Capping of achievement at GCSE through tiering.

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Introduction

The GCSE (General Certificate in Secondary Education) was first examined in 1988, and aimed to provide a single qualification which could meet the needs of those students who had previously taken either General Certificate of Education (GCE) O-level, Certificate of Secondary Education (CSE), and at least some examinees who had previously completed school education without obtaining any academic qualifications. As such, the GCSE aimed to assess students with a very wide range of abilities. Assessments were structured to provide opportunities for students to demonstrate positive achievement, and to allow students to perform to the best of their ability (Bishop, Bullock, Martin, & Thompson, 1999). However, the challenge of designing assessments which were able to effectively differentiate between students of very different abilities was recognised from the earliest stages of the development of the GCSE. In this paper we investigate whether tiered GCSE papers allow all students to achieve the grade which best reflects their ability by investigating whether there is evidence to suggest that the achievement of some students is capped as a result of tiering.

In subjects such as history or art, it is considered possible to set tasks which allow responses at a wide range of different levels, and thus use a common paper for all grades. However, in other subjects (e.g. mathematics), it is difficult to produce assessments which can assess the full ability range without including questions which are either too easy or too demanding for many examinees. If all examinees in such subjects were given the same test regardless of their ability level, it might result in examinees at the lower proficiency level having to answer questions which were too difficult for them and examinees at the higher proficiency level having to attempt more questions which offered little challenge to them. In both the cases, the test-taking experience of the examinees could be unsatisfactory and might lead to frustration or boredom during the test thereby adversely affecting their performance. Furthermore, not enough questions might be targeted at both the highest and lowest proficiency levels, leading to difficulties in reliably differentiating between examinees at each end of the proficiency scale. Arguably, one way of approaching this issue is to include a large enough number of questions to target examinees at all ability levels. However, this could result in a very long question paper requiring considerable testing time.

In the early years of the GCSE different strategies for differentiated assessment were used. The National Criteria for GCSE (Department of Education and Science, 1985a, 1985b) specified that appropriate differentiation strategies should be used, but allowed for some flexibility. Some specifications used a tiered structure (Long, 1990), in which question papers targeted at different (but overlapping grades) were used, and teachers and students had to select which paper was most appropriate, based on their expected performance in the examination. Since 1994, the use of tiering has become more widespread, and in 1998 the number of tiers and the overlapping grade range was unified across specifications to the current two-tier design, as shown in Table 1[1].The foundation tier spans grades C-G, and the higher tier grades A*-D, with an allowed grade E for examinees who narrowly miss grade D. The two tiers therefore overlap primarily at grades C and D. Foundation tier examinees are capped at grade C, while higher tier examinees who do not achieve an allowed grade E or better are ungraded. This model allows all students to access the grade C, which is considered to be a “good pass” at GCSE, but is not generally considered sufficient for progression in that subject. Currently the Ofqual GCSE subject criteria specify which

[1] In the 1990s, and until 2006 for mathematics, some subjects used a three-tier design, with a foundation tier targeted at grades G-D, and intermediate tier targeted at grades E-B, and a higher tier targeted at grades A*-C. The move to a two tier design was largely motivated by the fact that the foundation tier, which did not allow examinees to achieve a grade C, was demotivating for students. Until 1998 some subjects, such as English had a higher tier which spanned grades A*/A to D/E, and a foundation tier which spanned only grades F and G.

subjects should use tiering, and which subjects should use common papers for all grades (Ofqual, 2013b).

Table 1: Tiering design currently specified by Ofqual for GCSEs.

Grade	*Tier*			
		F	*H*	
*A**				
A				
B				
C				
D				
E				
F				
G				

The use of tiering in GCSE assessments has caused concern in two main areas. Firstly, despite the fact that a grade should represent a certain standard of performance, certain grades (C, D and E) may be obtained by two different routes: a C may be awarded for obtaining more marks on a less demanding paper, or fewer marks on a more demanding paper. Particularly in those subjects which specify different content for the higher tier, it might be difficult to make the same inferences about candidates achieving the same grade via the two different routes. (For further discussion of the comparability issues associated with awarding overlapping grades at foundation and higher tier, please see Dhawan &Wilson, 2013; Wheadon & Béguin, 2010) Secondly, the need to choose which paper a student should be entered for raises the possibility that students may be entered for an inappropriate tier, which may prevent students from achieving the best grade which they are capable of, or alternatively, students may be ungraded if they are not able to achieve the grades targeted by the higher tier. While some early evidence suggested that teachers were able to make appropriate decisions about entry (Good & Cresswell, 1988), other research has suggested that some examinees may have had their achievement capped on the foundation tier (Baird et al., 2001). There is some evidence to suggest that certain groups of students are more likely to be entered for the foundation tier than others, leading to an increased risk that their achievement may be capped. For example, previous work has shown that boys and students from economically deprived backgrounds are more likely to be entered for the foundation tier (Elwood & Murphy, 2002; Gillborn & Youdell, 2000). Since the introduction of the GCSE, the use of the grade C as an accountability measure (Acquah, 2013) for schools and teachers has become increasingly important. As there is a perception that it is easier to obtain a grade C on foundation tier compared to higher tier (Ofqual, 2013a), there may be pressure to enter students for the foundation tier, to obtain a ‘safe’ grade C, even though this would potentially cap some students’ achievement at grade C, who might otherwise have obtained a grade B. Furthermore, some university and FE (Further Education) institutions require a grade B at GCSE for progression, a grade which is not available on the foundation tier (Department for Education, 2012). While it does not necessarily seem problematic that lower ability examinees are less likely to progress to more advanced qualifications in a subject, it would be problematic if examinees were not given the opportunity to achieve the best grade possible, given their ability, due to a grade cap at foundation tier.

In this paper we investigate whether there is evidence that students’ achievement is capped as a result of tiering by examining structural features of the assessments, and modelling the characteristics (e.g. gender, deprivation, prior attainment, ethnic origin) of examinees entered for foundation and higher tier papers. The study investigated a total of eight specifications, from three subject areas: English, science and mathematics. These specifications represented a range of different tiering strategies. Three specifications used linear assessment, in which all assessment is taken at the end of the course. Five specifications had unitised assessment, in which the content is divided into units which are assessed separately, and may be taken at different stages of the course, with the opportunity for resits (Vidal Rodeiro & Nádas, 2012). The unitised specifications were certificated in 2012, before the new rule on linear assessment had been introduced in England.

Analysis

Eight popular OCR GCSE specifications in mathematics, science and English were investigated. These subjects represented a variety of different assessment structures, using different percentages of tiered assessments, and different distribution of content across tiers. The majority of specifications in the analysis were certificated in June 2012. Since very few GCSEs used linear assessment in 2012, two further specifications from 2011 and 2007 were also included in the analysis. Assessment data was linked to information from the National Pupil Database. The National Pupil Database (NPD), which is compiled by the Department for Education, is a longitudinal database for all children in schools in England, linking student characteristics to school and college learning aims and attainment. The NPD holds pupil and school characteristics such as age, gender, ethnicity, level of deprivation, attendance and exclusions, matched to pupil level attainment data (Key Stage 2 to Key Stage 5 assessments and other external examinations). Students who start in a school/college are only recorded on the NPD if they enter for a qualification; those who leave school/college after a short time or do not sit examinations are not present in the data.

Table 2: Specifications included in the analysis.

Specification	Percentage of tiered assessment	Entry size	Year
Mathematics (linear)	100%	23210	2012
Mathematics (unitised)	100%	28939	2012
Mathematics linear (2011)	100%	43709	2011
Core Science (unitised)	66.8%	60700	2012
Additional Science (unitised)	66.8%	49210	2012
Double Science linear (2007)	80%	17662	2007
English Language	40%	35084	2012
English Literature	75%	26846	2012

Two strands of analysis were conducted:

(1) A notional B grade boundary was calculated for foundation tier units to investigate whether examinees might have been able to achieve a grade B on the foundation tier.

(2) Regression analyses investigated whether prior attainment, gender, level of deprivation and ethnicity predicted the probability of entry to the foundation tier.

Notional Grade B boundary

Following Baird et al. (2001), a notional B grade boundary was calculated, set at the difference between the C and D grade boundary (i.e. one grade boundary width) above the C boundary, and the proportion of examinees who achieved above this boundary was determined. This analysis relied on the fact that the grade C boundary was low enough to allow an additional grade boundary one grade boundary width above it. This was the case in all units, except for one in the English Literature specification. At the time when Baird et al. (2001) conducted their analyses, GCSEs were linear, so it was possible to aggregate marks directly. However, five of the eight specifications analysed in the current study were unitised. In unitised specifications, raw marks are converted to standardized UMS marks, to allow performance on units in different examination sessions to be compared. In the case of a GCSE Core Science unit, examinees achieving a grade C obtain UMS marks in the range of

30-34. On the foundation tier, which is capped at grade C, the maximum UMS mark available is 34. Examinees who achieve raw marks more than one grade boundary width above the highest grade boundary (the C boundary for foundation tier) are capped at the maximum UMS marks for the paper. By introducing a notional grade B boundary, examinees with raw marks above that boundary were awarded raw marks in the B range, 35-39. Any examinees who achieved raw marks one grade boundary width above the notional grade B boundary were capped at the maximum UMS marks available for a B, 39. In each unit, typically less than 1% of examinees had their marks capped for this reason. These recalculated UMS marks were then aggregated with the marks obtained on other units in the specification, and the grade calculated.

Findings

For unitised specifications, in which students have the opportunity to take assessments across the whole GCSE course, very few foundation tier examinees achieved marks above a notional B grade boundary, suggesting that there was little capping of achievement. However, for linear specifications, where students take all assessments at the end of the course, students' achievement was more likely to be capped. Table 3 and Figure 1 show the percentage of students who achieved marks above the notional grade B boundary, as a percentage of students taking foundation tier units, and of all examinees. Linear specifications are shaded.

Table 3: Percentage of examinees above the notional grade B boundary.

Specification	% foundation tier only	% all examinees
Mathematics B linear	15.40	10.14
Mathematics A	2.70	1.31
Mathematics linear (2011)	16.53	10.10
Core Science	1.84	0.73
Additional Science	3.32	1.00
Double Science linear (2007)	16.91	6.34
English Language	0.18	0.04
English Literature	2.07	0.46

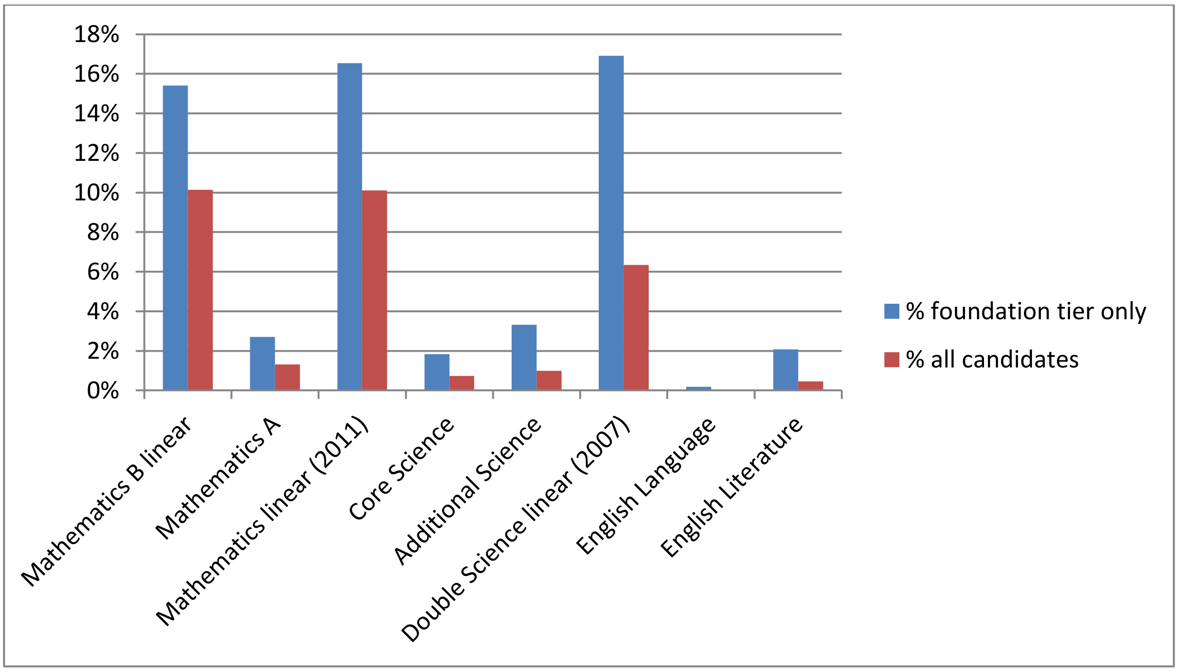

Figure 1: Percentage of examinees above the notional grade B boundary.

Factors affecting entry for tiers

This analysis was carried out to determine whether there is a statistical association of tier of entry with prior attainment, gender, school type, ethnicity and deprivation. Logistic regression was carried out to investigate the relationship between entry for tiers and the other factors. This analysis was conducted on all candidates entered for the foundation tier whose assessment data could be matched to the NPD, with the exception of those examinees who took units from a mixture of tiers. These examinees were excluded from the analysis, because relatively few examinees took a mixture of tiers.

OCR databases were used to obtain the tier of entry for examinees who were awarded their GCSE in June 2012. The two specifications which were awarded prior to 2012 (Mathematics Linear (2011) and Double Science linear (2007) were not included in this analysis, due to differences in classifications of ethnicity in the NPD. The OCR data was matched with the NPD. It was not possible to match every examinee, so the number of examinees used in this analysis is somewhat lower than for other analyses. Detailed information about the regression models is given in the Appendix.

The following information about the examinees was extracted from the NPD data:

- Prior attainment: Key Stage 2 marks according to the subject – English, mathematics or science from the year 2007.
- Gender
- Ethnicity: classified into seven major ethnic groupings (White, Asian, Black, Chinese, Mixed, Any other ethnic group and Unclassified).
- Deprivation: The Income Deprivation Affecting Children Indices (IDACI) score was used. IDACI is derived from the pupil's postcode and has a value between 0 and 1 (where 1=highest level of deprivation).

The regression analyses showed that:

- Once other factors were taken into account, the higher the level of prior attainment at KS2, the less likely students were to be entered for the foundation tier.
- Once other factors were taken into account, boys were more likely to be entered for the foundation tier than girls.
- Once other factors were taken into account, the higher the level of deprivation, the more likely the students were to be entered for the foundation tier; this was particularly the case in mathematics, and particularly for a linear mathematics specification.
- Once other factors were taken into account, there were no strong effects of ethnicity, but numbers of students from minority ethnic groups were very low. There was no evidence of any group being more likely to be entered for foundation tier.

Discussion

This study investigated the extent to which there is evidence that examinees' achievement was capped in eight OCR GCSE specifications in English, mathematics and science, and examined whether the background characteristics of students led to a greater probability of entry in foundation tier units. A notional B grade boundary was calculated for foundation tier units, and the percentage of examinees achieving above this boundary determined. UMS marks for the foundation tier were recalculated assuming that the notional B grade was available on the foundation tier, and the marks were re-aggregated to determine the extent to which examinees' grades at certificate level would change. Overall, for the unitised specifications, relatively little evidence of capping of achievement was observed. However, a much higher percentage of students who took linear specifications were estimated to have had their achievement capped. Despite this, given the small number of specifications used in the study, it is not clear whether this finding would generalise. Examinee data was matched to the NPD, and regression analyses were used to examine the role of prior attainment (KS2 performance), gender, socioeconomic status (IDACI score) and ethnicity in determining whether examinees were entered for the foundation tier. Once prior attainment was controlled for, male examinees and examinees identified as having higher levels of deprivation were found to be more likely to be entered for the foundation tier.

One disadvantage of the tiering model is the need for teachers to decide on the most appropriate tier of entry for students. In principle it is only necessary to decide on entry tiers a few months before the assessment. However, in practice, streaming/setting decisions, and the need to choose whether students should study either the foundation or higher tier curriculum, mean that decisions about tiering may be made very early, sometimes even at the start of the GCSE course (Dunne et al., 2007; Gillborn & Youdell, 2000), even for courses with 100% terminal assessment. It is likely that this is particularly the case for subjects such as the sciences, mathematics and modern foreign languages, which specify additional content for the higher tier. Teachers report that decisions about set placement, and entry for tiers are based on prior attainment, but that behavioural and psychological factors may also play a role (Dunne et al., 2007). However, analyses of tier entry have also indicated that gender, socioeconomic status and ethnicity may influence the tier which a student is entered for.

Across specifications, we found that once prior attainment in the subject at KS2 was controlled for, boys were more likely to be entered for the foundation tier than girls. This is consistent with previous work on mathematics GCSE, (conducted when mathematics used a three tier structure), which found that boys were more likely to be entered for the foundation tier in mathematics (Elwood & Murphy, 2002). Furthermore, we found that examinees from economically deprived areas were more likely to be entered for the foundation tier, particularly in mathematics, and particularly in the linear mathematics specifications. This finding reflects the results obtained by Gillborn and Youdell (2000) in a case study of schools in the 1990s. In contrast, while both Strand (2012) (at KS3) and Gillborn and Youdell (2000) (at GCSE) found that students from certain ethnic minorities were more likely to be entered for the lower or foundation tier, we did not find consistent effects of ethnicity across the specifications analysed. However, it is possible that this was due to the relatively small number of examinees from ethnic minorities in the dataset. Furthermore, it is possible that different methods of classifying ethnicity led to different findings. It remains unclear, however, to what extent these findings are a direct result of tiering, and the particular tiering structure in use, and to what extent they reflect the impact of a range of educational factors (both formal and informal) which may affect tiering decisions. After all, entry decisions for tiering are influenced by the effects of many decisions made throughout a student's education.

The increased risk of capping associated with linear specifications could be considered surprising, because decision about tier entry can be delayed until a later stage in the course, allowing schools more flexibility to arrange teaching to accommodate differences in the foundation and higher tier curriculum. Furthermore, teachers would have more information about students' abilities, which would facilitate the decision. What might explain the observed difference between the linear and the unitised specifications? Entering examinees for tiers in a linear specification is much "higher risk" than in a unitised specification, because entry decisions are made for 100% of the specification, which is sat at the same time, with fewer, or less convenient, opportunities for resitting. Teachers might, therefore, be more conservative in entry decisions, and this might affect certain groups of students, to a greater extent. Although the grade C is perceived as a minimum acceptable standard of attainment, it is not generally sufficient for progression in that subject, particularly in mathematics. Since boys and examinees from more deprived backgrounds are more likely to be entered for the foundation tier even when their prior attainment is taken into consideration, this may limit their opportunities for progression in those subjects for those students. The alignment of the top of the foundation tier with grade C may interact with the predicted achievement for such students, if they are perceived to be less likely to cope with the demands and style of higher tier assessments. Furthermore, if there is little expectation for these students to progress on to a route which requires a grade B or better (such as A levels or vocational training), then there is little motivation for schools to "risk" the higher tier, potentially capping their achievements.

Any analysis of the extent of capping of achievement through tiering aims to quantify what student performance might have been under different circumstances. As such, our findings should be considered to be estimates. The question of whether a very strong performance on a foundation tier paper (i.e. above the notional grade B boundary) is comparable to a grade B awarded on the higher tier remains an open question. The foundation tier papers analysed in this study were not designed to assess students at the grade B level, and it is not clear whether or not the papers included sufficiently demanding items. Furthermore, if it is necessary to be assessed on the full range of the higher tier curriculum to be awarded a grade B, then examinees who perform very well on the less demanding material on the foundation tier could not be said to have demonstrated that they have achieved at the level of grade B. However, this question lies at the heart of the comparability issues associated with overlapping grades: since grades C and D can be awarded on this basis, then it is not unreasonable to argue that grade B might be too.

Implications for GCSE reform

At the time of writing, GCSEs are being reformed. Since June 2014, GCSEs have been assessed linearly, with 100% terminal assessment. This return to linear assessment will be retained in the new fully reformed GCSEs which will be first taught from 2015 (mathematics and English), with other subjects following in subsequent years. The findings from the current study suggest that there may be an increase in capping of achievement as a result of the return to linear assessment. Further work examining capping of achievement in GCSE assessments from 2014 would be needed to determine whether this is in fact the case. In the new GCSEs, tiering will be retained in mathematics and the sciences (Ofqual, 2013c), and it has been proposed that tiering should be retained in modern foreign languages (Ofqual, 2014a). The new GCSEs in English Language and English Literature will not be tiered. A new grading model will be used, so that students will be awarded grades from 9-1 (9 is the highest), replacing the A*-G system. Under the new grading model, the higher tier will span grades 9-4, and the foundation tier grades 5-1, with an overlap at grades 4 and 5 (Ofqual, 2013d). It has been proposed that the bottom of grade 4 will be aligned with the bottom of the current grade C (Ofqual, 2014b). As a result, a higher standard will be required to achieve the top grade (grade 5) on the foundation tier than at present (grade C), leading to more demanding foundation tier papers. It is currently unclear how these reforms to the grading system will affect capping of achievement, although increasing the maximum grade available on the foundation tier seems likely to lead to an overall rise in the number of foundation tier entries. Furthermore, performance measures are being reformed, reducing the focus on the grade C (or its replacement) as a key threshold grade in most subjects (Department for Education, 2013). It seems plausible that this may reduce the pressure on teachers to "play it safe" and enter students for the foundation tier.

Summary and Conclusions

This study investigated the extent to which students' achievement at GCSE might be capped as a result of tiering. Overall, the majority of students entered for the foundation tier appear to have been entered correctly. There was little evidence that students who were entered for the foundation tier had their achievement capped, particularly for unitised specifications. There was some evidence to suggest that this was more likely for students who took linear specifications. However, due to the small number of specifications analysed in the study, further work would be necessary to determine whether this finding can be generalised.

Regression analyses showed that boys, and students from economically deprived backgrounds were more likely to be entered for the foundation tier, even when prior attainment was taken into account. However, this is not necessarily a direct result of tiering: decisions on tier entry are likely to be affected by many other decisions taken earlier in a student's education, such as streaming/setting on the basis of ability.

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Appendix

Regression models for the factors affecting entry to the foundation tier

This analysis was carried out to determine whether there is a statistical association of tier of entry with prior attainment, gender, school type, ethnicity and deprivation.

No interactions between the independent variables were included in the models.

Odds ratio for the independent variables presented here represents the factor of increase in the odds of being entered for the foundation tier when the value of a categorical independent variable changes from the baseline/reference to a specified category or when the value of a continuous independent variable increases by a specified unit. An odds ratio greater than 1 here indicates an increase in the likelihood of being entered for the foundation tier with a greater odds ratio indicating a greater likelihood. Conversely, an odds ratio less than 1 indicates a decrease in the likelihood of being entered for the foundation tier with a smaller odds ratio indicating a smaller likelihood. And, finally, an odds ratio equal to 1 indicates an equal likelihood of being entered for the foundation tier.

Table A1: English Language
Number of candidates: F=5957, H=20040, Total=25997

Variables		N	%	Coefficient	Standard Error	p	Odds ratio
Constant				5.36	0.10	<.0001	
Gender	[M]	3466	58.2				
	F	2491	41.8	-0.38	0.04	<.0001	0.69
Prior attainment (KS2 English mark)				-0.10	0.00	<.0001	0.90
Level of deprivation (IDACI)				0.70	0.13	<.0001	2.00
Ethnicity	[White]	5080	87.1				
	Any other ethnic group	45	0.8	-0.93	0.20	<.0001	0.40
	Asian	294	5.0	-0.91	0.08	<.0001	0.40
	Black	165	2.8	-0.71	0.12	<.0001	0.49
	Chinese	9	0.2	-1.54	0.39	<.0001	0.22
	Mixed	175	3.0	-0.37	0.10	0.0004	0.69
	Unclassified	67	1.2	-0.15	0.18	0.3849	0.86

Interpretation of Table A1: The table shows that the level of deprivation was a statistically significant predictor of the tier of entry. It shows that for candidates with the same prior attainment at KS2, the higher the level of deprivation the greater the probability of being entered for the foundation tier. An odds ratio of 2.00 for IDACI suggests that those high on this index had a high likelihood of being entered for the foundation tier. The results also show that for the candidates with the same prior attainment at KS2, females had a lower probability of being entered for the foundation tier than males; and that a higher KS2 mark in English indicated a somewhat lower probability of being entered for the foundation tier. The number of candidates in ethnic minority groups was very small compared to the White majority to give any meaningful results. However, overall it seems that for candidates with the same prior attainment at KS2, the minority groups were less likely to be entered for the foundation tier as compared to those classified as White.

Similar tables for the rest of the specifications are given below.

Table A2: English Literature
Number of candidates: F=5889, H=22467, Total=28356

Variables		N	%	Coefficient	Standard Error	p	Odds ratio
Constant				5.11	0.06	<.0001	
Gender	[M]	3394	57.6				
	F	2495	42.4	-0.36	0.02	<.0001	0.70
Prior attainment (KS2 English mark)				-0.11	0.00	<.0001	0.90
Level of deprivation (IDACI)				1.11	0.08	<.0001	3.05
Ethnicity	[White]	5010	86.4				
	Any other ethnic group	44	0.8	-0.93	0.12	<.0001	0.40
	Asian	296	5.1	-0.83	0.05	<.0001	0.44
	Black	192	3.3	-0.53	0.07	<.0001	0.59
	Chinese	10	0.2	-1.42	0.24	<.0001	0.24
	Mixed	183	3.2	-0.34	0.06	<.0001	0.72
	Unclassified	67	1.2	0.04	0.11	0.6732	1.05

Interpretation of Table A2: candidates from more deprived backgrounds were more likely to be entered for the foundation tier, even when prior attainment was controlled for. Girls were less likely to be entered for the foundation tier than boys.

Table A3: Mathematics A
Number of candidates: F=4827, H=10961, Total=15788

Variables		N	%	Coefficient	Standard Error	p	Odds ratio
Constant				8.11	0.10	<.0001	
Gender	[M]	2541	52.6				
	F	2286	47.4	-0.65	0.03	<.0001	0.52
Prior attainment (KS2 Science mark)				-0.13	0.00	<.0001	0.88
Level of deprivation (IDACI)				1.39	0.12	<.0001	4.01
Ethnicity	[White]	4230	89.5				
	Any other ethnic group	21	0.4	-1.35	0.21	<.0001	0.26
	Asian	178	3.8	-1.43	0.08	<.0001	0.24
	Black	106	2.2	-1.08	0.12	<.0001	0.34
	Chinese	8	0.2	-1.06	0.34	0.0016	0.35
	Mixed	134	2.8	-0.41	0.09	<.0001	0.67
	Unclassified	49	1.0	-0.03	0.17	0.8513	0.97

Interpretation of Table A3: candidates from more deprived backgrounds were more likely to be entered for the foundation tier, even when prior attainment was controlled for. Girls were less likely to be entered for the foundation tier than boys.

Table A4: Mathematics B Linear
Number of candidates: F=7901, H=6928, Total=14829

Variables		N	%	Coefficient	Standard Error	p	Odds ratio
Constant				7.37	0.13	<.0001	
Gender	[M]	4066	51.5				
	F	3835	48.5	-0.24	0.05	<.0001	0.79
Prior attainment (KS2 mathematics mark)				-0.12	0.00	<.0001	0.89
Level of deprivation (IDACI)				2.13	0.16	<.0001	8.41
Ethnicity	[White]	6993	89.6				
	Any other ethnic group	26	0.3	-1.02	0.39	0.0082	0.36
	Asian	325	4.2	-1.17	0.12	<.0001	0.31
	Black	149	1.9	-1.47	0.18	<.0001	0.23
	Chinese	3	0.0	-3.31	0.75	<.0001	0.04
	Mixed	253	3.2	-0.27	0.14	0.0520	0.76
	Unclassified	60	0.8	-0.48	0.25	0.0574	0.62

Interpretation of Table A4: candidates from more deprived backgrounds were much more likely to be entered for the foundation tier, even when prior attainment was controlled for. The effect of deprivation was much stronger for Mathematics B linear than other specifications included in the study. Girls were less likely to be entered for the foundation tier than boys.

Table A5: Core Science
Number of candidates: F=20021, H=35095, Total=55116

Variables		N	%	Coefficient	Standard Error	p	Odds ratio
Constant				6.36	0.04	<.0001	
Gender	[M]	10266	51.3				
	F	9755	48.7	-0.20	0.01	<.0001	0.82
Prior attainment (KS2 Science mark)				-0.12	0.00	<.0001	0.88
Level of deprivation (IDACI)				1.22	0.04	<.0001	3.38
Ethnicity	[White]	16520	82.7				
	Any other ethnic group	178	0.9	-1.04	0.06	<.0001	0.35
	Asian	1419	7.1	-0.67	0.02	<.0001	0.51
	Black	965	4.8	-0.78	0.03	<.0001	0.46
	Chinese	33	0.2	-1.35	0.12	<.0001	0.26
	Mixed	683	3.4	-0.28	0.03	<.0001	0.75
	Unclassified	177	0.9	-0.10	0.06	0.1265	0.91

Interpretation for Table A5: candidates from more deprived backgrounds were more likely to be entered for the foundation tier, even when prior attainment was controlled for. Girls were less likely to be entered for the foundation tier than boys.

Table A6: Additional Science
Number of candidates: F=11690, H=31554, Total=43244

Variables		N	%	Coefficient	Standard Error	p	Odds ratio
Constant				5.40	0.04	<.0001	
Gender	[M]	6038	51.6				
	F	5652	48.4	-0.19	0.01	<.0001	0.83
Prior attainment (KS2 Science mark)				-0.11	0.00	<.0001	0.89
Level of deprivation (IDACI)				1.14	0.04	<.0001	3.12
Ethnicity	[White]	9523	81.6				
	Any other ethnic group	115	1.0	-0.99	0.07	<.0001	0.37
	Asian	889	7.6	-0.63	0.03	<.0001	0.53
	Black	624	5.6	-0.75	0.03	<.0001	0.47
	Chinese	14	0.1	-2.18	0.18	<.0001	0.11
	Mixed	400	3.4	-0.35	0.04	<.0001	0.70
	Unclassified	112	1.0	-0.08	0.07	0.2223	0.92

Interpretation of Table A6: candidates from more deprived backgrounds were more likely to be entered for the foundation tier, even when prior attainment was controlled for. Girls were less likely to be entered for the foundation tier than boys.