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Student rank order and post-16 subject choices

Research Report

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Executive summary

The transition from Key Stage 4 (KS4) to post-16 education marks a shift from a broad programme of study (around 8-10 subjects) to a narrower programme (usually 1-4 subjects). Within the constraints of course availability and entry criteria, students must make important choices. Known influences on post-16 subject choices include perceptions of usefulness, advice from teachers and university admissions staff, enjoyment and interest, domain-specific self-concept (e.g., "I'm particularly good at Geography"), peers and family, and, to a lesser extent, perceived subject difficulty (Cuff, 2017; Vidal Rodeiro, 2007).

Students' post-16 pathways matter because different subjects as well as qualifications are associated with variable future opportunities in higher education, training, and careers, and with differing labour market returns (Dilnot, 2018; Hupkau et al., 2017). Despite the importance of post-16 subject choices, the factors driving them remain under-researched (Battiston et al., 2020). In the literature more broadly, however, research from psychology and economics has identified that students' reference groups (e.g., classmates) may be a relevant aspect to consider. For instance, the well-documented 'big-fish-little-pond' effect shows that a student with a given level of ability tends to perceive themself as more competent if they have lower-ability classmates than if they have higher-ability classmates.

In this study, we investigated how a student's rank within a GCSE subject in their school relates to their progression to post-16 study in that subject, by making use of an unusual dataset from summer 2020. After the cancellation of examinations due to Covid-19, teachers in England were required to submit predicted grades and within-subject rank orderings for GCSE candidates. These 'centre-assessment grades' were statistically moderated to produce so-called 'calculated grades', and students were awarded whichever grade was higher.

Summer 2020 GCSE data from OCR was linked to data including post-16 learning aims (PLAMS data from the National Pupil Database), detailing the subjects and qualifications students were studying for in autumn 2020. The data enabled us to statistically model the effect of within-subject rankings on within-subject progression, while controlling for potentially confounding variables. We first produced descriptive statistics on students' characteristics, subject grades and percentile ranks by within-subject progression. We then used multilevel logistic regression models to predict the probability of students with different within-school percentile ranks for their subject progressing to post-16 study in that same subject, after controlling for GCSE grade in the subject of interest, average grade across all *other* KS4 subjects, gender, ethnicity, school type, and the clustering of students within schools.

Some key findings are summarised here:

- As expected, students with higher grades in a subject were more likely to continue to a post-16 course in that subject than those with lower grades
- Compared to those with the same subject grade who did not continue, students who continued a subject post-16 had higher average percentile ranks in that subject, and lower average grades across their *other* KS4 subjects

- After controlling for student characteristics and grades (as described above), within-subject percentile rank was a statistically significant predictor of within-subject progression in all but two of the GCSE subjects analysed. For otherwise similar students at different percentile ranks, the predicted probabilities of within-subject progression showed non-trivial differences.

These findings are consistent with big-fish-little-pond effects influencing post-16 choices and offer a new contribution to understanding post-16 subject choice in England. Whilst recognising the limitations, we argue that analysis of the unique summer 2020 dataset confirms that reference-group effects merit attention from those wishing to understand post-16 choices.

Statement on data

This work was produced using statistical data from the ONS (Office for National Statistics). The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

Introduction

The transition from Key Stage 4 (KS4) to post-16 education marks a shift from a broad programme of study (around 8-10 subjects) to a narrower programme (usually 1-4 subjects). Course availability and entry criteria may impose constraints, but within these, students reaching the end of KS4 must make important choices about which subjects and qualifications to pursue in their post-16 education. Students' choices matter because different subjects as well as qualifications are associated with variable future opportunities in higher education and training, variable options for career entry and progression, and differing labour market returns (Conlon & Patrignani, 2015; Dilnot, 2018; Hupkau et al., 2017).

While previous research has identified a range of factors that influence students' post-16 subject choices, the underlying drivers are not necessarily well understood. Battiston et al. (2020) argued that despite the importance of post-16 subject choices, the factors driving them remain under-researched. In the literature more broadly, however, research from psychology and economics has identified that students' reference groups (e.g., classmates) may be a relevant aspect to consider. For instance, the well-documented 'big-fish-little-pond' effect shows that a student with a given level of ability tends to perceive themself as more competent if they have lower-ability classmates than if they have higher-ability classmates. Given what we already know about students' reported influences (which include academic self-concept, and beliefs about relative subject difficulty), it therefore seemed plausible to hypothesise that a student's position relative to their reference group could influence their post-16 choices.

The main aim of this research was, therefore, to investigate whether students' within-school rank in a GCSE subject predicted their likelihood of progressing to post-16 study in that subject. Our hypothesis was that, other things being equal, a GCSE student at a higher rank within their subject would be more likely to continue that subject post-16.

Previous research has shown significant variation in within-subject progression rates by subject GCSE grade (e.g., Gill, 2018). As part of the overall investigation into the role of student ranks, we therefore considered it important to pay close attention to GCSE grades, and addressed three sub-questions:

1. Are students with higher grades in a GCSE subject more likely to continue studying that subject after KS4?
2. Are students more likely to continue studying a subject after KS4 when they are relatively strong in that subject (i.e., their grade in this subject is high relative to their average performance across other KS4 subjects)?
3. Are students with a higher within-subject rank in their school more likely to continue studying that subject after KS4 than students with a lower within-subject rank?

Literature review

Data on progression from GCSE to A level shows an unsurprisingly strong relationship between GCSE subject grade and progression to AS/A level study in that subject (Gill, 2018). Subject grades on their own, however, explain only some of the choices made by students reaching the end of KS4. Considering post-16 choices in purely quantitative terms, the data shows persistent differences by gender, socio-economic background and subject. After accounting for subject grades, there remain some enduring differences by subject and gender (Gill, 2018). For instance, progression from GCSE to A level Physics is persistently higher among male students, while the reverse is true in Biology. Research into the low uptake of Maths and Physics A levels among suitably qualified girls has pointed to low confidence in these subjects as an issue (Cassidy et al., 2018), but has not succeeded in fully explaining the observed differences.

So-called 'facilitating' A levels have been extensively studied due to their gatekeeping function for high-prestige universities, and the fact that their uptake has been persistently lower among students from lower socio-economic groups. Researching this disparity of uptake, Dilnot (2016) found that after controlling for prior attainment and choice of KS4 subjects, there was little variation in post-16 subject choice by socio-economic status. Consequently, Dilnot concluded that the socio-economic 'gap' in A level subject choice required addressing disparities in prior attainment and KS4 subject choices, above decision-making at the end of KS4.

In research that engages with students themselves, the factors that students cite as influencing their post-16 subject choices include perceptions of usefulness, advice from teachers and university admissions staff, enjoyment and interest, domain-specific self-concept (e.g., "I'm particularly good at Geography"), peers and family, and, to a lesser extent, perceived subject difficulty (Cuff, 2017; Vidal Rodeiro, 2007). In research specifically focused on the interaction between perceived subject difficulty and subject choices, Cuff (2017) found that teachers and students alike focused on person-specific conceptions of subject difficulty, considered dependent on the individual's strengths. The students in Cuff's study also noted that perceived difficulty could actually be altered by enjoyment, via enjoyment promoting harder work in the subject (p. 26). Overall, Cuff (2017) found that A level subject choices appeared to be driven by a combination of enjoyment, usefulness and difficulty, where the perception of difficulty was primarily person-specific rather than absolute (p. 35).

Peer and reference group effects

Battiston et al. (2020) argue that the influence of peers on individuals' behaviour and choices has been widely documented, and that the question of how peer groups might affect post-16 educational choices is therefore a more than reasonable question to consider. Students themselves do not seem to credit peers with influencing their post-16 choices to any great extent, but in studies such as those by Cuff (2017) and Vidal Rodeiro (2007), peer influence appears to be considered in direct forms: advice from peers, imitation of peers, or wishing to be taught in a friendship group (e.g., "My friends were taking this subject" Vidal Rodeiro (2007, p. 30)). The research does not appear to engage with the idea of peers shaping other influences discussed, including the highly important feelings of enjoyment, individual strengths and perceived difficulty.

An important way in which peers may affect choices is through forming students' reference groups. The psychological literature posits that reference group effects may be at work in shaping both subject preferences and academic self-concepts – that is, beliefs about one's own competence in different school subjects. In general, psychologists have recognised for a long time that self-concepts are "based on the objective accomplishments evaluated in relation to frames of reference" (Koivuhovi et al., 2020, p. 2; see also Marsh et al., 2008, pp. 321-324). In educational settings, a well-documented effect of this relative evaluation is the big-fish-little-pond effect (BFLPE - Marsh, 1984; Marsh et al., 2008). BFLPE predicts that the academic self-concept of a student in a class of high-achieving classmates will be lower than the academic self-concept of an equally capable student in a class of average-achieving classmates (Koivuhovi et al., 2020, p. 2). Research with students of varying ages has shown that after accounting for students' own subject grades, having a high-achieving reference group (e.g., class) can negatively affect student conceptions of being 'good at' a particular subject (Koivuhovi et al., 2020), and also their level of subject interest (Trautwein et al., 2006) – both of which are known to matter for post-16 subject choices.

Besides BFLPE – a form of contrast effect – student preferences and choices may also be influenced by a student's reference group via assimilation effects. Assimilation effects (e.g., a 'reflected glory' effect) would posit that having higher-attaining classmates increases academic self-concept. In a highly relevant study investigating students' choice of post-16 educational pathways (but not subjects), Battiston et al. (2020) found strong evidence that having high-attaining peers reduced the likelihood of students enrolling on a vocational post-16 pathway.

BFLPE research has been criticised by some psychologists (e.g., Dai & Rinn, 2008) for "disproportionately" focusing on one form of social comparison, while paying insufficient attention to other factors. The effect of lower self-concept when a student is a member of a higher-achieving reference group has, however, been observed in a very wide variety of settings and study types, including large-scale studies such as PISA (Marsh et al., 2008). Marsh et al. (2008) further argue that the theoretical account offered by BFLPE is a specific case of more general frame-of-reference effects, and that the account does not claim this to be the only influence on academic self-concept.

Rank order studies

The majority of BFLPE studies have considered student ability in relation to the average achievement level of their reference group. There is also, however, research evidence for effects of within-group rank order[1]. Murphy and Weinhardt (2020), for instance, demonstrated that students' within-subject rank order in primary school predicted performance and subject choices in secondary school, while Elsner et al. (2021) showed that a higher within-module rank

[1] Note that although the studies mentioned use the terminology "rank order" and "ordinal rank", student within-group ordinal ranks were in all cases transformed into within-group percentile ranks before analysis (see Denning et al., 2021, p. 21; Elsner et al., 2021, p. 3188; Murphy & Weinhardt, 2020, p. 2788). This was to avoid results being driven by variation in group size (this variation prevents absolute ranks being comparable across groups – whether classes, schools or university teaching groups).

significantly increased the likelihood of undergraduates choosing a follow-up course in the same subject and graduating in a related major. Notably, studies have shown substantial effects of student rank order over both short time periods (e.g., Elsner et al., 2021) and very long time periods (e.g., Denning et al., 2021).

The rank order studies cited above analysed within-group rank orders derived from assessment results. Murphy and Weinhardt (2020) analysed a primary school rank order measure derived from national end-of-primary assessments sat at age 11, and interpreted this "as a proxy for perceived ranking based on interactions with peers over the previous six years of primary school, along with repeated teacher feedback" (p. 2788). Elsner et al. (2021) derived within-group student ranks from undergraduate grade point average (GPA), and again, interpreted this as a proxy for students' perceived ranking. Denning et al. (2021) calculated within-class rank orders based on low-stakes primary school tests in Maths and English. The authors state that students may not know or even "care particularly" about their ranking in these specific tests, but that "we interpret our test score rank measure as a proxy for students' day-to-day academic ranking in their class" (p. 22).

In these studies, the causal arguments being made do not depend on students having perfect knowledge of their (measured) rank, and the authors emphasise that imperfect knowledge is equivalent to measurement error in the rank variable – which is likely to, if anything, "attenuate our estimates and work against finding an effect" (Elsner et al., 2021, p. 3188). Murphy and Weinhardt acknowledge that the relationship between the (measured) rank and students' perceived ranking is not certain, but note that there is good evidence to believe that it is a good proxy (Murphy & Weinhardt, 2020, p. 2789). Denning et al., like Murphy and Weinhardt, emphasise that student awareness of within-group rank develops over time, as they "learn about their rank through repeated interactions throughout elementary school with their class peers (e.g., by observing who answers the most questions or gets the best grades in assignments)" (Denning et al., 2021, p. 22). At the undergraduate level, meanwhile, Elsner et al. (2021) note that "students may become aware of their rank after the grades from the previous term are released, which often triggers intense discussions among students" (p. 3188).

Interestingly, Denning et al. (2021) are explicit that their study of student rank order effects is agnostic about the mechanism or mechanisms involved. In contrast to psychological studies in a similar area, the authors "… define the rank effect to include any reactions to the rank of a student by any individual; the student, parents, or teachers. For example, if teachers invest more effort in the worst (or best) students, or parents invest in their child less if they believe their child is performing better than their peers irrespective of their absolute performance, then this would be included into the rank effect ... In summary, anything that is a reaction to a student's rank is a potential mechanism including student effort, parental investment, and teacher investment. In contrast, any predetermined factor that covaries with rank conditional on achievement could generate a bias." (Denning et al., 2021, p. 4)

Data and methods

Data

In this research, we made use of data on students' within-subject rank order that was available due to the unusual circumstance of GCSE awarding in England in summer 2020. The usual summer examinations series was cancelled due to Covid-19, and teachers were required to submit predicted grades known as 'centre-assessment grades' (CAGs) and within-subject rank orderings for GCSE candidates (Ofqual, 2020b). The CAGs were statistically standardised to produce so-called 'calculated grades', with the goals of ensuring fairness to students from different schools, maintaining the overall national standard relative to previous years, and thereby maintaining public confidence in grades (Ofqual, 2020a). High levels of concern were expressed about calculated grades, and students were, in the end, awarded the higher of the two grades, either the CAG or the calculated grade (Stratton et al., 2021).

We obtained a complete dataset of summer 2020 GCSE results data from OCR. This listed all GCSEs awarded by OCR, including the centre assessed grade (CAG), calculated grade, and final GCSE grade awarded for each entry. The OCR GCSE data was linked to datasets from the National Pupil Database[2] obtained from the Department for Education and made available via the ONS Secure Research Service environment (SRS). These datasets were the KS4 pupil and exam results data for the academic year 2019/20, linked to the Spring School Census for 2019/20, and Post-16 Learning Aims (PLAMS) data for the academic year 2020/21. PLAMS is a module of the Autumn School Census where schools list the qualifications that Year 12 students are studying for, and the data is collected primarily to calculate school funding. The PLAMS module is compulsory for schools with a sixth form (DfE, 2022), but not for sixth form colleges, further education colleges and independent schools. Unsurprisingly, previous work has shown that these centre types can be severely under-represented in the PLAMS data (Zanini & Williamson, 2016).

Table 1 shows the variables obtained from each dataset.

Table 1: Datasets and variables analysed.

Dataset	Variables
OCR GCSE results data for summer 2020	Unique candidate identifier and centre number GCSE subject Centre assessment grade (CAG) Calculated GCSE grade Final GCSE grade

[2] The National Pupil Database (NPD) is a longitudinal database for children in schools in England, linking pupil characteristics to school and college learning aims and attainment. It holds pupil level attainment data for pupils in all schools who take regulated qualifications, and pupil and school characteristics (e.g., age, gender, ethnicity, special educational needs, eligibility for free school meals, etc.) sourced from the School Census for maintained schools only.

KS4 pupil and results data 2019/20	Gender Ethnicity (Asian, Black, Chinese, Mixed, Other, White) School type (Comprehensive, Independent, Other, Secondary Modern, Selective) IDACI score[3] Year group KS4 qualifications and subjects KS4 grades
PLAMS 2020/21	Post-16 qualifications and subjects

From the variables shown in Table 1, additional variables were derived for use in the analyses. Firstly, students were classified into terciles based on their IDACI score, as a proxy for level of socio-economic disadvantage. The terciles were calculated based on the complete Year 11 cohort in 2019/20. Secondly, to indicate level of overall achievement, students were classified into terciles based on their average KS4 point score per entry, counting achievement in GCSEs and equivalents[4]. As for the IDACI terciles, the overall attainment terciles were calculated based on the complete Year 11 cohort (not just students successfully matched to the PLAMS data).

Based on existing literature, we expected that within-subject progression from GCSE to post-16 courses would be influenced not only by a student's subject grade, but also the student's performance in their other GCSE subjects, since the choice of whether or not to continue a subject could depend on whether it was among the student's 'best' subjects as well as on absolute levels of attainment. For each GCSE result belonging to our matched KS4 candidates, we therefore calculated the candidate's average KS4 grade (including GCSEs and equivalents) across all other subjects. A single student with results in multiple GCSE subjects therefore had multiple "Average KS4 grade (other subjects)" measures.

Finally, we calculated subject-specific percentile ranks[5] for students within their school year group, based on all students entered for the same GCSE subject at the same centre. For convenience, we refer to students from the same school and year group taking the same subject as 'classmates', while recognising that the teaching groups actually used are of course likely to vary by school type and subject entry size. The calculation of the percentile ranks considered all candidates in the OCR results data, not just those we had successfully matched to PLAMS data. The percentile ranks were calculated by ordering candidates by their CAG and then by calculated grade, as differences in calculated grades among students with the same CAG reflect the teacher's ranking of those students. Highest ranks were assigned to the highest

[3] The Income Deprivation Affecting Children Index (IDACI) is a measure of deprivation in a local area, and records the proportion of all children aged 0 to 15 in that area who are living in income deprived families. The IDACI scores recorded in the National Pupil Database are derived from each pupil's postcode. For full details of the IDACI derivation, see McLennan et al. (2019, p. 33).

[4] For details on how this is calculated, see DfE (2017).

[5] Although schools provided CAGs and rank orders to awarding bodies, only CAGs and calculated grades were available in the data used in this research. For this reason, rank orders were calculated (using both sets of grades, as described).

grades, and tied students were given the average of the tied ranks. Since class sizes vary, these ranks would not be comparable across different classes, and so ranks were then converted to within-group percentile ranks[6]. Table 2 shows a small example, for a fictional GCSE class of 10 students.

Table 2: Example of percentile ranking for single class (fictional data).

Rank (highest = best)	Percentile rank	Student	CAG	Calculated grade	Comments
10	100	A	8	9	This student's CAG was higher, indicating that the teacher placed them at the top of the grade 8s
8	80	B	8	8	We cannot tell the class rankings of students B, C and D, but we know from their calculated grades that the teacher placed them lower than student A and higher than students E and F
		C	8	8	
		D	8	8	
5.5	55	E	8	7	We cannot tell the class rankings of students E and F, but we know from their calculated grades that the teacher placed them lower than students A to E, and from their CAG that they were placed higher than student G.
		F	8	7	
4	40	G	7	7	
3	30	H	7	6	
1.5	15	I	6	6	
		J	6	6	

Students may or may not have known the CAGs and within-subject rank orders underlying these percentile ranks. In this research, we were interested in the rank ordering (in itself), as a product of teacher judgements, and we interpret it as a proxy for students' "day-to-day academic ranking in their class" (Denning et al., 2021, p. 22). We note that teachers' judgements of subject-specific achievement (which were the source of the CAGs and rank orders) are communicated to students throughout the duration of a GCSE course via both formal teacher assessments (e.g., end of term assignments) and informally, in ways that are either immediately visible to the class (e.g., verbal praise in lessons), or likely to be shared by students comparing grades (as observed by Elsner et al. (2021)). Hence, our working assumption is that the derived percentile ranks are a good proxy for students' own perceptions of their within-class rank. However, like Denning et al. (2021), we are interested in any effects of the within-class rank order, and recognise that the mechanism may include teacher, school, or parent responses to the rank order, besides any effects of students' perceived ranking. In the extreme case that

[6] This follows the approach used in existing rank order studies – see Denning et al. (2021, p. 21); Elsner et al. (2021, p. 3188); Murphy and Weinhardt (2020, p. 2788). Note that, in these studies, "percentile ranks" were in fact calculated as proportions (bounded by zero and one), and in the case of Elsner et al., they were subsequently standardised to have a mean of zero and standard deviation of one. In this report, by contrast, we use percentile ranks on the usual scale of zero to one hundred, as we considered this more straightforward to interpret.

students were entirely unaware of the rank order analysed in this research (a situation we consider very unlikely), the effects associated with the rank order would remain of interest.

Analyses

Analysis was restricted to OCR students in Year 11 in academic year 2019/20. The Year 11 OCR GCSE candidates who were successfully matched to the PLAMS dataset are referred to as the "matched candidates" from here on. Analysis of post-16 learning aims was restricted to learning aims that these students had begun in August 2020 or later (i.e., after KS4), and that were still active at the point of the PLAMS census completion (i.e., the student had not withdrawn or transferred from the learning aim).

We first produced descriptive statistics on the characteristics of matched candidates by subject. This was a necessary precursor to investigation of within-subject progression, since it was possible that the sample of students available from the linked OCR-PLAMS data might not be representative of GCSE candidates in these subjects more generally. We next produced descriptive statistics on GCSE subject grades, rates of within-subject progression from GCSE to post-16 study, average KS4 grades (across other subjects) and percentile ranks.

To answer the main research question, we used multilevel logistic regression models to predict the probability of students with different within-school percentile ranks for their subject progressing to post-16 study in that same subject, after controlling for potentially confounding variables. Models were estimated based on all matched candidates who had achieved a GCSE pass grade (i.e., grade 4 or above) in the subject of interest, or in the single sciences, a grade 5 or above (due to statistical disclosure controls[7], the low numbers of candidates progressing from grade 4 in the single sciences could not be reported).

The model structure for all subjects was a multilevel logistic regression model, with random intercept at centre level. The outcome predicted was a binary variable indicating progression to AS or A level in same subject, or a binary variable indicating progression to another L3 (non-AS/A level) course in same subject.

The predictor variables were the following:

- GCSE grade in subject of interest
- Average KS4 grade across all other subjects (excluding subject of interest)
- Interaction between subject GCSE grade, and average KS4 grade across other subjects
- Gender (ref=Female)
- School type (ref=Comprehensive)
- Ethnicity (ref=White)
- IDACI group (ref=Medium)
- Within-school percentile rank of student for the subject of interest.

[7] The outputs from the analyses in this report were checked by the researchers and the ONS to ensure they met disclosure control standards. Statistical disclosure is when a small number of observations are presented as an output and can lead to the identification of an individual. In this work we used the usual threshold for data held in the ONS SRS (every cell should have a minimum count of 10 to be considered safe).

For the purposes of calculating progression statistics and modelling progression, GCSE courses in the same or very similar subjects were grouped together. Table 3 shows the subjects (or subject groups) taken by at least one matched candidate. For 12 GCSE subjects we were able to match KS4 results to post-16 learning aims for at least 5000 candidates. The analyses were carried out separately for each of these 12 subjects.

Table 3: Number of matched candidates per GCSE subject.

	Subject group	**Frequency**	**Percent**
Included in analyses	Computing	24550	17.6
	Mathematics	15203	10.9
	Geography	10187	7.3
	History	9219	6.6
	English[8]	8597	6.2
	Sports	8504	6.1
	Science	7419	5.3
	Biology	6800	4.9
	Chemistry	6757	4.9
	Business	6671	4.8
	Physics	6452	4.6
	Art & Design[9]	6107	4.4
Excluded from analyses	Drama	3224	2.3
	Music	3057	2.2
	Religious Studies	3045	2.2
	Economics	2898	2.1
	D&T	1990	1.4
	Psychology	1830	1.3
	Latin	1570	1.1
	Media	1455	1.0
	Food Prep and Nutrition	1231	0.9
	Classical Civilisation	1041	0.8
	Citizenship Studies	652	0.5
	Ancient History	370	0.3
	Textiles	305	0.2
	Classical Greek	128	0.1

[8] Including English Language (n=4201) and English Literature (n=4396).

[9] Including Fine Art (n=3559); Art, Craft and Design (n=1189); Photography (n=809); and 3D Studies, Critical and Contextual Studies and Graphics (n=550).

The post-16 qualifications that were counted as “progression in the same subject” for each GCSE subject are shown in Table 4. Progression to AS/A level study in the same subject was investigated for all 12 GCSE subjects. Progression to other Level 3 courses (non-AS/A level, for example, Applied Generals or other vocational qualifications) was analysed where non-AS/A level courses in the GCSE subject existed: in Business, Computing, Mathematics, Science, and Sports. Non-AS/A level courses in Art & Design were also investigated, but uptake among the matched candidates was very low, and thus reporting would have involved extensive suppression in order to comply with Statistical Disclosure Controls.

Table 4: Progression qualifications, by GCSE subject.

GCSE subject	AS/A level progression	L3 (non-AS/A level) progression	Notable related subjects not counted as progression in same subject
Art & Design	AS/A level Art & Design (3D Studies) AS/A level Art & Design (Critical Studies) AS/A level Art & Design (Fine Art) AS/A level Art & Design (Graphics) AS/A level Art & Design (Photography)	Any L3 (non-AS/A level) in Visual Arts; Art & Design; Cartoon Drawing	History of Art; AS/A level Textiles; Media/Film/TV Studies; D&T Textiles
Biology	AS/A level Biology		
Business	AS/A level Business AS/A level Accounting/Finance	Any L3 (non-AS/A level) in Business and Administration; Accounting	Economics; Law
Chemistry	AS/A level Chemistry		
Computing	AS/A level Computing	Any L3 (non-AS/A level) in Computing; Computer Architecture / Systems	IT and Computer Use/Appreciation; Electronics
English	AS/A level English Literature AS/A level English Language AS/A level English Language & Literature		Drama & Theatre Studies; Media/Film/TV Studies
Geography	AS/A level Geography		Geology; Environmental Science
History	AS/A level History AS/A level Ancient History		Classical Civilisation; Classics; Government & Politics
Mathematics	AS/A level Mathematics AS/A level Further Maths AS/A level Mathematics (Statistics)	Core Maths; other L3 Mathematics; Mathematical Studies	
Physics	AS/A level Physics		Engineering; Computing
Science	AS/A level Biology AS/A level Chemistry AS/A level Physics	Any L3 (non-AS/A level) in Science & Mathematics; Applied Science	Food & Nutrition
Sports	AS/A level Physical Education/Sports Studies	Any L3 (non-AS/A level) in Sport	

Results

The results are presented in three sections, corresponding to the three research questions. The first section looks at how within-subject progression rates varied by GCSE subject grade, for each of the GCSE subjects analysed. The second section considers students' average KS4 grades (across *other* subjects), to investigate the hypothesis that candidates would be more likely to progress to post-16 study in their stronger subjects than in their weaker subjects. The third and final section presents the findings on percentile rank: firstly in terms of descriptive statistics, and then the results of the regression modelling.

Progression rates by GCSE subject grade

Figures 1-8 show the proportion of matched GCSE candidates in each subject at each grade who progressed to post-16 study in the same subject. The accompanying tables are referenced in each figure caption and are located in Appendix A.

Within-subject progression to AS/A level increased with GCSE grade in almost all subjects: the exceptions were Geography (Figure 5), where within-subject progression among grade 9 candidates was slightly lower than for grade 8 candidates; Business (Figure 7), where progression peaked among grade 6 candidates and then declined; and Sport (Figure 8), where the progression rate was extremely similar across grades 7 to 9.

Progression rates to non-AS/A level qualifications showed distinctive patterns that differed from the patterns for AS/A level progression. In all subjects where it was analysed, non-AS/A level within-subject progression was less common than A level progression in the same subject, and in most cases decreased (rather than increased) with GCSE subject grade.

The following sections expand on the summary given above, and look in more detail at how within-subject progression varied by GCSE subject grade in each subject.

Mathematics and Computing

In Mathematics, in contrast to other GCSE subjects, within-subject progression to AS/A level was still low at grade 6. The increase in progression rate with GCSE grade was particularly steep, however, and over 80% of grade 9 candidates progressed to AS/A level Mathematics, far higher than the within-subject progression rate for grade 9 candidates in other subjects. Progression to non-AS/A level Mathematics was low at all GCSE grades, and peaked at grade 6 (just under 5%).

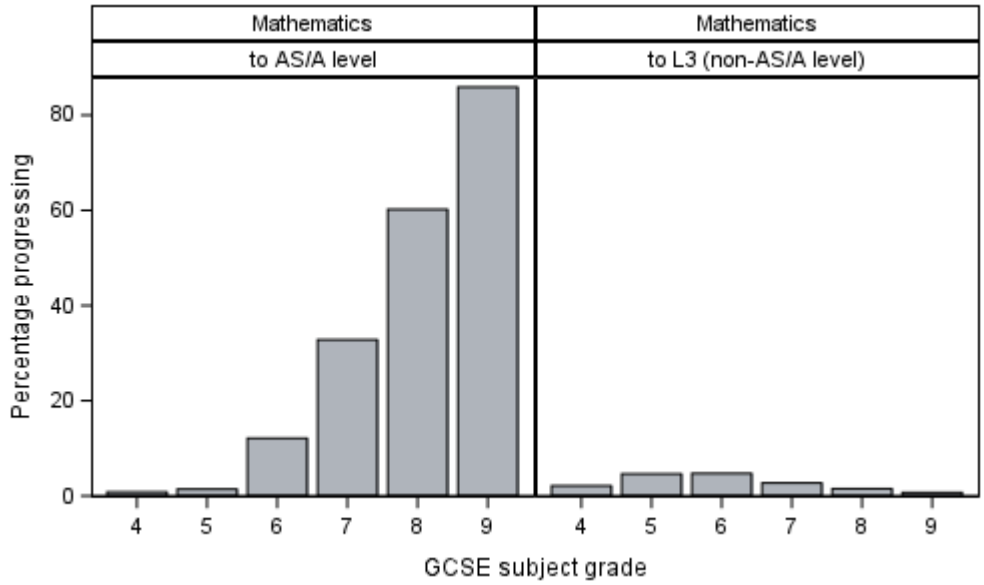

Figure 1: Progression from GCSE Mathematics to post-16 study in Mathematics, by GCSE grade (based on data in Table 15 and Table 16).

Within-subject progression to AS/A level Computing also increased steeply by grade, but less so than for Mathematics. Unusually, there was some within-subject progression even at grades 3 and below, and at grade 9 the within-subject progression rate to A level was around 50%. Within-subject progression to non-AS/A level Computing was similar for GCSE Computing candidates with grades 3 and below and with grade 4, then declined with increasing grade.

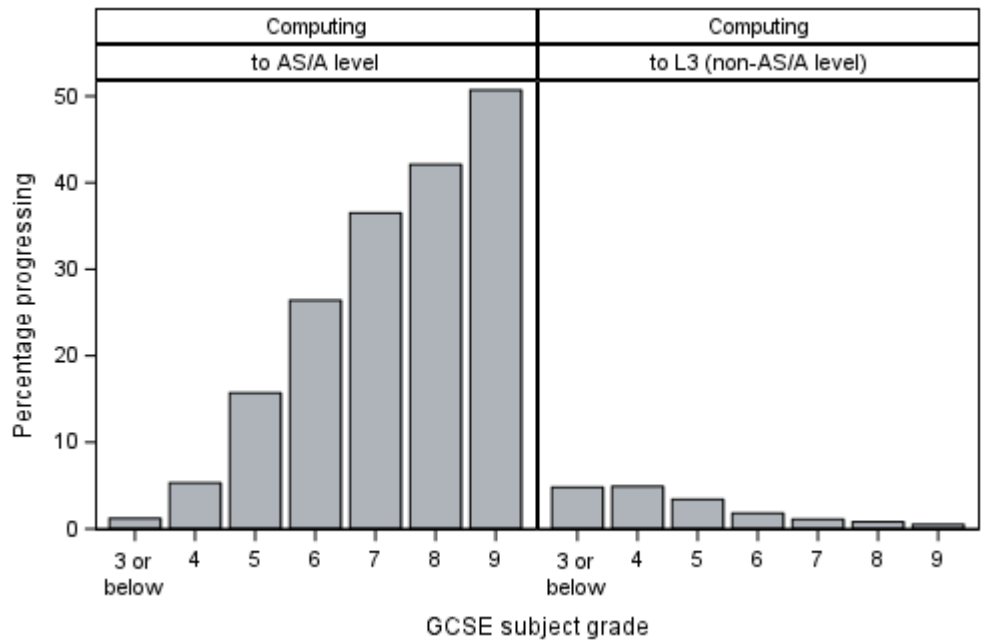

Figure 2: Progression from GCSE Computing to post-16 study in Computing, by GCSE grade (based on data in Table 17 and Table 18).

Sciences

For the separate sciences, within-subject progression was low among grade 5 candidates, but highest for Biology. The progression rate increased particularly sharply between grade 5 (9%) and grade 6 (30%) in Biology, then only moderately for subsequent grades. In Chemistry and Physics, by contrast, within-subject progression increased steeply from grade 5 up to grade 9. For all grades, progression rates within Physics were lower than the corresponding progression rates in Biology and Chemistry.

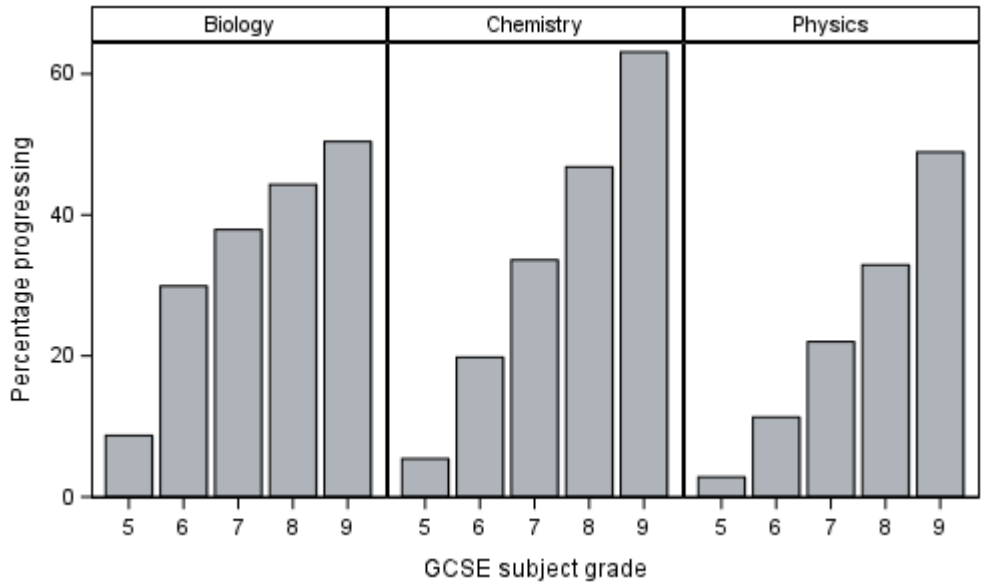

Figure 3: Progression from single sciences GCSEs to AS/A level study in the same subject, by GCSE grade (based on data in Table 19, Table 20 and Table 21).

For GCSE Combined Science, progression to a non-AS/A level science course was highest for candidates with grade 5-4 (12%) then decreased with increasing GCSE grade.

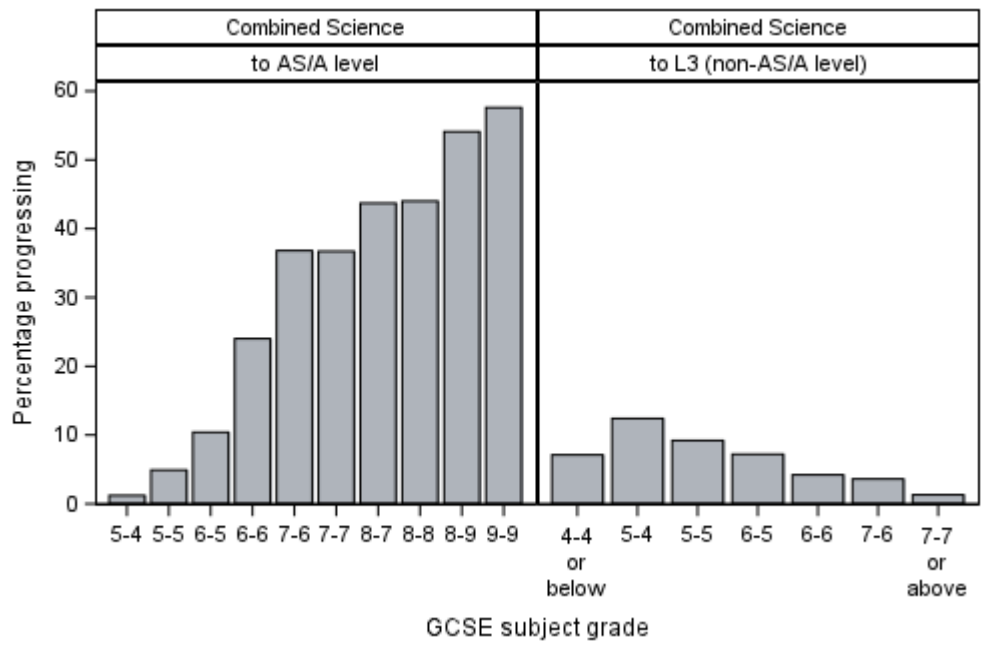

Figure 4: Progression from GCSE Combined Science to post-16 study in science, by GCSE grade (based on data in Table 22 and Table 23).

Humanities

Among the humanities subjects (Figure 5), there was a noticeable contrast between English and Geography. In Geography, as already noted, within-subject progression did not increase at grade 9 (and in fact was similar across grades 7 to 9), whereas in English, there was a steep increase between within-subject progression at grade 8 (22%) and grade 9 (33%). Progression rates increased steeply in History, and among candidates at grades 7 to 9 within-subject progression was higher than for English and Geography candidates of any grades.

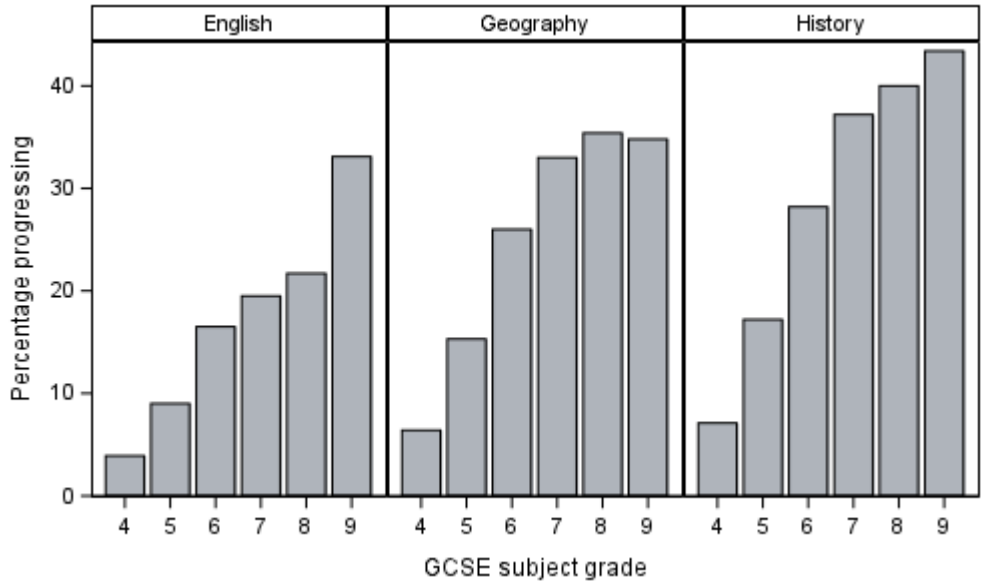

Figure 5: Progression from humanities GCSEs to AS/A level study in the same subject, by GCSE grade (based on data in Table 24, Table 25 and Table 26).

Other subjects

Progression from GCSE Art & Design to AS/A level Art & Design increased with grade (Figure 6). Within-subject progression was strong at the lower grades (only Business candidates showed higher within-subject progression from grade 4) and also the highest grades (over 50% of grade 9 candidates progressed, comparable to the rates from science GCSEs).

Business and Sports were notable for showing a much smaller discrepancy than other subjects in the percentages of candidates progressing to A level and non-A level courses in the same subject. In both subjects, as already noted, progression to A level did not increase with GCSE grade: progression to A level declined above grade 6 among GCSE Business candidates, and plateaued after grade 7 for GCSE Sports candidates. In both subjects, the highest non-A level progression rate was among grade 4 candidates, and declined with increasing GCSE grade.

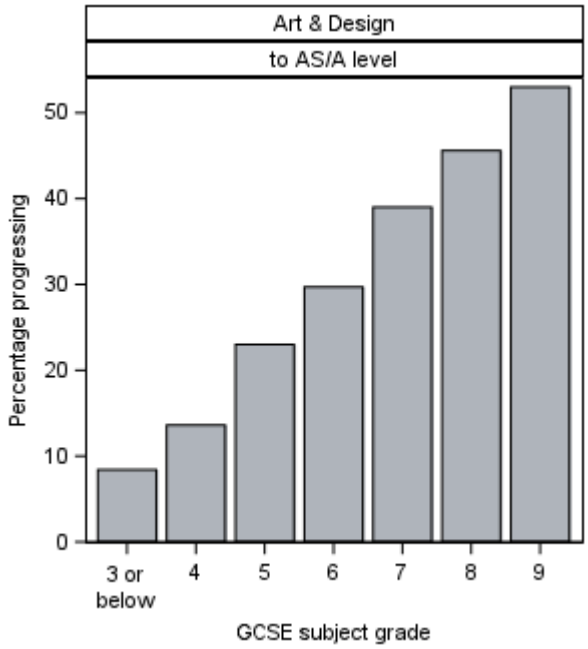

Figure 6: Progression from GCSE Art & Design to AS/A level Art & Design, by GCSE grade (based on data in Table 27).

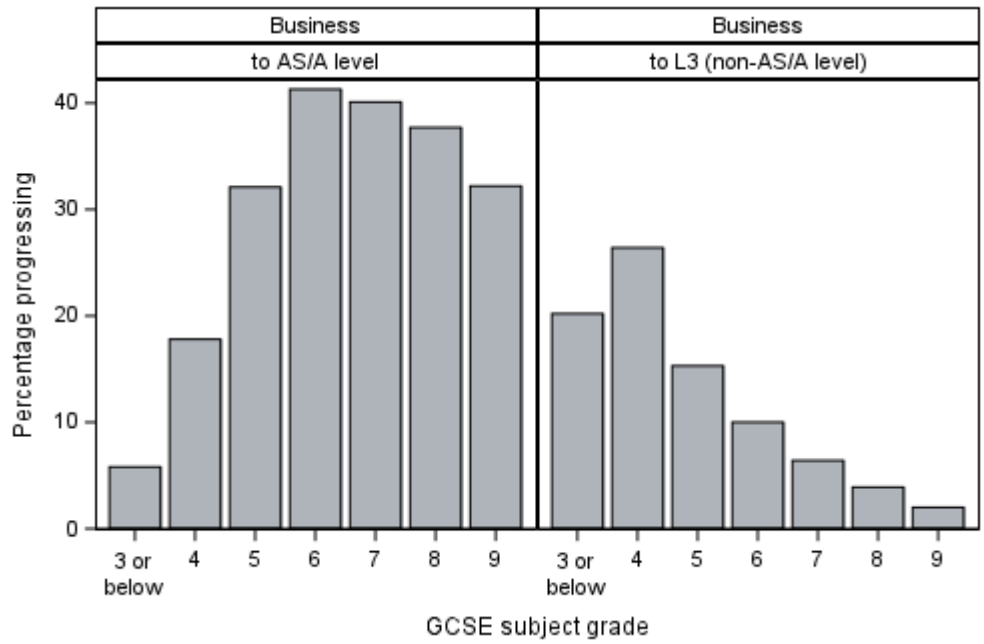

Figure 7: Progression from GCSE Business to post-16 study in Business, by GCSE grade (based on data in Table 28 and Table 29).

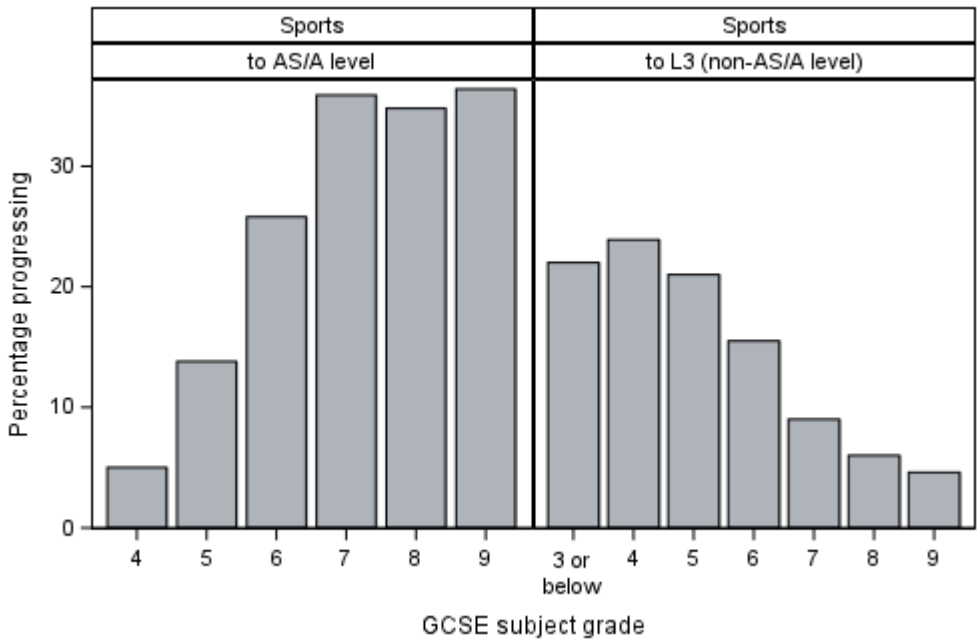

Figure 8: Progression from GCSE Sports to post-16 study in Sports, by GCSE grade (based on data in Table 30 and Table 31).

Progression and average KS4 grades

We hypothesised at the start of this research that candidates would be more likely to progress to post-16 study in their stronger subjects than in their weaker subjects. This section investigates this.

As explained in the 'Data and methods' section, for each GCSE result belonging to the matched candidates, we calculated the candidate's mean KS4 grade across all other subjects (calculated separately for each GCSE subject the candidate took). Table 5 shows the average KS4 grade achieved across other subjects for the matched candidates in each GCSE subject who were included in the regression analyses (i.e., with a subject grade of at least 4, or at least 5 in the separate sciences).

Table 5: Average KS4 grades across other subjects (calculated from weighted averages of values in Table 15-Table 31).

GCSE subject		**N**	**Average KS4 grade across other subjects (to nearest half grade)**
Maths and Computing	Mathematics	13868	6
	Computing	22399	6.5
Sciences	Biology	6436	7
	Chemistry	6294	7
	Physics	6024	7
	Combined Science	5634	6
Humanities	English	8312	6.5
	Geography	9347	6.5
	History	8396	6.5
Other subjects	Art & Design	5870	6
	Business	6274	6
	Sports	8067	6

In terms of the difference between single GCSE subject grades and average KS4 grade across other subjects, the descriptive statistics tables in Appendix A (Table 15-Table 31) show the results we would expect: for example, for candidates with a lower subject grade (e.g., 4 or 5), mean KS4 grade across other subjects tended to be higher than the candidate's subject grade, while for candidates with the highest subject grades (8 or 9), mean KS4 grade across other subjects tended to be lower than the subject grade.

The relationship between mean KS4 grade across other subjects and GCSE subject grade was, however, consistently different for candidates who did and did not continue the GCSE subject to A level. For each grade and subject analysed, Table 6 shows the difference between the mean KS4 grade across other subjects for candidates who progressed to A level in the subject, and the mean KS4 grade across other subjects for candidates who did not progress (the summary of differences in average KS4 grade difference for GCSE Combined Science candidates is reported separately in Table 8 due to the different grading structure of this qualification). The differences were in the expected direction: with few exceptions, Table 6 shows negative values, indicating that candidates who continued their GCSE subject to A level tended to have a lower mean KS4 grade across their other subjects than candidates with the same subject grade who did not progress. The size of the difference varied by subject: in Biology and Chemistry, the difference in mean KS4 grade across other subjects was on the lower side (up to 0.3 of a grade), whilst in other subjects the difference was generally between 0.3 and one whole grade.

Table 6: Average KS4 grade (excluding subject of interest) difference (candidates who progressed to AS/A level in the same subject compared to candidates who did not).

GCSE subject		GCSE subject grade							Source data
		3 or below	4	5	6	7	8	9	
Maths and Computing	Mathematics	*	-0.10	-0.50	-0.50	-0.50	-0.60	-0.30	Table 15
	Computing	0.00	-0.40	-0.40	-0.50	-0.50	-0.50	-0.40	Table 17
Sciences	Biology	*	*	-0.10	-0.30	-0.20	-0.20	-0.10	Table 19
	Chemistry	*	*	0.00	-0.30	-0.30	-0.20	-0.10	Table 20
	Physics	*	*	-0.30	-0.40	-0.40	-0.40	-0.20	Table 21
Humanities	English	*	-0.30	-0.60	-0.80	-0.90	-0.80	-0.40	Table 24
	Geography	*	-0.30	-0.40	-0.40	-0.60	-0.60	-0.40	Table 25
	History	*	-0.40	-0.50	-0.40	-0.50	-0.50	-0.50	Table 26
Other subjects	Art & Design	-0.40	-0.50	-0.50	-0.70	-0.70	-0.80	-0.70	Table 27
	Business	0.10	0.00	-0.30	-0.40	-0.70	-0.80	-0.80	Table 28
	Sports	*	-0.10	-0.20	-0.40	-0.50	-0.60	-0.60	Table 30

*Descriptive statistics not calculated for these grades due to statistical disclosure control.

Table 7 shows the same differences in mean KS4 grade, but for progression to non-AS/A level courses. The pattern of differences for progression from GCSE Mathematics to non-AS/A level Mathematics was mixed. For the other subjects, the differences in mean KS4 grade across other subjects were in the expected negative direction, indicating that candidates who continued the subject to a post-16 non-AS/A level course tended to have a lower mean KS4 grade across their other subjects than candidates who did not.

Table 7: Average KS4 grade difference (candidates who progressed to Other L3 course in the same subject compared to candidates who did not).

GCSE subject	GCSE subject grade							Source data
	3 or below	4	5	6	7	8	9	
Mathematics	*	-0.20	-0.20	-0.20	-0.20	0.40	0.00	Table 16
Computing	-0.40	-0.50	-0.60	-0.50	-0.80	-0.90	-1.40	Table 18
Business	-0.20	-0.40	-0.50	-0.70	-0.50	-0.80	-0.30	Table 29
Sports	-0.40	-0.60	-0.80	-0.80	-0.90	-0.70	-1.40	Table 31

*Descriptive statistics not calculated for these grades due to statistical disclosure control.

The differences in mean KS4 across other subjects for candidates who did and did not progress from GCSE Combined Science (Table 8) were all in the expected direction.

Table 8: Average KS4 grade difference (candidates who progressed from GCSE Combined Science to post-16 science compared to candidates who did not).

	GCSE Combined Science grade										Source data
	4-4 or below	5-4	5-5	6-5	6-6	7-6	7-7	8-7	8-8	8-9	9-9	
to AS/A level	*	0.40	-0.10	-0.30	-0.30	-0.20	-0.60	-0.40	-0.70	-0.30	-0.30	Table 22
	4-4 or below	**5-4**	**5-5**	**6-5**	**6-6**	**7-6**	**7-7 or above**					
to L3 (non-AS/A level)	-0.20	-0.50	-0.50	-0.60	-0.50	-0.60	-0.70					Table 23

*Descriptive statistics not calculated for these grades due to statistical disclosure control.

Progression and within-subject ranks

Descriptive statistics

Our hypothesis regarding percentile ranks was that, other things being equal, a GCSE candidate at a higher rank within their subject would be more likely to continue that subject post-16. For each GCSE subject and grade analysed, Table 9 shows the difference between the mean percentile rank of those who continued to AS/A level, and the mean percentile rank of those who did not. As in the analysis of mean KS4 grades, the differences were in the expected direction: they were positive in almost all cases, confirming that candidates who progressed to A level tended to have a higher percentile rank than candidates of the same grade who did not. The exceptions to this (negative values – indicating a higher mean percentile rank among those who did *not* progress) were found among the lower grades analysed, and more frequently in Business and Sports than in other subjects.

Table 10 shows the same summary of differences in percentile rank, but for progression to non-AS/A level courses (and hence includes only the subjects where such progression was analysed). In Mathematics, there was no clear pattern: the difference in mean percentile rank between candidates who progressed and those who did not was positive at grades 6, 7 and 8, but negative at grades 4, 5 and 9. In Computing, Business and Sports, the differences in mean percentile rank were generally positive (indicating a higher mean rank among those who progressed), at least for grades 5 and above.

The summary of differences in percentile rank for GCSE Combined Science candidates is reported separately (Table 11) due to the different grading structure. At all grades, GCSE

Combined Science candidates who progressed to post-16 courses in science had higher mean percentile ranks than candidates who did not.

Table 9: Differences in mean percentile rank (candidates who progressed to AS/A level in the same subject compared to candidates who did not).

GCSE subject		GCSE subject grade							Source data
		3 or below	4	5	6	7	8	9	
Maths and Computing	Mathematics	*	-5.00	2.20	3.70	3.60	4.60	1.80	Table 15
	Computing	-1.30	2.40	2.30	3.30	3.20	2.90	1.20	Table 17
Sciences	Biology	*	*	3.30	4.70	2.00	1.90	1.20	Table 19
	Chemistry	*	*	9.10	4.70	0.90	0.20	1.50	Table 20
	Physics	*	*	-1.60	1.20	1.70	1.30	0.80	Table 21
Humanities	English	*	2.50	0.70	7.40	12.40	6.70	1.50	Table 24
	Geography	*	-2.30	0.90	1.00	1.80	1.60	1.00	Table 25
	History	*	-0.20	1.30	1.80	3.00	2.30	0.90	Table 26
Other subjects	Art & Design	7.30	0.00	0.80	-1.60	1.10	0.10	0.50	Table 27
	Business	-0.50	2.00	-1.20	0.50	2.80	3.10	2.20	Table 28
	Sports	*	-0.50	-0.60	1.20	1.20	1.30	0.40	Table 30

*Descriptive statistics not calculated for these grades due to statistical disclosure control.

Table 10: Differences in mean percentile rank (candidates who progressed to Other L3 course in the same subject compared to candidates who did not).

GCSE subject	GCSE subject grade							Source data
	3 or below	4	5	6	7	8	9	
Mathematics	*	-1.40	-1.20	3.60	4.20	7.50	-1.30	Table 16
Computing	-1.40	-2.30	-1.30	6.20	6.00	6.50	3.60	Table 18
Business	2.80	-1.80	2.10	5.30	8.20	3.90	1.80	Table 29
Sports	-3.50	-0.80	0.30	1.00	2.60	1.30	1.20	Table 31

*Descriptive statistics not calculated for these grades due to statistical disclosure control.

Table 11: Differences in mean percentile rank (candidates who progressed from GCSE Combined Science to post-16 study in science).

	GCSE Combined Science grade										Source data
	4-4 or below	5-4	5-5	6-5	6-6	7-6	7-7	8-7	8-8	8-9	9-9	
to AS/A level	*	1.70	6.80	1.90	0.90	1.50	2.10	2.10	3.70	0.30	2.50	Table 22
	4-4 or below	**5-4**	**5-5**	**6-5**	**6-6**	**7-6**	**7-7 or above**					
to L3 (non-AS/A level)	7.70	3.10	6.30	5.00	4.40	7.70	3.90					Table 23

*Descriptive statistics not calculated for these grades due to statistical disclosure control.

Regression modelling

Multilevel logistic regression models were used to model the probability of matched candidates with different percentile ranks progressing to post-16 study in each subject, while accounting for GCSE grades, school type and candidate characteristics. The motivation for taking these characteristics into account (i.e., going beyond the descriptive analyses previously presented) was that both KS4 attainment and post-16 subject choices are known to vary by candidate characteristics. For example, KS4 attainment is consistently observed

to be higher among students with low levels of socio-economic deprivation, and among students from selective schools. Uptake of 'facilitating' subjects at A level is also observed to be higher among students from these groups (Dilnot, 2016). In order to understand how within-subject progression varied by within-subject rank, we therefore considered it necessary to properly account for the potentially confounding variables of school and candidate characteristics, rather than simply GCSE subject grades (as in the descriptive tables).

Within-subject progression to AS/A level and within-subject progression to L3 (non-AS/A level) study were modelled separately. Before carrying out the regression modelling, we inspected descriptive statistics on the characteristics of matched candidates (see Appendix B). These showed that the matched candidates were slightly over-representative of students from low deprivation groups and students with medium to high KS4 attainment, in comparison with students from higher deprivation groups and with lower KS4 attainment, but gave no cause for concern in terms of proceeding with the regression modelling.

Table 12 shows the estimated model parameters for progression from GCSE Mathematics to AS/A level Mathematics, as an example. The estimated parameters for all other models are shown in Appendix C. Table 12 shows that percentile rank, GCSE Mathematics grade, and the interaction of GCSE Mathematics grade with average KS4 grade across other subjects were all statistically significant predictors. In terms of student characteristics, gender and certain ethnicities, but not school type or IDACI group, were also significant predictors of progression in Mathematics. It should be noted that the predictor variables are not standardised, and that the percentile rank variable remains on a scale from zero to one hundred (while GCSE grades are on the usual zero to nine scale). The very small value of the model parameter estimate for percentile rank (0.02) corresponds to a single percentage point change in percentile rank.

Overall, the results from the regression models showed that percentile rank was a positive predictor of within-subject progression to AS/A level in the majority of GCSE subjects studied (Table 13). In the models of progression to other L3 (non-AS/A level) qualifications, the results were much more mixed: percentile rank was a positive predictor only in Combined Science. In progression from GCSE Computing to other L3 (non-AS/A level) Computing, percentile rank was estimated to have a statistically significant and **negative** effect. The regression analyses therefore confirmed what was suggested by the descriptive statistics, that is, that other things being equal, a GCSE student at a higher rank within their subject was more likely to continue studying that subject at AS/A level than an otherwise similar GCSE student at a lower rank within their subject.

Table 12: Estimated model parameters, progression from GCSE to AS/A level Mathematics.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-14.38	0.93	-15.53	<.0001
GCSE Maths grade		2.17	0.13	16.26	<.0001
Average KS4 exc. Maths		-0.16	0.15	-1.07	0.283
(GCSE Maths)*(Average KS4 exc. Maths)		-0.06	0.02	-3.21	0.001
Gender	M	1.00	0.07	14.62	<.0001
	[F]	0.00	.	.	.
School type	Independent	-0.11	0.70	-0.16	0.875
	Other	-0.81	0.74	-1.09	0.274
	Secondary Modern	-0.31	0.49	-0.63	0.529
	Selective	0.50	0.31	1.59	0.111
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	0.74	0.10	7.2	<.0001
	Black	0.84	0.16	5.14	<.0001
	Chinese	1.19	0.34	3.49	0.001
	Missing	0.96	0.32	3.03	0.002
	Mixed	0.42	0.14	3.08	0.002
	Other	1.03	0.27	3.86	0.000
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.08	0.07	-1.12	0.261
	3-High	-0.04	0.09	-0.47	0.642
	Missing	-0.09	0.52	-0.17	0.867
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.02	0.00	5.33	<.0001

Regression based on matched GCSE Mathematics students, grade 4 or above (N=13,753).

Table 13: Summary of estimated regression parameters for percentile rank variable.

Destination	GCSE subject		Estimate	Pr > |t|	Comment	Source (reg. results table)
AS/A level	Maths and Computing	Mathematics	0.02	<.0001		Table 12
		Computing	0.01	<.0001		Table 40
	Sciences	Biology	0.01	0.006		Table 42
		Chemistry	0.01	0.008		Table 43
		Physics	0.01	0.012		Table 44
		Combined science	0.03	<.0001		Table 45
	Humanities	English	0.02	<.0001		Table 47
		Geography	0.01	0.012		Table 48
		History	0.02	<.0001		Table 49
	Other subjects	Art & Design	0.00	0.148	Non sig.	Table 54
		Business	0.00	0.952	Non sig.	Table 50
		Sports	0.01	0.005		Table 52
Other L3		Mathematics	0.01	0.097	Marginal	Table 39
		Computing	-0.02	0.002	Negative	Table 41
		Combined science	0.03	0.005		Table 46
		Business	-0.01	0.385	Non sig.	Table 51
		Sports	0.00	0.978	Non sig.	Table 53

Although not the main focus of the analyses, the results from the regression models also help to explain the effect of students' characteristics on progression within a subject. In particular:

- GCSE subject grade was a positive predictor of within-subject progression in all models except for progression to other L3 courses (non-AS/A level) in Computing and in Business.
- The effect of average KS4 grade across other subjects varied by GCSE subject and by destination (AS/A level or other L3 qualifications).
- The interaction between GCSE subject grade and average KS4 across other subjects was negative in almost all models.
- Gender was a statistically significant predictor in many subjects, and the direction of effects were generally as expected from previous research: the estimated regression parameter for gender (corresponding to the estimated impact on progression of being a male rather than female candidate) was large and positive in Physics, Computing and AS/A level Mathematics; and large and negative in Biology and English (Table 14).
- The estimated regression parameters for school type, ethnicity, IDACI group varied by subject and destination. No statistically significant effects were found for attendance at an independent school.

Table 14: Summary of estimated regression parameters for gender.

Destination	**GCSE subject**		**Estimate**	**Pr > |t|**	**Comment**	**Source (reg. results table)**
AS/A level	Maths and Computing	Mathematics	1.00	<.0001		Table 12
		Computing	0.73	<.0001		Table 40
	Sciences	Biology	-0.91	<.0001		Table 42
		Chemistry	-0.38	<.0001		Table 43
		Physics	1.65	<.0001		Table 44
		Combined science	-0.05	0.536	Non sig.	Table 45
	Humanities	English	-1.03	<.0001		Table 47
		Geography	0.17	0.005		Table 48
		History	0.15	0.011		Table 49
	Other subjects	Art & Design	-0.24	0.003		Table 54
		Business	0.31	<.0001		Table 50
		Sports	0.30	<.0001		Table 52
Other L3		Mathematics	0.18	0.132	Non sig.	Table 39
		Computing	0.90	<.0001		Table 41
		Combined science	-0.36	0.011		Table 46
		Business	0.17	0.133	Non sig.	Table 51
		Sports	0.45	<.0001		Table 53

Predicted probabilities of progression

In order to better interpret the logistic regression outputs, for subjects in which percentile rank was a significant predictor of progression to AS/A level we calculated predicted probabilities of progression for candidates with plausible grade profiles. First, we calculated four sets of predicted probabilities in order to contextualise the effects of percentile rank against the effect of average KS4 grade across other subjects. These predicted probabilities corresponded to candidates with average KS4 grades across other subjects of 6 and 8 with a percentile rank of 95, and candidates with average KS4 grades across other subjects of 6 and 8 at the 50th percentile. All of these predicted probabilities were for a female candidate, attending a comprehensive school, of white ethnicity, and from a medium-deprivation background.

To give further context to the magnitude of effects found for percentile rank, we compared predicted probabilities for male and female candidates with the same grades, for all subjects where both a statistically significant gender effect and percentile rank effect were found. Again, four sets of predicted probabilities were calculated: for male and female candidates with a percentile rank of 95, and male and female candidates with a percentile rank of 50. These predicted probabilities were for a candidate attending a comprehensive school, of white ethnicity, from the medium-deprivation IDACI group, and the average KS4 grade across other subjects was fixed at the mean for matched candidates in that subject (see Table 5).

Mathematics and Computing

Figure 9 and Figure 10 show the predicted probabilities of within-subject progression to AS/A level Mathematics. For example, Figure 9 shows that for a grade 8 candidate whose average KS4 grade in other subjects was grade 6, the predicted probability of progression was 0.7 for a candidate in the top 5% of their classmates, and 0.5 for candidate whose performance was at the median level among their classmates. The predicted probabilities for a grade 8 candidate whose average KS4 grade across other subjects was also grade 8 were lower: just under 0.4 for a candidate with percentile rank 95, and just over 0.2 for a candidate with percentile rank 50.

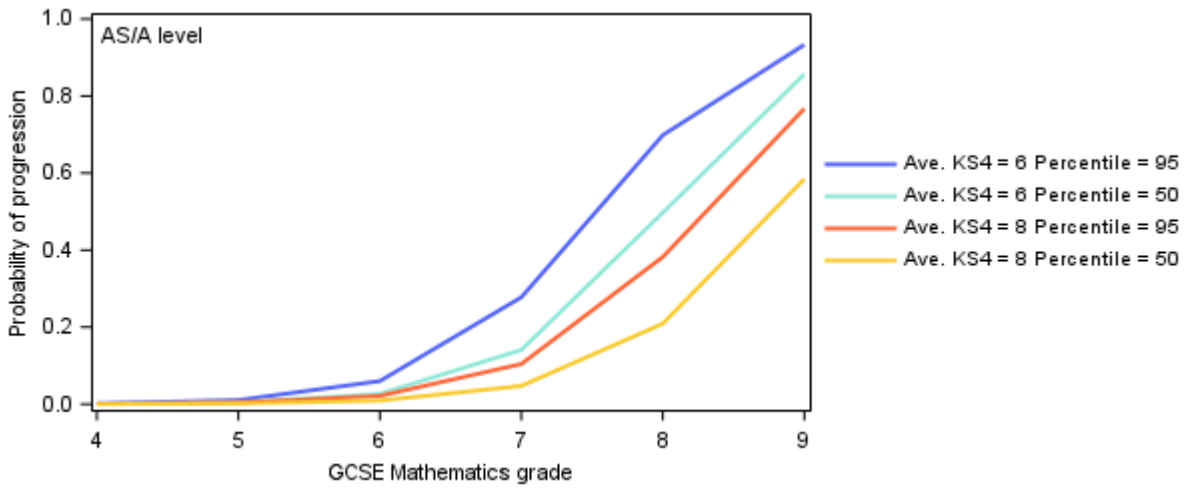

Figure 9: Predicted probabilities of progression from GCSE Mathematics to AS/A level Mathematics (calculated from regression parameters in Table 12).

Figure 10 shows that the predicted probabilities of within-subject progression to AS/A level Mathematics were much higher for male candidates than for female candidates. In particular, the predicted probabilities of progression for a female student at the 95th percentile were slightly lower than the predicted probabilities for a male candidate with the same grades at the 50th percentile.

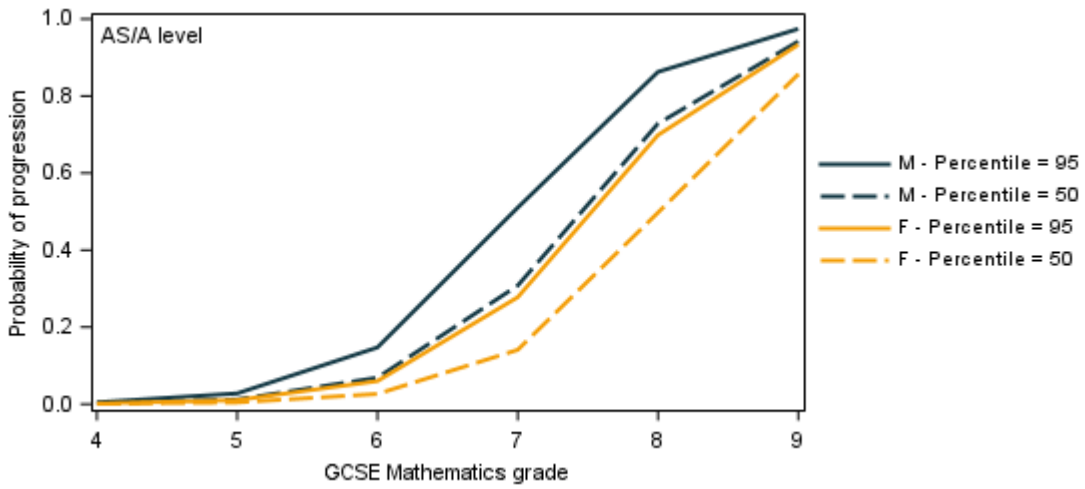

Figure 10: Predicted probabilities of progression to AS/A level Mathematics, by gender (calculated from regression parameters in Table 12).

Figure 11 shows the predicted probabilities of within-subject progression to AS/A level Computing, and the differences by percentile rank were slightly smaller than those in Mathematics. For a grade 8 candidate with an average KS4 grade of 6 in their other subjects, the predicted probabilities of progression to AS/A level Computing were 0.66 for a candidate at the 95th percentile and 0.53 for a candidate at the 50th percentile.

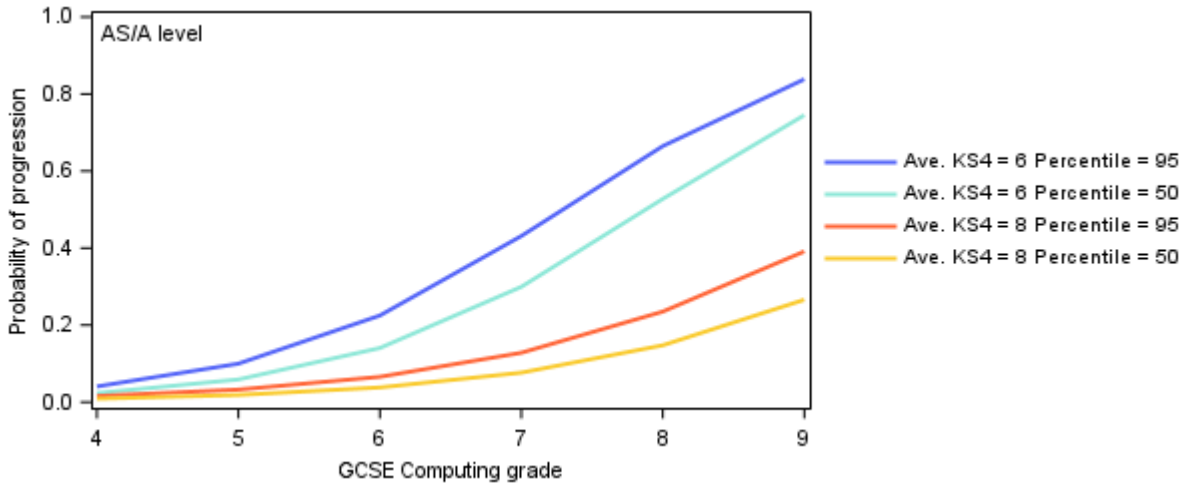

Figure 11: Predicted probabilities of progression from GCSE Computing to AS/A level Computing (calculated from regression parameters in Table 40).

As for Mathematics, the predicted probabilities of within-subject progression to AS/A level Computing were much higher for male candidates than for female candidates (Figure 12). In particular, the predicted probabilities of progression for a female student at the 95th percentile were slightly lower than the predicted probabilities for a male candidate with the same grades at the 50th percentile.

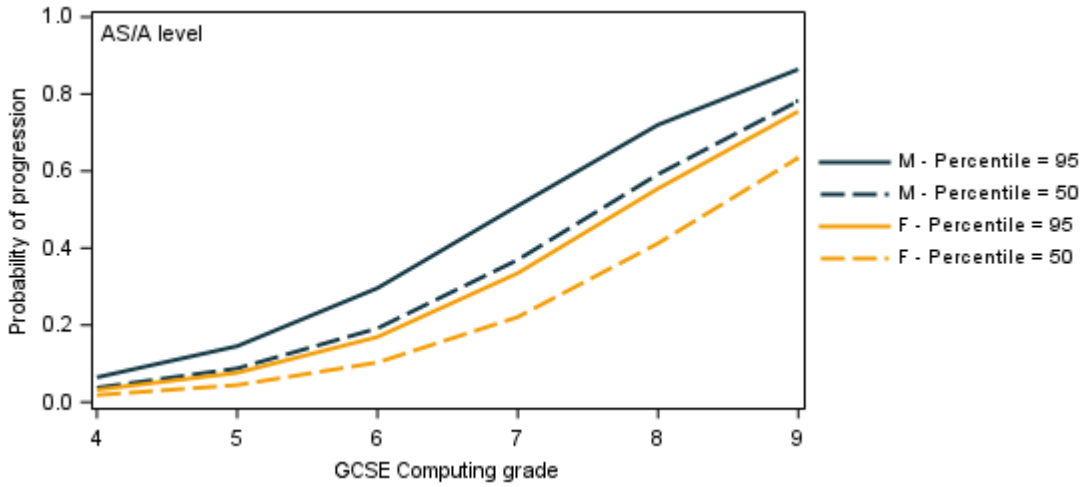

Figure 12: Predicted probabilities of progression to AS/A level Computing, by gender (calculated from regression parameters in Table 40).

Sciences

Figure 13 - Figure 18 show the predicted probabilities of progression for the single sciences. In these subjects, the differences according to percentile rank were smaller than those in the Mathematics and Computing progression models.

In the sciences, particularly strong gender effects were found in Biology and Physics. In both Biology and Physics, the differences in predicted probabilities by percentile rank were smaller than the differences in predicted probabilities by gender. For instance, the probabilities of progressing from GCSE Biology to A level for female grade 8 candidates were 0.70 (for a student at the 95th percentile) and 0.63 (50th percentile), while the corresponding probabilities for male grade 8 candidates were 0.48 ((95th percentile) and 0.41 (50th percentile). In Physics, the probabilities of progressing from GCSE Physics to A level for male grade 8 candidates were 0.61 (for a student at the 95th percentile) and 0.52 (50th percentile), while the corresponding probabilities for female grade 8 candidates were 0.23 (95th percentile) and 0.17 (50th percentile).

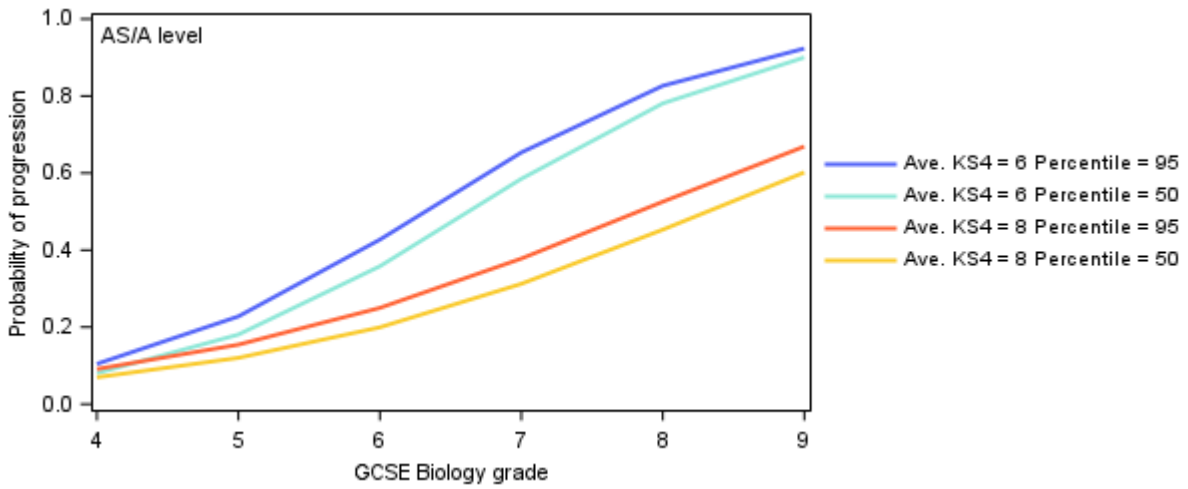

Figure 13: Predicted probabilities of progression from GCSE Biology to AS/A level Biology (calculated from regression parameters in Table 42).

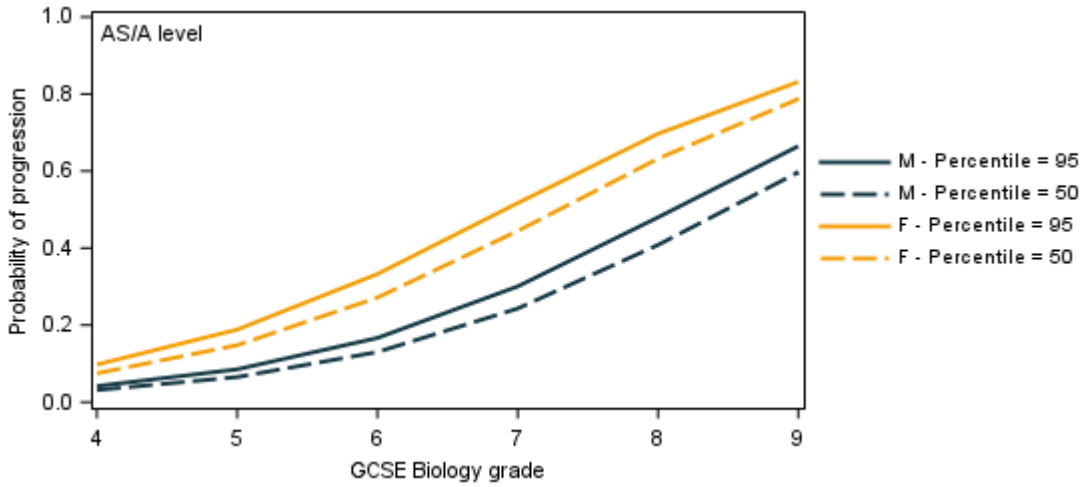

Figure 14: Predicted probabilities of progression to AS/A level Biology by gender (calculated from regression parameters in Table 42).

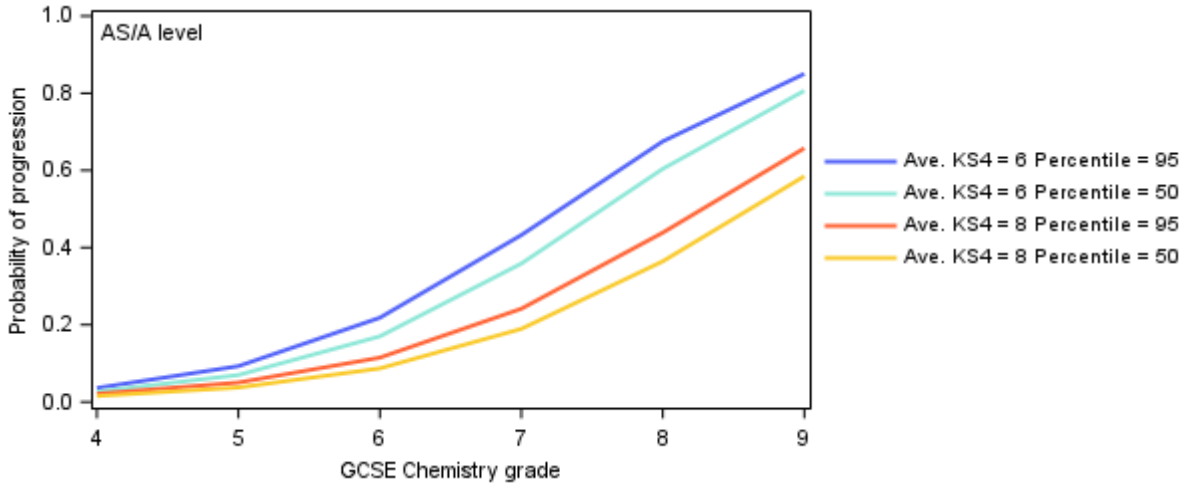

Figure 15: Predicted probabilities of progression from GCSE Chemistry to AS/A level Chemistry (calculated from regression parameters in Table 43).

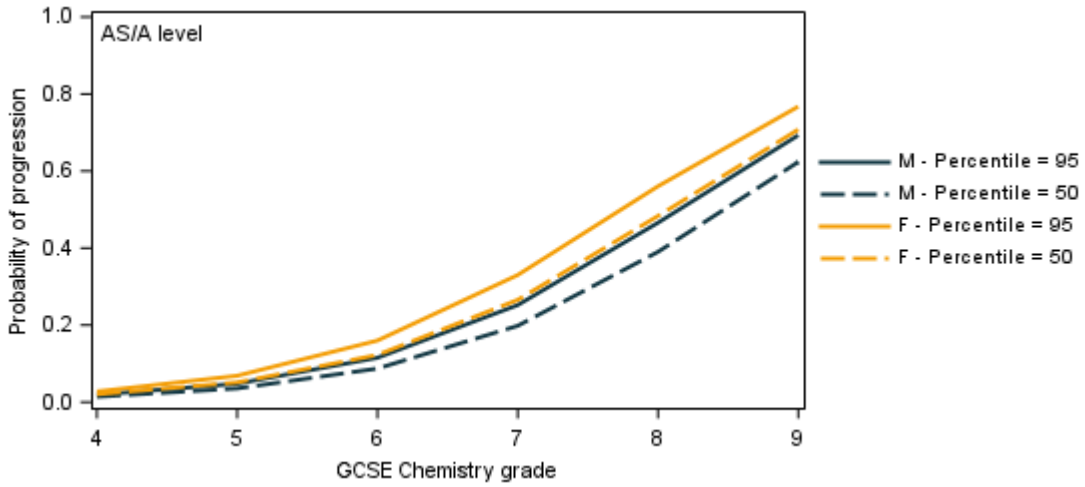

Figure 16: Predicted probabilities of progression to AS/A level Chemistry, by gender (calculated from regression parameters in Table 43).

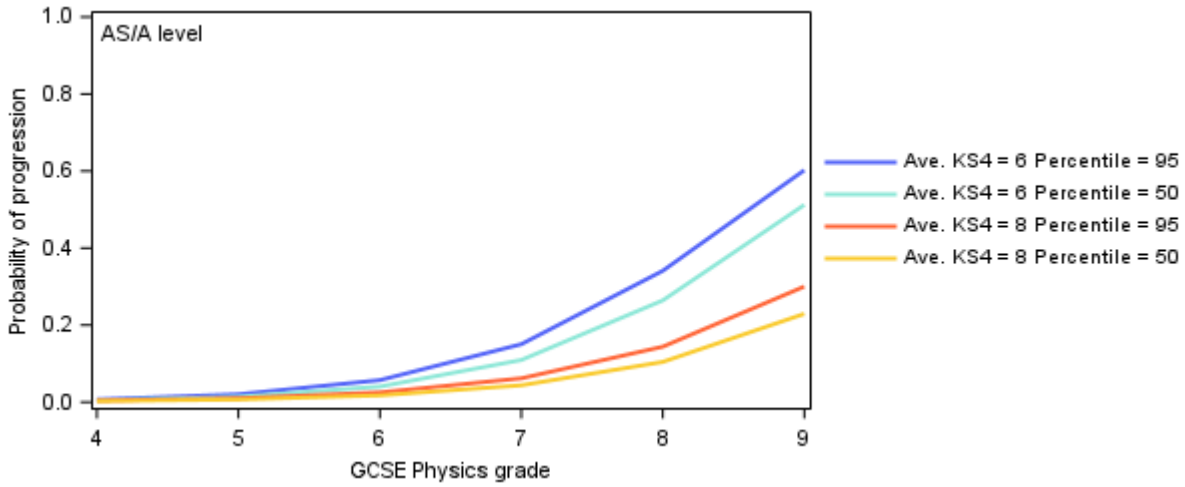

Figure 17: Predicted probabilities of progression from GCSE Physics to AS/A level Physics (calculated from regression parameters in Table 44).

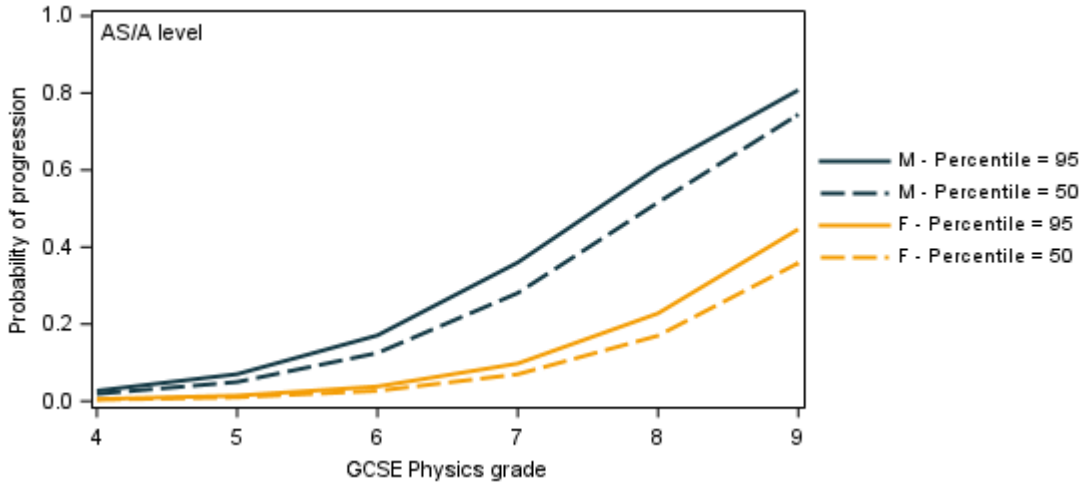

Figure 18: Predicted probabilities of progression to AS/A level Physics, by gender (calculated from regression parameters in Table 44).

For Combined Science (Figure 19), the differences in predicted probability according to percentile rank were large: 0.71 for a candidate with grade 8-8 and an average KS4 grade of 6 at the 95th percentile, but just 0.41 for a candidate with the same grades at the 50th percentile.

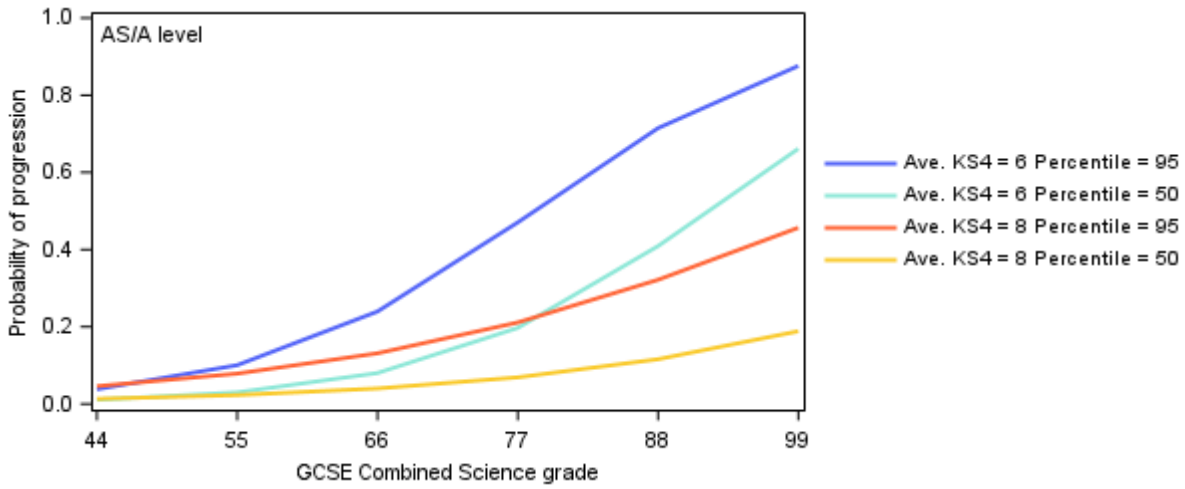

Figure 19: Predicted probabilities of progression from GCSE Combined Science to AS/A level science (any) (calculated from regression parameters in Table 45).

Humanities

In the humanities subjects, the estimated effect of percentile rank was far stronger in English and History than in Geography. At grade 8, with an average KS4 grade of 6, the predicted probabilities of within-subject progression for English were 0.78 (95th percentile) and 0.60 (50th percentile), and in History 0.74 (95th percentile) and 0.57 (50th percentile). In Geography, the corresponding probabilities were 0.71 (95th percentile) and 0.64 (50th percentile).

The strongest gender effect by far, among the humanities subjects, was for progression in English. The estimated probabilities of within-subject progression for male candidates at the 95th percentile were slightly lower than the probabilities for female candidates of the same grade profile at the 50th percentile (Figure 21).

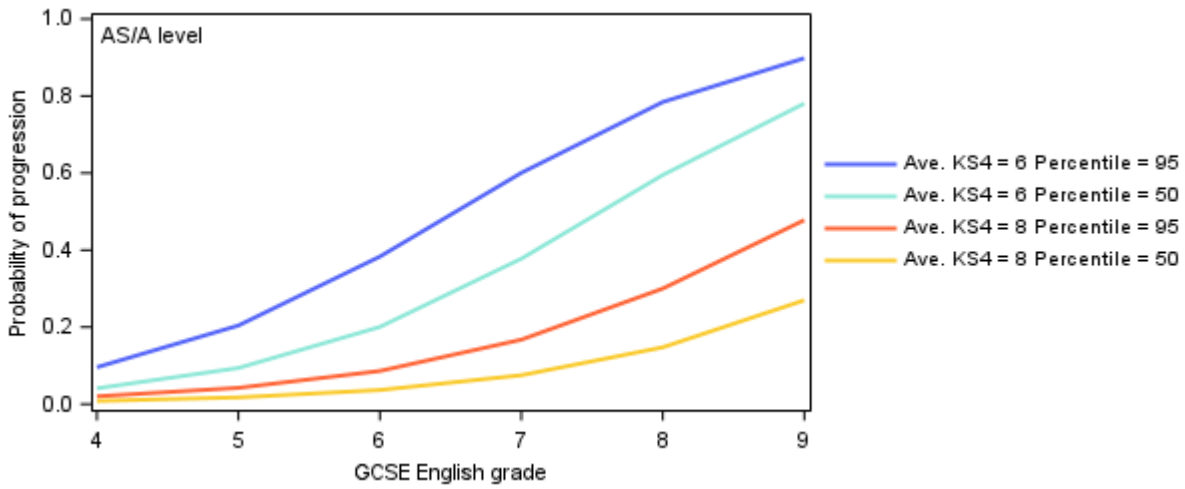

Figure 20: Predicted probabilities of progression from GCSE English to AS/A level English (calculated from regression parameters in Table 47).

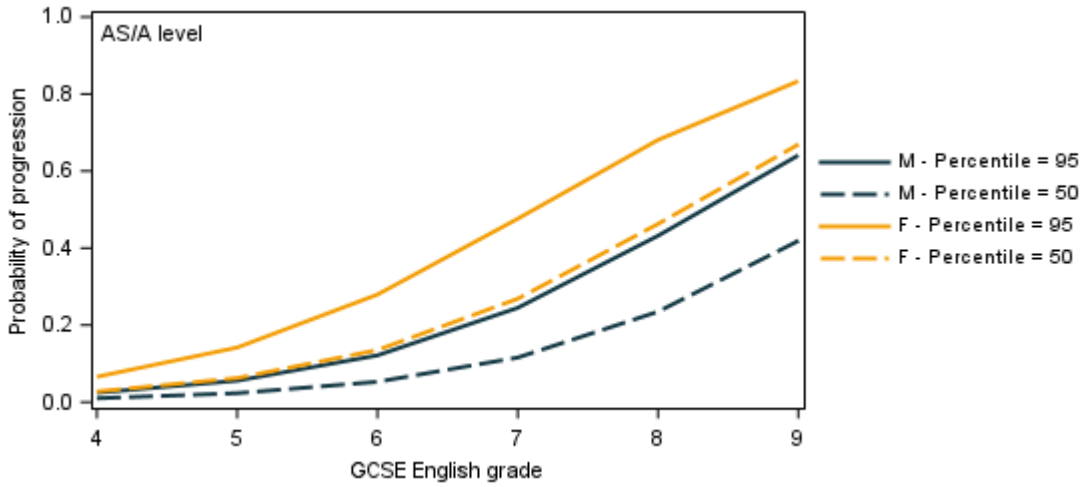

Figure 21: Predicted probabilities of progression from GCSE English to AS/A level English, by gender (calculated from regression parameters in Table 47).

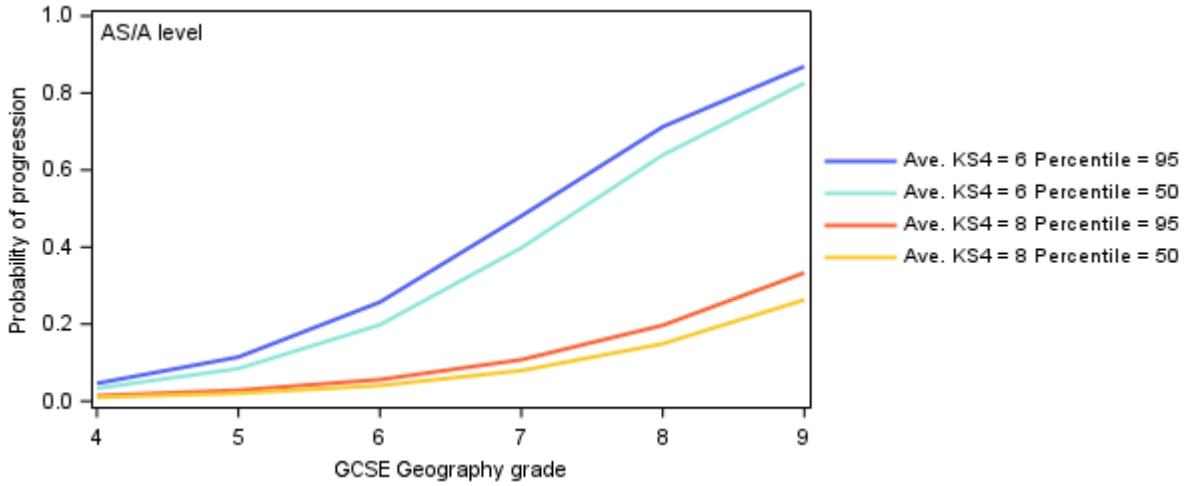

Figure 22: Predicted probabilities of progression from GCSE Geography to AS/A level Geography (calculated from regression parameters in Table 48).

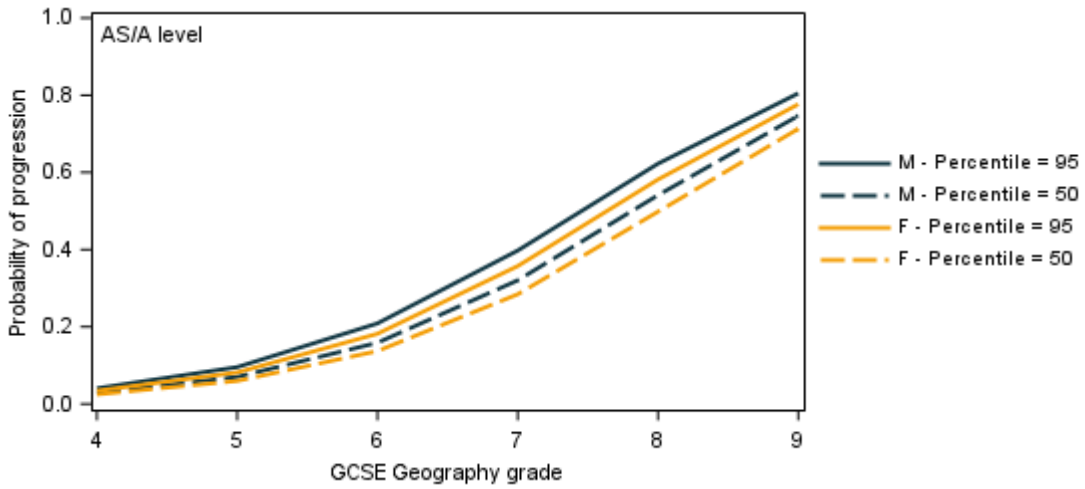

Figure 23: Predicted probabilities of progression from GCSE Geography to AS/A level Geography, by gender (calculated from regression parameters in Table 48).

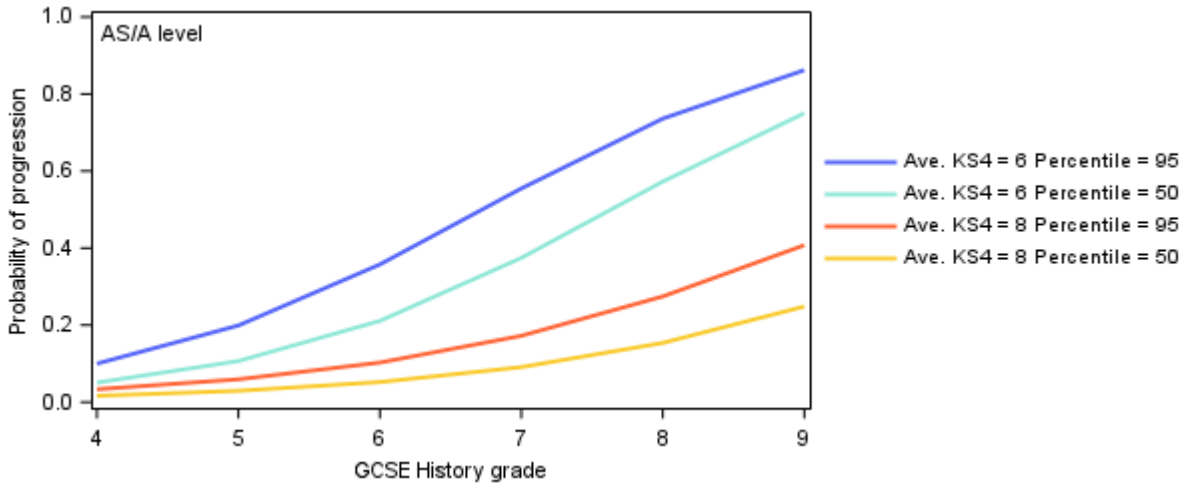

Figure 24: Predicted probabilities of progression from GCSE History to AS/A level History (calculated from regression parameters in Table 49).

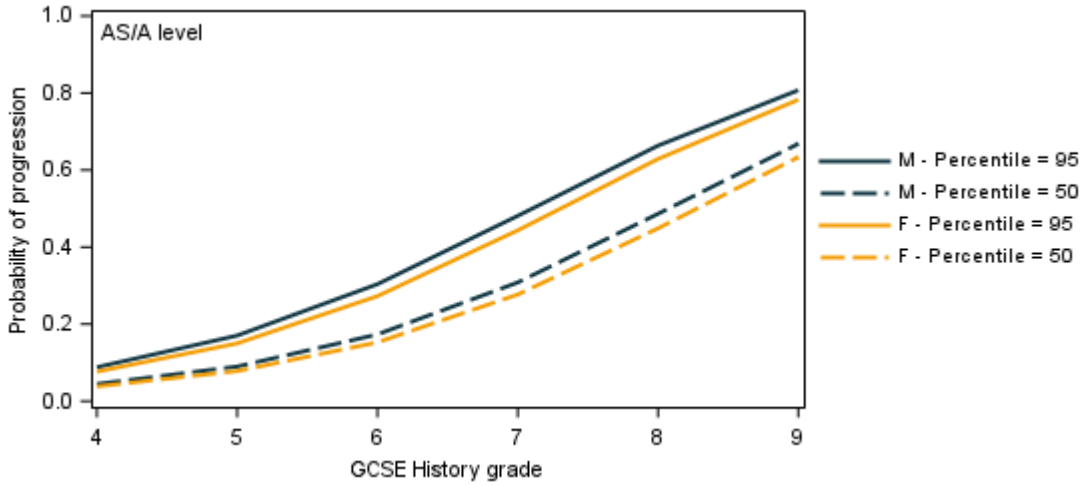

Figure 25: Predicted probabilities of progression from GCSE History to AS/A level History, by gender (calculated from regression parameters in Table 49).

Other subjects

Figure 26 and Figure 27 show the predicted probabilities of progressing from GCSE to AS/A level Sport. The differences in probabilities according to percentile rank were moderately sized: for a grade 8 candidate with an average KS4 grade of 6, the probabilities were 0.58 for a candidate at the 95th percentile and 0.47 for a candidate at the 50th percentile.

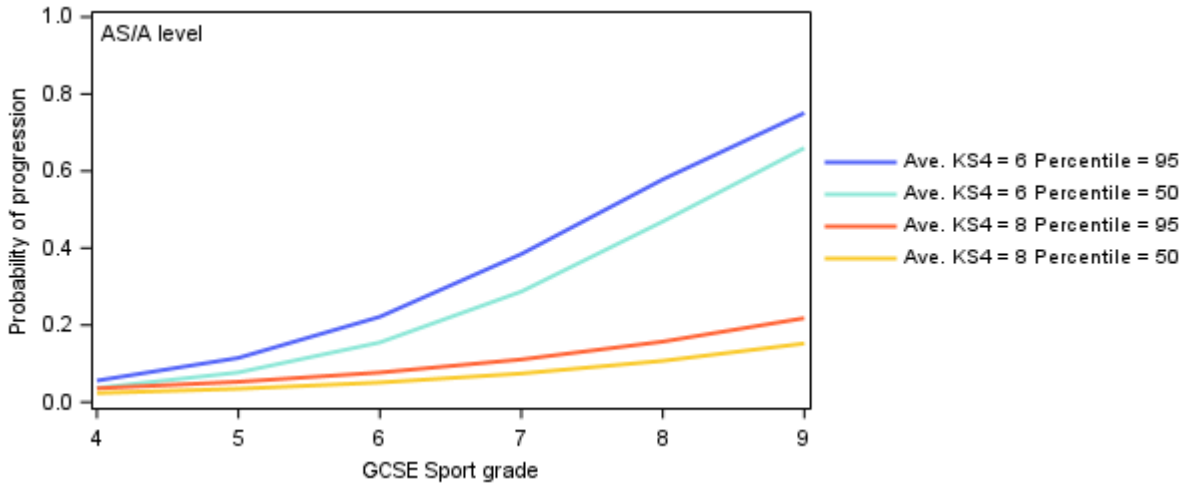

Figure 26: Predicted probabilities of progression from GCSE Sport to AS/A level Sport (calculated from regression parameters in Table 52).

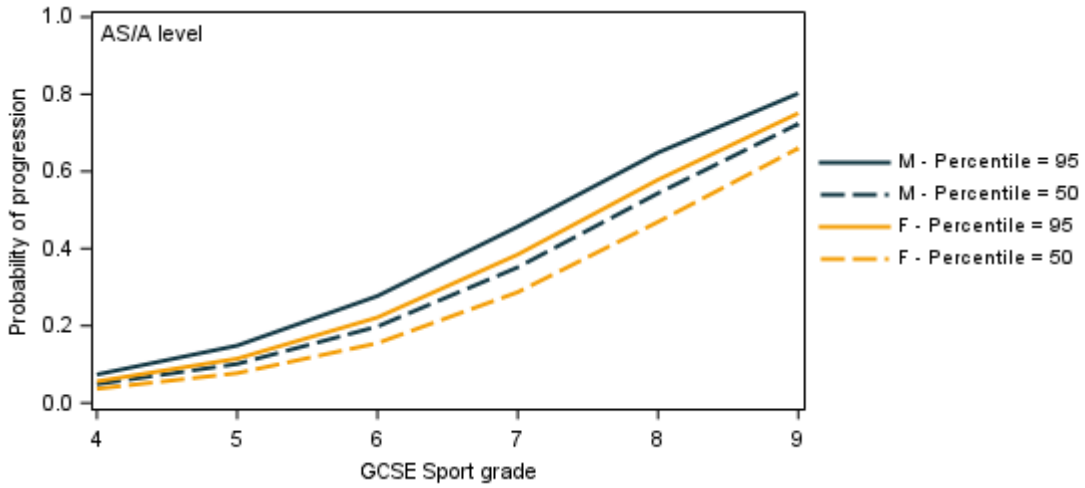

Figure 27: Predicted probabilities of progression from GCSE Sport to AS/A level Sport, by gender (calculated from regression parameters in Table 52).

Discussion

As found in previous research, the descriptive statistics showed that within-subject progression to AS/A level increased with GCSE grade in almost all subjects. The only subjects where this was not the case were Geography (where within-subject progression peaked at grade 8), Business (progression peaked at grade 6) and Sport (progression rates were extremely similar across grades 7 to 9). For non-AS/A level qualifications, by contrast, within-subject progression rates mostly decreased, rather than increased, with GCSE subject grade.

Considering candidates' average KS4 grades in relation to their GCSE subject grade, the findings showed that candidates who continued their GCSE subject to A level tended to have a lower mean KS4 grade across their other subjects than candidates with the same subject grade who did not progress. This was in line with the expectation that candidates would be more likely to continue a subject after KS4 if it was one of their stronger subjects at GCSE level.

In terms of the overall question of interest, the findings showed that candidates whose within-school rank was higher were more likely to continue the study of a GCSE subject to AS/A level than candidates with the same GCSE grade profile who were at a lower percentile rank for their school. The effect was found in almost all the GCSE subjects analysed, with the exception of GCSE Business Studies and Art & Design. In progression to other L3 (non-AS/A level) courses, the results were more mixed: higher percentile rank predicted a higher probability of progression from GCSEs in Mathematics and Combined Science, but a lower probability of progression from GCSE Computing (and was not a statistically significant predictor for other L3 courses in Business and Sport).

We recognise that in Business, Computing and Sports, and to a certain extent Art & Design, the breadth of available level 3 courses means that within-subject progression may be a different and more complex matter than in GCSE subjects such as History, where the continuation of that subject after KS4 is represented by perhaps just a single A level. The research used a strict definition of within-subject progression, which had the benefit of allowing the same criteria to be applied to each subject, but this approach may not have captured the full story for GCSE subjects that lead to broad and particularly applied routes at level 3.

Comparing the predicted probabilities of progression to AS/A level for candidates with plausible grade profiles showed that the magnitude of differences by percentile rank could be substantial. The difference between the estimated probabilities for a student in the top 5% of their GCSE class compared to a student with the same grades at the median level for their class was over ten percentage points in many of the subjects analysed. Considering the effect of percentile rank in comparison with gender effects offers a useful context in some subjects. In Mathematics, for example, the gap between estimated progression for 95th percentile and 50th percentile GCSE candidates was roughly equal in size to the gap in estimated progression between male and female candidates – at grade 8, around 15-20 percentage points. In Biology and Physics, by contrast, differences by percentile rank – though not small – were small in comparison with gender differences.

An important limitation of the research is that no independent measure of candidate attainment level was available. The unique dataset available from summer 2020 GCSE awarding offered an opportunity in the form of a large number of teachers' rankings of

students, but at the same time it lacked the externally-assessed measure of candidate attainment that would be available in other years. This limits the impact of the findings in terms of their contribution to the literature on reference group effects, as our interpretation of the results has to recognise that both the rankings and awarded GCSE grades were derived from teacher judgements, and consequently not independent. However, this limitation did not prevent us from answering the central research question: students ranked more highly in their subject in their school were indeed more likely to continue that subject to post-16 study, including after controlling for awarded grades and other student and school characteristics. Furthermore, teachers' rank orders are meaningful and of interest (in themselves) and should not be viewed solely as a poor alternative to external measures of student attainment. In particular, teachers' within-subject rank orders of students within a school are highly relevant to the ideas of academic self-concept and reference groups, as teachers' judgements (whether formally, in teacher assessment, or informally) are communicated throughout the duration of a GCSE course. In contrast, the information on student rank communicated by external GCSE assessment is only available after course completion, and after students have made their post-16 choices (though final grades achieved can alter these plans).

In conclusion, these findings offer a new contribution to understanding post-16 subject choice in England. Whilst recognising the limitations, we argue that analysis of the unique summer 2020 dataset confirms that reference-group effects merit attention from those wishing to understand post-16 choices.

References

Battiston, A., Hedges, S., Lazarowicz, T., & Speckesser, S. (2020). *Peer Effects and Social Influence in Post-16 Educational Choice*. Research Discussion Paper 025. Centre for Vocational Education Research.

Cassidy, R., Cattan, S., Crawford, C., & Dytham, S. (2018). *How can we increase girls' uptake of maths and physics A-level?* The Institute for Fiscal Studies. https://ifs.org.uk/publications/13277

Conlon, G., & Patrignani, P. (2015). *The earnings and employment returns to A levels: A report to the Department for Education*. London Economics.

Cuff, B. M. P. (2017). *Perceptions of subject difficulty and subject choices: Are the two linked, and if so, how? (Ofqual/17/6288)*. Ofqual.

Dai, D. Y., & Rinn, A. N. (2008). The Big-Fish-Little-Pond Effect: What Do We Know and Where Do We Go from Here? *Educational Psychology Review, 20*(3), 283-317. https://doi.org/10.1007/s10648-008-9071-x

Denning, J. T., Murphy, R., & Weinhardt, F. (2021). Class Rank and Long-Run Outcomes. *The Review of Economics and Statistics*, 1-45. https://doi.org/10.1162/rest_a_01125

DfE. (2017). *16-18 Accountability Measures: Technical Guide. For measures in 2017.* Department for Education.

DfE. (2022). *School census 2021 to 2022: Business and technical specification, version 1.7*. Department for Education. https://www.gov.uk/government/publications/school-census-2021-to-2022-technical-information

Dilnot, C. (2016). How does the choice of A-level subjects vary with students' socio-economic status in English state schools? *British Educational Research Journal, 42*(6), 1081-1106. https://doi.org/10.1002/berj.3250

Dilnot, C. (2018). The relationship between A-level subject choice and league table score of university attended: the 'facilitating', the 'less suitable', and the counter-intuitive. *Oxford Review of Education, 44*(1), 118-137. https://doi.org/10.1080/03054985.2018.1409976

Elsner, B., Isphording, I. E., & Zölitz, U. (2021). Achievement Rank Affects Performance and Major Choices in College. *The Economic Journal, 131*(640), 3182-3206. https://doi.org/10.1093/ej/ueab034

Gill, T. (2018). *Progression from GCSE to A level, 2017*. Statistics Report Series No. 124. Cambridge Assessment. https://www.cambridgeassessment.org.uk/Images/560531-progression-from-gcse-to-a-level-2017.pdf

Hupkau, C., McNally, S., Ruiz-Valenzuela, J., & Ventura, G. (2017). Post-compulsory education in England: Choices and implications. *National Institute Economic Review, 240*(1), R42-R57.

Koivuhovi, S., Marsh, H. W., Dicke, T., Sahdra, B., Guo, J., Parker, P. D., & Vainikainen, M.-P. (2020). Academic self-concept formation and peer-group contagion: Development of the big-fish-little-pond effect in primary-school classrooms and peer groups. *Journal of Educational Psychology*. https://doi.org/10.1037/edu0000554

Marsh, H. W. (1984). Self-concept: The application of a frame of reference model to explain paradoxical results. *Australian Journal of Education, 28*(2), 165–181.

Marsh, H. W., Seaton, M., Trautwein, U., Lüdtke, O., Hau, K. T., O'Mara, A. J., & Craven, R. G. (2008). The Big-fish–little-pond-effect Stands Up to Critical Scrutiny: Implications for Theory, Methodology, and Future Research. *Educational Psychology Review, 20*(3), 319-350. https://doi.org/10.1007/s10648-008-9075-6

McLennan, D., Noble, S., Noble, M., Plunkett, E., Wright, G., & Gutacker, N. (2019). *The English Indices of Deprivation 2019: Technical report*. Ministry of Housing, Communities and Local Government, UK Government https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833951/IoD2019_Technical_Report.pdf

Murphy, R., & Weinhardt, F. (2020). Top of the Class: The Importance of Ordinal Rank. *The Review of Economic Studies, 87*(6), 2777-2826. https://doi.org/10.1093/restud/rdaa020

Ofqual. (2020a). *Awarding GCSE, AS, A level, advanced extension awards and extended project qualifications in summer 2020: interim report*. Ofqual/20/6656/1.

Ofqual. (2020b). *Summer 2020 grades for GCSE, AS and A level, Extended Project Qualification and Advanced Extension Award in maths*.

Stratton, T., Zanini, N., & Noden, P. (2021). *An evaluation of centre assessment grades from summer 2020*. Ofqual/21/6816/1.

Trautwein, U., Lüdtke, O., Marsh, H. W., Köller, O., & Baumert, J. (2006). Tracking, grading, and student motivation: Using group composition and status to predict self-concept and interest in ninth-grade mathematics. *Journal of Educational Psychology, 98*(4), 788-806. https://doi.org/10.1037/0022-0663.98.4.788

Vidal Rodeiro, C. (2007). *A Level subject choice in England: patterns of uptake and factors affecting subject preference*. University of Cambridge Local Examinations Syndicate. https://www.cambridgeassessment.org.uk/Images/111069-a-level-subject-choice-in-england-patterns-of-uptake-and-factors-affecting-subject-preferences.pdf

Zanini, N., & Williamson, J. (2016). *Learning Aims: A Preliminary Exploration to Monitor the A/AS Reform*. Cambridge Assessment.

Appendix A: progression statistics, by subject

Mathematics and Computing

Table 15: Descriptive progression statistics for GCSE Mathematics candidates (to AS/A level).

GCSE Mathematics grade	N			Percent		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	1335	*Very low progression rate from these grades*				-	-	-	-
4	2483	2463	20	99.2	0.8	45.2	40.2	4.6	4.5
5	3485	3436	49	98.6	1.4	59.2	61.4	5.3	4.8
6	2266	1992	274	87.9	12.1	64.6	68.3	6.0	5.5
7	2309	1551	758	67.2	32.8	72.7	76.3	6.7	6.2
8	1885	750	1135	39.8	60.2	80.4	85.0	7.6	7.0
9	1440	203	1237	14.1	85.9	91.9	93.7	8.2	7.9

Table 16: Descriptive progression statistics for GCSE Mathematics candidates (to L3 non-AS/A level).

GCSE Mathematics grade	N			Percent		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	1335	*Very low progression rate from these grades*				-	-	-	-
4	2483	2431	52	97.9	2.1	45.2	43.8	4.6	4.4
5	3485	3324	161	95.4	4.6	59.3	58.1	5.3	5.1
6	2266	2160	106	95.3	4.7	64.9	68.5	6.0	5.8
7	2309	2247	62	97.3	2.7	73.7	77.9	6.6	6.4
8	1885	1857	28	98.5	1.5	83.0	90.5	7.2	7.6
9	1440	1430	10	99.3	0.7	93.5	92.2	8.0	8.0

Progression to non-A Level L3 in Mathematics was mainly (over 95%) to Core Maths.

Table 17: Descriptive progression statistics for GCSE Computing candidates (to AS/A level).

GCSE Computing grade	N			Percent		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	2151	2126	25	98.8	1.2	20.1	18.8	4.3	4.3
4	3075	2913	162	94.7	5.3	34.1	36.5	5.2	4.8
5	4012	3381	631	84.3	15.7	44.8	47.1	5.8	5.4
6	4588	3379	1209	73.6	26.4	56.1	59.4	6.5	6.0
7	4280	2718	1562	63.5	36.5	67.7	70.9	7.1	6.6
8	3584	2076	1508	57.9	42.1	79.4	82.3	7.7	7.2
9	2860	1409	1451	49.3	50.7	92.4	93.6	8.4	8.0

Table 18: Descriptive progression statistics for GCSE Computing candidates (to L3 non-AS/A level).

GCSE Computing grade	N			Percent		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	2151	2047	104	95.2	4.8	20.1	18.7	4.4	4.0
4	3075	2924	151	95.1	4.9	34.3	32.0	5.2	4.7
5	4012	3876	136	96.6	3.4	45.2	43.9	5.7	5.1
6	4588	4505	83	98.2	1.8	56.9	63.1	6.3	5.8
7	4280	4235	45	98.9	1.1	68.8	74.8	6.9	6.1
8	3584	3554	30	99.2	0.8	80.6	87.1	7.5	6.6
9	2860	2846	14	99.5	0.5	93.0	96.6	8.2	6.8

Sciences

Table 19: Descriptive progression statistics for GCSE Biology candidates.

GCSE Biology grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
4 or below	364	*Very low progression rate from these grades*				-	-	-	-
5	806	736	70	91.3	8.7	26.7	30.0	5.6	5.5
6	1427	1000	427	70.1	29.9	34.8	39.5	6.4	6.1
7	1547	960	587	62.1	37.9	51.5	53.5	7.0	6.8
8	1371	764	607	55.7	44.3	68.1	70.0	7.7	7.5
9	1285	638	647	49.6	50.4	87.3	88.5	8.3	8.2

Table 20: Descriptive progression statistics for GCSE Chemistry candidates.

GCSE Chemistry grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
4 or below	463	*Very low progression rate from these grades*				-	-	-	-
5	838	793	45	94.6	5.4	27.9	37.0	5.7	5.7
6	1327	1064	263	80.2	19.8	36.4	41.1	6.4	6.1
7	1472	977	495	66.4	33.6	51.8	52.7	7.1	6.8
8	1320	702	618	53.2	46.8	68.4	68.6	7.7	7.5
9	1337	494	843	36.9	63.1	85.1	86.6	8.3	8.2

Table 21: Descriptive progression statistics for GCSE Physics candidates.

GCSE Physics grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
4 or below	428	*Very low progression rate from these grades*				-	-	-	-
5	823	800	23	97.2	2.8	29.7	28.1	5.7	5.4
6	1296	1149	147	88.7	11.3	37.6	38.8	6.4	6.0
7	1387	1082	305	78.0	22.0	52.0	53.7	7.0	6.6
8	1281	859	422	67.1	32.9	67.9	69.2	7.7	7.3
9	1237	632	605	51.1	48.9	86.9	87.7	8.3	8.1

Table 22: Descriptive progression statistics for GCSE Combined Science candidates (to AS/A level).

GCSE Combined Science grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
4-4 or below	1785	*Very low progression rate from these grades*				-	-	-	-
5-4	812	802	10	98.8	1.2	51.4	53.1	4.9	5.3
5-5	1359	1293	66	95.1	4.9	62.7	69.5	5.3	5.2
6-5	681	610	71	89.6	10.4	69.3	71.2	5.7	5.4
6-6	865	657	208	76.0	24.0	77.6	78.5	6.0	5.7
7-6	549	347	202	63.2	36.8	82.8	84.3	6.3	6.1
7-7	485	307	178	63.3	36.7	86.8	88.9	6.7	6.1
8-7	284	160	124	56.3	43.7	90.1	92.2	6.9	6.5
8-8	248	139	109	56.0	44.0	91.3	95.0	7.4	6.7
9-8	148	68	80	45.9	54.1	95.5	95.8	7.4	7.1
9-9	203	86	117	42.4	57.6	95.9	98.4	7.9	7.6

Table 23: Descriptive progression statistics for GCSE Combined Science candidates (to L3 non-AS/A level).

GCSE Combined Science grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)	
		No	Yes	No	Yes	No	Yes	No	Yes
4-4 or below	1785	1659	126	92.9	7.1	31.8	39.5	4.3	4.1
5-4	812	711	101	87.6	12.4	51.0	54.1	5.0	4.5
5-5	1359	1234	125	90.8	9.2	62.4	68.7	5.3	4.8
6-5	681	632	49	92.8	7.2	69.2	74.2	5.7	5.1
6-6	865	829	36	95.8	4.2	77.6	82.0	5.9	5.4
7-6	549	529	20	96.4	3.6	83.1	90.8	6.3	5.7
7-7 or above	1368	1350	18	98.7	1.3	91.5	95.4	6.9	6.2

Humanities

Table 24: Descriptive progression statistics for GCSE English candidates.

GCSE English grade	N			Percent		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	285	*Very low progression rate from these grades*				-	-	-	-
4	744	715	29	96.1	3.9	29.2	31.7	4.6	4.3
5	1371	1247	124	91.0	9.0	44.2	44.9	5.5	4.9
6	1958	1635	323	83.5	16.5	52.4	59.8	6.4	5.6
7	1896	1526	370	80.5	19.5	57.3	69.7	7.3	6.4
8	1421	1113	308	78.3	21.7	73.6	80.3	8.0	7.2
9	922	617	305	66.9	33.1	90.6	92.1	8.5	8.1

Table 25: Descriptive progression statistics for GCSE Geography candidates.

GCSE Geography grade	N			Percent		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	840	*Very low progression rate from these grades*				-	-	-	-
4	1138	1065	73	93.6	6.4	36.6	34.3	4.8	4.5
5	1619	1372	247	84.7	15.3	48.0	48.9	5.4	5.0
6	1989	1471	518	74.0	26.0	59.2	60.2	6.1	5.7
7	1832	1227	605	67.0	33.0	68.9	70.7	6.9	6.3
8	1552	1003	549	64.6	35.4	79.9	81.5	7.6	7.0
9	1217	794	423	65.2	34.8	91.7	92.7	8.3	7.9

Table 26: Descriptive progression statistics for GCSE History candidates.

GCSE History grade	N			Percent		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	823	*Very low progression rate from these grades*				-	-	-	-
4	1057	982	75	92.9	7.1	36.5	36.3	4.9	4.5
5	1422	1177	245	82.8	17.2	48.1	49.4	5.5	5.0
6	1727	1240	487	71.8	28.2	59.6	61.4	6.1	5.7
7	1714	1077	637	62.8	37.2	69.5	72.5	6.8	6.3
8	1438	863	575	60.0	40.0	79.8	82.1	7.5	7.0
9	1038	587	451	56.6	43.4	92.7	93.6	8.3	7.8

Other subjects

Table 27: Descriptive progression statistics for GCSE Art & Design candidates (to AS/A level).

GCSE Art & Design grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	237	217	20	91.6	8.4	15.0	22.3	4.0	3.6
4	597	516	81	86.4	13.6	29.5	29.5	4.7	4.2
5	1093	842	251	77.0	23.0	43.6	44.4	5.3	4.8
6	1386	975	411	70.3	29.7	58.6	57.0	6.0	5.3
7	1226	748	478	61.0	39.0	70.9	72.0	6.7	6.0
8	919	500	419	54.4	45.6	82.3	82.4	7.3	6.5
9	649	305	344	47.0	53.0	93.1	93.6	7.8	7.1

Table 28: Descriptive progression statistics for GCSE Business candidates (to AS/A level).

GCSE Business grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	397	374	23	94.2	5.8	17.0	16.5	4.0	4.1
4	769	632	137	82.2	17.8	31.5	33.5	4.6	4.6
5	1226	833	393	67.9	32.1	46.1	44.9	5.3	5.0
6	1364	800	564	58.7	41.3	58.6	59.1	6.0	5.6
7	1277	765	512	59.9	40.1	70.0	72.8	6.8	6.1
8	940	586	354	62.3	37.7	82.4	85.5	7.4	6.6
9	698	473	225	67.8	32.2	93.1	95.3	8.1	7.3

Table 29: Descriptive progression statistics for GCSE Business candidates (to L3 non-AS/A level).

GCSE Business grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	397	317	80	79.8	20.2	16.4	19.2	4.1	3.9
4	769	566	203	73.6	26.4	32.3	30.5	4.7	4.3
5	1226	1038	188	84.7	15.3	45.4	47.5	5.3	4.8
6	1364	1227	137	90.0	10.0	58.3	63.6	5.9	5.2
7	1277	1195	82	93.6	6.4	70.6	78.8	6.5	6.0
8	940	903	37	96.1	3.9	83.4	87.3	7.1	6.3
9	698	684	14	98.0	2.0	93.8	95.6	7.8	7.5

Table 30: Descriptive progression statistics for GCSE Sports candidates (to AS/A level).

GCSE Sports grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level		Continued subject at AS/A Level	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	437	*Very low progression rate from these grades*				-	-	-	-
4	979	930	49	95.0	5.0	30.0	29.5	4.8	4.7
5	1560	1345	215	86.2	13.8	42.8	42.2	5.3	5.1
6	1933	1434	499	74.2	25.8	58.1	59.3	6.0	5.6
7	1514	971	543	64.1	35.9	72.4	73.6	6.7	6.2
8	1224	798	426	65.2	34.8	84.0	85.3	7.3	6.7
9	857	545	312	63.6	36.4	94.7	95.1	7.9	7.3

Table 31: Descriptive progression statistics for GCSE Sports candidates (to L3 non-AS/A level).

GCSE Sports grade	N			%		Mean			
						Percentile rank		Average KS4 grade (other subjects)	
	All	Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)		Continued subject at L3 (non-AS/A Level)	
		No	Yes	No	Yes	No	Yes	No	Yes
3 or below	437	341	96	78.0	22.0	17.6	14.1	4.2	3.8
4	979	745	234	76.1	23.9	30.2	29.4	4.9	4.3
5	1560	1232	328	79.0	21.0	42.6	42.9	5.5	4.7
6	1933	1633	300	84.5	15.5	58.2	59.2	6.0	5.2
7	1514	1377	137	91.0	9.0	72.6	75.2	6.6	5.7
8	1224	1150	74	94.0	6.0	84.4	85.7	7.1	6.4
9	857	818	39	95.4	4.6	94.8	96.0	7.8	6.4

Appendix B: description of matched candidates

Table 32 shows how the overall KS4 attainment level of matched candidates varied across GCSE subjects. The subjects with the most skewed attainment distributions were the single sciences, where over 70% of candidates were from the highest KS4 attainment group, and only about 3% of candidates had low KS4 attainment. Attainment distributions in other subjects were more balanced, although high-attaining and medium-attaining students were still over-represented in comparison with low-attaining students. Combined Science had the lowest proportion of high-attainment candidates of the GCSE subjects analysed (just 25%), and over 50% of candidates with medium KS4 attainment.

Table 32: Average KS4 attainment groups of matched candidates, by GCSE subject.

GCSE subject	N	N			Percent		
		Average KS4 Attainment			Average KS4 Attainment		
		1-Low	2-Medium	3-High	1-Low	2-Medium	3-High
Art & Design	6107	946	2635	2526	15.5	43.2	41.4
Biology	6800	235	1792	4773	3.5	26.4	70.2
Business	6671	1010	2888	2773	15.1	43.3	41.6
Chemistry	6757	219	1766	4772	3.2	26.1	70.6
Computing	24550	2729	8873	12948	11.1	36.1	52.7
English	8597	915	2693	4989	10.6	31.3	58.0
Geography	10187	1447	3877	4863	14.2	38.1	47.7
History	9219	1251	3647	4321	13.6	39.6	46.9
Mathematics	15203	3103	6349	5751	20.4	41.8	37.8
Physics	6452	195	1744	4513	3.0	27.0	70.0
Combined Science	7419	1748	3827	1844	23.6	51.6	24.9
Sports	8504	1076	3819	3609	12.7	44.9	42.4

Table 33 shows a reasonably even gender split among matched candidates in most GCSE subjects. The exceptions were Art & Design (69% female), Computing (77% male), and Sports (59% Male).

Table 33: Gender of matched candidates, by GCSE subject.

GCSE subject	N	N		Percent	
		Gender		Gender	
		F	M	F	M
Art & Design	6107	4217	1890	69.1	31.0
Biology	6800	3600	3200	52.9	47.1
Business	6671	2940	3731	44.1	55.9
Chemistry	6757	3538	3219	52.4	47.6
Computing	24550	5612	18938	22.9	77.1
English	8597	4769	3828	55.5	44.5
Geography	10187	4760	5427	46.7	53.3
History	9219	5179	4040	56.2	43.8
Mathematics	15203	8282	6921	54.5	45.5
Physics	6452	3390	3062	52.5	47.5
Combined Science	7419	4023	3396	54.2	45.8
Sports	8504	3461	5043	40.7	59.3

In all GCSE subjects, the majority of matched candidates were from comprehensive schools (Table 35). The proportion of comprehensive school candidates was far lower in English (57%) than in other subjects, however, and the proportions of independent school, secondary modern and selective school candidates correspondingly higher. The proportion of matched GCSE English candidates from an Independent school (6.2%, compared to ~1% in most other subjects) may explain the high average attainment of this group, as shown in Table 32. The sciences showed a very clear association with school type: the separate sciences had lower than average proportions of candidates from comprehensive schools (~75%), no candidates from secondary modern schools (after rounding), and a high proportion of candidates from selective schools (> 20%). For Combined Science, by contrast, the selective school share was just 2%, and the comprehensive school share of candidates was 94%.

Table 34: School types of matched candidates, by GCSE subject (numbers).

GCSE subject	N	N*					
		School type					
		No data	Comprehensive	Independent	Other	Secondary Modern	Selective
Art & Design	6110	100	4960	200	50	280	530
Biology	6800	10	5040	110	10	0	1630
Business	6670	30	5370	60	0	320	890
Chemistry	6760	10	5040	90	0	0	1620
Computing	24550	310	20430	320	30	580	2880
English	8600	150	4900	530	10	610	2400
Geography	10190	120	8180	140	10	220	1520
History	9220	220	7590	150	90	190	990
Mathematics	15200	130	13250	130	160	400	1140
Physics	6450	10	5000	90	0	0	1360
Combined Science	7420	70	6960	70	10	140	170
Sports	8500	230	7290	160	0	150	670

**All values in this table rounded to the nearest 10 students, for statistical disclosure control.*

Table 35: School types of matched candidates, by GCSE subject (percentages).

GCSE subject	Percent*					
	School type					
	No data	Comprehensive	Independent	Other	Secondary Modern	Selective
Art & Design	1.6	81.2	3.3	0.8	4.6	8.7
Biology	0.1	74.1	1.6	0.1	0.0	24.0
Business	0.4	80.5	0.9	0.0	4.8	13.3
Chemistry	0.1	74.6	1.3	0.0	0.0	24.0
Computing	1.3	83.2	1.3	0.1	2.4	11.7
English	1.7	57.0	6.2	0.1	7.1	27.9
Geography	1.2	80.3	1.4	0.1	2.2	14.9
History	2.4	82.3	1.6	1.0	2.1	10.7
Mathematics	0.9	87.2	0.9	1.1	2.6	7.5
Physics	0.2	77.5	1.4	0.0	0.0	21.1
Combined Science	0.9	93.8	0.9	0.1	1.9	2.3
Sports	2.7	85.8	1.9	0.0	1.8	7.9

**All percentages in this table are based on the rounded data shown in* Table 34*, for statistical disclosure control.*

In terms of the ethnicity of matched candidates (Table 37), Asian students accounted for higher proportions of candidates in the separate sciences, and a particularly low proportion of candidates in Sports. Black students represented a particularly high proportion of matched candidates in Combined Science (12%), while White students represented fairly low proportions of candidates in all sciences (single and combined), and a particularly high proportion of candidates in Sports.

Table 36: Ethnicity of matched candidates, by GCSE subject (numbers).

GCSE subject	N	N						
		Ethnicity						
		No data	Asian	Black	Chinese	Mixed	Other	White
Art & Design	6107	291	739	295	32	307	161	4282
Biology	6800	189	1485	491	47	385	153	4050
Business	6671	138	1122	428	41	334	129	4479
Chemistry	6757	169	1488	496	50	383	157	4014
Computing	24550	665	4759	1612	241	1431	653	15189
English	8597	647	1428	451	84	559	161	5267
Geography	10187	277	1865	737	73	586	188	6461
History	9219	252	1039	460	39	497	157	6775
Mathematics	15203	248	2022	745	76	726	223	11163
Physics	6452	167	1428	471	43	365	149	3829
Combined Science	7419	148	1436	895	31	486	209	4214
Sports	8504	268	489	523	19	469	107	6629

Table 37: Ethnicity of matched candidates, by GCSE subject (percentages).

GCSE subject	Percent						
	Ethnicity						
	No data	Asian	Black	Chinese	Mixed	Other	White
Art & Design	4.8	12.1	4.8	0.5	5.0	2.6	70.1
Biology	2.8	21.8	7.2	0.7	5.7	2.3	59.6
Business	2.1	16.8	6.4	0.6	5.0	1.9	67.1
Chemistry	2.5	22.0	7.3	0.7	5.7	2.3	59.4
Computing	2.7	19.4	6.6	1.0	5.8	2.7	61.9
English	7.5	16.6	5.3	1.0	6.5	1.9	61.3
Geography	2.7	18.3	7.2	0.7	5.8	1.9	63.4
History	2.7	11.3	5.0	0.4	5.4	1.7	73.5
Mathematics	1.6	13.3	4.9	0.5	4.8	1.5	73.4
Physics	2.6	22.1	7.3	0.7	5.7	2.3	59.4
Combined Science	2.0	19.4	12.1	0.4	6.6	2.8	56.8
Sports	3.2	5.8	6.2	0.2	5.5	1.3	78.0

In terms of IDACI groups (used as a proxy for socio-economic deprivation), Table 38 shows that Combined Science candidates were much more likely than matched candidates in other GCSE subjects to be from a high deprivation group, and Sports candidates were less likely than others to be from a high deprivation group. In English, a much higher proportion of matched candidates than in other subjects had no deprivation data (7%), which can be accounted for by the high proportion of matched English candidates from independent schools (Table 35). In all subjects, there were substantial numbers of matched candidates in

each of the IDACI groups, but low-deprivation candidates tended to be over-represented (~30-40%) in comparison with high-deprivation candidates (~20-30%).

Table 38: Deprivation groups of matched candidates, by GCSE subject.

GCSE subject	N	N				Percent			
		IDACI group				IDACI group			
		No data	1-Low	2-Medium	3-High	No data	1-Low	2-Medium	3-High
Art & Design	6107	217	2117	1965	1808	3.6	34.7	32.2	29.6
Biology	6800	119	2837	2112	1732	1.8	41.7	31.1	25.5
Business	6671	83	3011	2166	1411	1.2	45.1	32.5	21.2
Chemistry	6757	101	2800	2122	1734	1.5	41.4	31.4	25.7
Computing	24550	367	8643	8248	7292	1.5	35.2	33.6	29.7
English	8597	572	3528	2589	1908	6.7	41.0	30.1	22.2
Geography	10187	171	4035	3391	2590	1.7	39.6	33.3	25.4
History	9219	162	3636	3124	2297	1.8	39.4	33.9	24.9
Mathematics	15203	206	5733	4926	4338	1.4	37.7	32.4	28.5
Physics	6452	100	2649	2030	1673	1.6	41.1	31.5	25.9
Combined Science	7419	89	2030	2428	2872	1.2	27.4	32.7	38.7
Sports	8504	183	4117	2713	1491	2.2	48.4	31.9	17.5

Appendix C: modelling outputs

Mathematics and Computing

Table 39: Estimated model parameters, progression from GCSE Mathematics to L3 (non-AS/A level) Mathematics.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-7.24	1.19	-6.07	<.0001
GCSE Maths grade		0.40	0.24	1.67	0.094
Average KS4 exc. Maths		0.44	0.20	2.19	0.028
(GCSE Maths)*(Average KS4 exc. Maths)		-0.11	0.03	-3.30	0.001
Gender	M	0.18	0.12	1.51	0.132
	[F]	0.00	.	.	.
School type	Independent	3.21	3.84	0.84	0.404
	Other	-0.88	2.22	-0.40	0.693
	Secondary Modern	0.37	1.23	0.30	0.765
	Selective	-0.25	0.98	-0.25	0.800
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-0.03	0.21	-0.17	0.868
	Black	-0.03	0.28	-0.12	0.902
	Chinese	-2.72	3.56	-0.76	0.445
	Missing	-0.51	0.69	-0.75	0.454
	Mixed	0.27	0.24	1.16	0.247
	Other	-1.63	0.85	-1.93	0.054
	[White]	0.00	.	.	.
IDACI group	1-Low	0.02	0.14	0.14	0.891
	3-High	0.08	0.15	0.54	0.592
	Missing	-2.53	3.68	-0.69	0.492
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.01	0.01	1.66	0.097

Regression based on matched GCSE Mathematics students who achieved grade 4 or above (N=13,753).

Table 40: Estimated model parameters, progression from GCSE Computing to AS/A level Computing.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-7.99	0.46	-17.54	<.0001
GCSE Computing grade		1.63	0.07	22.43	<.0001
Average KS4 exc. Computing		-0.04	0.07	-0.53	0.599
(GCSE Computing)*(Average KS4 exc. Computing)		-0.11	0.01	-11.23	<.0001
Gender	M	0.73	0.05	13.59	<.0001
	[F]	0.00	.	.	.
School type	Independent	0.67	0.51	1.33	0.184
	Other	-0.16	0.90	-0.18	0.858
	Secondary Modern	-0.72	0.23	-3.19	0.001
	Selective	0.25	0.13	1.89	0.059
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-0.24	0.06	-4.30	<.0001
	Black	-0.10	0.09	-1.16	0.245
	Chinese	-0.04	0.16	-0.23	0.818
	Missing	-0.05	0.16	-0.33	0.744
	Mixed	-0.03	0.08	-0.42	0.672
	Other	-0.37	0.12	-3.03	0.002
	[White]	0.00	.	.	.
IDACI group	1-Low	0.05	0.05	1.14	0.256
	3-High	0.15	0.05	2.90	0.004
	Missing	-0.75	0.44	-1.68	0.093
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.01	0.00	7.57	<.0001

Regression based on matched GCSE Computing students who achieved grade 4 or above (N=22,114).

Table 41: Estimated model parameters, progression from GCSE Computing to L3 (non-AS/A level) Computing.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-2.55	1.41	-1.80	0.072
GCSE Computing grade		0.07	0.26	0.25	0.802
Average KS4 exc. Computing		-1.22	0.24	-5.04	<.0001
(GCSE Computing)*(Average KS4 exc. Computing)		0.04	0.04	0.99	0.325
Gender	M	0.90	0.22	4.11	<.0001
	[F]	0.00	.	.	.
School type	Independent	0.86	1.42	0.61	0.543
	Other	-2.66	11.90	-0.22	0.823
	Secondary Modern	0.64	0.90	0.71	0.476
	Selective	-4.86	3.09	-1.57	0.116
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	0.20	0.21	0.99	0.323
	Black	0.08	0.29	0.28	0.779
	Chinese	0.79	0.77	1.02	0.306
	Missing	0.31	0.53	0.59	0.554
	Mixed	-0.68	0.32	-2.14	0.033
	Other	-0.86	0.52	-1.64	0.102
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.18	0.17	-1.07	0.284
	3-High	0.05	0.16	0.28	0.781
	Missing	-0.68	0.95	-0.72	0.471
	[2-Medium]	0.00	.	.	.
Percentile Rank		-0.02	0.01	-3.04	0.002

Regression based on matched GCSE Computing students who achieved grade 4 or above (N=22,114).

Sciences

Table 42: Estimated model parameters, progression from GCSE Biology to AS/A level Biology.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-9.94	1.11	-8.92	<.0001
GCSE Biology grade		1.91	0.16	11.70	<.0001
Average KS4 exc. Biology		0.58	0.16	3.51	0.001
(GCSE Biology)*(Average KS4 exc. Biology)		-0.16	0.02	-7.36	<.0001
Gender	M	-0.91	0.06	-14.13	<.0001
	[F]	0.00	.	.	.
School type	Independent	-0.29	1.23	-0.23	0.815
	Secondary Modern	-0.43	1.33	-0.32	0.749
	Selective	-0.29	0.12	-2.33	0.020
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	0.59	0.08	7.46	<.0001
	Black	0.59	0.12	4.91	<.0001
	Chinese	0.10	0.33	0.31	0.756
	Missing	0.40	0.27	1.48	0.139
	Mixed	0.16	0.13	1.23	0.220
	Other	0.88	0.19	4.67	<.0001
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.10	0.07	-1.41	0.159
	3-High	-0.17	0.08	-2.05	0.040
	Missing	-0.20	1.18	-0.17	0.865
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.01	0.00	2.78	0.006

Regression based on matched GCSE Biology students who achieved grade 5 or above (N=6430).

Table 43: Estimated model parameters, progression from GCSE Chemistry to AS/A level Chemistry.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-7.57	1.28	-5.92	<.0001
GCSE Chemistry grade		1.32	0.18	7.34	<.0001
Average KS4 exc. Chemistry		-0.06	0.19	-0.34	0.732
(GCSE Chemistry)*(Average KS4 exc. Chemistry)		-0.05	0.02	-2.14	0.032
Gender	M	-0.38	0.07	-5.45	<.0001
	[F]	0.00	.	.	.
School type	Independent	4.90	13.53	0.36	0.717
	Secondary Modern	-4.85	16.58	-0.29	0.770
	Selective	-0.20	0.14	-1.42	0.156
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	1.09	0.08	12.88	<.0001
	Black	0.96	0.13	7.67	<.0001
	Chinese	0.41	0.31	1.30	0.192
	Missing	0.43	0.30	1.43	0.152
	Mixed	0.44	0.13	3.29	0.001
	Other	1.11	0.20	5.67	<.0001
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.02	0.08	-0.25	0.803
	3-High	0.00	0.09	-0.02	0.986
	Missing	-4.92	13.52	-0.36	0.716
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.01	0.00	2.67	0.008

Regression based on matched GCSE Chemistry students who achieved grade 5 or above (N=6288).

Table 44: Estimated model parameters, progression from GCSE Physics to AS/A level Physics.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-9.92	1.54	-6.43	<.0001
GCSE Physics grade		1.48	0.21	7.03	<.0001
Average KS4 exc. Physics		-0.02	0.23	-0.07	0.945
(GCSE Physics)*(Average KS4 exc. Physics)		-0.07	0.03	-2.30	0.021
Gender	M	1.65	0.09	18.45	<.0001
	[F]	0.00	.	.	.
School type	Independent	-0.66	1.36	-0.48	0.629
	Other	-8.40	24.00	-0.35	0.726
	Secondary Modern	0.62	1.48	0.42	0.675
	Selective	0.17	0.21	0.83	0.405
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	0.17	0.10	1.65	0.098
	Black	-0.18	0.16	-1.12	0.261
	Chinese	0.11	0.38	0.29	0.773
	Missing	0.25	0.34	0.74	0.459
	Mixed	-0.03	0.16	-0.18	0.857
	Other	0.00	0.25	-0.02	0.985
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.04	0.09	-0.43	0.670
	3-High	0.22	0.10	2.08	0.038
	Missing	0.50	1.28	0.39	0.699
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.01	0.00	2.50	0.012

Regression based on matched GCSE Physics students who achieved grade 5 or above (N=6018).

Table 45: Estimated model parameters, progression from GCSE Combined Science to AS/A level Science (any).

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-16.25	1.32	-12.34	<.0001
GCSE Combined Science grade		1.22	0.11	10.70	<.0001
Average KS4 exc. Combined Science		1.03	0.21	4.80	<.0001
(GCSE Combined Science)*(Average KS4 exc. Combined Science)		-0.12	0.02	-7.45	<.0001
Gender	M	-0.05	0.09	-0.62	0.536
	[F]	0.00	.	.	.
School type	Independent	-0.84	1.40	-0.60	0.548
	Other	0.94	1.43	0.65	0.513
	Secondary Modern	0.04	0.60	0.07	0.946
	Selective	-0.22	0.44	-0.50	0.615
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	0.57	0.12	4.68	<.0001
	Black	0.42	0.15	2.87	0.004
	Chinese	0.07	0.48	0.14	0.892
	Missing	1.05	0.40	2.65	0.008
	Mixed	0.21	0.17	1.24	0.214
	Other	0.66	0.23	2.90	0.004
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.13	0.10	-1.27	0.204
	3-High	-0.15	0.10	-1.47	0.142
	Missing	-0.35	1.28	-0.28	0.783
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.03	0.01	5.42	<.0001

Regression based on matched GCSE Combined Science students who achieved grade 5-4 or above (N=5591).

Table 46: Estimated model parameters, progression from GCSE Combined Science to L3 (non-AS/A level) Science (any).

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		7.95	2.50	3.18	0.002
GCSE Combined Science grade		-0.68	0.26	-2.62	0.009
Average KS4 exc. Combined Science		-1.83	0.45	-4.10	<.0001
(GCSE Combined Science)*(Average KS4 exc. Combined Science)		0.06	0.04	1.64	0.102
Gender	M	-0.36	0.14	-2.55	0.011
	[F]	0.00	.	.	.
School type	Independent	1.55	6.95	0.22	0.823
	Other	2.38	6.74	0.35	0.725
	Secondary Modern	-1.07	1.72	-0.62	0.534
	Selective	-2.45	2.78	-0.88	0.377
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	0.15	0.21	0.70	0.481
	Black	0.06	0.23	0.27	0.789
	Chinese	0.98	0.85	1.16	0.245
	Missing	-0.21	0.70	-0.30	0.764
	Mixed	-0.88	0.39	-2.23	0.026
	Other	0.63	0.37	1.70	0.089
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.27	0.19	-1.38	0.166
	3-High	-0.15	0.17	-0.87	0.384
	Missing	-0.75	6.90	-0.11	0.914
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.03	0.01	2.84	0.005

Regression based on matched GCSE Combined Science students who achieved grade 5-4 or above (N=5591).

Humanities

Table 47: Estimated model parameters, progression from GCSE English to AS/A level English.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-4.31	0.83	-5.20	<.0001
GCSE English grade		1.26	0.14	9.10	<.0001
Average KS4 exc. English		-0.56	0.13	-4.32	<.0001
(GCSE English)*(Average KS4 exc. English)		-0.06	0.02	-3.49	0.001
Gender	M	-1.03	0.09	-11.17	<.0001
	[F]	0.00	.	.	.
School type	Independent	-0.76	16.21	-0.05	0.963
	Other	-4.71	11.67	-0.40	0.687
	Secondary Modern	-1.12	0.74	-1.51	0.130
	Selective	0.40	0.38	1.05	0.294
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-0.81	0.13	-6.24	<.0001
	Black	-0.41	0.18	-2.29	0.022
	Chinese	-0.62	0.38	-1.62	0.106
	Missing	0.33	0.34	0.97	0.331
	Mixed	-0.07	0.13	-0.54	0.592
	Other	0.03	0.24	0.14	0.891
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.25	0.09	-2.81	0.005
	3-High	-0.10	0.11	-0.93	0.352
	Missing	0.45	16.21	0.03	0.978
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.02	0.00	5.26	<.0001

Regression based on matched GCSE English students who achieved grade 4 or above (N=8162).

Table 48: Estimated model parameters, progression from GCSE Geography to AS/A level Geography.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-7.31	0.67	-10.90	<.0001
GCSE Geography grade		1.81	0.11	16.59	<.0001
Average KS4 exc. Geography		-0.06	0.11	-0.54	0.586
(GCSE Geography)*(Average KS4 exc. Geography)		-0.14	0.02	-8.96	<.0001
Gender	M	0.17	0.06	2.84	0.005
	[F]	0.00	.	.	.
School type	Independent	0.66	0.68	0.97	0.331
	Other	0.54	1.55	0.35	0.729
	Secondary Modern	0.01	0.37	0.04	0.968
	Selective	0.21	0.20	1.06	0.288
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-0.85	0.10	-8.60	<.0001
	Black	-0.72	0.15	-4.91	<.0001
	Chinese	-0.57	0.33	-1.71	0.088
	Missing	-0.22	0.25	-0.88	0.378
	Mixed	-0.31	0.12	-2.52	0.012
	Other	-0.56	0.25	-2.22	0.027
	[White]	0.00	.	.	.
IDACI group	1-Low	0.31	0.07	4.69	<.0001
	3-High	-0.23	0.09	-2.61	0.009
	Missing	-0.34	0.59	-0.59	0.558
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.01	0.00	2.52	0.012

Regression based on matched GCSE Geography students who achieved grade 4 or above (N=9222).

Table 49: Estimated model parameters, progression from GCSE History to AS/A level History.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-5.98	0.67	-8.91	<.0001
GCSE History grade		1.43	0.11	13.35	<.0001
Average KS4 exc. History		-0.17	0.11	-1.46	0.145
(GCSE History)*(Average KS4 exc. History)		-0.10	0.02	-6.77	<.0001
Gender	M	0.15	0.06	2.55	0.011
	[F]	0.00	.	.	.
School type	Independent	-0.58	0.87	-0.66	0.507
	Other	0.72	0.69	1.05	0.295
	Secondary Modern	-0.92	0.37	-2.46	0.014
	Selective	0.71	0.22	3.16	0.002
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-0.66	0.11	-5.76	<.0001
	Black	-0.78	0.16	-4.82	<.0001
	Chinese	-1.54	0.63	-2.46	0.014
	Missing	-0.29	0.27	-1.09	0.275
	Mixed	-0.21	0.12	-1.66	0.098
	Other	-0.68	0.25	-2.76	0.006
	[White]	0.00	.	.	.
IDACI group	1-Low	0.02	0.07	0.26	0.799
	3-High	-0.03	0.08	-0.41	0.685
	Missing	1.14	0.79	1.44	0.151
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.02	0.00	5.45	<.0001

Regression based on matched GCSE History students who achieved grade 4 or above (N=8193).

Other subjects

Table 50: Estimated model parameters, progression from GCSE Business to AS/A level Business.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-8.54	0.74	-11.48	<.0001
GCSE Business grade		1.88	0.13	14.07	<.0001
Average KS4 exc. Business		0.70	0.13	5.57	<.0001
(GCSE Business)*(Average KS4 exc. Business)		-0.21	0.02	-11.79	<.0001
Gender	M	0.31	0.07	4.70	<.0001
	[F]	0.00	.	.	.
School type	Independent	0.31	1.18	0.26	0.795
	Other	1.11	1.77	0.63	0.531
	Secondary Modern	0.18	0.38	0.48	0.630
	Selective	-0.27	0.33	-0.80	0.423
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-0.23	0.11	-2.18	0.030
	Black	-0.15	0.15	-1.02	0.307
	Chinese	-0.63	0.51	-1.23	0.218
	Missing	-0.04	0.31	-0.13	0.897
	Mixed	-0.17	0.15	-1.13	0.258
	Other	-0.42	0.26	-1.62	0.105
	[White]	0.00	.	.	.
IDACI group	1-Low	0.05	0.08	0.64	0.520
	3-High	-0.19	0.10	-1.96	0.050
	Missing	-0.61	1.05	-0.58	0.562
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.00	0.00	-0.06	0.952

Regression based on matched GCSE Business students who achieved grade 4 or above (N=6248).

Table 51: Estimated model parameters, progression from GCSE Business to L3 (non-AS/A level) Business.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		4.58	1.21	3.79	0.000
GCSE Business grade		-0.23	0.24	-0.98	0.328
Average KS4 exc. Business		-1.32	0.22	-5.98	<.0001
(GCSE Business)*(Average KS4 exc. Business)		0.05	0.03	1.45	0.146
Gender	M	0.17	0.11	1.50	0.133
	[F]	0.00	.	.	.
School type	Independent	-0.97	1.36	-0.72	0.474
	Other	-4.79	21.42	-0.22	0.823
	Secondary Modern	-0.20	0.68	-0.29	0.769
	Selective	-2.33	0.81	-2.89	0.004
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-0.23	0.19	-1.24	0.214
	Black	0.09	0.21	0.44	0.659
	Chinese	-0.33	1.34	-0.25	0.804
	Missing	0.52	0.46	1.14	0.255
	Mixed	0.05	0.23	0.23	0.821
	Other	0.34	0.33	1.01	0.314
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.25	0.13	-1.89	0.060
	3-High	0.03	0.15	0.18	0.854
	Missing	0.17	1.04	0.17	0.868
	[2-Medium]	0.00	.	.	.
Percentile Rank		-0.01	0.01	-0.87	0.385

Regression based on matched GCSE Business students who achieved grade 4 or above (N=6248).

Table 52: Estimated model parameters, progression from GCSE Sport to AS/A level Sport.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-10.12	0.83	-12.16	<.0001
GCSE Sport grade		1.94	0.14	13.94	<.0001
Average KS4 exc. Sport		0.54	0.14	3.94	<.0001
(GCSE Sport)*(Average KS4 exc. Sport)		-0.19	0.02	-10.11	<.0001
Gender	M	0.30	0.07	4.37	<.0001
	[F]	0.00	.	.	.
School type	Independent	5.37	6.37	0.84	0.399
	Other	-3.79	14.12	-0.27	0.788
	Secondary Modern	-0.29	0.53	-0.54	0.587
	Selective	0.14	0.28	0.49	0.621
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-1.06	0.20	-5.20	<.0001
	Black	-0.49	0.17	-2.89	0.004
	Chinese	-0.74	0.91	-0.82	0.415
	Missing	-0.11	0.32	-0.34	0.736
	Mixed	-0.30	0.15	-2.01	0.045
	Other	-0.81	0.41	-1.99	0.047
	[White]	0.00	.	.	.
IDACI group	1-Low	0.00	0.07	0.03	0.977
	3-High	-0.19	0.11	-1.71	0.088
	Missing	-5.12	6.35	-0.81	0.420
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.01	0.00	2.83	0.005

Regression based on matched GCSE Sport students who achieved grade 4 or above (N=7843).

Table 53: Estimated model parameters, progression from GCSE Sport to L3 (non-AS/A level) Sport.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		2.70	1.07	2.51	0.012
GCSE Sport grade		0.45	0.20	2.24	0.025
Average KS4 exc. Sport		-1.25	0.19	-6.45	<.0001
(GCSE Sport)*(Average KS4 exc. Sport)		-0.03	0.03	-0.90	0.366
Gender	M	0.45	0.09	4.83	<.0001
	[F]	0.00	.	.	.
School type	Independent	4.06	5.15	0.79	0.431
	Other	-5.56	11.90	-0.47	0.640
	Secondary Modern	0.13	0.67	0.20	0.844
	Selective	-2.39	0.66	-3.64	0.000
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-0.90	0.26	-3.42	0.001
	Black	-0.78	0.21	-3.64	0.000
	Chinese	0.60	0.93	0.65	0.515
	Missing	-0.03	0.39	-0.07	0.948
	Mixed	0.01	0.19	0.07	0.942
	Other	-0.93	0.49	-1.89	0.058
	[White]	0.00	.	.	.
IDACI group	1-Low	0.01	0.10	0.09	0.930
	3-High	0.16	0.13	1.17	0.242
	Missing	-4.29	5.12	-0.84	0.402
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.00	0.00	0.03	0.978

Regression based on matched GCSE Sport students who achieved grade 4 or above (N=7843).

Table 54: Estimated model parameters, progression from GCSE Art & Design to AS/A level Art & Design.

Effect	Group	Estimate	Standard Error	t Value	Pr > |t|
Intercept		-3.64	0.70	-5.19	<.0001
GCSE Art & Design grade		1.13	0.12	9.67	<.0001
Average KS4 exc. Art & Design		-0.35	0.12	-2.94	0.003
(GCSE Art & Design)*(Average KS4 exc. Art & Design)		-0.06	0.02	-3.59	0.000
Gender	M	-0.24	0.08	-3.00	0.003
	[F]	0.00	.	.	.
School type	Independent	0.40	1.04	0.39	0.698
	Other	-0.15	0.67	-0.23	0.821
	Secondary Modern	-0.30	0.29	-1.05	0.292
	Selective	0.38	0.22	1.70	0.090
	[Comprehensive]	0.00	.	.	.
Ethnicity	Asian	-0.95	0.14	-7.01	<.0001
	Black	-0.32	0.17	-1.94	0.052
	Chinese	0.88	0.42	2.09	0.037
	Missing	-0.34	0.28	-1.19	0.233
	Mixed	0.03	0.15	0.19	0.852
	Other	-0.47	0.23	-2.07	0.038
	[White]	0.00	.	.	.
IDACI group	1-Low	-0.01	0.08	-0.11	0.912
	3-High	-0.19	0.09	-2.03	0.042
	Missing	-0.03	0.98	-0.03	0.975
	[2-Medium]	0.00	.	.	.
Percentile Rank		0.00	0.00	1.45	0.148

Regression based on matched GCSE Art & Design students who achieved grade 4 or above (N=5776).