessment (PISA), conducted by the Organisation for Economic Co-operation and Development, tests the skills and knowledge of 15-year-old students worldwide in mathematics, reading, and science. Initially launched in 2000 in 43 countries, a key objective of PISA is to inform and support education policy making within countries. The findings allow policy-makers to measure the extent of acquired knowledge and skills of students in their own countries relative to those in other countries, set policy targets aimed improving their own educational systems, and learn from policies and practices applied in other parts of the world (OECD, 2000). In 2015, representing about 29 million 15-year-olds in the schools of 72 participating countries and economies, approximately 540,000 students took part in PISA.

PISA incorporates a unique combination of features to ultimately produce a high-quality measure of a student's objective ability with characteristically high levels of validity and reliability worldwide. These features include: "1) strong quality assurance mechanisms for translation, sampling, and test administration; 2) measures to achieve cultural and linguistic breadth in the assessment materials, particularly through countries' participation in the development and revision processes for the production of the items; and 3) state of the art technology and methodology for data handling" (OECD, 2010). For example and firstly, with relation to scoring, and given that PISA 2009 included considerable open constructed-response items, "detailed guidelines were developed for the scoring guides themselves, training material to recruit scorers, and workshop materials used for the training of national scorers" [See (https://nces.ed.gov/statprog/handbook/pisa_surveydesign.asp)]. This meant that only "professional staff, trained in the international guidelines, were responsible for test administration" and that "school staff members were only responsible for specifying parental consent requirements, listing students, and providing testing space" [See (https://nces.ed.gov/statprog/handbook/pisa_surveydesign.asp)]. This point is crucial for the present study, because this greatly limits the risk of arbitrary grading and of teachers being influenced by possible gender stereotypes.

Secondly, decisions about the scope and nature of the PISA tests, comprised of individual items in English, mathematics, and science are "made by leading experts in participating countries, and are steered jointly by governments on the basis of shared, policy-driven interests" (OECD, 2010).

And lastly, in relation to the administration of PISA 2009 in the US, "representatives of each jurisdiction reviewed the items for possible bias and for relevance to PISA's goals. The intention was to reflect in the assessment the national, cultural, and linguistic variety of the OECD jurisdictions" [See (https://nces.ed.gov/statprog/handbook/pisa_surveydesign.asp)]. It is because of these features that PISA is considered the most comprehensive and rigorous *international* programme for assessing student performance, objective ability.

The LSAY includes five plausible values for the PISA scores. For our analyses, we used the first plausible values.

The self-confidence variables

Self-confidence is the difference between self-assessment about abilities and "objective" measures, i.e. the PISA scores. The self-assessment variables are measured in comparison with other students, while the PISA scores are absolute measures of abilities. So we need a relative "objective" measure of abilities, such that we compute the gap between the individual's PISA score and the average PISA score at his/her school. We obtain this latter information by computing the average PISA score of all the students participating in LSAY who are enrolled in the same school at wave 1[17]. We then define 5 categories to identify whether students do "objectively" very well/better than average/about average/not very well /very poorly compared to other students at the same school. The thresholds used to define those categories are:

- 'Very well' if difference between pupil's and school's PISA score > 50 (50 represents around half of a standard deviation of the distribution of the scores in the whole LSAY)
- 'Better than average' if difference between pupil's and school's PISA score ≤ 50 and > 10 (10 represents around 10% of a standard deviation)
- 'About average' if difference between pupil's and school's PISA score ≤ 10 and ≥ -10
- 'Not very well' if difference between pupil's and school's PISA score < -10 and ≥ -50
- 'Very poorly' if difference between pupil's and school's PISA score < -50

We will test other thresholds as robustness checks.

Finally, the self-confidence variables are constructed in the following way. The student is identified as:

- over-confident in a subject if his/her self-assessment is strictly higher than his/her "true" relative position. For instance, if the student thinks he/she does 'very well' while he/she actually does 'better than average', then the student is identified as over-confident.
- assessing rightly him/herself in a subject if his/her self-assessment is strictly similar to his/her "true" relative position,
- under-confident in a subject if his/her self-assessment is strictly lower than his/her "true" relative position.

[17] The school's average PISA score is computed using the whole LSAY sample. As some of the schools include a small number of students participating in LSAY, as a robustness check, we will use the average PISA score computed at the state level.

3.4. Sample selection

We select the students for which we observe subjects choices in Year 12 in 2010 or 2011. Our final sample includes 6148 students.

4. Descriptive statistics

Table 1 presents some descriptive statistics about all the explanatory variables we use in the estimations. Girls get significantly higher PISA scores in reading than boys, while we observe the contrary in mathematics and science (see also Figure 1).
Figures 2 and 3 show that both the averages of PISA scores and the averages of the gap between pupil's and school's PISA score, are moving logically according to pupils' self-assessment of their abilities compared to other students. This is true for both boys and girls.
Boys are more over-confident than girls in English but there are no gender differences in the other subjects (Table 1).

Table 1: Descriptive statistics for the explanatory variables used in the estimations

		Boys	Girls
Number of obs – Unweighted (Total=6,148)		2,595	3,553
Proportion – Unweighted		42.21 %	57.79 %
Proportion – Weighted		45.66 %	54.34 %
PISA score[1] Mean (Std. Dev.)	Reading	520.2 (89.7)	545.8 (84.5)*
	Maths	537.9 (88.1)	521.5 (84.7)*
	Sciences	549.1 (96.4)	541.3 (89.2)*
Self-assessment. "How well are you doing in ..."			
English/ literacy	1 Very well	13.93 %	20.79 %
	2 Better than average	29.25 %	28.63 %
	3 About average	45.06 %	41.21 %
	4 Not very well	6.45 %	5.30 %
	5 Very poorly	1.07 %	0.90 %
	6 Not studying this subject/Missing	4.25 %	3.18 %
Maths	1 Very well	20.18 %	16.32 %
	2 Better than average	28.50 %	23.42 %
	3 About average	35.64 %	39.64 %
	4 Not very well	9.21 %	13.22 %
	5 Very poorly	1.94 %	3.27 %
	6 Not studying this subject/Missing	4.53 %	4.13 %
Science	1 Very well	17.35 %	14.58 %
	2 Better than average	23.85 %	20.20 %
	3 About average	32.31 %	38.39 %
	4 Not very well	8.25 %	10.55 %
	5 Very poorly	1.79 %	2.39 %
	6 Not studying this subject/Missing	16.46 %	13.88 %
Self-confidence: comparison real and subjective ranking			

English/ literacy	Over-confident	43.86 %	36.13 %
	Right assessment	19.84 %	25.34 %
	Under-confident	32.04 %	35.35 %
	Missing	4.25 %	3.18 %
Maths	Over-confident	38.62 %	41.16 %
	Right assessment	24.14 %	23.75 %
	Under-confident	32.71 %	30.96 %
	Missing	4.54 %	4.14 %
Science	Over-confident	31.81 %	33.84 %
	Right assessment	21.91 %	21.62 %
	Under-confident	29.81 %	30.66 %
	Missing	16.46 %	13.88 %
Effort: "How much time do you typically spend each week on study or homework?"			
Maths	No time	12.04 %	10.34 %
	Less than 2 hours a week	37.48 %	35.84 %
	2 or more but less than 4 hrs/week	28.88 %	30.48 %
	4 or more but less than 6 hrs/week	12.80 %	15.85 %
	6 or more hours a week	4.59 %	4.78 %
	Missing	4.20 %	2.71 %
Science	No time	24.82 %	24.08 %
	Less than 2 hours a week	40.73 %	39.19 %
	2 or more but less than 4 hrs/week	19.56 %	22.28 %
	4 or more but less than 6 hrs/week	7.59 %	8.67 %
	6 or more hours a week	2.71 %	2.81 %
	Missing	4.59 %	2.98 %
Other subjects	No time	10.19 %	6.09 %
	Less than 2 hours a week	35.57 %	30.11 %
	2 or more but less than 4 hrs/week	27.10 %	31.47 %
	4 or more but less than 6 hrs/week	14.68 %	19.88 %
	6 or more hours a week	8.09 %	9.77 %
	Missing	4.38 %	2.68 %
Indigenous student		2.60 %	2.96 %
Mother at home		96.20 %	96.41 %
Father at home		86.38 %	83.62 %
Brother(s) at home		56.38 %	57.29 %
Sister(s) at home		54.79 %	54.37 %
Grandparent(s) at home		4.77 %	5.46 %
Mother Uni or PhD		29.68 %	30.67 %
Father Uni or PhD		32.01 %	28.45 %
State	1 ACT	1.88 %	1.91 %
	2 NSW	28.56 %	31.36 %
	3 VIC	21.19 %	22.86 %
	4 QLD	26.13 %	21.70 %
	5 SA	8.52 %	7.65 %
	6 WA	11.40 %	11.98 %
	7 TAS	1.46 %	1.72 %
	8 NT	0.85 %	0.82 %
	Metropolitan	76.41 %	76.34 %

School Geographic location	Provincial	21.89 %	22.56 %
	Remote	1.70 %	1.10 %
Mother works	Full time	46.49 %	47.31 %
	Part time	26.57 %	27.65 %
	Other	26.94 %	25.04 %
Father works	Full time	80.89 %	80.37 %
	Part time	5.72 %	6.66 %
	Other	13.39 %	12.97 %

This table reports descriptive statistics of the listed variables that were calculated using weighted data from the LSAY.
* Means are significantly different between boys and girls, at the 5% level.
[1] We consider the first plausible value.

Figure 1: Distribution of PISA test scores by gender

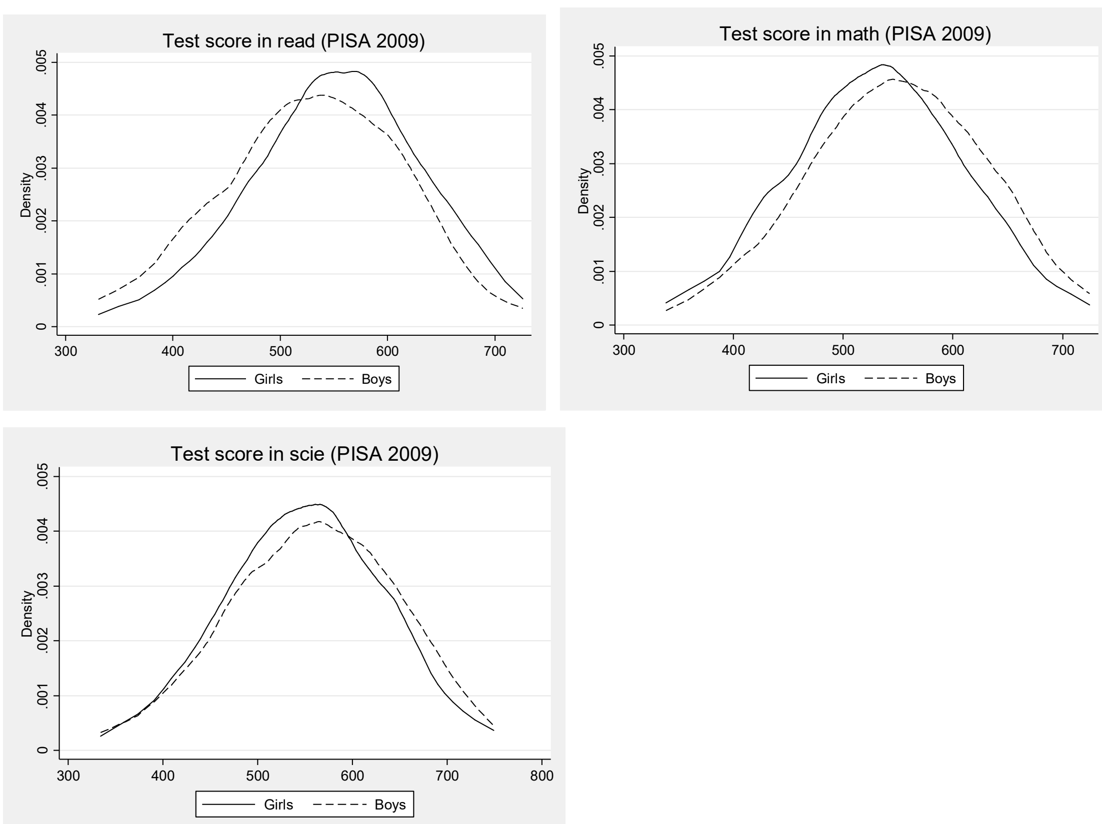
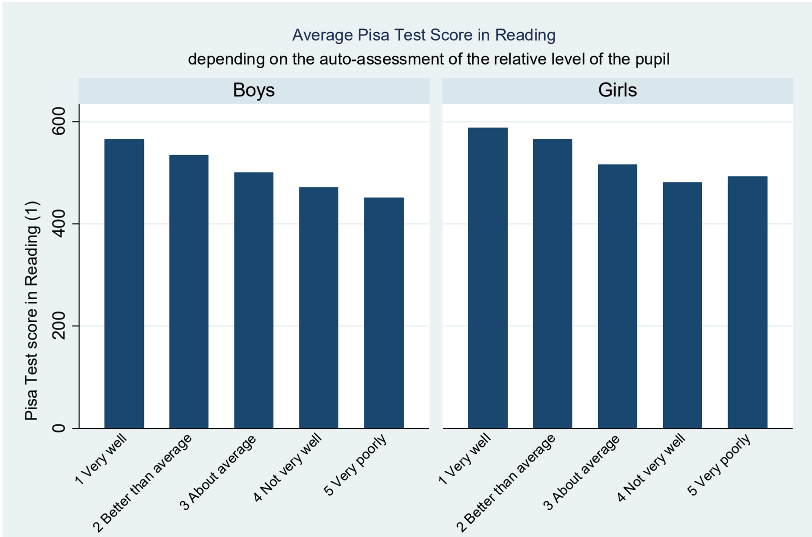
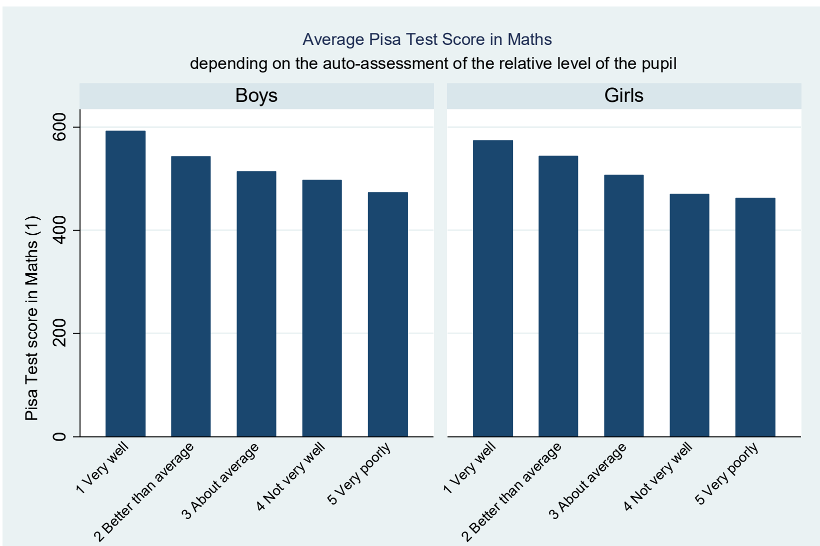


Figure 2: Average PISA test scores, according to pupils' self-assessment of their abilities compared to other students


Average Pisa Test Score in Reading
depending on the auto-assessment of the relative level of the pupil
Boys
Girls
Pisa Test score in Reading (1)
0
200
400
600
1 Very well
2 Better than average
3 About average
4 Not very well
5 Very poorly


Average Pisa Test Score in Maths
depending on the auto-assessment of the relative level of the pupil
Boys
Girls
Pisa Test score in Maths (1)
0
200
400
600
1 Very well
2 Better than average
3 About average
4 Not very well
5 Very poorly

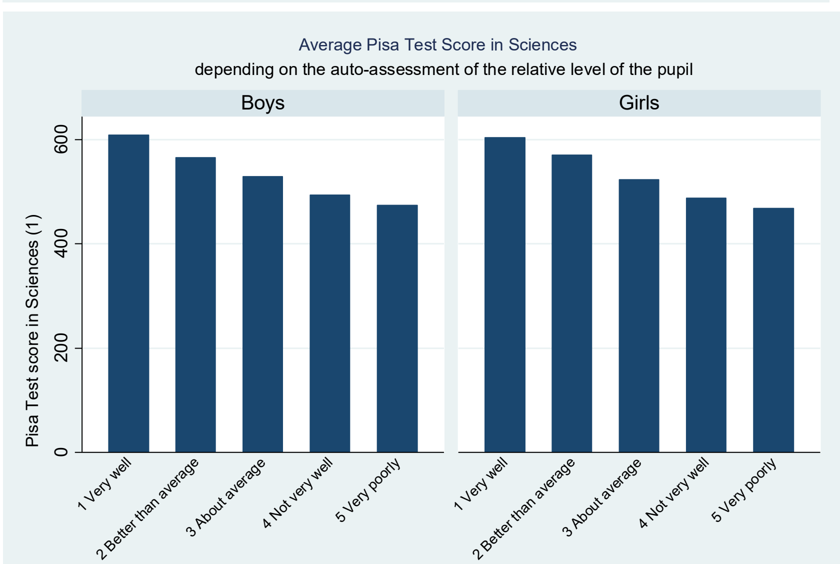
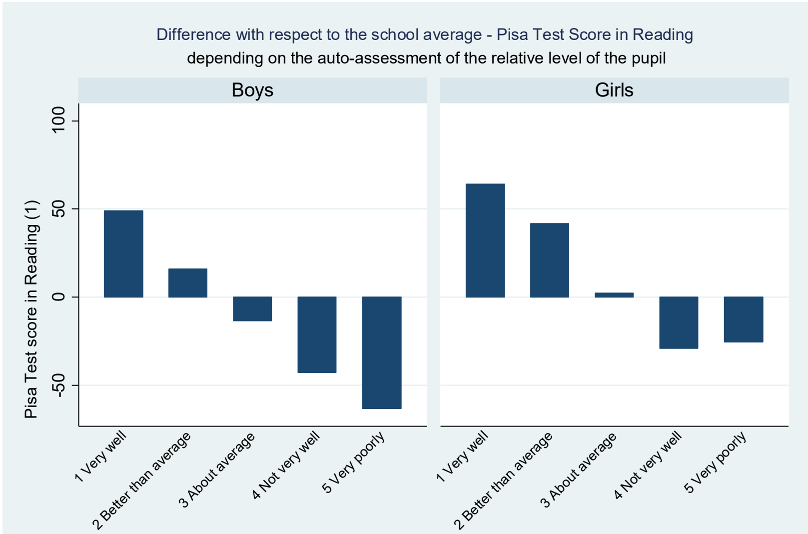
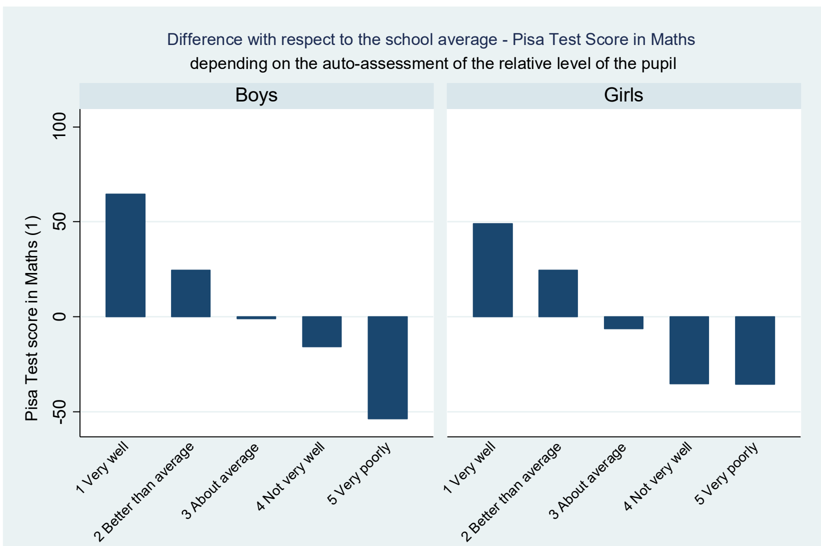

Average Pisa Test Score in Sciences
depending on the auto-assessment of the relative level of the pupil
Boys
Girls
Pisa Test score in Sciences (1)
0
200
400
600
1 Very well
2 Better than average
3 About average
4 Not very well
5 Very poorly

Figure 3: Gap between the pupil's PISA score and the school's average PISA score, according to pupils' self-assessment of their abilities compared to other students


Difference with respect to the school average - Pisa Test Score in Reading
depending on the auto-assessment of the relative level of the pupil
Boys
Girls
Pisa Test score in Reading (1)
100
50
0
-50
1 Very well
2 Better than average
3 About average
4 Not very well
5 Very poorly


Difference with respect to the school average - Pisa Test Score in Maths
depending on the auto-assessment of the relative level of the pupil
Boys
Girls
Pisa Test score in Maths (1)
100
50
0
-50
1 Very well
2 Better than average
3 About average
4 Not very well
5 Very poorly

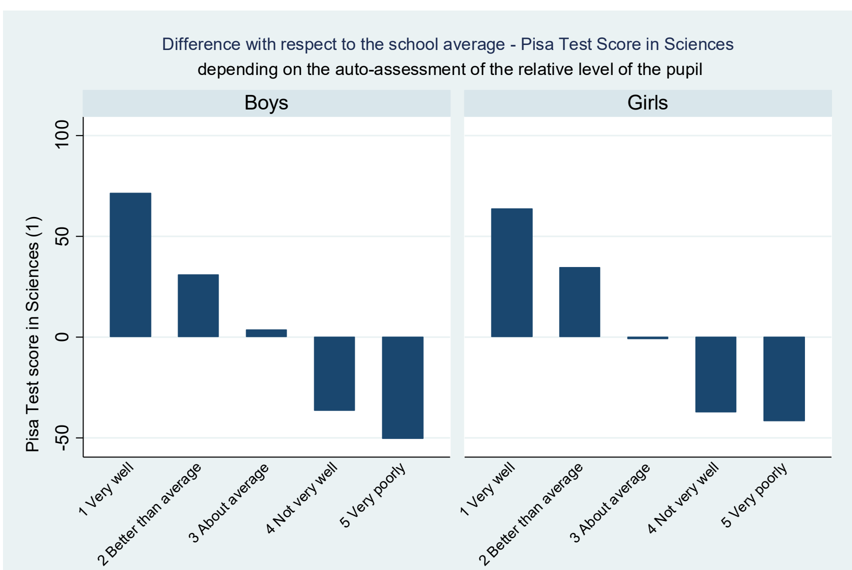

Difference with respect to the school average - Pisa Test Score in Sciences
depending on the auto-assessment of the relative level of the pupil
Boys
Girls
Pisa Test score in Sciences (1)
100
50
0
-50
1 Very well
2 Better than average
3 About average
4 Not very well
5 Very poorly

Table 2 displays the percentage of boys and girls choosing at least one subject in each field of study.
* No gender difference: English, Science, Other
* More boys: Maths, Health and Physical education, Computing, Technology
* More girls: LOTE, Business (weak gender difference), Humanities, Arts, Home Economics

Table 2: Descriptive statistics: % of boys/girls choosing at least one subject in a type

Type of subjects	Boys	Girls
English	95.23 %	96.37 %
LOTE (language other than English)	5.97 %	11.30 %
Maths	88.07 %	78.31 %
Science	52.02 %	51.80 %
Business	20.57 %	24.89 %
Humanities/Social Science	42.23 %	51.06 %
Arts	25.15 %	39.26 %
Health/physical education	35.82 %	29.21 %
Computing	20.30 %	6.31 %
Home economics	8.67 %	23.57 %
Technology	31.71 %	10.86 %
Other	13.19 %	12.52 %

N=6,148. This table reports percentages that were calculated using weighted data from the LSAY.
For instance: 95.23% of boys choose at least one subject in English.

5. Empirical Strategy

We estimate the determinants of the choices using four specifications, which help us to gradually remove some of the concerns related to the endogeneity of the PISA scores.

1) The first specification only includes the gender indicator and the PISA scores as control variables, to investigate whether the choices depend on test scores.

Using the PISA scores removes the bias that teachers' grading practices may be impacted by their gender stereotypes (e.g., Lavy, 2008; Cornwell, Mustard, & Van Parys, 2013), because as described above, the people who grade the PISA tests are not the teachers.

2) The second specification adds the demographic and socioeconomic status variables that are all described in Table 1. Indeed, family background and the characteristics of the localisation may impact both the scores and the choices, and we control for all the available characteristics that we expect to be correlated with both.

3) We then use the third specification to investigate whether the coefficients of the gender indicator and the scores change when we add effort indicators as additional controls. Indeed, effort seems to be a strong source of endogeneity. By increasing their effort in a subject, a pupil will probably get higher test scores, and choose this field of study accordingly. Pupils

might provide different levels of effort because of different tastes for each discipline, or because they might underestimate their skill in a given subject, leading them to under-invest in terms of effort.

To the best of our knowledge, introducing directly the effort as stated by the students is new in the literature.

4) In addition to the cognitive skills measured by the PISA scores and the effort, non cognitive skills are likely to play a role. In particular, the estimated coefficients of the PISA scores may capture not only the effect of the score in itself but also the misperception of students about their own abilities. As such, the fourth specification is the complete one where are added the self-confidence indicators. This allows us to investigate whether self-confidence exerts an impact on subject choices and whether adding confidence into the analysis changes the estimated effects of the PISA scores.

6. Results

6.1. Evidence in terms of choice of at least one subject in a field of study

Tables 3 to 7 present the results for the choice of at least one subject in LOTE (language other than English) (Table 3), Math (Table 4), Science (Table 5), Humanities (Table 6) and Arts (Table 7). Only the key estimated coefficients are displayed, i.e. for the gender indicator, PISA scores and self-confidence indicators. The results for the other subjects being a bit less significant, they are displayed in Appendix tables (from Tables A1 to A6). The coefficients of the effort indicators are also displayed in Appendix (Table A7) as we are more interested in how the estimated effects of the key variables are changed when we add a control for the effort, rather than the effort coefficients themselves.

Note that for the self-confidence variables, we include the indicators of over-confidence and right assessment, such that under-confidence is the reference category. An indicator for a missing value at the self-confidence variable is also included, but not displayed in the tables.

In most of the cases, the three first models show quite similar results of the PISA scores. Introducing the demographic and SES controls does not change the effects of the scores. This suggests that omitting them is not an important source of endogeneity of the test scores. However, this is not the case when we add self-confidence: the coefficients of the scores are very often changed in the most complete specification. Analyses that omit to control for beliefs about abilities lead to biased coefficients of the “objective” abilities.

Gender effect

The gender coefficient is not significant for the “traditional academic” fields of study (Maths, Science, Humanities, LOTE). However, everything else constant, girls choose significantly less Technology and Health & physical education than boys, and significantly more Business and Home economics than boys. Girls also choose more Arts than boys, but the coefficient is significant only in the complete specification with both effort and self-confidence.

Effect of the relevant score

The relevant score means the score in the subject that is closely related to the field of study. For instance, when studying the choice of Maths, the relevant score is Maths, while this is Reading for the choice of Humanities.

Usually, the relevant score for a field of study tends to increase the choice of this field. This is more the case for girls than boys for the choice of LOTE (score in Reading), and more the case for boys than girls for the choice of Maths, Science, Humanities. For the choice of Arts, the coefficient of the Reading score is strongly significant and positive for boys, while it is insignificant and with a negative sign for girls. The score in Science exerts similar positive effects for boys and girls for the choice of Computing.

So globally, boys seem to be more sensitive than girls to the relevant score when making their choices. It means that when making their choices, boys are more sensitive to the expected return of their relevant abilities, in terms of satisfaction or monetary reward.

Regarding other fields of study (for which it's more difficult to say which score is relevant), test scores have mainly no effect or even negative effects, meaning that more able students avoids to choose them. For instance, scores in Math and Science have no effects on the choice of Technology. The choice of business is not at all driven by the PISA scores in the complete specification. Interestingly, for the choice of Health, scores in Science have a positive and significant effect for girls while a negative and significant effect for boys. Regarding the choice of Home economics and Others, the coefficients of the scores are often negative.

Effect of self-confidence in the relevant subject

Usually, being over-confident in one subject leads to choose more the relevant field of study. This is the case for the choice of Maths, Science, Humanities, Arts (only for boys), LOTE (but not significant). For Maths, Science, Humanities, the effect of self-confidence is similar for boys and girls.

A consequence of this is that omitting self-confidence leads to under-estimate the effect of the PISA score in the relevant subject. This is due to two effects. First, the correlation between over-confidence in the relevant subject and the choice of the field of study is positive. Second, the correlation between the score in the relevant subject and being over-confident in this field of study is negative[18]. This second effect is true for the three scores. Thus the product of these two correlations is negative.

Effect of the scores and self-confidence in the non-relevant subjects

We often find some negative effects of over-confidence or right assessment (compared to under-confidence) in a non relevant subject. Over-confidence in English decreases the choice of Math (only for girls) and of Science for both girls and boys. Over-confidence in Math decreases the choice of Humanities for boys, while over-confidence in Science decreases this choice for girls. Over-confidence in Math (and a bit in Science too) decreases the choice of Arts for both boys and girls. For the other fields of study, confidence in any subject usually decreases the choice of these fields, perhaps because they may be considered as less "prestigious". This is the case for Health & physical education, Computing, Others and Home economics.

For these different cases, when adding the confidence indicators, we usually find that the effect of the non-relevant score becomes weaker if the effect of this score was positive without confidence, or more negative if it was already negative. Specifically for the choice of Science, the reading score coefficient was positive and significant for girls without controls for confidence, while the coefficient becomes close to zero and insignificant when adding confidence. So omitting self-confidence suggested that the Reading score had an impact, while this is not true if we add self-confidence. This

[18] This effect may be partly due to the way the self-assessment question is asked. The question is relative, so the very best students cannot be considered as over-estimating themselves.

effect is the conjunction of two correlations: being over-confident for girls in Reading is negatively correlated with the choice of Science and having a good score in reading is negatively correlated with being over-confident in English. To give a second example, for Arts, the negative effect of the score in Math to choose Arts is even stronger when adding confidence for boys. For girls, the negative effect of the score in Math starts to be significant only when adding confidence.

Effort

Adding effort as controls does not change the effects of the PISA scores, or only slightly in a few rare cases. This suggests that the effort is not an important source of endogeneity with respect to test scores in this context.

General comments about self-confidence

Self-confidence in the different subjects is usually a strong predictor of the choice of a subject in Math, Science, Humanities and Arts. However, self-confidence does not exert much impact for the choice of LOTE and Technology. Some effects exist for the other fields of study but are not necessarily very strong.

Gender differences in the effects of scores

Looking at the complete specifications with all the controls included, a few gender differences exist in the effects of scores, but they are not systematic.

A score is sometimes only significant for girls but not for boys. This is the case for the Reading score to choose LOTE (positive effect), of the Math score to choose Science (positive), of the Reading score to choose Computing or Health or Home economics (negative) or again the Science score to choose Home economics or Others (negative).

However, the negative effect of the reading score to choose Technology is only significant for boys, as is the case for the math score to choose Humanities or Home economics. The positive effect of the Reading score to choose Arts is also only significant for boys.

Table 3: Probit estimation of the choice of at least one LOTE (language other than English) subject.

	Key controls -> Controls included ↓	**Gender: Girl=1**	**PISA Scores[1]**					
			Reading		**Math**		**Science**	
			Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
(1)	**Only PISA scores**	0.76	0.13	0.42***	0.11	0.05	0.11	-0.20**
		(0.48)	(0.15)	(0.10)	(0.12)	(0.08)	(0.18)	(0.10)
(2)	**+ Demo & SES**	0.76	0.04	0.36***	0.03	-0.03	0.19	-0.13
		(0.47)	(0.15)	(0.10)	(0.12)	(0.09)	(0.18)	(0.10)
(3)	**+ Effort**	0.75	0.02	0.34***	0.02	-0.05	0.20	-0.12
		(0.47)	(0.15)	(0.10)	(0.12)	(0.09)	(0.18)	(0.11)
(4)	**+ Self-confidence**	0.26	0.11	0.40***	0.03	-0.01	0.14	-0.10
		(0.60)	(0.17)	(0.11)	(0.13)	(0.09)	(0.19)	(0.11)
			Self-confidence English[2]		**Self-confidence Math[2]**		**Self-confidence Science[2]**	
		REF: Under-confident	**Correct / Over**	**Correct / Over**	**Correct / Over**	**Correct / Over**	**Correct / Over**	**Correct / Over**
			0.14 / 0.24	-0.01 / 0.09	-0.09 / 0.02	0.08 / 0.18*	0.01 / -0.16	0.03 / 0.11
			(0.14) / (0.16)	(0.09) / (0.11)	(0.13) / (0.16)	(0.09) / (0.10)	(0.13) / (0.19)	(0.09) / (0.11)

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table 4: Probit estimation of the choice of at least one Math subject.

	Key controls -> Controls included ↓	**Gender: Girl=1**	**PISA Scores[1]**					
			Reading		**Math**		**Science**	
			Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
(1)	**Only PISA scores**	-0.00	-0.06	-0.01	0.30***	0.32***	0.12	-0.01
		(0.36)	(0.12)	(0.08)	(0.11)	(0.08)	(0.14)	(0.09)
(2)	**+ Demo & SES**	0.17	-0.06	-0.01	0.37***	0.30***	0.11	0.02
		(0.40)	(0.13)	(0.09)	(0.13)	(0.08)	(0.15)	(0.10)
(3)	**+ Effort**	0.15	-0.03	-0.01	0.36***	0.29***	0.05	-0.00
		(0.41)	(0.14)	(0.09)	(0.13)	(0.09)	(0.16)	(0.10)
(4)	**+ Self-confidence**	0.45	-0.13	-0.10	0.51***	0.47***	0.13	0.01
		(0.60)	(0.15)	(0.10)	(0.14)	(0.10)	(0.17)	(0.11)

			Self-confidence English[2]				**Self-confidence Math[2]**				**Self-confidence Science[2]**			
(4)	**+ Self-confidence**	*REF: Under-confident*	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**
			0.15	-0.18	-0.31***	-0.34***	0.28**	0.46***	0.39***	0.56***	-0.01	0.26	0.25**	0.08
			(0.13)	(0.16)	(0.09)	(0.11)	(0.12)	(0.15)	(0.09)	(0.11)	(0.13)	(0.17)	(0.10)	(0.11)

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.
[1] The PISA scores are divided by 100 for easier readability.
[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table 5: Probit estimation of the choice of at least one Science subject.

<table>
<tr><th rowspan="3"></th><th rowspan="3">Key controls ->
Controls included ↓</th><th rowspan="3">Gender: Girl=1</th><th colspan="12">PISA Scores[1]</th></tr>
<tr><th colspan="4">Reading</th><th colspan="4">Math</th><th colspan="4">Science</th></tr>
<tr><th colspan="2">Boys</th><th colspan="2">Girls</th><th colspan="2">Boys</th><th colspan="2">Girls</th><th colspan="2">Boys</th><th colspan="2">Girls</th></tr>
<tr><td>(1)</td><td>Only PISA scores</td><td>0.32
(0.30)</td><td colspan="2">0.07
(0.09)</td><td colspan="2">0.17**
(0.07)</td><td colspan="2">0.18**
(0.09)</td><td colspan="2">0.26***
(0.07)</td><td colspan="2">0.26**
(0.10)</td><td colspan="2">0.03
(0.08)</td></tr>
<tr><td>(2)</td><td>+ Demo & SES</td><td>0.31
(0.30)</td><td colspan="2">0.04
(0.09)</td><td colspan="2">0.15**
(0.07)</td><td colspan="2">0.16*
(0.09)</td><td colspan="2">0.23***
(0.07)</td><td colspan="2">0.29***
(0.10)</td><td colspan="2">0.06
(0.08)</td></tr>
<tr><td>(3)</td><td>+ Effort</td><td>0.29
(0.32)</td><td colspan="2">0.06
(0.10)</td><td colspan="2">0.13*
(0.08)</td><td colspan="2">0.12
(0.10)</td><td colspan="2">0.17**
(0.08)</td><td colspan="2">0.25**
(0.11)</td><td colspan="2">0.09
(0.08)</td></tr>
<tr><td rowspan="4">(4)</td><td rowspan="4">+ Self-confidence</td><td>0.37
(0.44)</td><td colspan="2">0.00
(0.11)</td><td colspan="2">0.05
(0.08)</td><td colspan="2">0.14
(0.10)</td><td colspan="2">0.16**
(0.08)</td><td colspan="2">0.37***
(0.11)</td><td colspan="2">0.27***
(0.09)</td></tr>
<tr><td rowspan="3">REF: Under-confident</td><th colspan="4">Self-confidence English[2]</th><th colspan="4">Self-confidence Math[2]</th><th colspan="4">Self-confidence Science[2]</th></tr>
<tr><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th></tr>
<tr><td>-0.10
(0.09)</td><td>-0.19*
(0.11)</td><td>-0.29***
(0.07)</td><td>-0.31***
(0.09)</td><td>0.11
(0.09)</td><td>0.20*
(0.11)</td><td>-0.02
(0.07)</td><td>0.05
(0.09)</td><td>0.43***
(0.10)</td><td>0.46***
(0.12)</td><td>0.28***
(0.08)</td><td>0.53***
(0.09)</td></tr>
</table>

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table 6: Probit estimation of the choice of at least one Humanities subject.

<table>
<tr><th rowspan="3"></th><th rowspan="3">Key controls -> Controls included ↓</th><th rowspan="3">Gender: Girl=1</th><th colspan="12">PISA Scores[1]</th></tr>
<tr><th colspan="4">Reading</th><th colspan="4">Math</th><th colspan="4">Science</th></tr>
<tr><th colspan="2">Boys</th><th colspan="2">Girls</th><th colspan="2">Boys</th><th colspan="2">Girls</th><th colspan="2">Boys</th><th colspan="2">Girls</th></tr>
<tr><td rowspan="2">(1)</td><td rowspan="2">Only PISA scores</td><td>-0.07</td><td colspan="2">0.34***</td><td colspan="2">0.10</td><td colspan="2">-0.22**</td><td colspan="2">-0.03</td><td colspan="2">0.07</td><td colspan="2">0.17**</td></tr>
<tr><td>(0.28)</td><td colspan="2">(0.09)</td><td colspan="2">(0.07)</td><td colspan="2">(0.09)</td><td colspan="2">(0.07)</td><td colspan="2">(0.10)</td><td colspan="2">(0.08)</td></tr>
<tr><td rowspan="2">(2)</td><td rowspan="2">+ Demo & SES</td><td>0.04</td><td colspan="2">0.34***</td><td colspan="2">0.13*</td><td colspan="2">-0.18**</td><td colspan="2">-0.05</td><td colspan="2">0.01</td><td colspan="2">0.11</td></tr>
<tr><td>(0.29)</td><td colspan="2">(0.09)</td><td colspan="2">(0.08)</td><td colspan="2">(0.09)</td><td colspan="2">(0.07)</td><td colspan="2">(0.10)</td><td colspan="2">(0.08)</td></tr>
<tr><td rowspan="2">(3)</td><td rowspan="2">+ Effort</td><td>-0.02</td><td colspan="2">0.31***</td><td colspan="2">0.10</td><td colspan="2">-0.18**</td><td colspan="2">-0.05</td><td colspan="2">0.01</td><td colspan="2">0.12</td></tr>
<tr><td>(0.29)</td><td colspan="2">(0.09)</td><td colspan="2">(0.08)</td><td colspan="2">(0.09)</td><td colspan="2">(0.07)</td><td colspan="2">(0.10)</td><td colspan="2">(0.08)</td></tr>
<tr><td rowspan="6">(4)</td><td rowspan="6">+ Self-confidence</td><td>0.10</td><td colspan="2">0.42***</td><td colspan="2">0.20**</td><td colspan="2">-0.27***</td><td colspan="2">-0.04</td><td colspan="2">0.05</td><td colspan="2">0.04</td></tr>
<tr><td>(0.42)</td><td colspan="2">(0.10)</td><td colspan="2">(0.08)</td><td colspan="2">(0.09)</td><td colspan="2">(0.07)</td><td colspan="2">(0.10)</td><td colspan="2">(0.08)</td></tr>
<tr><td rowspan="4">REF: Under-confident</td><th colspan="4">Self-confidence English[2]</th><th colspan="4">Self-confidence Math[2]</th><th colspan="4">Self-confidence Science[2]</th></tr>
<tr><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th><th>Correct</th><th>Over</th></tr>
<tr><td>0.15*</td><td>0.31***</td><td>0.19***</td><td>0.30***</td><td>-0.13</td><td>-0.25**</td><td>-0.04</td><td>0.00</td><td>0.06</td><td>0.18</td><td>-0.01</td><td>-0.18**</td></tr>
<tr><td>(0.09)</td><td>(0.11)</td><td>(0.07)</td><td>(0.08)</td><td>(0.08)</td><td>(0.11)</td><td>(0.07)</td><td>(0.08)</td><td>(0.09)</td><td>(0.11)</td><td>(0.08)</td><td>(0.09)</td></tr>
</table>

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table 7: Probit estimation of the choice of at least one Art subject.

	Key controls -> Controls included ↓	**Gender: Girl=1**	**PISA Scores[1]**					
			Reading		**Math**		**Science**	
			Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
(1)	**Only PISA scores**	0.31	0.28***	-0.02	-0.20**	-0.04	-0.16	-0.01
		(0.30)	(0.10)	(0.07)	(0.09)	(0.07)	(0.10)	(0.08)
(2)	**+ Demo & SES**	0.33	0.25***	-0.05	-0.18**	-0.08	-0.16	0.04
		(0.30)	(0.10)	(0.07)	(0.09)	(0.07)	(0.11)	(0.08)
(3)	**+ Effort**	0.36	0.25**	-0.05	-0.17*	-0.06	-0.15	0.04
		(0.30)	(0.10)	(0.07)	(0.09)	(0.07)	(0.11)	(0.08)
(4)	**+ Self-confidence**	0.89**	0.36***	-0.03	-0.28***	-0.15**	-0.16	0.01
		(0.44)	(0.11)	(0.08)	(0.10)	(0.07)	(0.11)	(0.08)

			Self-confidence English[2]				**Self-confidence Math[2]**				**Self-confidence Science[2]**			
			Boys		Girls		Boys		Girls		Boys		Girls	
			Correct	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**
(4)	**+ Self-confidence**	*REF: Under-confident*	0.22**	0.35***	-0.04	0.05	-0.13	-0.31***	-0.23***	-0.35***	-0.35***	-0.14	-0.06	-0.10
			(0.09)	(0.12)	(0.07)	(0.08)	(0.09)	(0.11)	(0.07)	(0.08)	(0.10)	(0.12)	(0.08)	(0.09)

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

6.2. Evidence in terms of combinations of subjects

We next group the different fields of study into three large categories: STEM, Humanities and Others. The large category STEM includes Math, Science, Computing and Technology. Humanities includes English, Humanities, Arts, LOTE and Business. Other includes Health and Physical Education, Home Economics and Others. We then count how many subjects the students chose in each large category. Students are then grouped according to seven types of combinations of subjects. In particular we separate students who chose a lot of STEM subjects, students who chose a lot of Humanities subjects and students with more balanced choices.

Results from the complete model (specification 4) are displayed in Table 8. The reference is for the choice of a large number of scientific subjects (stem >= 3). All other things being equal, girls tend to make other choices, except for the choice of two scientific subjects and two or less literary or other subjects (Stem = 2 and Huma + others < 3). So even when one has checked for grades, efforts and judgements on own abilities, girls show a tendency to choose more frequently profiles with few scientific subjects and/or many literary subjects.

The reading score has little impact on choices, except that it increases the probability of choosing combinations with many literary subjects, but only for boys, which offsets for good students the lower probability of this choice for boys. Symmetrically a good mark in mathematics tends to reduce for girls the choices they normally make frequently to the benefit of the reference (many scientific subjects). Generally speaking, all choices are reduced compared to the reference for boys and girls (but not always significantly) when the mathematical score increases, which corresponds to intuition. The same is true for science grades, but the effect is generally more pronounced for boys. Finally, students who overestimate themselves in a topic tend to choose more frequently combinations of subjects for which the topic is relevant. The differences between boys and girls are fairly small, although boys seem to be more sensitive to their views on their math level and girls on their English and science level.

Table 8: Multinomial logit: Students' profile of choices.

Complete specification (4) with PISA scores, Demographic and SES controls, Effort and Self-confidence

Key controls ↓			Combination of Subjects →	Total number less than 3	Stem=0	Stem = 1 Huma >= 3	Stem = 1 Huma < 3	Stem = 2 Huma + others < 3	Stem = 2 Huma + others >= 3	Stem >= 3 ***REF***
Gender: Girl = 1				3.42* (1.96)	2.94 (2.19)	3.95*** (1.12)	5.68*** (1.46)	-4.32** (1.90)	2.27** (0.93)	
PISA scores[1]	**Reading**		**Boys**	0.09 (0.44)	1.06 (0.70)	0.88*** (0.26)	-0.23 (0.37)	-0.58 (0.38)	0.58*** (0.21)	
			Girls	-0.54 (0.38)	0.25 (0.30)	0.08 (0.20)	-0.44 (0.27)	-0.03 (0.39)	-0.35* (0.18)	
	Math		**Boys**	-0.89** (0.41)	-0.35 (0.55)	-0.47* (0.26)	-0.36 (0.38)	-0.42 (0.43)	-0.52*** (0.18)	
			Girls	-0.17 (0.32)	-1.12*** (0.26)	-0.76*** (0.17)	-1.21*** (0.30)	-0.38 (0.32)	-0.26 (0.17)	
	Science		**Boys**	-0.53 (0.48)	-1.72** (0.69)	-0.63** (0.28)	-0.32 (0.32)	-0.25 (0.44)	-0.44** (0.20)	
			Girls	-1.13*** (0.38)	-0.41 (0.30)	-0.10 (0.20)	-0.05 (0.30)	-0.01 (0.37)	-0.05 (0.18)	
Self-confidence[2] *REF: Under-confident*	**English**	**Boys**	**Correct**	-0.23 (0.40)	0.44 (0.42)	0.56*** (0.20)	-0.20 (0.33)	0.42 (0.34)	0.23 (0.17)	
			Over	-0.52 (0.44)	1.43** (0.57)	0.61** (0.27)	0.32 (0.33)	0.13 (0.39)	0.41* (0.22)	
		Girls	**Correct**	0.60* (0.34)	0.64*** (0.25)	0.62*** (0.15)	0.45* (0.25)	0.36 (0.30)	0.12 (0.14)	
			Over	0.87** (0.37)	1.44*** (0.32)	0.98*** (0.21)	0.85*** (0.29)	1.03*** (0.35)	0.52*** (0.18)	
	Math	**Boys**	**Correct**	-0.36 (0.38)	-0.36 (0.38)	-0.64*** (0.20)	-0.28 (0.29)	-0.66** (0.33)	-0.14 (0.17)	
			Over	-0.49 (0.43)	-1.01* (0.58)	-0.61** (0.27)	-0.52 (0.42)	-1.09*** (0.38)	-0.21 (0.20)	
		Girls	**Correct**	-0.38 (0.38)	-0.67*** (0.25)	-0.36** (0.16)	-0.74*** (0.28)	-0.16 (0.32)	-0.35** (0.15)	
			Over	-0.66 (0.41)	-0.88*** (0.29)	-0.39** (0.19)	-0.67** (0.30)	0.21 (0.34)	-0.24 (0.18)	
	Science	**Boys**	**Correct**	-0.37 (0.40)	-0.66 (0.40)	-0.37* (0.19)	-0.42 (0.26)	-0.36 (0.31)	-0.63*** (0.17)	
			Over	-0.33 (0.46)	-1.67*** (0.57)	-0.54** (0.27)	-0.60* (0.36)	-0.57 (0.43)	-0.70*** (0.23)	
		Girls	**Correct**	-0.80** (0.35)	-0.40 (0.27)	-0.34** (0.16)	-0.82*** (0.24)	-0.31 (0.32)	-0.42*** (0.15)	
			Over	-1.39*** (0.40)	-1.18*** (0.32)	-0.95*** (0.21)	-1.30*** (0.31)	-1.23*** (0.42)	-0.65*** (0.19)	

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Only the key coefficients are shown.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

NEXT STEPS (Forthcoming):

- Computation of the marginal effects. We will compute them for several combinations of PISA score levels in reading, maths, sciences. This will allow us to compare choices of boys and girls depending on their global ability, but also depending on whether they have a comparative advantage in a subject. Outstanding question: fixing effort and self-confidence at global sample means or at the boys [girls] means for boys [girls]?

- **Decomposition**, to identify what proportion is explained by cognitive abilities and what proportion by non-cognitive abilities.

- **Counterfactual analysis**:
What would be the choices of girls/boys if they had the same scores and confidence than boys/girls?
What would be the choices of girls/boys if they valued their scores and confidence as boys/girls?

7. Robustness checks

Forthcoming

8. Conclusion

This paper investigates to what extent confidence in one's abilities helps to explain subject choices in high school. Especially, we are trying to answer the question: are subject choices influenced by gender differences in test scores and beliefs about abilities?

The 2009 cohort of the Longitudinal Surveys of Australian Youth (LSAY) shows that girls slightly under-estimate themselves in English compared to boys. However, there are no gender differences in self-confidence in math or science.

First estimation results show that failing to control for self-confidence leads to biased coefficients of the PISA scores. However, omitting to control for the effort does not change the results, which suggests that effort not an important source of endogeneity with respect to test scores.
Boys seem to be more sensitive than girls to the relevant score when making their choices. However, girls are more sensitive (negatively) to their confidence in the non-relevant subjects.
When choosing their whole set of subjects, girls are more sensitive than boys to their confidence in English (difference quite pronounced) and in science (slight difference). Boys are more sensitive than girls to their confidence in Math (slightly).

More analyses are needed to be able to provide precise policy recommendations. However, these results already show that making girls valuing more their skills when making their choices, and making students more aware of their true skills would have an impact on choices.

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Appendix

Table A1: Probit estimation of the choice of at least one Business subject.

	Key controls -> Controls included ↓	**Gender: Girl=1**	**PISA Scores[1]** Reading Boys	Reading Girls	Math Boys	Math Girls	Science Boys	Science Girls
(1)	**Only PISA scores**	1.34*** (0.31)	0.19* (0.10)	-0.06 (0.08)	0.04 (0.09)	-0.01 (0.07)	-0.23** (0.11)	-0.16* (0.09)
(2)	**+ Demo & SES**	1.44*** (0.33)	0.15 (0.11)	-0.14* (0.08)	0.03 (0.10)	-0.08 (0.08)	-0.17 (0.12)	-0.00 (0.09)
(3)	**+ Effort**	1.45*** (0.33)	0.13 (0.11)	-0.14* (0.08)	0.04 (0.10)	-0.07 (0.08)	-0.14 (0.12)	-0.01 (0.09)
(4)	**+ Self-confidence**	1.79*** (0.51)	0.15 (0.13)	-0.15 (0.09)	0.15 (0.11)	-0.07 (0.09)	-0.20 (0.13)	0.02 (0.09)
			Self-confidence English[2] Boys	Girls	**Self-confidence Math[2]** Boys	Girls	**Self-confidence Science[2]** Boys	Girls
		REF: Under-confident	**Correct** 0.10 (0.10); **Over** 0.10 (0.13)	**Correct** -0.04 (0.09); **Over** -0.07 (0.10)	**Correct** -0.00 (0.10); **Over** 0.33*** (0.12)	**Correct** -0.10 (0.09); **Over** -0.02 (0.10)	**Correct** -0.13 (0.11); **Over** -0.23* (0.13)	**Correct** -0.08 (0.09); **Over** 0.09 (0.10)

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table A2: Probit estimation of the choice of at least one Technology subject.

	Key controls -> Controls included ↓	**Gender: Girl=1**	**PISA Scores[1]**					
			Reading		**Math**		**Science**	
			Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
(1)	**Only PISA scores**	-2.49*** (0.32)	-0.50*** (0.10)	-0.07 (0.09)	-0.12 (0.09)	0.04 (0.08)	0.15 (0.10)	-0.09 (0.10)
(2)	**+ Demo & SES**	-2.53*** (0.32)	-0.47*** (0.10)	-0.03 (0.10)	-0.11 (0.09)	0.04 (0.09)	0.10 (0.10)	-0.14 (0.10)
(3)	**+ Effort**	-2.52*** (0.32)	-0.46*** (0.10)	-0.03 (0.10)	-0.09 (0.09)	0.08 (0.09)	0.11 (0.10)	-0.14 (0.10)
(4)	**+ Self-confidence**	-2.80*** (0.46)	-0.52*** (0.11)	-0.06 (0.11)	-0.12 (0.10)	0.09 (0.09)	0.15 (0.11)	-0.12 (0.11)
			Self-confidence English[2]		**Self-confidence Math[2]**		**Self-confidence Science[2]**	
		REF: Under-confident	**Correct:** -0.15 (0.09) **Over:** -0.16 (0.11)	**Correct:** -0.15 (0.09) **Over:** -0.11 (0.11)	**Correct:** -0.10 (0.09) **Over:** -0.13 (0.11)	**Correct:** 0.04 (0.10) **Over:** 0.05 (0.11)	**Correct:** 0.07 (0.10) **Over:** 0.13 (0.12)	**Correct:** -0.10 (0.10) **Over:** 0.05 (0.11)

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table A3: Probit estimation of the choice of at least one Computing subject.

	Key controls -> Controls included ↓	**Gender: Girl=1**	**PISA Scores[1]**					
			Reading		**Math**		**Science**	
			Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
(1)	**Only PISA scores**	-0.07	-0.13	-0.41***	-0.39***	-0.21**	0.33***	0.31***
		(0.39)	(0.10)	(0.11)	(0.09)	(0.10)	(0.11)	(0.12)
(2)	**+ Demo & SES**	-0.03	-0.09	-0.38***	-0.36***	-0.20**	0.29**	0.30**
		(0.39)	(0.11)	(0.11)	(0.10)	(0.10)	(0.12)	(0.12)
(3)	**+ Effort**	-0.03	-0.09	-0.37***	-0.35***	-0.18*	0.30***	0.29**
		(0.38)	(0.11)	(0.11)	(0.10)	(0.10)	(0.11)	(0.12)
(4)	**+ Self-confidence**	-0.20	-0.09	-0.46***	-0.42***	-0.21**	0.30**	0.32***
		(0.51)	(0.12)	(0.12)	(0.11)	(0.10)	(0.12)	(0.12)

	Self-confidence English[2]				**Self-confidence Math[2]**				**Self-confidence Science[2]**			
	Boys		Girls		Boys		Girls		Boys		Girls	
REF: Under-confident	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**
(4)	-0.08	0.01	-0.05	-0.23*	-0.07	-0.22**	0.03	-0.10	-0.28***	-0.10	-0.06	0.08
	(0.10)	(0.12)	(0.11)	(0.13)	(0.09)	(0.11)	(0.11)	(0.12)	(0.10)	(0.13)	(0.13)	(0.13)

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table A4: Probit estimation of the choice of at least one Health and Physical Education subject.

	Key controls -> Controls included ↓	**Gender: Girl=1**	**PISA Scores[1]**					
			Reading		**Math**		**Science**	
			Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
(1)	**Only PISA scores**	-0.69** (0.29)	-0.23** (0.09)	-0.34*** (0.08)	0.05 (0.09)	-0.05 (0.07)	-0.16 (0.10)	0.16* (0.08)
(2)	**+ Demo & SES**	-0.78*** (0.30)	-0.20** (0.09)	-0.34*** (0.08)	0.04 (0.09)	-0.06 (0.07)	-0.16 (0.10)	0.19** (0.08)
(3)	**+ Effort**	-0.82*** (0.30)	-0.20** (0.10)	-0.33*** (0.08)	0.05 (0.09)	-0.04 (0.07)	-0.16 (0.10)	0.18** (0.08)
(4)	**+ Self-confidence**	-1.14*** (0.44)	-0.16 (0.10)	-0.38*** (0.09)	0.02 (0.10)	-0.06 (0.08)	-0.23** (0.11)	0.23** (0.09)
			Self-confidence English[2]		**Self-confidence Math[2]**		**Self-confidence Science[2]**	
		REF: Under-confident	**Correct** / **Over**	**Correct** / **Over**	**Correct** / **Over**	**Correct** / **Over**	**Correct** / **Over**	**Correct** / **Over**
			0.00 (0.09) / 0.09 (0.11)	-0.27*** (0.08) / -0.18** (0.09)	-0.10 (0.08) / -0.14 (0.10)	0.04 (0.08) / -0.01 (0.09)	-0.10 (0.09) / -0.28** (0.12)	-0.07 (0.08) / 0.10 (0.09)

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.
[1] The PISA scores are divided by 100 for easier readability.
[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table A5: Probit estimation of the choice of at least one Home Economics subject.

	Key controls -> Controls included ↓	Gender: Girl=1	PISA Scores[1]											
			Reading				Math				Science			
			Boys		Girls		Boys		Girls		Boys		Girls	
(1)	Only PISA scores	1.29*** (0.35)	-0.04 (0.13)		-0.19** (0.08)		-0.41*** (0.12)		-0.12* (0.07)		0.17 (0.13)		-0.09 (0.09)	
(2)	+ Demo & SES	1.57*** (0.37)	0.01 (0.14)		-0.16* (0.09)		-0.34*** (0.12)		-0.08 (0.08)		0.09 (0.13)		-0.17* (0.09)	
(3)	+ Effort	1.55*** (0.38)	-0.01 (0.14)		-0.14* (0.09)		-0.31** (0.13)		-0.05 (0.08)		0.10 (0.13)		-0.18* (0.09)	
(4)	+ Self-confidence	1.99*** (0.53)	0.02 (0.15)		-0.19** (0.09)		-0.34** (0.15)		-0.09 (0.08)		0.08 (0.15)		-0.19** (0.09)	
			Self-confidence English[2]				Self-confidence Math[2]				Self-confidence Science[2]			
		REF: Under-confident	Correct	Over	Correct	Over	Correct	Over	Correct	Over	Correct	Over	Correct	Over
			-0.34** (0.14)	-0.02 (0.15)	-0.04 (0.08)	-0.10 (0.09)	0.01 (0.13)	-0.06 (0.17)	-0.09 (0.08)	-0.16* (0.09)	-0.05 (0.14)	-0.16 (0.17)	-0.15* (0.09)	-0.08 (0.10)

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table A6: Probit estimation of the choice of at least one Others subject.

	Key controls -> Controls included ↓	**Gender: Girl=1**	**PISA Scores[1]**					
			Reading		**Math**		**Science**	
			Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
(1)	**Only PISA scores**	0.10	-0.20*	-0.12	0.04	-0.03	-0.17	-0.21*
		(0.34)	(0.11)	(0.09)	(0.11)	(0.09)	(0.11)	(0.11)
(2)	**+ Demo & SES**	0.03	-0.15	-0.11	0.04	0.00	-0.22*	-0.23**
		(0.36)	(0.11)	(0.10)	(0.11)	(0.09)	(0.12)	(0.11)
(3)	**+ Effort**	0.06	-0.13	-0.10	0.06	0.01	-0.22*	-0.22**
		(0.36)	(0.11)	(0.10)	(0.11)	(0.09)	(0.12)	(0.11)
(4)	**+ Self-confidence**	0.51	-0.13	-0.06	0.03	0.01	-0.17	-0.30***
		(0.53)	(0.12)	(0.11)	(0.12)	(0.10)	(0.13)	(0.11)

			Self-confidence English[2]				**Self-confidence Math[2]**				**Self-confidence Science[2]**			
			Boys		Girls		Boys		Girls		Boys		Girls	
		REF: Under-confident	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**	**Correct**	**Over**
(4)	**+ Self-confidence**		-0.01	0.06	0.03	0.07	-0.24**	-0.14	-0.04	-0.06	-0.03	0.11	-0.15	-0.24**
			(0.12)	(0.13)	(0.10)	(0.11)	(0.11)	(0.14)	(0.10)	(0.12)	(0.12)	(0.14)	(0.11)	(0.12)

N= 6,148. The coefficients are reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Only the key coefficients are shown. Demographic and SES controls include Indigenous status, mother/ father/ brother(s)/ sister(s)/ grandparent(s) at home, mother's/ father's education, state, school geographic location, mother's/ father's work time.

[1] The PISA scores are divided by 100 for easier readability.

[2] The self-confidence variables also include an indicator for a missing value, which are not displayed here.

Table A7: Effort coefficients - Probit estimations of the choice of at least one subject in each field of study

		Effort: "How much time do you typically spend each week on study or homework?"														
		Other subjects					**Maths**					**Science**				
Fields of study↓	*REF: No time*	< 2h	≥ 2h but < 4h	≥ 4h but < 6h	≥ 6h	Miss	< 2h	≥ 2h but < 4h	≥ 4h but < 6h	≥ 6h	Miss	< 2h	≥ 2h but < 4h	≥ 4h but < 6h	≥ 6h	Miss
LOTE	**(3) Without confidence**	0.10	0.16	0.29	0.22	0.11	0.02	0.19	0.08	0.13	0.51**	0.03	0.01	0.08	-0.03	-0.31*
		(0.18)	(0.18)	(0.18)	(0.20)	(0.24)	(0.15)	(0.15)	(0.16)	(0.20)	(0.25)	(0.09)	(0.10)	(0.13)	(0.19)	(0.18)
	(4) With confidence	0.12	0.17	0.30	0.24	-0.15	-0.01	0.14	0.02	0.05	0.44*	0.01	-0.01	0.08	-0.04	-0.53***
		(0.18)	(0.18)	(0.19)	(0.21)	(0.24)	(0.15)	(0.15)	(0.17)	(0.21)	(0.25)	(0.10)	(0.11)	(0.14)	(0.20)	(0.18)
Math	**(3) Without confidence**	-0.41***	-0.53***	-0.74***	-0.85***	-0.94**	0.68***	1.01***	1.07***	1.35***	0.80*	0.06	0.13	0.23	0.41*	0.35
		(0.13)	(0.13)	(0.15)	(0.16)	(0.45)	(0.11)	(0.12)	(0.14)	(0.18)	(0.47)	(0.08)	(0.10)	(0.14)	(0.23)	(0.33)
	(4) With confidence	-0.27**	-0.39***	-0.58***	-0.68***	-0.73	0.59***	0.87***	0.91***	1.18***	0.98**	-0.02	0.07	0.16	0.33	0.49
		(0.13)	(0.14)	(0.15)	(0.17)	(0.47)	(0.11)	(0.12)	(0.15)	(0.19)	(0.45)	(0.09)	(0.11)	(0.15)	(0.25)	(0.33)
Science	**(3) Without confidence**	-0.52***	-0.68***	-0.84***	-0.77***	-0.20	0.09	0.14	0.09	0.13	0.21	0.87***	1.22***	1.55***	1.68***	0.32
		(0.11)	(0.12)	(0.12)	(0.13)	(0.29)	(0.10)	(0.10)	(0.12)	(0.16)	(0.37)	(0.07)	(0.08)	(0.11)	(0.18)	(0.30)
	(4) With confidence	-0.44***	-0.56***	-0.71***	-0.62***	-0.10	0.21**	0.24**	0.21*	0.22	0.16	0.51***	0.82***	1.12***	1.21***	0.33
		(0.11)	(0.12)	(0.13)	(0.14)	(0.31)	(0.10)	(0.11)	(0.12)	(0.16)	(0.44)	(0.08)	(0.09)	(0.12)	(0.18)	(0.38)
Humanities	**(3) Without confidence**	0.31***	0.43***	0.55***	0.51***	-0.06	-0.02	0.06	0.01	-0.06	0.16	0.03	-0.12*	-0.15	-0.10	0.15
		(0.11)	(0.11)	(0.12)	(0.13)	(0.34)	(0.09)	(0.10)	(0.11)	(0.14)	(0.36)	(0.06)	(0.07)	(0.09)	(0.15)	(0.23)
	(4) With confidence	0.29***	0.41***	0.51***	0.47***	-0.02	-0.00	0.08	0.03	-0.06	0.15	0.01	-0.15*	-0.18*	-0.11	0.20
		(0.11)	(0.11)	(0.12)	(0.13)	(0.34)	(0.10)	(0.10)	(0.11)	(0.15)	(0.35)	(0.08)	(0.09)	(0.11)	(0.16)	(0.23)
Art	**(3) Without confidence**	0.21*	0.22**	0.25**	0.32**	-0.15	-0.33***	-0.39***	-0.37***	-0.47***	-0.22	-0.02	-0.10	-0.07	-0.30*	0.30
		(0.11)	(0.11)	(0.12)	(0.13)	(0.27)	(0.09)	(0.09)	(0.11)	(0.15)	(0.32)	(0.06)	(0.07)	(0.10)	(0.16)	(0.24)
	(4) With confidence	0.12	0.12	0.15	0.20	-0.25	-0.30***	-0.34***	-0.31***	-0.39***	-0.30	0.10	0.04	0.07	-0.12	0.29
		(0.11)	(0.11)	(0.12)	(0.13)	(0.27)	(0.09)	(0.10)	(0.11)	(0.15)	(0.32)	(0.08)	(0.09)	(0.11)	(0.17)	(0.24)
Business	**(3) Without confidence**	0.04	0.15	0.05	0.03	0.19	0.33***	0.31***	0.46***	0.67***	-0.04	-0.27***	-0.41***	-0.64***	-0.53***	-0.07
		(0.12)	(0.12)	(0.13)	(0.14)	(0.34)	(0.11)	(0.12)	(0.13)	(0.17)	(0.38)	(0.07)	(0.08)	(0.11)	(0.17)	(0.26)
	(4) With confidence	0.06	0.17	0.08	0.06	0.23	0.32***	0.29**	0.44***	0.64***	-0.06	-0.30***	-0.44***	-0.66***	-0.55***	-0.10
		(0.12)	(0.13)	(0.13)	(0.15)	(0.36)	(0.11)	(0.12)	(0.14)	(0.17)	(0.41)	(0.09)	(0.10)	(0.12)	(0.18)	(0.27)
Technology	**(3) Without confidence**	0.21*	-0.01	0.06	0.02	0.08	-0.12	-0.08	-0.08	0.07	0.10	-0.20***	-0.16*	-0.30***	-0.47**	-0.24
		(0.11)	(0.12)	(0.13)	(0.14)	(0.27)	(0.10)	(0.11)	(0.13)	(0.18)	(0.33)	(0.07)	(0.08)	(0.12)	(0.19)	(0.26)

	(4) With confidence	0.18 (0.11)	-0.05 (0.12)	0.03 (0.13)	-0.01 (0.14)	-0.11 (0.29)	-0.13 (0.10)	-0.07 (0.11)	-0.07 (0.13)	0.09 (0.18)	0.02 (0.35)	-0.11 (0.09)	-0.07 (0.10)	-0.21 (0.13)	-0.39** (0.20)	-0.31 (0.27)
Computing	**(3) Without confidence**	-0.10 (0.13)	-0.05 (0.13)	-0.04 (0.14)	-0.02 (0.17)	-0.75** (0.31)	0.06 (0.11)	-0.00 (0.12)	0.06 (0.14)	-0.18 (0.20)	0.35 (0.38)	-0.24*** (0.08)	-0.15 (0.09)	-0.28** (0.13)	-0.13 (0.20)	-0.05 (0.31)
	(4) With confidence	-0.10 (0.13)	-0.05 (0.13)	-0.04 (0.14)	0.01 (0.17)	-0.88*** (0.32)	0.05 (0.12)	-0.01 (0.13)	0.07 (0.15)	-0.20 (0.21)	0.36 (0.37)	-0.20** (0.10)	-0.10 (0.11)	-0.24 (0.15)	-0.05 (0.21)	-0.13 (0.29)
Health / Physical Education	**(3) Without confidence**	-0.08 (0.10)	-0.04 (0.11)	-0.07 (0.11)	-0.12 (0.13)	0.08 (0.32)	0.01 (0.09)	-0.10 (0.10)	-0.12 (0.11)	-0.32** (0.16)	-0.31 (0.36)	0.08 (0.06)	0.02 (0.07)	-0.01 (0.10)	-0.28* (0.17)	-0.00 (0.25)
	(4) With confidence	-0.06 (0.11)	-0.01 (0.11)	-0.04 (0.11)	-0.09 (0.13)	0.08 (0.34)	-0.01 (0.09)	-0.13 (0.10)	-0.13 (0.11)	-0.33** (0.16)	-0.26 (0.37)	0.09 (0.08)	0.04 (0.09)	0.02 (0.11)	-0.24 (0.18)	-0.01 (0.25)
Home Economics	**(3) Without confidence**	0.03 (0.12)	0.03 (0.12)	-0.04 (0.14)	0.03 (0.16)	0.05 (0.27)	0.03 (0.10)	0.00 (0.11)	0.03 (0.14)	-0.01 (0.18)	0.31 (0.34)	-0.13* (0.07)	-0.24*** (0.09)	-0.56*** (0.13)	-0.34 (0.27)	-0.69** (0.27)
	(4) With confidence	-0.01 (0.12)	-0.02 (0.12)	-0.10 (0.13)	-0.06 (0.15)	0.08 (0.28)	0.06 (0.10)	0.05 (0.11)	0.09 (0.13)	0.08 (0.18)	0.38 (0.33)	-0.07 (0.09)	-0.17* (0.10)	-0.48*** (0.14)	-0.27 (0.27)	-0.59** (0.25)
Others	**(3) Without confidence**	0.02 (0.12)	-0.10 (0.13)	-0.02 (0.13)	0.08 (0.15)	0.18 (0.34)	-0.19* (0.10)	-0.21* (0.11)	-0.12 (0.13)	-0.29 (0.19)	0.07 (0.47)	-0.07 (0.08)	-0.08 (0.09)	-0.20 (0.13)	-0.24 (0.22)	-0.55 (0.39)
	(4) With confidence	0.05 (0.12)	-0.07 (0.13)	0.01 (0.14)	0.13 (0.15)	0.30 (0.34)	-0.22** (0.11)	-0.23* (0.12)	-0.13 (0.14)	-0.33* (0.19)	0.10 (0.44)	-0.08 (0.09)	-0.09 (0.11)	-0.22 (0.14)	-0.23 (0.23)	-0.47 (0.36)

N= 6,148. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.