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Students' Academic Self-Perception

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Executive Summary

There is a large gap in higher education attainment between different groups of society, especially along gender, class and ethnic dimensions. Reducing these gaps in attainment has been at the forefront of policy makers, not only in this country but also in most advanced economy with policies ranging from financial support to positive discrimination. However, policies can only be effective if the reasons behind these gaps are understood.

Several explanations have been suggested to explain these gaps. Economists have focused on market failures and particularly that in the absence of collateral, students from some background may be unable – or unwilling – to finance their education by loan. This suggests that policies of grants should reduce the attainment gap; however evidence of the efficiency of these policies has been mixed.

Another reason for not investing in higher education may be a lack of information on the costs and benefits of education. While they are some evidence that individuals from lower social class underestimate the benefit and over-estimate the costs, it is unclear whether this could fully account for the observed gap.

This research explores another reason why individuals from specific group do not invest in higher education. We postulate that they may have misbelieves in their own ability and under estimate their chance of success.

To test this hypothesis we rely on two datasets. The first is the 2003 PISA which surveyed 15 year old, and administered a comprehensive test in mathematics. Pupils were also asked whether they expected to attend higher education. In this survey, we did not find any evidence

that individuals from lower social class are less confident in their mathematical ability. However, we estimate that mathematical efficacy (and to a lower extend, self-evaluation) has a positive effect on the prospect of going to higher education. An increase in one standard deviation in self-efficacy increases the probability of expecting to go to university by ½ the amount of an increase in one standard deviation in test score.

The second dataset is based on an online survey of first year students in two British universities. We find that males overestimate their own performance in math and English, as well as their position in the score distribution. Relative to students with the most favourable background, working class students under-estimate their performance in math and white students under-estimate their relative position in both math and English. . The gender and class gaps are especially large in numeracy, at around 20% of the average score.

Self-perception also correlates with educational confidence in general but the effect is small. The effect of self-perception on the decision to participate in higher education does not seem to work through its effect on risk aversion and the returns to higher education, because self-perception is only weakly correlated with these factors.

Policies that raise academic self-confidence in schools are, unsurprisingly, likely to raise participation rates but are unlikely to close participation gaps unless targeted only at under-represented groups. This is not to suggest that students should be praised whatever their results but on the contrary, trained to develop objective views about their own ability.

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Acknowledgments

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1. Introduction

For decades, ensuring equal opportunity in access to higher education has been one of the main aims of policy makers in most countries, with the introduction of policies ranging from improved information to positive discrimination. The Higher Education Funding Council for England, for example, states that its mission includes "ensuring equality of opportunity for disabled students, mature students, women and men, and all ethnic groups"[1]. However, despite these efforts, and the general expansion of participation in higher education, large gaps in access between groups remain.

Here, we investigate the effect of students' perception of their absolute and relative ability on these gaps. Perceived ability affects the expected costs and benefits of attending higher education and might thus impact on the decision to attend university. Firstly, this paper explores the correlation between academic self-perception and the decision to attend university. Secondly, we examine whether differences in academic self-perception are related to socioeconomic background, and hence whether gaps in educational attainment between socioeconomic groups might be rooted in differences in self-perception. Finally, we assess whether self-perception of current abilities is correlated with expectations of success in future academic work and with expectations of the benefits of higher education.

The paper uses two British datasets and focuses on three groups with relatively low education attainment: lower social class, male and ethnic minority pupils. In Britain, the gap in higher education attainment between the top and bottom three social classes has been hovering around 26 percentage points since the 1960s (DfES, 2003). The under-achievement of boys, at all academic levels, has become an active field of research (see Ammermueller and Dolton (2006) or Goldin et al. (2006) for example). Females overtook males in the number of students in higher education in the 1990s, and by 2004 they represented 53% of students. In 2005, ethnic minorities represented 16% of students and 9% of the working population (Connor et al., 2004). However, the participation differs greatly by ethnic groups and there are

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[1] This statement is found on HEFCE webpage and throughout several official publications; see http://www.hefce.ac.uk/widen/ or the report of the Admissions to Higher Education Review (2004).

concerns that ethnic minority students tend to be concentrated in lower-ranking institutions and degree programmes, and in specific locations such as London. Altogether, the reasons for the gaps in attainment between these groups are not well understood.

The higher education attainment gap may stem from differences in family resources, secondary education quality, heterogenous returns, peer effects or market failures to name a few of the factors. Market failures are multiple. First, individuals who would enjoy positive returns to their investment in higher education may be prevented access due to financial constraints. In the absence of full publicly-guaranteed loans or grants, they cannot borrow against their future earnings and are deterred by the costs of entry into higher education. Economists have provided mixed evidence regarding financial constraints. For example, experimental evidence on the Educational Maintenance Allowance, a means tested benefit for 16 to 18 year olds in the UK, supports the view that that financial support increased participation for poorer pupils (Battistin et al., 2004). In contrast, Baumgartner and Steiner (2006) find no effect on participation from a reform increasing the generosity of student aid for poorer students in Germany. In the US, Dynarski (2003, 2005) finds that student aid increased college participation and completion, whilst other studies find increased participation in Georgia (Cornwell et al, 2006) but not in Tennessee (Penn and Kyle, 2007). Altogether Carneiro and Heckman. (2003), calculate that financial constraints can only explain about 10% of the gap in educational attainment in the US. In the UK, this proportion may be even lower as tuition fees are lower.

A second type of market failure involves imperfect information on the costs, benefits or quality of higher education. In the UK, information on costs[2] and quality is fairly easily available at low cost, although pupils from families that have never experienced higher education have lower rates of participation, which could suggest that differences in the information set matter (DfES, 2003). Evidence from Canada for example, shows that poorer families grossly under-estimate the returns to education and over-estimate tuition costs (Usher, 2005).

[2] There have been changes to the costs structures of higher education in the last decades but in all periods a unique price was charged by almost all higher education institutions. So differences in the information about the tuition costs of higher education are unlikely to play a major role. The main costs of attending higher education are thus foregone earnings and living costs. Nonetheless 35% of pupils who did not apply felt they did not have enough information about the cost of going to university (Connor et al., 2001)

This paper focuses on a third type of failure: the individual's perception and misperception of his or her academic ability. Judgement of ability is likely to play a critical role in the decision to invest in higher education, in the choice of institution, the choice of degree and the chances of completion. Underestimation of ability could reduce enrolment, because students overestimate the difficulties they will face, under estimate their probability of success and doubt they have the talents to reap the labour market rewards (Marsh 1990). Conversely, over confident individuals may enter higher education without considering the competition (Camerer and Lovallo, 1999) and find that they are out of their depth, potentially reducing completion rates and crowding out more able students. In a qualitative analysis of young people in England and Wales (Connor et al., 2001), 13 percents of pupils cited uncertainties about their ability as the main reason for not going to university.We discuss the existing literature on these issues in Section 2.

To assess the impact of academic self-perception, we rely on evidence from two datasets that together reveal complementary evidence. First, we examine the "England and Wales" component of the Program for International Student Assessment (PISA). In 2003, students in grade 10 (age 15) were tested on their mathematics knowledge. The questionnaire also elicited measures of confidence in mathematics and student's expectations regarding attending higher education. We can thus assess whether self-perception is linked to expectations of attending university, after controlling for measures of mathematics ability based on the PISA tests. We can also assess to what extent self-perception and expectations differ between demographic groups. A drawback of this data is that it asks about self-perceptions along only one academic dimension – mathematics – and contains no information about where pupils rank themselves relative to others in terms of their abilities.

To gain more insight into absolute and relative ability expectations in other academic dimensions we use a second dataset, the Student Expectation Survey (2005), which is a small on-line study of the expectations of incoming first-year university students. This survey was conducted at two British universities and asks students to evaluate their own performance in two tests in literacy and numeracy, both in terms of absolute score and relative to others who took the tests. Additionally, using other questions on this survey, we can assess whether academic self-perception is correlated with studying strategy, estimated probability of success and expected returns to education. The two surveys are described in more details in Section 3.

The structure of the rest of the paper is as follows. Presentation of our main results commences in Section 4 with regression analysis of the behaviour of 15 year old pupils from the PISA survey. Section 5 extends the analysis to our small sample of first year university students. Section 6 provides brief further discussions and conclusions

2. Literature

If people are accurate at judging their own abilities, then self-perception would have no role as a 'market failure' in the acquisition of education and skills. However, individuals exhibit bounded-rationality concerning educational decisions if they are poor at predicting their own performance. Psychologists have long documented that there is indeed a weak correlation between actual and perceived performance in several domains – see Dunning et al. (2004) for an extensive review. In the academic domain, the correlation between first-year college students' own and instructors' evaluations, for example, is only 0.35 (Chemers et al., 2001). Other work further highlights the relevance of sex, age, social class and reference group (Marsh and Hau, 2003; Wiltfang and Scarbecz, 1990; James, 2002), and in particular the "big fish little pond effect" by which individuals' self-esteem is negatively related to the academic achievement of peers (Marsh and Parker, 1984). Some differences may be institution based. For example, if higher quality schools make more efficient use of information and provide more accurate feedback to their pupils, those pupils may become better at judging their own performance (see Dunning et al., 2004). There are thus many reasons to consider self-perception as an important determinant of the attainment gaps in higher education.

Students generally over-estimate their own ability (Falchikov and Boud, 1989) but are better at predicting the mean outcomes for their peers. Hence they tend to be over-optimistic. For most tasks, more than p% think that they belong to the top p-percentile (Krueger, 1999). This positive self-image arises because individuals are egocentric when they form their expectations. Individuals use their own (expected) outcome to predict their relative standing but neglect to consider the difficulty of the tasks for the others. Moore and Kim (2003) show that the easier the tasks the more positive the image of the self. For more challenging tasks, individuals are overly pessimistic regarding their relative position. Moreover, less competent students tend to have poorer judgement (Hacker et al, 2000). This may be because similar skills are needed to succeed at the test and to judge own performance. Other evidence suggests that students overestimate their performance in secondary education. In England, 96% of secondary school pupils believe that they are "Average" or above when asked how good they are at their school work (Gibbons and Silva 2007)[3], and predict GCSE[4] scores 10% above their actual achievement (Sullivan, 2006). In higher education too 90%, of first year students reported being average or above average (Thorpe et al, 2007). Some of these studies also report that female and lower social class pupils under-estimate their own performance (Sullivan) and over-estimate the average performance of the group (Thorpe et al.).

Further evidence suggests that these differences in self-perception have important consequences. Marsh et al. (2005) use longitudinal data to show that students who are better at assessing themselves allocate their study time more efficiently and have better academic outcomes. Moreover, Murnane et al. (2001) show that self-esteem is associated with higher earnings. However, Baumeister et al. (2003) in their review find no causal effect of self-esteem on educational attainment. One reason for this finding may be that over confidence can have adverse as well as positive consequences when it comes to participation in risky activities[5]. For example, Camerer and Lovallo (1999) argue, on the basis of experimental evidence, that individuals exhibit "reference group neglect" when they compete. Participants correctly estimate that the average gain is going to be negative but predict positive gains for themselves, thus creating excess entry in the game. A similar argument might lead to excess entry in higher education. The consequence might be lower completion rates, and, if the supply of higher education is constrained, a crowding out of less-self confident but more able pupils.

[3] Over-inflated self-rating is not specific to students with 94% of college professors also judging the quality of their work as above average (Cross, 1977).
[4] GCSE is a national examination taking place at the end of compulsory schooling.
[5] In non-academic set up, it is for example found that drivers who attended a course to improve ice-driving had more accidents after the course than a non-treated group of drivers as the self-confidence boost was greater than the improvement in ability (Christensen and Glad, 1996).

3. Data and Descriptive Analysis

PISA 2003 and the self-perception of 15 year old pupils

To answer the question whether perceived ability matters in the decision to go to university, we rely on the "England and Wales" component of the 2003 PISA. Compared to previous evidence that relied on a few hundreds individuals, this wave contains 9,535 observations[6]. PISA is a triennial international survey organised by the OECD to assess 15-year old's knowledge in a given topic. In 2003, PISA tested students in mathematics[7] and asked a series of questions on confidence in mathematics in general (not the specific test). Specifically, students were asked how confident they felt solving eight different types of problem, such as working out a train time table or calculating petrol consumption. A standardised score of *mathematical efficacy* is derived from their responses. Another two measures of mathematical self-perception can be constructed: *mathematical anxiety* and *mathematical self-evaluation* (OCED, 2003). Mathematical anxiety is based on five questions, such as "I often worry that it will be difficult for me in mathematic classes", and mathematical self-evaluation is a score computed from an additional five questions such as "I learn mathematics quickly". The correlations between these three concepts of academic self-perception are (in absolute value) between 0.50 and 0.70.

PISA 2003 also contains information on parental occupation (which we use to define social class[8]), family structure, parental education, language spoken at home, number of books in the household, the age of the child (in months), the current school class attended, migration status and self-reported amount of time spent self-studying math per week as well as instruction time in mathematics, as reported by the head of school. The PISA dataset samples schools and, secondarily, students within these schools, hence we can define a pupil-school

[6] England and Wales were not included in the final PISA report due to lower school and student participation rates than advocated by the OECD protocol. However, Micklewright and Schnepf (2006) show that the sample is nonetheless broadly representative.
[7] The 2000 PISA focused on language. However, it cannot be used here as it does not contain information about perception of competence in language. Several measures of math scores are available in PISA. Here we use the normalised first plausible value. Using a principal component of the first 5 plausible values led to similar results.
[8] Occupation is reported at the four digit level for both parents. We use the first digit only and report the higher occupation. We then recode occupation in 5 categories only (roughly accounting each for 20% of the sample). The categories are Manager, Professionals, Associate professionals and Secretarial, Craft and related occupation, and a final category for all remaining occupations.

relative score as the standardised difference between individual score and the school average score. Importantly for our purposes, participants were asked to report the highest qualification that they expected to achieve.

Descriptive statistics for the PISA data are shown in Table 1, revealing that boys outperform girls in maths in absolute and relative scores. Boys also have significantly greater efficacy, evaluate their mathematical skills more positively and show lower levels of anxiety. Despite these positive outcomes, boys are less likely than girls to expect to go to higher education. In our data, 50% of girls aim to obtain a higher education qualification but only 40% of boys have this ambition. These figures give a gender ratio in higher education of 57/43, exactly equal to the gender balance in higher education in the UK at the time (HESA 2004/05). Turning to our second focus of interest, social class, we see that pupils with professional parents (SOC II) are the highest performers, have the greatest level of self-confidence in math and the highest expectations to go to university. Pupils from the lowest social class (SOC V) have the worst outcomes. The gap in expected attendance to university between the top 2 and bottom 3 social classes is 24 percentage points, close to the observed gap in attainment in England. Lastly, natives perform significantly worse than non-native in absolute terms, but there are no differences in pupil-school relative scores, implying that natives and non-natives attend different schools. Compared to non-natives and first-generation pupils, native pupils have lower levels of academic self-esteem, and a smaller proportion expects to go to university.

Student Expectations Survey and the self-perception of 1st year undergraduates

Our second data source is an online survey of first year students at two British universities students, carried out in October 2005. Institution A is a “Sixties” university whilst Institution B is a “post-1992” university[9]. Two different methods were used to select survey participants. First, students registered in Economics (Institution A) and Psychology (Institution B) were contacted during one of the “Freshers’ Week” introductory lectures and

[9] Expansion of higher education in the UK has been concentrated in three periods. The old universities were built through out the centuries up to the Victorian period. In the Sixties, a large expansion of the sector took place with the creation of new universities. In 1992, the distinction between polytechnic colleges and universities was abolished leading to a large expansion of the university sector.

asked to complete the test and questionnaire, either in their own time or during pre-booked computer sessions attended by a member of staff. Second, in Institution B only, students registered in Economics, Language or Business completed, in their own time, the questionnaire as a requisite of their Induction Study Skills programme. In both types of recruitment, students were informed during the initial contact that on completion of the questionnaire they would enter a lottery for a monetary prize. The sample is clearly not representative of the population of first year students in the UK, although the two universities are typical higher education institutions. It is not possible to calculate a precise response rate as the number of students who attended the initial lecture where the information about the survey was circulated was not recorded. However, it is generally believed that there is a positive relationship between ability and lecture attendance. Hence the selected population is probably more able than the potential population. If ability is positively related to self-perception, this is likely to bias our estimates downwards. The sample obviously suffers from selection issues relative to the population of school leavers, since it includes only individuals who were registered at university[10]. Since only a minority of lower social class individuals go to university, those that we observed in the sample will have high self-esteem relative to their peers, thus biasing our estimates of the population social class effects downwards. Despites these drawbacks, the survey provides unique information that is pertinent to our research question and that is not found in any other dataset.

The starting point of the survey questionnaire is a short test in numeracy and in literacy. These tests provide the basis for the objective assessment of ability. Both tests were similar to those used by the Teacher Training Agency and Thorpe et al. (2007). The numeric test contained 10 mental arithmetic problems which had to be completed within 20 seconds each. The literacy test consisted of three sections: spelling, grammar and comprehension which had to be completed in less than 5 minutes. The scores are calculated as one point for each correct answer so that test scores range from 0 to 10. Note that the questions are not multiple-choice, so students cannot guess the correct answer. For both tests the maximum score recorded is 8. The questionnaire also asks about socio-economic characteristics of the individuals, including social class, A-level score and ethnicity.

[10] However, students were surveyed as they entered university, so that their expectations and perceptions had not been affected by their experience of higher education. Thirty "non-first year" students are excluded from the analyses as their knowledge acquired in the previous year at university could affect their perception of the group's ability. Three additional students had to be excluded due to non-response on some of the control variables.

A unique feature of this survey is that students were asked – after completing the tests – to evaluate their own and others' average score, as well as their expected position in the test distribution[11][12]. These evaluations are used to measure self-perception. Unlike PISA, which asks general questions about ability and confidence, the self-perception questions in the Student Expectations Survey elicit expectations of performance in a specific test. Hence even if the tests are noisy or biased measures of ability, we would still expect the self-perception responses to be unbiased estimates of achievement in the tests. The measure of expected relative performance is particularly interesting since, after just a few days at university, students would have little objective information on the quality of their peers, so this measure would reflect their preconceived position in the ability distribution.

A total of 416 students completed the questionnaire. Table 2 provides descriptive statistics for the final sample. The majority (54%) report themselves as being "middle" class, with 16% describing themselves as "upper" and 19% "working" class. The remainder did not provide an answer[13]. Just under half the sample are women (45%) 12% are ethnic minority students. Both groups are under-represented by about 10 percentage points compared to national statistics. The students have the following demographic characteristics: 90% are aged under-21, 6% describe themselves as disabled, 10% are non-UK resident and 45% are the first member of their direct family to go to university. Note that University A represents only 6% of the sample.

[11] Since students may have a limited understanding of distributions; the exact phrasing of this question was kept as non-technical as possible. "If you can imagine the spread of marks from all the new students please indicate how you think you have performed. For example, if you think you were in the top 30% of marks (but not top 20%) select the 'top 30%' category".

[12] Students were not asked about their perceived ability before conducting the test and thus the performance was not affected by self-prophecy bias. However, some social characteristics such as age and gender were asked before the test. Additionally, students may have taken the test in a group in which case the salient characteristics of the groups may have affected the performance at the test. Steele and Aronson (1995) for example, show that students from visible minorities perform less well at test in which their minority is not expected to do well but no difference is observed when the minority is not known to be a poor performer at this task.

[13] In 2001/2002, 26% of young entrants to full time degree courses came from skilled manual, partly skilled and unskilled background (Admissions to Higher Education, 2004), which are likely to be individuals self-declaring themselves as working class. Excluding the non-respondents, 22% of our sample is from working class background which is not significantly different from the national statistics. Self reported class is often unreliable but is the appropriate measure here since self-perception is related to the group that the individual believes to belong to rather than the true class.

The remaining variables presented in Table 2 relate to test scores and academic self-perception. The students struggled with the maths test hard and the mean score is only 2.7 out of 10. For each numeracy question, between 6% and 50% of students did not answer. However, 90% of students answered 5 or more questions and only 2 students had missing responses on all 10 questions. There is also no evidence that the response rate decreased as the test progressed. One concern might be that participants did not try to get the correct answers. However, the correlation between response rate and the difficulty of the question (proxied by the proportion of students who answered correctly) is 0.55, suggesting that non-response could be due to a genuine lack of knowledge. In literacy, 89% of students answered all questions. As a robustness check, the empirical analysis was also conducted on the sub-sample of participants who answered at least one numeracy question correctly. The results are similar to those presented later in the paper. There is thus no evidence that students did not take the test seriously.

As expected from our reading of the literature, students over-estimate their own numeracy score: expecting to score 3.50 on average, but scoring only 2.73, a gap of 0.77. However, the correlation between predicted and realised score is rather high (0.74). Again in line with previous psychological literature, respondents seem to have taken an 'egocentric' view of their own difficulties with the test and did not account of the fact that other students were likely to have struggled too. They therefore over-estimate the average group score by over 2.5 points and are overly pessimistic in estimating their position in the score distribution, placing themselves on average at the 38th percentile[14]. However, the correlation between predicted and realised decile is 0.52 so there is clearly some tendency for those who rank themselves high to score high and those who rank themselves low to score low.

The pattern of results for the literacy test is similar, although students expect a higher score than in numeracy (5.47 as against 3.50) and achieve a higher mean score (4.31 as against 2.73). Students over-estimate their own performance to an even greater extent in literacy than in maths (a gap of 1.16 points) but their error in predicting the group score is similar on both tests. On average, students are overly pessimistic about their relative position in literacy but less so in numeracy, ranking themselves at the 43rd percentile. Curiously, the correlation

[14] Note also that students did not assume that the tests were designed to return a mean of 5 out of 10. The median score is 5 for numeracy and 6 for literacy, but a full distribution of scores is reported in the responses so this variable is likely to be representative of students' judgement of the group ability.

between realised and predicted achievement in literacy is very low, both in terms of the test score (correlation of 0.2) and the decile position in the distribution (0.15).

We now investigate whether the gaps between realised and predicted test scores differs for our three areas of interest – gender, social class, and ethnicity. Figures 1A and 1B report the distribution of realised and predicted scores separately by group and we describe the key features below. For all groups, the distribution of predicted scores lies to the right of the realised score distribution. Individuals from all social classes over-estimate their performance both in numeracy and literacy but those from lower social classes have, on average, the smallest bias. The mean gap between true and expected score is a full point for numeracy and 1.3 points for literacy for upper class students, but only 0.5 and 0.9, respectively, for lower class. The relationship between self-estimation bias and social class amongst these university students is monotonic, with upper class students being the most self-confident.

Girls under-perform boys by a full point in the numeracy test, but the average gap in expected performance is even higher at 1.5 points, suggesting that women overestimate their performance to a lesser extent than men. In literacy, women outperform men by 0.35 points but again overestimate by less than men. The differences by ethnic groups are less pronounced, with no significance difference between ethnic groups in either mean expected or realised performance in numeracy. In literacy white students have a mean test-score that is 10% greater than non-white students.

These results for 1st year undergraduates are in line with the social psychology literature on self-assessment. All groups of students significantly over-estimate their own performance by 27% to 29% compared to the mean achieved score. Students perform better and over estimate their performance more on the literacy task, hence, as in Moore and Kim (2003), we find that participants tend to over-estimate their performance more for tasks they find easier. We find evidence that students are egocentric in predicting their performance relative to their peers. Students tend to overestimate their peers' performance in tests that they find difficult and tend to rank themselves higher in the distribution when the test is easier. As in the rest of the literature, boys over-estimate their own performance to a greater extent than girls do. Pupils from higher social classes overestimate their performance on these specific tests by more than their peers from more disadvantaged social backgrounds. This finding is in contrast to the pattern shown in Table 1 for age-15 secondary school pupils, in which higher social classes appear under-confident in their maths abilities in comparison to their actual achievement. There is no clear difference in the perceived score distribution by ethnicity amongst university students.

4. Regression Evidence Based on 15 Year Old Pupils

Links between pupil characteristics and self-perception

We now consider the links between the socioeconomic characteristics of pupils and their self perceived maths ability, using the PISA dataset. Our method is simply to regress separately the standardised test scores and self-perception measures on indicators of pupils' social class and migration status. Statistically significant coefficients of interest from these models are presented in the charts in Figure 2. All the models are estimated separately for boys and girls by ordinary least squares[15] and include a range of controls listed in the notes to Figure 2. We do not find any significant differences in any of the outcomes by origin status, hence we do not report these coefficients.

On the tests – referring to the first group of bars in each panel of the figure – pupils from the higher-ranked social groups score between one third and one half of a standard deviation above those from the lowest two social backgrounds. It is well known that children from poorer backgrounds have lower academic achievements, and we will not dwell long on this issue here. In part this could be because of lower school quality (peer groups, teaching quality etc.), but the social class differences persist – though attenuated – when we control for mean achievement in the school by using pupil-school relative test scores as the dependent variable. Thus, the difference in test by social background cannot solely be due to school characteristics.

[15] A pooled model was also estimated. Boys score 0.14 of a standard deviation greater than girls in absolute and relative scores, and rate their efficacy, anxiety and self-concept 0.35 of a standard deviation higher, 0.33 of a standard deviation lower and 0.34 of a standard deviation higher respectively but are 15% less likely to expect to go to university.

The third to fifth groups of bars in Figure 2 display the coefficients from the self-perception regressions. After controlling for the pupil's environment and their test score, there are still significant, but small, differences in academic self-perception by social class. In line with Baumeister et al. (2003) we show that own test performance is highly positively correlated with the measures of self-esteem. This dataset does not allow us to test whether self-confidence encourages achievement or high achievement engenders self-confidence. Moreover, some doubt has to remain as to whether the test or the student's self- perception is the best measure of their underlying ability. We also find evidence of the "big fish small pond effect" (Marsh and Parker, 1984) i.e. the school average score is always negatively associated with academic self-esteem.

The greater self-perception of higher social class pupils, observed in Table 1, disappears when controlling for own test-score. Contrary to Sullivan (2006), pupils from higher social classes show lower self-efficacy, lower self-evaluation, and greater anxiety (conditional on test-score based achievement and average school test scores). This finding may be due to the "big fish small pond effect", where pupils in more affluent families have lower self-esteem because their reference peer group has higher average ability. Alternatively, the lower self-esteem of individuals from higher social background could stem from higher parental expectations creating additional performance pressure on the children. All these conclusions are similar for boys and girls.

Links between self-perception and higher education expectations

We originally hypothesised that the misperception of own ability could impede some groups of students on their path to university. Whilst PISA cannot answer this question directly since it is a survey of 15 year olds, it nevertheless contains valuable information on the highest qualification pupils expect to achieve, as described in Section 3. We explore the relationship between perceptions and pupils' stated intentions of going to university using a linear probability (OLS) model. The regressions results are reported in Table 3. In the first column, we estimate the model separately for boys and girls without any controls for self-perception or test performance. This provides us with a reduced-form estimate of the relationship between social class, migration status and probability of going to university. Then, in the second column we add controls for own and school-mean test scores and finally math perceptions.

The three measures of academic self-esteem from PISA are used separately in three different regressions reported in the third to fifth columns.

For girls, social class is strongly related to the decision to attend university, with girls from the top two social classes being 10 percentage points more likely to expect to go than girls from the baseline social class. However, this gap, lower than observed for higher education participation in the UK, disappears when own and school test score are included. This finding suggests that any impact of social class on higher education participation works through differences in achievement and schooling that are already manifest by age 15. As we would expect, both, own and school performance, are positively correlated with the decision to go to university. A one standard deviation improvement in own test score is associated with a 16.3 percentage point increase in the probability of expecting to attend university. The corresponding figure for school scores is 2.8 percentage points. First generation pupils are 14 percentage points more likely than natives to expect to continue to higher education.

Adding measures of mathematical self-perception to these specifications does not alter these conclusions. However, self-perception plays an important role. For both boys and girls, a one standard deviation increase in efficacy is associated with a 7 percentage point increase in the probability of expecting to attend university[16]. Despite being highly mutually correlated, it can be seen that these measures of self-perception capture different domains of self-confidence, because the coefficients on anxiety and self-evaluation are much smaller and less significant. A one standard deviation change in efficacy is equivalent to a half standard deviation change in own test score and to a 2 standard deviation shift in the school score. The effect of self-evaluation is only half that size and anxiety is never significant. We have also estimated models which allow interactions between self-perception and social class, but these interactions were statistically insignificant. In general, results are rather similar for boys and girls, although the average school score is unrelated to boys' decision to go to university. The effects of self-perception are about 1 percentage points larger for boys, but this difference is not statistically significant.

[16] If the test score is only a noisy measure of ability and the self-perception a better proxy for it, we would expect some colinearity between the two variables so that the inclusion of one would lead to an increase in the standard errors of the estimated coefficient. This is not observed which give us some confidence that the two variables are not measuring the same concept.

It is worth summarising what we have shown for these age-15 pupils. Self-perception differs by social class and is also correlated with the decision to attend university. However, the effect of self-perception on higher education expectations operates independently of social class background. In fact, pupils from higher-ranked occupations tend to have lower academic self-esteem than lower-ranked occupations, and girls have lower self-esteem than boys. Therefore, self-perception may not explain the educational attainment gaps that are observed by gender, social class or ethnicity.

5. Evidence Amongst First Year University Students

First year students' test performance

The results in Section 4 analysed how secondary school-age pupils' self perception of ability varies across social groups, and how these self-perceptions are linked to expectations of going to university. We now consider these issues amongst our sample of students in the Student Expectation Survey, who have continued into higher education. Again we use regression analyses to explore the contributions of gender, social class and ethnicity to academic self-perception.

Firstly, we assess whether the performance at the tests and the probability of not answering test questions differs by gender, social class or ethnicity. The coefficients from our regression analyses are presented in Table 4. All models are estimated by Ordinary Least Squares, and include the additional regressors listed in the table. Looking at the first column it can be seen that men outperform women in numeracy by a full point, controlling for the other factors shown, which include prior achievement as represented by A-level score. However, there are no class or ethnicity differences in numeracy score, conditional on prior achievement. In literacy (second column) the gender pattern is reversed and women out-perform men by 0.4 points, white students score 0.5 points higher than non-white students, but again there are no significant class differences.

Additionally, since the tests do not penalise for "guessing" the correct answer, it is also informative to check whether some students are more risk averse than others and only respond when they know the correct answer. Thus, in column 3 of Table 4, we report estimates of regression models that feature students' total number of question non-responses as the dependent variable. These specifications also control for the test score. Only 22% of students responded to all numeracy questions and there is a large variation in non-response. In literacy, 89% of pupils responded to all questions and there is insufficient variation for the results to be informative, so we do not report them. Looking at the coefficients, it can be seen that male students are likely to reply to more questions, whilst working class students replied to 0.6 fewer questions. The differences are quite substantial. Working class students, for example, reply to 17% fewer questions than upper class students. However, we are unable to distinguish whether this finding stems from these students being slower or being less confident at guessing an answer.

To summarise, males outperform females in numeracy and answer more questions but performed less well on the literacy tasks. Working class students answer less questions but their test scores are not significantly affected. There is no difference in numeracy performance by ethnic background but white students are slightly better in literacy scoring 0.5 points higher.

Evaluating own performance and relative position

Next we consider how gender, class and ethnicity are linked to pupils' predicted test scores and predicted ranking amongst peers. Table 5 presents estimated coefficients from models in which we regress pupils' predicted test scores for numeracy (Columns 1), or literacy (Column 2) on pupil characteristics. In all specifications, we include realised test performance as a regressor, so the coefficients can be interpreted as the determinants of the expectation bias[17]. As in Dunning et al. (2004), more able students are better at predicting their performance: the estimate on own score is always significantly less than unity. A student with a score of 0 over-estimates her performance by a staggering 1.8 points in numeracy (Column 1) and 3.8 in literacy (Column 3). In numeracy male students over-estimate their performance by an extra 0.6 points more than females. Students from working class under-estimate their score by 0.6

[17] We also estimate a model where the difference between the predicted and realised score is used as the dependent variable. Such a model is less flexible than the one presented since it imposes a coefficient of -1 on the realised score. Results from this model do not differ widely from those presented.

points compared to upper class students, but no significant difference is found for white students. These estimates may appear small but they should be compared to a mean performance in numeracy of 2.72 points, implying female and working class students under-estimate themselves by 20% to 25% at the mean compared to male and upper class students. Students are poor at predicting performance in literacy and 70% of students over-estimate their score. The fit of the base model is much worse in literacy (an R^2 of 0.05) compared to than numeracy (an R^2 of 0.57). Males are again found to over-estimate their score, by an additional 0.42 points or 10% of the mean, but whites and working class students tend to underestimate but not significantly so[18].

A concern in interpreting the estimated coefficients in these models is that unobservable characteristics may be correlated with the variables of interest and also with predicted score leading to biased OLS estimates. For example, the type of schools working class pupils go to may differ in such a way that these pupils are worse at self-assessment than upper-class students. If so, then the coefficient on working class would be a biased estimate of the effect of class, because it captures school differences. We first investigated this issue by estimating the numeracy and literacy models simultaneously using a Seemingly Unrelated Regression Equations (SURE) model. This estimation method allows us to test if the unobservable components determining prediction biases in literacy and numeracy are correlated. It turns out that the correlation between the literacy and numeracy error components is 0.39 and we reject the independence of the error terms suggesting that unobservable individual components do affect both test predictions. Estimating the equations jointly however, does not alter any of the previous conclusions and is not presented in Table 5. To control directly for unobservable components that are common to both literacy and numeracy prediction errors, we have also estimated OLS models in which the prediction error in one test enters as an explanatory variable in the model of prediction errors in the other test (i.e. literacy and numeracy and vice versa). The numeracy results are largely unchanged by this strategy, but the estimated coefficients on working class and age, while remaining significant, are reduced by 10% and 20% respectively. In the literacy model all pupil characteristics other than test score become insignificant factors. Again due to space constraint, these results are not reported.

[18] A model including interaction between score and the group identifiers estimates that for males, each additional test point lead to an over-estimation of own performance by 0.24 point. Other interactions term were never found significant in the numeracy test. In the literacy model, the interaction between social class and score is significant and when included the main term also becomes significant and negative.

To assess how gender, class and ethnicity are linked to pupils' assessment of their relative position in the distribution of scores we repeat the analysis described above, but replacing predicted test score with the difference between predicted score decile and actual score decile[19]. The results are in Columns 3 and 4 of Table 5. As shown in Table 1, students tend to be pessimistic and, for both tests, 85% believed to be in the bottom half of the distribution. Being egocentric, students under-estimate their relative performance in numeracy by 1.1 decile, and better performing students (with higher test scores) under-estimate their relative position by a greater extent. In literacy, students overestimate more if they are at the bottom of the test score distribution. Compared to girls, boys over-estimate their position in both numeracy (by 0.9 deciles) and literacy (by 0.4 deciles). White students also significantly under-estimate their position in the distribution relative to non-whites by 0.5 to 0.7 deciles. Working class students under-estimate theirs by 0.4 (insignificant in base model) compared to upper class students[20].

Analysis of cross-test correlation in the prediction bias comes to similar conclusions to that carried out for the test score prediction bias, described above. First, estimating the two equations simultaneously (by SURE) reveals that the error terms are indeed correlated (0.33) and we can reject the independence of the two error terms. If we include the decile prediction bias for one test as a regressor in the model for the other we find little change in the numeracy equation estimates. None of the characteristics of interest is a highly significant factor in explaining errors in predicting relative position in the distribution of literacy scores, once we control for the student's error in predicting his or her position in the numeracy distribution.

To summarise this section, we find that students are poor at predicting their own score. In our models of student misperceptions, the constant is always significantly different from zero. Moreover, self-assessment depends on observable characteristics. Boys over-estimate their performance more than girls, the differences reaching 0.7 points in numeracy and 0.4 points in literacy. Working class students over-estimate their performance to a much smaller extent than pupils from more advantaged backgrounds. This difference is the most salient in

[19] For this we compute scores with a penalty for wrong answers which increases the dispersion of scores. This improves the precision of the estimates but does not substantially alter the conclusions compared to a score attributing points only for correct answers.

[20] The estimate on social class becomes significant when interaction terms with test score were included in the literacy model. In all models, social class is marginally insignificant with p-values around 0.11

numeracy, with a social gap reaching 0.6 points. For white students, significant gaps in self-assessment are observed. White students under-estimate their ranking by 0.7 and 0.5 decile in numeracy and literacy respectively. Note that we find no support for the assumption that students who are the first to go from their family have less accurate predictions of their own ability. Moreover, the gap in numeracy self-assessment is not solely due to unobserved characteristics correlated with gender or class, as it does not disappear when a measure of bias at the literacy test is included as a proxy for unobservable characteristics.

We do not have any prior views on whether absolute or relative perceived ability explains the decision to attend university but since our conclusions regarding both perceptions are rather similar this may not be a crucial distinction. Note that in the PISA evidence, we report that both own and relative performance are significantly related to the expectation of attending higher education. Students under-estimate their ranking in numeracy and over-estimate it in literacy, maybe because the later test was perceived as easier. In both tests boys significantly over-estimate their own performance and their position in the test distribution. Whites under-estimate their relative position and working class students under-estimate their own numeracy performance compared to upper class students.

Studying behaviour and other expectations

The expectation dataset contains several measures of academic motivation, expectation of success and risk. These measures are of interest since they are likely to be correlated with the decision to participate in higher education. In this section, we assess whether these outcomes are correlated with academic self-perception and whether they differ by gender, social class, and ethnic group.

We first consider academic motivation. We rely on 10 different measures of motivation based on survey statements. Students could respond by marking their level of agreement with each of these statements on a 4-point Likert scale, with the highest agreement coded as 4. Students who responded that they "did not know" are excluded so the sample size varies for each statement (with a maximum of 7% missing observations on any one statement). Our modelling approach uses an ordered probit and Table 6 reports the marginal effects, estimated at the mean for the probability of responding "I agree strongly" (the highest level of agreement). The specifications include a number of pupil characteristics listed in the notes to Table 6, including prior achievement measured by A-level point scores. Looking at the significant coefficients in the first column it can be seen that men put less effort in understanding things, are less worried that they are not good enough for the course and are more confident that they will keep up with others. These results are in line with the view that men have more self-confidence. Additionally, we observe differences in the reason for choosing a subject of study. As in Montmarquette et al. (2002), men are more likely to admit to have chosen a degree because of its financial returns rather than out of interest.

Working class students lack confidence on all measures. The effect can be quite substantial and the individuals are about 9 percentage points less likely to strongly believe that they will be able to keep up with the others on this course. These findings are consistent with the lower self-perception of pupils from these groups. Moreover the reasons given for participating in higher education differ for working class students. They admit to entering higher education in order to get a qualification for a specific job. As such, they are less likely to agree with the statement that they would rather choose a degree they can complete than a more difficult one with higher earnings. This could explain why being working class is associated with a 18 percentage point reduction in the probability of enjoying the degree. Working class students also admit that they to not put a lot of effort into understanding things. There is no difference in these measures of educational motivation by ethnic status.

Columns 5 and 6 show how the literacy test scores and the errors in predicting performance in the literacy tests are linked to these self reported indicators of academic motivation[21]. Despite conditioning on A-level score, those with a higher test score are less worried about not being good enough for the course and put less effort into studying. Having greater academic ability, these students are less likely to have chosen a degree for its returns or for a specific occupation, maybe because they believe they can succeed whatever their degree subject. Students who place themselves higher up the test score distribution are more likely to agree that they are good enough for the course, but less likely to have chosen a course for a specific job or its returns. Maybe, as for the higher ability students, the self-confidence represented in this indicator of higher academic self-perception makes students believe that they can succeed whatever their degree subject.

[21] The literacy and numeracy scores produce similar results, as does the absolute versus relative prediction error.

Next, we investigate the components of the decision to invest in higher education. We can distinguish between measures of how risky and valuable this investment is perceived to be. The first six measures relate to the risk that students are taking when attending higher education. Students were asked to report their expected probability of passing the first year at university (1): 87% believe that they would. They were also asked to report the same probability for the other students on their course. The difference between their own expected probability of success and the average probability of success is a measure of their self-confidence (2). Students estimate of their own probability of success is 10 percentage points greater than their estimate of the average probability of success, which is suggestive of "reference group neglect" described in Camerer and Lovallo (1999).

Students are also asked to imagine a situation where the mean probability of success is known before registering for a course or university. They then report the lowest probability of success that will make them decide to change degree (3) or not go to university (4). A high value of this threshold probability indicates a higher level of risk aversion. On average, the marginal graduation rate that will make them switch subject is 57%. The marginal graduation rate before they decide not to go to university is 40%, which is considerably lower than the failure rate observed in the UK. By these measures, the students in this sample appear not be highly averse to risk.

Finally, we compute the difference between the expected probability of graduating and the threshold probability which would induce the student to switch degree (5) or stop university (6)[22]. The smaller this value, the more marginal was the decision to choose this degree or attend university respectively. These differences range from 30 to 45 points on average, so the expected pass rate is well above the marginal rate that would make students change their investment decision.

The determinants of these measures of risks are estimated by ordinary least squares, as reported in Table 7. The models include the same set of variables as those used to estimate educational motivation in Table 6. In general, the variation in the risk of educational investment is difficult to explain. The only significant effects are found for white students,

[22] We recoded to 0 the 5 individuals who had negative values, as this denoted a lack of rationality.

who are 8 percentage points more likely to believe they will pass first year, and less likely to see themselves as marginal students. Individuals with higher test score and greater self-perception estimate their probability of first year success to be 1.5 percentage points higher. Surprisingly, considering the consistent evidence of men self-confidence, there is almost no significant difference in the level of academic risk by sex.

The average and mode of the expected grade on graduation corresponds to an Upper-Second class degree which is the minimum grade for applying to post-graduate studies and an important requirement in the job market. After controlling for ability (A-levels, tests score) middle class students, as well as white students, expect significantly lower grades than their peers. However, at 1.7 grade points, the difference is small. Academic self-esteem and test score are associated with more confidence in passing the first year and a higher expected degree classification, but this effect is small. A student with the average positive test prediction error expects to score only 0.5 points more in their degree than a student with an accurate prediction of own performance at the literacy test. Men expect to graduate with an additional 2 points.

Finally, as suggested in the introduction, gaps in attainment could stem from differences in the expected returns to higher education. Students report their expected earnings at age 45-50 with and without a degree[23]. These two values can be used to calculate the individuals' expected returns to their higher education. Students predict their earnings to be £47,500 as a graduate and £24,451 as a non-graduate. Compared to the Labour Force Survey (2005) these expectations are rational for non-graduate earnings (the LFS figure is £22,800), but inflated by 50% for graduates (the LFS figure is £32,500). This is not too surprising, because students gather information on graduate earnings while at university and first year students tend to be over-optimistic (Brunello et al., 2004). The expected returns, at 88%, are thus larger than the observed returns, which could lead to over-entry into higher education. The estimates of the determinants of expected earnings and returns are presented in rows 7 to 9 of Table 7.

Men expected earnings are between 18% and 28% greater than women. This is consistent with the observed gender pay gap and previous results on the wage expectations of European

[23] We trim the bottom and top 2% of the distribution to eliminate outliers. Expected returns are computed as the difference in expected earnings between graduates and non-graduates divided by non-graduates earnings. Returns are bottom coded at 0 and top coded at 5.

students (Brunello et al., 2004). Their expected returns to higher education are 23 percentage points greater than women. Lower social class students under-estimate graduate earnings by 18% compared to higher social class students, this large effect could be a significant factor in the gap in attainment.

To summarise, we find that men prioritise expected earnings when choosing a degree. Despite admitting to putting less effort and lacking organisation they are confident that they will keep up with others. Despite this confidence, males are not found to have taken more risk in their education investment decision, though they may have over-estimated the returns. Low social class students under-estimate the graduate earnings substantially and choose degree subjects that are job specific. They are much less confident that they will be able to succeed or enjoy their degree. There is no significant difference in the behaviour of students from different ethnic groups. Students with higher scores and with greater self-perception are more confident, expect higher grades, are less likely to have chosen a degree for its financial returns and expect lower salaries.

6. Discussion and Conclusion

Students are poor at predicting own performance in absolute and in relative terms. These misperceptions could affect their decision over whether or not to go to higher education. We find for example that self-reported 'efficacy' in maths is linked to age-15 pupils' expectations of going to university, even after controlling for observable achievement in maths tests: The effect of a one-standard deviation change in self reported efficacy is roughly equivalent to the effect of a half-standard deviation change in test-based achievement.

First year university students tend to overestimate their scores when faced with specific tests. These errors in self-assessment differ according to pupil characteristics, though only along a few dimensions are these differences large or significant. In particular 'working class' students underestimate numeracy performance relative to 'upper class' students and women underestimate relative to men in literacy and numeracy. White university students have a tendency to underestimate where they stand in the distribution of test scores. The gender and class gaps are especially large in numeracy, at around 20% of the average score. Self-perception also correlates with educational confidence in general but the effect is small. The effect of self-perception on the decision to participate in higher education does not seem to work through its effect on risk aversion and the returns to higher education, because self-perception is only weakly correlated with these factors.

However, the findings still leave room for many questions because these differences in self perception we observe can at best only partially explain the gender, class and ethnic gaps in higher education participation. And there are many contradictions. For instance, although working-class undergraduates underestimate their performance relative to others, we find that working-class secondary school pupils have less anxiety, greater confidence and a more positive self-evaluation in terms of their maths ability. This difference between the two samples is difficult to reconcile but may be due to: a) differences in peer groups between schools and university – a disadvantaged child may be confident when comparing herself to her school peers but less so when considering her position amongst university students; b) unobserved differences in attitude between the population of working class school pupils and the population of university entrants; or c) differences in the methods used to elicit academic self-perception in the school and university samples – predicted performance in specific tests amongst university students, and general measure of self-reported maths confidence amongst school leavers.

Another important question remains regarding the low participation rate of males in higher education despite their higher levels of academic self-esteem. On all measures, males are more self-confident and we would therefore expect an excess entry rate into higher education. One could hypothesise that males are so confident that they believe they will succeed in life without investing in higher education. This would be consistent with a model of counter-signalling (Feltovitch et al. 2002), where over-confident individuals do not invest in schools to signal their high (perceived) ability. Over-confident individuals are thus “too cool for school”.

Policies that raise academic self-confidence in schools are, unsurprisingly, likely to raise participation rates but are unlikely to close participation gaps unless targeted only at under-represented groups. This is not to suggest that students should be praised whatever their results but on the contrary, trained to develop objective views about their own ability.

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Table 1: Descriptive statistics from PISA (2003) England and Wales

	Maths score	Maths pupil-school relative score	Math efficacy	Math. anxiety	Math Self-evaluation	Expect to go to University	Obs.
Girls	-0.012*	-0.028*	-0.193*	0.121*	-0.077*	0.502*	4506
Boys	0.104	0.093	0.207	-0.244	0.300	0.398	4243
Social Class I	0.271*	0.128*	0.145*	-0.118*	0.154*	0.537*	1746
Social Class II	0.508*	0.260*	0.313*	-0.142*	0.200*	0.656*	1770
Social Class III	0.095*	0.067*	-0.025*	-0.048*	0.100	0.446*	2034
Social Class IV	-0.263*	-0.119*	-0.193*	0.017	0.017	0.327*	1679
Social Class V	-0.465	-0.214	-0.280	0.025	0.040	0.265	1363
Native	0.049	0.034	-0.007	-0.050	0.096	0.439	8084
1st Generation	0.078	0.073	0.109*	-0.178*	0.287*	0.650*	294
Non-native	0.196*	0.083	0.207*	-0.180*	0.270*	0.680*	250

Note: PISA (2003). * denotes significant difference of the mean values at the 95% confidence interval compared to the relevant base groups: boys, native and social class V.

Table 2: Summary statistics: Expectations of Students Survey

Variable	Mean	Std. Dev.
Male	0.544	0.498
Class missing	0.106	0.308
Upper Class	0.158	0.365
Middle class	0.544	0.499
Working class	0.192	0.394
White	0.873	0.333
Age <21	0.901	0.298
Disabled	0.057	0.232
University A	0.062	0.241
European students	0.062	0.241
International students	0.041	0.199
1st to go to university	0.448	0.497
Numerical score	2.725	2.005
Estimated own score	3.497	2.195
Estimated group mean score	5.303	1.703
Estimated decile	3.841	1.817
Literacy score	4.310	1.566
Estimated own score	5.474	1.968
Estimated group mean score	6.746	1.712
Estimated decile	4.357	1.461

Note: Expectation of Students Survey (2005) – 386 observations

Table 3: Linear probability of expectations at age 15 regarding university attendance

	Measures of mathematical self perception				
Female	No self perception measure	No self perception measure	Math efficacy	Math anxiety	Math self-evaluation
SOC 1	0.105	0.022	0.024	0.022	0.024
	[0.025]**	[0.023]	[0.023]	[0.023]	[0.023]
SOC 2	0.100	0.007	0.009	0.007	0.012
	[0.026]**	[0.025]	[0.025]	[0.025]	[0.025]
SOC 3	0.089	0.026	0.028	0.026	0.028
	[0.023]**	[0.022]	[0.021]	[0.022]	[0.022]
SOC 4	0.038	0.023	0.024	0.022	0.025
	[0.024]**	[0.023]	[0.023]	[0.023]	[0.023]
1st Generation	0.160	0.142	0.139	0.143	0.143
	[0.056]**	[0.059]*	[0.058]*	[0.059]*	[0.058]*
Non-native	0.026	-0.003	-0.003	-0.003	-0.004
	[0.046]	[0.046]	[0.045]	[0.046]	[0.046]
Math self-perception			0.064	0.003	0.024
			[0.009]**	[0.008]	[0.008]**
Normalised score		0.163	0.13	0.164	0.151
		[0.009]**	[0.010]**	[0.009]**	[0.010]**
Normalised school score		0.028	0.03	0.028	0.032
		[0.008]**	[0.008]**	[0.008]**	[0.008]**
Observations	4210				
R-squared	0.22	0.30	0.31	0.30	0.30
Male					
SOC 1	0.093	0.035	0.035	0.035	0.039
	[0.025]**	[0.024]	[0.024]	[0.024]	[0.024]
SOC 2	0.085	0.018	0.02	0.019	0.023
	[0.025]**	[0.025]	[0.024]	[0.025]	[0.025]
SOC 3	0.046	-0.007	-0.005	-0.007	-0.004
	[0.024]	[0.023]	[0.023]	[0.023]	[0.023]
SOC 4	-0.018	-0.034	-0.036	-0.035	-0.034
	[0.024]	[0.023]	[0.022]	[0.023]	[0.022]
1st Generation	0.138	0.121	0.117	0.12	0.117
	[0.052]**	[0.051]*	[0.051]*	[0.051]*	[0.051]*
Non-native	0.092	0.099	0.094	0.097	0.098
	[0.048]	[0.045]*	[0.045]*	[0.045]*	[0.045]*
Math self-perception			0.071	-0.012	0.035
			[0.009]**	[0.008]	[0.008]**
Normalised score		0.163	0.123	0.159	0.147
		[0.009]**	[0.010]**	[0.010]**	[0.010]**
Normalised school score		0.002	0.003	0.003	0.007
		[0.010]	[0.010]	[0.010]	[0.010]
Observations			3831		
R-squared	0.24	0.32	0.33	0.32	0.32

Note: Table reports OLS coefficients. Robust standard errors in brackets – clustered at school level. * significant at 5%; ** significant at 1%. Data: PISA (2003). The regression also includes the following covariates: age, grade, number of hours of math self-study per week, family structure, language spoken at home, numbers of books at home, Welsh sample, number of minutes of mathematics instruction per week, parental education and parental labour market activity.

Table 4: Determinants of test performance amongst university students

	Numeracy test score	Literacy test score	Numeracy non-response
Male	0.976	-0.401	-0.714
	[0.199]**	[0.162]*	[0.203]**
Middle class	0.213	0.350	0.176
	[0.278]	[0.226]	[0.276]
Working class	-0.379	0.120	0.619
	[0.335]	[0.273]	[0.332]+
SOC missing	0.395	0.327	0.386
	[0.389]	[0.317]	[0.386]
White	-0.359	0.504	-0.091
	[0.347]	[0.283]+	[0.344]
Age < 21	0.187	-0.523	-0.468
	[0.363]	[0.295]+	[0.360]
Disabled	-0.436	-0.114	0.160
	[0.419]	[0.341]	[0.416]
University A	1.151	0.985	0.055
	[0.421]**	[0.342]**	[0.421]
European student	0.644	-0.255	1.024
	[0.448]	[0.364]	[0.445]*
International student	0.711	0.658	0.963
	[0.566]	[0.460]	[0.562]+
A-levels score	0.047	0.028	0.003
	[0.014]**	[0.012]*	[0.014]
1st to go to university	0.597	-0.071	-0.067
	[0.200]**	[0.163]	[0.200]
Test score			-0.450
			[0.051]**
Constant	-0.007	2.847	3.429
	[0.641	[0.522]**	[0.636]**
Observations	382	382	382
R-squared	0.16	0.08	0.28

Note: Expectation of Students Survey (2005). Table reports OLS estimates. Standard errors are reported in brackets. +, * and ** signal significance at the 10%, 5% and 1% level respectively

Table 5: Determinants of 1st year university students' predictions

	Predicted own test performance		Bias in predicted decile	
	Numeracy	Literacy	Numeracy	Literacy
Male	0.657	0.428	0.912	0.382
	[0.159]**	[0.204]*	[0.176]**	[0.164]*
Middle	-0.196	0.141	0.007	-0.032
class	[0.215]	[0.284]	[0.243]	[0.229]
Working	-0.574	-0.221	-0.429	-0.431
Class	[0.259]*	[0.343]	[0.292]	[0.275]
Class	-0.114	0.072	-0.310	0.020
missing	[0.302]	[0.397]	[0.340]	[0.319]
White	-0.145	-0.249	-0.730	-0.490
	[0.269]	[0.356]	[0.304]*	[0.285]+
Age <21	-0.046	0.634	-0.032	0.502
	[0.281]	[0.371]+	[0.317]	[0.298]+
Disable	-0.126	-0.782	-0.115	-0.454
	[0.325]	[0.427]+	[0.366]	[0.343]
University A	-0.216	-0.017	0.180	-0.039
	[0.328]	[0.433]	[0.371]	[0.348]
European student	-0.092	-0.417	-0.048	-0.161
	[0.347]	[0.456]	[0.393]	[0.367]
International student	0.036	-0.281	-0.607	0.217
	[0.439]	[0.578]	[0.495]	[0.464]
1st to go to university	0.128	0.014	0.300	0.144
	[0.156]	[0.204]	[0.176]+	[0.164]
A-levels score	-0.011	-0.000	0.002	0.018
	[0.011]	[0.015]	[0.013]	[0.012]
Test score	0.768	0.261	-0.364	-0.585
	[0.040]**	[0.065]**	[0.016]**	[0.018]**
.				
Constant	1.789	3.842	-1.131	1.814
	[0.496]**	[0.679]**	[0.570]*	[0.525]**
R-squared	0.568	0.051	0.575	0.748
Observations	382	382	382	382

Note: Expectation of Students Survey (2005). Table reports OLS estimates. Standard errors are reported in brackets. +, * and ** signal significance at the 10%, 5% and 1% level respectively. Bias is the difference between the predicted and realised score or decile.

Table 6: Estimates of educational motivation (ordered probit marginal effects)

	Male	Middle class	Working class	White	Literacy score	Bias in literacy[a]	Mean (st. dev.) [obs.]
"I find it easy to organise my study time effectively"	-0.029 (0.021)	-0.007 (0.029)	-0.054 (0.025)*	-0.054 (0.045)	-0.015 (0.008)*	-0.003 (0.005)	2.770 (0.709) [382]
"University will enhance my career prospects"	-0.042 (0.048)	0.018 (0.068)	0.019 (0.081)	0.021 (0.085)	-0.027 (0.018)	0.011 (0.012)	3.618 (0.593) [385]
"I entered HE to get a specific job"	-0.011 (0.050)	0.096 (0.067)	0.142 (0.081)+	-0.032 (0.087)	-0.040 (0.018)*	-0.026 (0.012)*	3.243 (0.900) [375]
"I'm worried that I will not be good enough for this course"	-0.116 (0.024)**	0.035 (0.027)	0.095 (0.048)*	0.030 (0.028)	-0.015 (0.007)*	-0.015 (0.005)**	2.341 (0.937) [369]
"I want to learn about the subjects which really interest me"	-0.115 (0.044)**	-0.007 (0.060)	0.044 (0.075)	0.010 (0.076)	-0.006 (0.016)	0.009 (0.011)	3.171 (0.172) [379]
"I would rather choose a degree I can complete than a more difficult one with higher earnings"	-0.034 (0.028)	-0.052 (0.039)	-0.094 (0.033)**	0.005 (0.046)	0.006 (0.010)	-0.007 (0.007)	2.516 (0.921) [366]
"I generally put a lot of effort understanding difficult things"	-0.164 (0.042)**	-0.058 (0.058)	-0.109 (0.058)+	-0.001 (0.070)	-0.028 (0.015)+	0.006 (0.010)	3.124 (0.680) [380]
"I'm confident I will enjoy studying this topic"	-0.001 (0.049)	-0.084 (0.069)	-0.175 (0.070)*	-0.098 (0.088)	0.005 (0.018)	0.019 (0.012)	3.309 (0.611) [376]
"My success on this course will be linked to my ability"	0.001 (0.027)	0.018 (0.037)	0.025 (0.048)	-0.071 (0.057)	-0.005 (0.010)	0.003 (0.007)	2.800 (0.754) [379]
"I choose this degree because of its financial returns"	0.087 (0.021)**	0.039 (0.028)**	-0.003 (0.033)	-0.027 (0.041)	-0.028 (0.008)**	-0.016 (0.005)**	2.488 (0.886) [371]
"I will be able to keep up with the other students on this course"	0.149 (0.035)**	-0.039 (0.049)	-0.086 (0.048)+	-0.078 (0.070)	-0.009 (0.012)	0.010 (0.009)	3.022 (0.674) [357]

Note: Expectation of Students Survey (2005). Standard errors are reported in parentheses. Marginal effects of the probability of "I strongly agree" outcomes are calculated. The marginal effects are calculated at the mean values of the independent variables. The ordered probit model includes controls for age, disability status, institution, spatial origin, A-level score, an indicator for being the first to go to university in the family, test score in literacy. +, * and ** signal significance at the 10%, 5% and 1% level respectively. [a]Bias in literacy is measured as the difference between predicted and realised own scores.

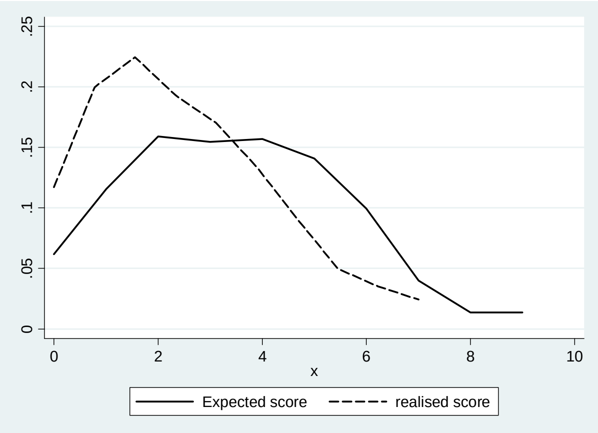
Table 7: Estimates of graduation risk and expected financial returns

	Male	Middle class	Working class	White	Score in Literacy	Bias in literacy[c]	Mean (St. Dev.) [obs][d]
(1) Expected probability of passing first year	1.283 (1.554)	-0.690 (2.146)	-1.919 (2.589)	8.979 (2.692)**	1.689 (0.572)**	1.373 (0.394)**	87.785 (14.982)
(2) Expected relative probability of passing 1st year[a]	-0.382 (1.747)	-2.075 (2.413)	-3.949 (2.911)	2.247 (3.027)	-0.756 (0.643)	-0.456 (0.443)	10.065 (16.192)
(3) Lowest probability of success before I switch course	0.209 (1.617)	5.099 (2.232)*	1.943 (2.693)	3.695 (2.801)	-0.391 (0.595)	0.231 (0.409)	57.215 (14.974)
(4) Lowest probability of success before I stop University	2.456 (1.986)	-1.642 (2.743)	-4.093 (3.310)	1.580 (3.442)	-0.126 (0.732)	0.398 (0.503)	39.832 (18.451)
(5) Difference between expected probability of success and switch probability[b] (3)	1.190 (1.848)	-5.437 (2.551)+	-3.368 (3.078)	-0.321 (3.201)	-0.797 (0.680)	0.406 (0.468)	29.769 (17.310)
(6) Difference between expected probability of success and stop probability[b] (4)	-1.348 (2.337)	0.422 (3.227)	2.517 (3.893)	2.884 (4.048)+	0.525 (0.860)	0.285 (0.592)	46.819 (21.949)
(7) Expected graduate ln earnings at age 45-50	0.207 (0.038)**	-0.087 (0.054)	-0.178 (0.065)**	0.066 (0.068)	-0.025 (0.014)+	-0.003 (0.010)	10.594 (0.522) [369]
(8) Expected non-graduate ln earnings at age 45-50	0.304 (0.055)**	-0.068 (0.077)	-0.105 (0.092)	-0.085 (0.096)	-0.050 (0.020)*	-0.011 (0.014)	10.036 (0.372) [367]
(9) Expected financial returns to degree at age 45-50	0.230 (0.110)*	0.053 (0.152)	0.027 (0.184)	-0.212 (0.191)	-0.045 (0.040)	-0.021 (0.028)	0.881 (0.997) [361]
(10) Expected grade point average on graduation	2.125 (0.750)**	-1.718 (1.038)+	-1.556 (1.249)	-1.842 (1.315)+	0.759 (0.276)**	0.577 (0.190)**	63.974 (7.188)

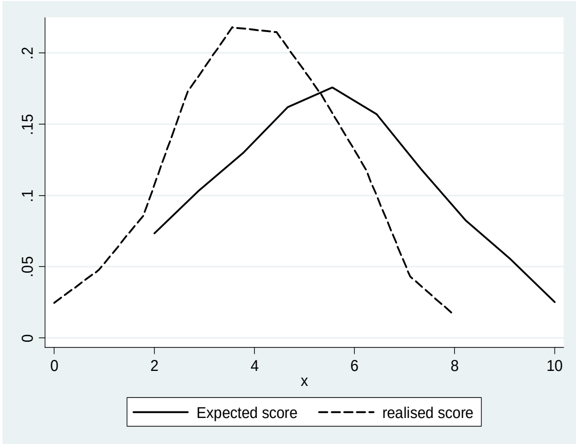
Note: Expectation of Students Survey (2005). Standard errors, clustered at institution level are reported in parentheses. The models are estimated by OLS and include controls for age, disability status, institution, spatial origin, A-level score, an indicator for being the first to go to university in the family, test score in calculus and literacy. +, * and ** signal significance at the 10%, 5% and 1% level respectively. [a] Expected relative success is the difference between the expected probability that I will complete first year of my degree and the expected percentage of fellow first year who will do it. [b]Difference between the expected probability that I complete the degree and the minimum probability of graduation before I switch course (5) or decide not to go to university (6). [c] Bias in numeracy and literacy are measured as the difference between predicted and realised own scores. [d] the number of observations is 386 unless an alternative is provided.

Figure 1-A: 1st year university students' realised and expected score by social class

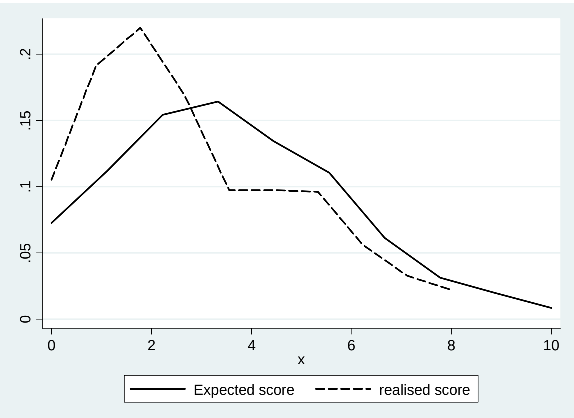
Higher social class - Numeracy



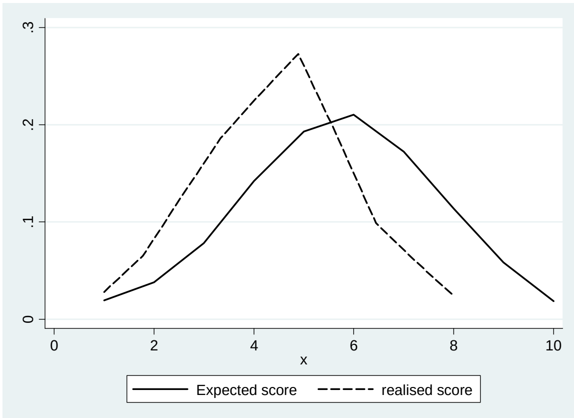
Higher social class - Literacy



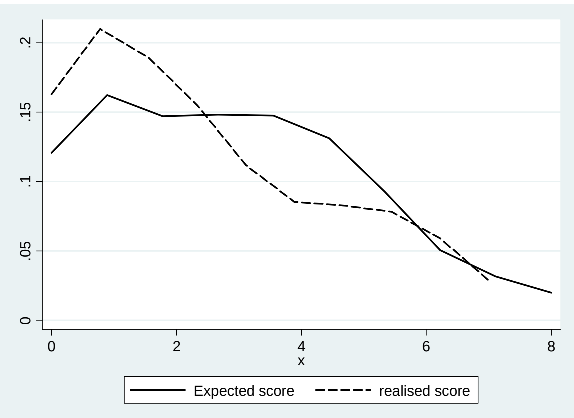
Middle social class - Numeracy



Middle social class - Literacy



Lower social class - Numeracy



Lower social class - Literacy

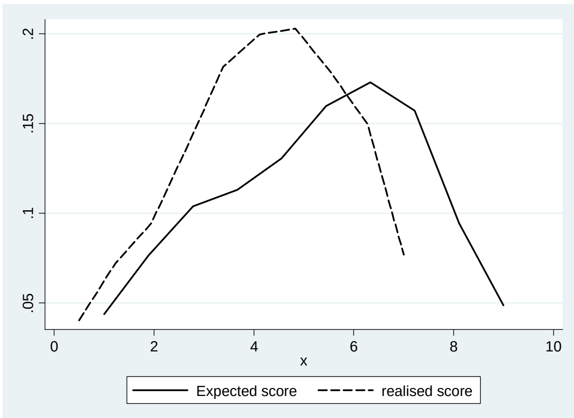
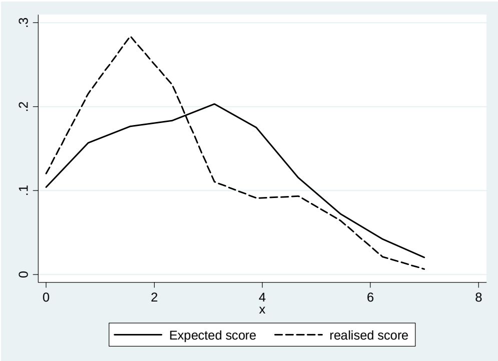
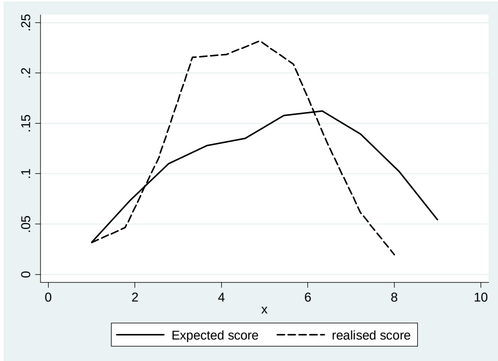


Figure 1-B: 1st year university students' realised and expected score by gender and ethnicity

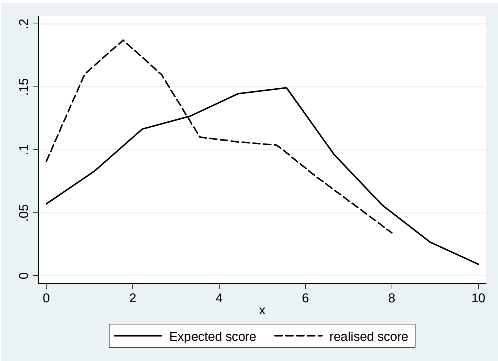
Female - Numeracy



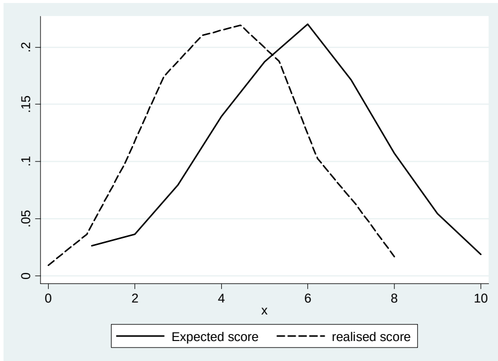
Female - Literacy



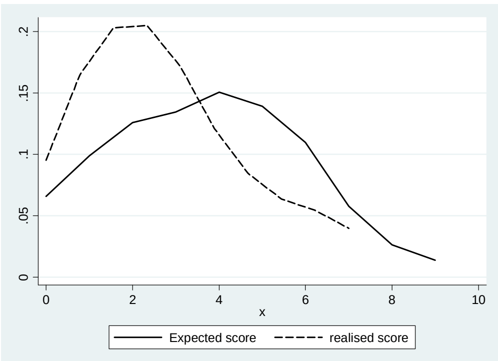
Male - Numeracy



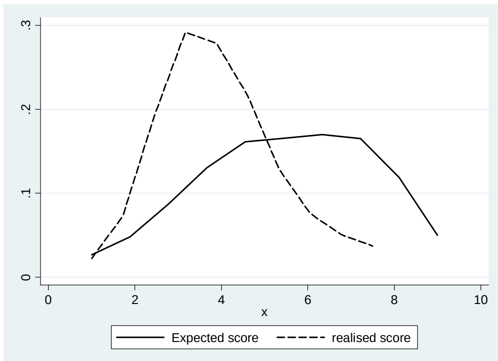
Male - Literacy



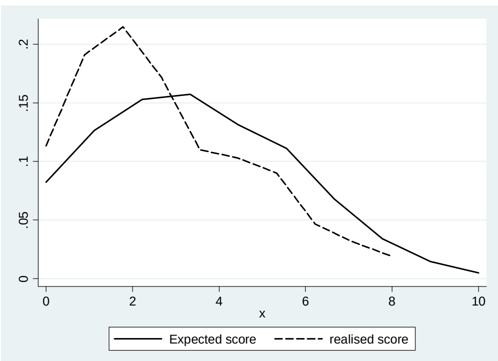
Ethnic minority- Numeracy



Ethnic minority - Literacy



White- Numeracy



White- Literacy

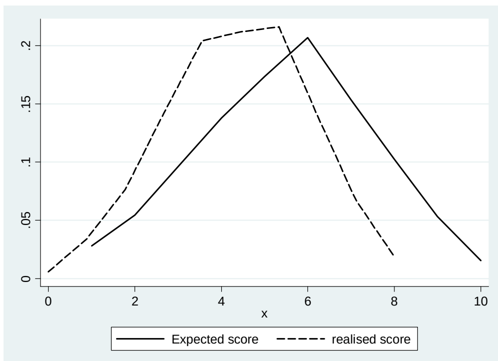
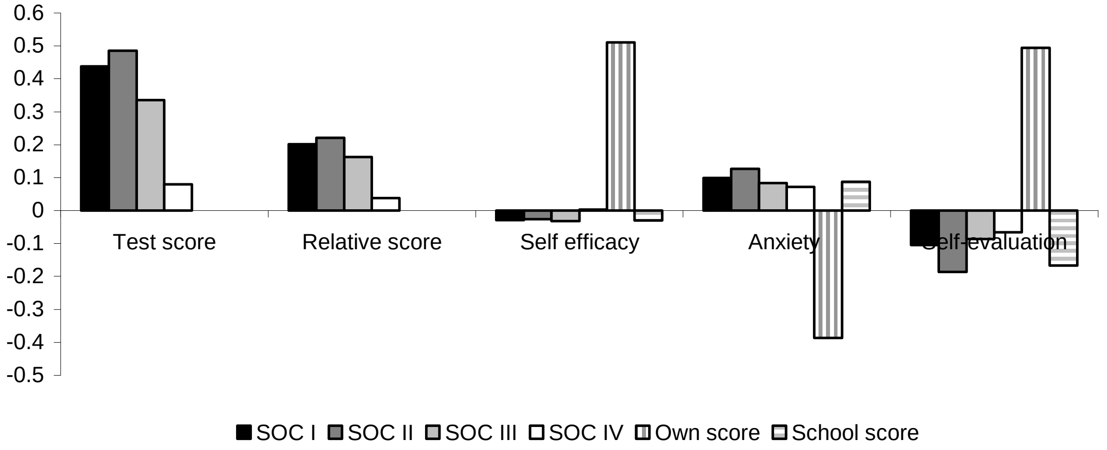
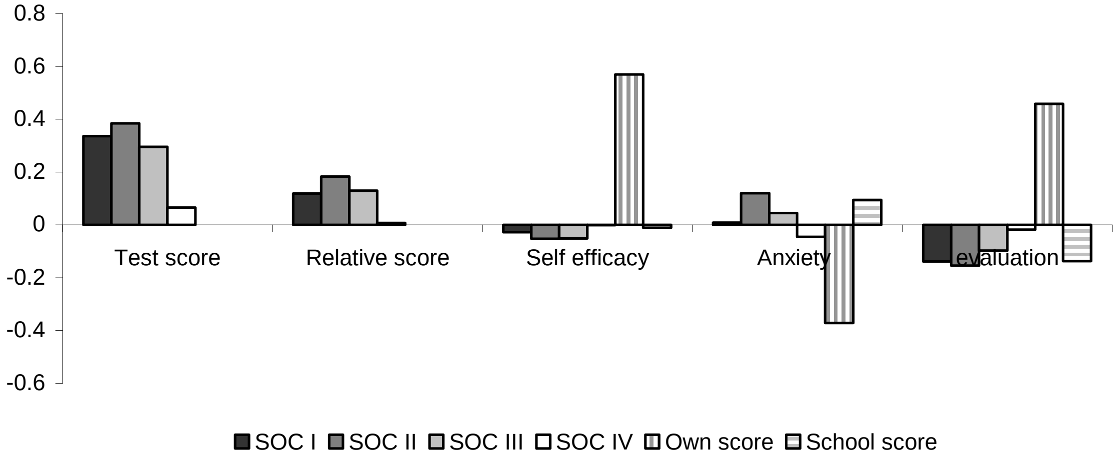


Figure 2: Gender, and class differences in scores and perceptions at age 15 – PISA 2003

A- Social class, math performance and perception - Girls



B- Social class, math performance and perception – Boys



Note: The above figures are OLS estimates of the effect of social class, own test score and school test score on the specified outcomes. All significant at 5% level, using standard errors clustered at school level. The regressions were run separately by gender using PISA 2003. The regression also includes the following covariates: age, grade, immigration status, number of hours of math self-study per week, family structure, language spoken at home, numbers of books at home, Welsh sample, minutes of mathematics instruction per week, parental education and parental labour market activity. Observations: 3931 girls, 3608 boys