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Do academically selective school systems strengthen the link between students' family backgrounds and the likelihood of higher education participation?

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ABSTRACT

Proponents of academic selection argue that academic selection helps children from disadvantaged backgrounds have better lifelong outcomes. However, the evidence needs to be clarified since selections by performance could be a proxy for selection by socioeconomic class. Based on the unique situation in England, where both selective and non-selective systems coexist, we evaluate whether students from selective schools are more likely to continue higher education than those in non-selective schools and whether the link between students' family backgrounds and their likelihood of higher education participation is stronger under a selective system. The results show that attending selective schools is associated with some post-18 advantages for pupils who stayed until the end of Key Stage 5, but brings disadvantages for those who left at earlier stages, even if we look at the upper bound of the selective school effect. Meanwhile, the link between students' family backgrounds and future opportunities is consistently stronger under the selective system.

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Introduction

Academic selection in an educational system is a practice where places in an educational institution are allocated based on academic ability. The grammar school system in England, for example, selects pupils based on their performance at a highly competitive entrance examination at the age of 11 (known as the 11-plus exam).

The grammar school system in England (a selective system that separates pupils into different educational tracks) has a long history. According to the 1944 Education Act, secondary education in England was selective nationally. Under this selective system, high-performing pupils usually attend grammar schools where pupils study for public exams (the General Certification of Education Examinations at O-level and A-level). Until the 1960s, pupils from grammar schools and elite fee-paying independent schools

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monopolised access to universities. In contrast, few pupils at modern secondary schools took public exams, and thus, opportunities for university entry were limited. These schools usually focused on practical subjects, such as basic literacy and numeracy, which are necessary for manual and more vocational jobs. Thus, grammar schools at that time were seen as the primary route to universities (Morris & Perry, 2017).

However, by the 1990s most grammar schools in England were converted into comprehensive schools. Today, only 163 grammar schools remain, accounting for only 5% of the pupils in the state education system in England (Bolton, 2017). This transition from a selective education system to a more comprehensive school resulted in an interesting situation where a selective system coexists alongside a non-selective education system in England. This situation offers a unique opportunity for researchers to examine the implications of this coexistence on educational policy, student outcomes and social equity.

The grammar school system in England, where admissions are based on performance on the 11-plus exam, has attracted criticisms from those who question whether such a meritocratic system is fair. The 11-plus is a standardised examination which tests students' problem-solving skills, including tests of verbal and non-verbal reasoning skills, and recently, maths and literacy were offered as well (Allen et al., 2017). Therefore, the system seems to be fair as selection is based on cognitive ability rather than social class and thus provides opportunities for high-performing children from disadvantaged backgrounds to gain access to higher education (HE) and better life outcomes (Mansfield, 2019). However, analyses of 11-plus results have shown that children on free school meals consistently do worse on such tests than their more privileged peers (Allen et al., 2017). These ability tests are not tutor-proof, as the developer of one of the 11-plus tests has declared (Miller, 2014). This means they are amenable to coaching. Pupils from more privileged backgrounds often had better access to resources and support to excel in such exams than their less privileged peers (Danhier & Martin, 2014; Goldsmith, 2011; Schmidt et al., 2015). Parents from more advantaged families often pay for private coaching or send their children to private schools where children are specially prepared for such admissions tests (Allen et al., 2017). Grammar schools are also typically located in more affluent areas (Andrews et al., 2016) and thus attract pupils from higher socioeconomic status (SES). It is also possible that parents from higher SES are able to afford to move to areas near grammar schools, which command higher property prices (Lu, 2018). Therefore, the higher academic outcomes of pupils in selective schools may not necessarily reflect the better quality of education but a consequence of selection by SES. Selection based on performance in such exams is seen as a covert way of social selection, a proxy for selection by social class (Andrews et al., 2016; Gardner & Cowan, 2000; Nye, 2016; Sibieta, 2016).

Consequently, the selective system has raised important questions and generated extensive research interest among academics concerned about equity in education and social mobility (Boliver & Capsda-Munsech, 2020). While some researchers have argued that the grammar school system gives pupils from lower socioeconomic backgrounds access to high-quality secondary education, elite HE and better life outcomes and improves social mobility for children from disadvantaged backgrounds (e.g. Mansfield, 2019), others contended that grammar schools, in fact, deepen social segregation and perpetuate inequity in access to HE and future employment opportunities (Boliver & Capsda-Munsech, 2020; Burgess et al., 2019).

Previous studies on the academic selection system and pupils' future opportunities usually compared children's academic outcomes or later salaries between selective

and non-selective schools within the selective system (e.g. Levaçić & Marsh, 2007; Schagen & Schagen, 2003). However, knowing this does not help us answer whether this entire selective system strengthens the link between pupils' backgrounds and HE participation compared to a non-selective system. The coexistence of selective and non-selective systems in England allows us to identify and compare the link between pupils' family backgrounds and their future opportunities under the two systems. Our study thus makes direct comparisons of the impact of pupils' backgrounds on HE participation between selective and non-selective systems. By comparing the link between pupils' backgrounds and academic outcomes under the two systems, we can say whether the selective system strengthens the impact of pupils' backgrounds on their later opportunities.

In this paper, we first assessed whether grammar schools are more effective than their non-selective counterparts in providing HE opportunities for their students. If grammar schools are more effective than comprehensive schools in improving HE participation, this, combined with selection by academic ability (and hence the socioeconomic backgrounds), could indeed widen the achievement gap between social groups and thus reinforce the link between pupils' family backgrounds and their future opportunities. Secondly, we directly evaluated how pupils' family backgrounds predict their later opportunities for HE participation in the selective and non-selective systems. We evaluated whether the impact of pupils' family backgrounds on post-18 opportunities is stronger under a selective system and whether academic selection reinforces the link between backgrounds and future destinations or indeed weakens the link.

Academic selection as a covert form of social selection exacerbates the link between family backgrounds and life opportunities

One of the primary aims of universal compulsory education is to equalise all children's access to education and reduce the link between family background and life opportunities for all (Gorard, 2010). Schools are intended to provide this opportunity (e.g. access to resources) that children from low-income families might otherwise not have. However, education outcomes, HE participation, and employment opportunities are strongly stratified by family background (Gorard & See, 2009). It is well-recognised that children from lower socioeconomic backgrounds start school behind their more privileged peers and are more likely to continue to fall behind their peers throughout their school career (Allen et al., 2017; Gorard & See, 2008). For example, a longitudinal study comparing British primary school students from 1921 to 2011 found that the influence of family SES on children's academic ability remained substantial (von Stumm et al., 2022).

There are no easy answers to this. Famously, Basil Bernstein explained that different social classes used different "codes", and those of the higher social class used "elaborated" codes to limit access to the education system they devised (Bernstein, 1964). Even though access to education is now open, children from lower class backgrounds who are used to the "restricted" codes employed by their family and social group may find the "elaborated" codes used in school a challenge. One of the most prominent theories explaining the persistent disadvantage that poor children experience at school is Bourdieu's (1977) theory on cultural capital and habitus. Bourdieu (1977) believed that parents from more privileged backgrounds have access to a kind of social or "cultural" capital, that they

invest in their children. For example, they have access to books, knowledge and resources that give their children a head start. Moreover, children's experiences in their environment or habitus shape their thoughts and behaviours. Children growing up in a household that loves reading and discussing ideas might develop a habit of reading and a desire to pursue knowledge (Bourdieu, 1977).

The ambition of grammar schools is to overcome family background by selecting children who excel academically, regardless of their background, through ability tests. But, as pupils' test results are very much patterned by social background (i.e. children from well-to-do, educated families tend to do better academically than their less privileged peers) for many reasons, including those identified by Bernstein (1964) and Bourdieu (1977), selecting children by ability may be a covert way of selecting by social background. Meanwhile, researchers have also questioned whether we can truly assess "ability", especially at an early age (Gardner & Cowan, 2000). While a pupil's test score is usually used as the indicator of academic ability, a short one-off exam is too simple to reflect pupils' learning experience over several years, especially when the test format is limited to written tasks, and the exam usually tests memorised facts only (Brown, 1995). Additionally, as we mentioned before, parents from more advantaged families could pay for private coaching to make their children well-prepared for ability tests, and test designers could also change the test content to make it more familiar to middle-class families (Gardner & Cowan, 2000). Hence, the selection of grammar schools not only does not equalise opportunities but also may actually exacerbate it.

As a result, there were stark differences in grammar school attendance by SES in England (Burgess et al., 2018). Burgess et al. (2018) found that less than 1% of those attending grammar schools in selective areas come from the most deprived 10% of families, while a quarter come from the most affluent 10%. Only less than 3% of grammar school students are eligible for free school meals, compared with 13.20% in the country (Andrews et al., 2016; Nye, 2016; Sibieta, 2016). A later study also confirmed that even if the grammar school selection process is relatively fair, stratification of early achievement still leads to a low probability of students from disadvantaged families attending grammar schools (Lu, 2018). This implied that if grammar schools are more successful in getting their students into post-18 education, the selection system might widen the achievement gap between different social groups and provide stratified post-18 opportunities for them.

Previous evidence on the impact of grammar schools on students' later opportunities

Apart from the question of who gets access to grammar schools, another fundamental issue is whether grammar schools are indeed more effective in raising pupils' academic performance. Schagen and Schagen (2003), for example, compared the Key Stage 3[1] (KS3) outcomes for pupils who were above average in their Key Stage 2[2] (KS2) assessment. These are children who might be in either grammar or modern secondary schools. They found that the expected KS3 outcomes for students in grammar schools are around half a level (8.62%) higher than students in comprehensive or modern secondary schools. Using multilevel modelling controlling for gender, age, and the school context, Levaçić and Marsh (2007) found that students educated in grammar schools gain 5.50 more general certificate of secondary education (GCSE) points than those in comprehensive schools. In contrast, those

who failed to attend grammar schools get 1.04 fewer GCSE points than those in comprehensive schools. Similarly, Atkinson et al. (2006) found that grammar school pupils obtain a 3.60 grade points bonus, raising total GCSEs from a grade of "C" to "B". The grade points bonus increases to 7.80 for pupils with just above average grades. Using logistic regression, Harris and Rose (2013) showed that studying in grammar schools will increase students' probability of successfully passing any GCSEs from 92.10 percent to 99.10 percent. For borderline students (high-performing pupils in secondary modern schools and low-performing pupils in grammar schools), the probability of successfully passing any GCSEs increased from 60.50 percent to 97.10 percent. Using a regression discontinuity design, Lu (2020) evaluated the effectiveness of grammar schools within one local area in England. The study reported that attending grammar school had a positive impact on children's academic attainment. However, because of the difference in the nature of selection across local authorities (LAs), the advantage of grammar schools in this single area could not be generalised to grammar schools in other areas. Different from conclusions from these studies, Gorard and Siddiqui's (2018) study suggested that grammar schools are no better than comprehensive schools. Attending grammar school does not accurately predict students' academic performance. Similarly, Coe and his colleagues (2008) observed that students in grammar schools had shown systematic academic advantages before being admitted to grammar schools. A more recent study noted that the high academic achievement of students in grammar schools is related to students' background characteristics, even after controlling for baseline variables (Leckie & Prior, 2022). To conclude, the actual effectiveness of grammar schools remains disputable.

Apart from evaluating academic performance, some studies have evaluated the impact of grammar schools on HE participation. Some of these studies suggested that grammar schools increased students' likelihood of HE participation. For example, Mansfield (2019) showed that although grammar schools offer only marginal advantages compared to comprehensive schools on progression to HE as a whole, grammar schools perform substantially better at enabling progression to highly selective universities. The differential advantage is even more apparent for progression to Oxbridge (Oxford and Cambridge universities). Similarly, Clark (2010) found that attending grammar schools had a positive impact on university enrolment, increasing the probability of students attending university by 19.90 percent for boys. Clark and Del Bono (2016) argued that grammar schools also positively impacted the number of years of completion of full-time education. Attendance at elite schools like grammar schools increases full-time education by one year and 0.80 years for men and women, respectively. A later study then concluded that the effect of grammar school on HE participation is somewhat mixed, and the estimated effect differs depending on the baseline variables used (Lu, 2021). The main factor influencing HE participation is still the pre-existing differences between pupils in grammar schools and those in non-selective schools (Leckie & Prior, 2022).

A handful of empirical studies have investigated whether attending grammar school in England strengthened/weakened the link between pupils' family backgrounds and their later opportunities. Boliver and Swift (2011) suggested that grammar school benefits low-income children in so far as it improves their likelihood of earning a higher income. However, it did not improve their social class as the benefit was only related to limited movements within the income distribution. Buscha and Gorman (2021) also found little or no evidence to support the contention that selective schools benefit social mobility.

Unfortunately, these studies still focused on the comparison between grammar schools and non-selective schools without comparing whether the link between pupils' family backgrounds and their later opportunities is stronger under a selective system than under a non-selective system. Based on the limited previous evidence on the issue, we will first evaluate whether grammar school attendance is associated with a more advantaged pattern of HE participation, and we then directly assess the link between pupils' family backgrounds and HE participation and compare the pattern between selective and non-selective systems.

Methods

Data

Our study used data on HE participation for the 2007/2008 KS2 cohort,[3] who finished Key Stage 4 (KS4) in 2012/2013 and Key Stage 5 (KS5) in 2014/2015 from the National Pupil Database (NPD). The NPD cohort is then linked to the 2015/2016 Higher Education Statistics Agency (HESA) data, which contains information about pupils' participation in HE. As the NPD data extract only includes pupils with valid KS5 records, it contains approximately 438,000 pupils, accounting for 70% of the total 633,000 cases in the same year. It needs to be noted that the NPD data for this cohort is only linked to the 2015/2016 HESA data. This means the analysis excludes those who did not start post-18 education immediately after finishing their KS5 but chose to attend HE institutions in later years. These are usually pupils from the most advantaged families (Hammer, 2003). However, as the proportion of returning pupils is low, only around 4%, according to Raffe et al. (2001), the omission would not make a substantial difference to the general pattern (although omitting a large proportion of more privileged pupils might decrease the estimated results for grammar schools).

Currently, only 36 local authorities (LAs) have grammar schools and select pupils at 11 years old. Therefore, this study defined selective LAs as local areas where grammar schools exist, while non-selective LAs are areas where there is no grammar school in this area and all secondary schools are comprehensive in nature. The analysis is then conducted on all pupils who finished KS5 in 2014/2015 in 36 selective LAs compared to those in non-selective LAs. Out of the total 612,027 cases within the whole cohort, there are 539,610 cases in mainstream state-funded schools (excluding special schools and independent schools). Among these pupils, 481,681 cases have complete records for all the information, such as students' background and attainment variables, as described below, and are thus included for analysis. Around 10% of cases were missing key background information, making imputation impossible. These were, therefore, excluded from the analysis. Omitting these would not substantially affect the overall results as the number is small.

Analysis

The results are presented in descriptive bivariate tabulations as well as in multi-stage binary logistic regressions. A binary logistic regression model predicts the probabilities of a binary outcome and provides the relative odds ratios. Although we used odds ratios, we did notice the discussion on using odds ratios or marginal effects by researchers. Odds ratios are used

here because we are comparing the odds of an event happening in selective and non-selective groups, whereas marginal effects tell us changes in the probability of the outcome variable (e.g. attending HE or not) as a result of a change in the independent variable. However, apart from the discussion on their differences, current studies have also noticed that both approaches can be converted into comparable effect sizes under certain circumstances, using a simple formula (Chinn, 2000). Although there is no perfect regression approach, and the methods of using odds ratios in logistic regression models have been criticised by researchers for reasons such as their susceptibility to missing variables and difficulty in measuring the degree of heterogeneity not observed in the model (Mood, 2010), we noticed that most previous studies on the impact of grammar school on pupils' post-16/18 outcomes (dichotomous variables) have used this technique (Coe et al., 2008; Gorard & Siddiqui, 2018; Harris & Rose, 2013; Lu, 2021; Mansfield, 2019). In order to present results comparable to previous studies and to understand the mixed evidence so far, this study chose a regression approach similar to previous studies. To make the estimation more accurate, we considered as many relevant variables as possible and applied population data instead of merely selecting a small group of samples. After mapping the field, we think a later study using other regression approaches (such as average marginal effects) would be beneficial, and a more systematic discussion on how the estimation differs when we use different regression techniques would be meaningful, as we mention in the limitation section as well.

To determine whether attending grammar schools is associated with a higher likelihood of attending HE and entrance to more selective universities, we analysed the data using multi-stage binary logistic regression analysis where we added explanatory variables in stages to see how much each variable explains the outcome, controlling for the other variables. The most important outcome indicators in the model are 1) an increase in the percentage correctness, which reveals how knowing certain sets of background variables increases the predictive ability of the model (or the pseudo-r-square), and 2) the Exp (B) of certain baseline variables (school type in this study), which compares the odds of HE participation for one group of pupils with the odds for another pupil group, producing an odds ratio.

Four sets of explanatory variables are used for these analyses. They are:

- KS2 pupil backgrounds and attainment
- School type (in grammar schools or not)
- KS4 pupil backgrounds and attainment
- KS5 pupil backgrounds and attainment

The explanatory variables are added in chronological order with pupils' KS2 backgrounds and attainment results first, including gender, month age, IDACI score (Income Deprivation Affecting Children Index),[4] FSM eligibility (Free School Meal),[5] SEN-PS (SEN School Action Plus),[6] EAL (English as an additional language) group, ethnicity (converted to dummy variables in reference to white pupils); and KS2 attainment variables. We noticed that KS2 might not be a proper measurement as these tests are taken around 6 months after children know whether they will attend grammar school or not and might be impacted by the results. However, this is the best available indicator in the national dataset, as the selection results of grammar schools are unavailable (also

cannot be compared with each other as LAs have different selection processes). We then included school types to distinguish grammar school pupils from others. In this categorical variable, we paid attention to pupils in grammar schools for both KS4 and KS5 education, those in grammar schools for KS4 education only, and those in grammar schools for KS5 education only. Overall, these variables help us distinguish whether attending grammar schools is associated with advantages in HE participation outcomes.

We then included their KS4 and KS5 backgrounds and attainment at later stages in order to see how the difference could be explained by their later development and examined whether universities might prefer pupils from grammar schools even if they share similar backgrounds and attainment at KS4 and KS5. Since IDACI and SEN provisions are stable at each stage, while FSM eligibility varies at each stage, we included FSM eligibility at KS4 and KS5 in the model. Therefore, the third stage includes pupils' KS4 FSM eligibility and their capped GCSE point score. For pre-2014 GCSE results, grade G equals 16-point scores, and the interval between each grade is 6-point scores, much higher than the scales for 2016 and 2017. The last stage includes the pupils' KS5 FSM eligibility, their A-level total point score, and the number of facilitating subjects in A-level tests. After adding these baseline variables, we no longer include school compositional variables to avoid over-controlling since we have already considered baseline variables from KS2 to KS5. It is also difficult to decide how to calculate compositional variables due to changes in student composition from KS2 to KS5.

The two binary outcome variables or dependent variables are attended university or not, and attended elite universities—Russell Group universities[7] or not. The information on whether pupils went to universities and the type of institutions they attended is provided in the 2015/2016 HESA data extract. After matching the NPD data with the HESA data, pupils with valid records in the HESA data are flagged as HE participants. The institution names in the HESA dataset are used to identify pupils in the Russell Group universities. We did not report standard errors or confidence intervals because, in this study, we analysed population data. Since standard errors (and, hence, confidence intervals) are based on the assumption that we are working with a sample drawn from a broader population, to help guide us in understanding whether we would expect a difference of the size seen or greater due to sampling variation alone, its interpretation in the context of population data is unclear, since there is no sample and, hence, no sampling error. As such, significance tests/standard errors/confidence intervals were not presented in the main text.

The second analysis is to see whether the link between participation in HE or selective universities and students' backgrounds is stronger for students attending grammar schools. We used the same variables and models described above to compare the predictive ability of pupils' backgrounds on HE participation for students in selective and non-selective systems. Meanwhile, we compared the correlation between the attainments of students at each of the four Key Stages in selective and non-selective regions and for FSM-eligible students in selective and non-selective areas.

Results

The descriptive results of HE participation and students' characteristics

Of the 117,506 pupils included for analysis, about 51,016 (43.42%) can be matched to HESA data, indicating that they are registered HE students and are likely to enroll in

universities. Among pupils with HE participation records in 2015, about 15,722 are in the Russell Group universities, accounting for 13.38% of the total number of pupils of this KS5 year group and 30.82% of all the HE participants included for analysis.

The rate of HE participation of pupils in grammar schools is considerably higher than the average rate of state schools in selective LAs. As mentioned before, pupils in grammar schools in KS4 may not continue to stay in these schools in KS5. There are slight differences in the number of pupils who entered universities. For pupils in grammar schools in KS4, 66.70% of them went to universities in 2015, and 35.40% were admitted into the Russell Group universities (Table 1). The rate is higher for KS5 grammar school pupils. 70.30% participate in HE after finishing KS5, including 37.50% in the Russell Group. For pupils who were in grammar schools during both KS4 and KS5, their rates are similar to KS5 grammar school pupils, with the proportion being 71.20% and 38.90%, respectively. The overall tendency shows that grammar school pupils have higher HE participation chances, and about half of the HE participants were admitted into the Russell Group universities.

However, those who left grammar schools at KS5 were more successful regarding the rate of HE participation and the Russell Group application than those who left at KS4. Nevertheless, grammar school pupils are more likely to participate in HE and attend a Russell Group university than the average in both selective and non-selective areas.

The analysis presents the characteristics of pupils with different HE participation patterns (Table 2). Patterns of HE participation differ among students from different socioeconomic backgrounds and attainment. Pupils from higher socioeconomic backgrounds with higher academic attainment are more likely to attend HE than those with lower attainment and from less advantaged backgrounds. Even among those who attend HE, grammar school pupils tend to have better degree outcomes than those not from grammar schools. The patterns are consistent in terms of family backgrounds and attainment at both KS4 and KS5.

As grammar school pupils tend to have higher attainment scores at KS4 and KS5, it is reasonable to expect them to have a higher chance of participating in HE and a greater likelihood of attending the Russell Group universities. The following models explore whether the favourable HE participation results for grammar school pupils can be explained by the type of secondary school they attended and how much of it is explained by their backgrounds. We conducted two logistic regression analyses, the first was to estimate how much students' prior academic performance and family backgrounds explain participation in HE or not, and the second was to explain the likelihood of attendance in a Russell Group university.

Table 1. HE participation patterns by types of school and local authorities.

	The percentage of HE participation	The percentage of attending the Russell Group universities
KS4 Grammar school pupils	66.7%	35.4%
KS5 Grammar school pupils	70.3%	37.5%
Both KS4 and KS5 Grammar school pupils	71.2%	38.9%
Average of selective LAs	43.3%	13.4%
Average of non-selective LAs	39.9%	9.8%

Table 2. Characteristics of pupils with different HE participation patterns in selective LAs.

		IDACI	FSM	SEN	EAL	KS2 total mark	Capped GCSE point score (pre-2014 scale)
Grammar schools	Non-participants	0.14	3%	1.3%	9%	159	402
	HE participants	0.12	2%	0.7%	12%	165	430
	The Russell Group participants	0.11	2%	0.6%	12%	170	446
Non-selective schools in selective LAs	Non-participants	0.20	12%	5.7%	11%	126	358
	HE participants	0.18	9%	2.7%	17%	140	393
	The Russell Group participants	0.15	6%	1.6%	16%	156	427
Average of selective LAs	Non-participants	0.1928	10.92%	5.172%	10.76%	129.96	363.28
	HE participants	0.1728	8.16%	2.46%	16.4%	143	397.44
	The Russell Group participants	0.1452	5.52%	1.48%	15.52%	157.68	429.28
Average of non-selective LAs	Non-participants	0.20	11%	4.3%	12.7%	134	373
	HE participants	0.19	9%	2.7%	17.9%	142	394
	The Russell Group participants	0.15	5%	1.5%	14.9%	158	446

Note: LA = Local Authority; IDACI = Income Deprivation Affecting Children Index, measures the proportion of all children aged 0 to 15 living in income-deprived families, ranges from 0-1; FSM = free school meals; SEN = special educational needs; EAL = English as an additional language; KS2 total mark = Key Stage 2 total mark of English and math; GCSE = General Certificate of Secondary Education; Non-participants = pupils with no record in higher education; HE participants = pupils with enrolment records in higher education; The Russell Group participants = pupils with enrolment records at the Russell Group universities.

Does attending grammar school increase students' chances of attending HE?

As 56.50% of pupils in selective LAs had participated in HE, this means that in the absence of further information, we can predict with 56.50% accuracy who is likely to go to HE or not just by guessing. If we know pupils' KS2 backgrounds and their attainment at KS2, we can increase the predictive accuracy of the model to 65.80% (Model 1 in Table 3). This increases the accuracy of our prediction by 9.30%. When school type is included, the total accuracy of the prediction reaches 66.90% (Model 2). The inclusion of school type accounts for 1.10% of the total variation.

Adding KS4 backgrounds and attainment into the model further takes up 2.60% of the total variation, which increases the accuracy of the model from 66.90% to 69.50% (Model 3). The final model (Model 4) adds KS5 backgrounds and attainment data. This increases the predictive accuracy by 6.80%, from 69.50% to 76.30%. Although the predictive ability of KS5 backgrounds and attainment may already be accounted for by pupils' KS2 and KS4 backgrounds and attainment in the previous stages, adding KS5 backgrounds and attainment variables further increases the predictive ability. This analysis

Table 3. Predictive accuracy of the logistic regression models of HE participation.

Model	Variables	Percentage correctness	Percentage of remaining variation explained
	Base figure	56.5	–
Model 1	KS2 baseline variables	65.8	9.3
Model 2	School type (in grammar schools or not)	66.9	1.1
Model 3	KS4 baseline variables	69.5	2.6
Model 4	KS5 baseline variables	76.3	6.8
	Overall	76.3	19.8

shows that the strongest predictor of pupils' HE participation is their KS2 and KS5 backgrounds and attainment. However, some unexplained variations remain even if pupils' backgrounds and attainment from KS2 to KS5 have been accounted for.

We then look at the estimated odds ratio of school type (the detailed results of the regression outcomes are included in Appendix 2). Model 2 (Table 4) includes school type to see whether attending grammar schools after KS2 correlates with any advantage in HE participation for pupils from similar family backgrounds and those with the same performance levels at KS2. We noticed that controlling for family backgrounds and KS2 attainment, the odds for pupils who went to grammar schools after KS2 and stayed in grammar schools until the end of KS5 are about 2.10 times as likely as equivalent pupils in non-selective state schools to participate in HE seven years later. It shows a strong positive correlation between grammar school attendance and HE participation. For pupils who only attended grammar schools during KS5, the odds are also twice as high as their counterparts with equivalent KS2 backgrounds and attainment in non-selective schools. However, for pupils who attended grammar schools only at KS4 and left afterward, the odds are only about 39.9% as their counterparts in non-selective schools to attend HE after accounting for KS2 backgrounds and attainment. We observed that pupils who left grammar schools after KS4 probably did not perform well enough to stay on at the end of KS4. Their GCSE capped point scores are 12% lower than the average in grammar schools. Around 5.60% of this group are FSM-eligible pupils, much higher than the average of 2.60% in grammar schools. This suggests that grammar schools might systematically exclude low-performing and disadvantaged pupils, presenting a creaming-off effect. What is left are high-performing students from more advantaged backgrounds. Suppose we included the group that left before KS5 (possibly because they did not meet the stringent academic criteria of grammar schools); the proportion of grammar school students who do not continue to HE would be higher. The dramatically lower rate of HE participation of pupils who left grammar schools, compared with their counterparts in non-selective schools, implies that they might be systematically less willing to continue study or academically unready for HE, showing how the overall advantage is at the high cost of others under this "meritocratic" system. This suggests the potential risk of the selection system. Even if pupils were initially admitted into grammar schools, if they are not well adapted to these highly competitive schools, their post-18 results might be substantially worse than peers in non-selective schools.

Controlling for the background variables and attainment at KS4 (Model 3), we found that the odds of HE participation for pupils who stayed in grammar schools at both

Table 4. Logistic regression models of HE participation.

Variables	Model 1	Model 2		Model 3		Model 4	
	Control	Control		Control		Control	
KS2 baseline variables	Yes	Yes		Yes		Yes	
KS4 baseline variables				Yes		Yes	
KS5 baseline variables						Yes	
		Predictive results					
School type (in grammar schools or not)	–	B	Exp(B)	B	Exp(B)	B	Exp(B)
Both KS4 and KS5	–	0.741	2.097	0.415	1.514	−0.011	0.989
KS4 only	–	−0.919	0.399	−0.668	0.513	−0.221	0.802
KS5 only	–	0.697	2.008	0.3	1.349	−0.144	0.866

KS4 and KS5 were still higher than those in non-selective schools. The comparison between Model 3 and Model 2 demonstrates that the raw advantage of attending grammar schools for pupils with equivalent attainment and from similar family backgrounds at the end of KS2 has been primarily accounted for by the better GCSE result of grammar school pupils at the end of KS4. Compared with the pupils with similar KS2 and KS4 backgrounds and attainment in non-selective schools, the odds for pupils who only attended grammar schools during the KS5 period were 1.35 times higher to participate in HE than the latter.

Adding students' backgrounds and attainment at KS5 after controlling for KS2 and KS4 variables, pupils who went to grammar schools after KS2 and stayed in grammar schools before the end of KS5 were very similar to others in non-selective schools, reflecting the predominant role of KS5 attainment in predicting pupils' HE participation (although we need to acknowledge the possibility of ceiling effects). There is no evidence that universities favour grammar school pupils more than others if they share similar attainment.

Does attending grammar school increase students' chances of attending a Russell Group university?

This section attempts to answer whether attending grammar schools is associated with higher chances of attending a Russell Group university. The outcome variable is whether to attend Russell Group universities or not. The explanatory variables are students' backgrounds, KS2, KS4 and KS5 attainment and whether they attend grammar school. However, due to the small number of pupils in the Russell Group universities compared with the whole population of this year's group in selective LAs, the prediction accuracy at baseline is high (87%), leaving small spaces for growth when different sets of explanatory variables are entered into the model. After adding KS2 backgrounds and attainment, the prediction accuracy of the model grows from 87% to 87.60% (Model 5 in Table 5), and the growth brought from introducing school type into the model is only 0.10% (Model 6). The increase is slightly more apparent when KS4 backgrounds and attainment are added, reaching 89% (Model 7). The last model experiences a minor growth after KS5 backgrounds and attainment are included, with the final prediction accuracy of the model being 90.40% (Model 8). The detailed results of the regression outcomes are included in Appendix 1.

After accounting for pupils' prior primary differences at KS2 (Model 5 in Table 6), whether they went to grammar schools or not is added to Model 6. Although adding

Table 5. Predictive accuracy of Russell Group universities participation.

Variables	Percentage correctness	Percentage of remaining variation explained
Base figure	87	–
KS2 baseline variables	87.6	0.6
School type (in grammar schools or not)	87.7	0.1
KS4 baseline variables	89	1.3
KS5 baseline variables	90.4	1.6
Overall	90.4	3.4

this variable brings a minor increase to the overall prediction accuracy, the odds ratio also shows that after accounting for backgrounds and attainment at KS2, those who attended grammar schools have higher rates of going to elite universities. Specifically, for pupils who went to grammar schools after KS2 and stayed there at KS5, the odds of entering the Russell Group seven years later are 1.38 times as high as equivalent pupils in non-selective schools. It indicates a positive correlation between grammar school attendance and the participation rate of the Russell Group. Compared with pupils with similar KS2 backgrounds and attainment in non-selective schools, those who only attended grammar schools in KS5 have advantages in attending elite universities in the future, with the odds ratio being 1.56.

However, those who left grammar school after KS4 are less likely to gain entry to Russell Group universities than those in non-selective schools. Attending grammar school up to KS4 did not accord them any more advantage than equivalent students in non-selective schools. As we mentioned previously, this is not surprising as pupils who left grammar schools after KS4 are usually those who did not perform well enough in their GCSE exam to stay on. The pattern, again, suggests that grammar schools might be systematically excluding low-performing and disadvantaged pupils, intentionally or unintentionally, under this "meritocratic" system.

In Model 7, after including KS4 backgrounds and attainment, the advantage of grammar school pupils in attending elite universities for certain pupil groups remains unchanged. This reveals that about half of the advantages of grammar school attendance can be explained by their pupils' superior attainment at the end of KS4. Model 8 adds KS5 backgrounds and attainment on the basis of Model 7. The result shows that attending grammar schools is still associated with a slight advantage in attending elite universities for some pupils. But again, grammar school pupils who left before KS5 ended are less likely to attend elite universities than those who stayed until KS5. Their participation rate in elite universities is also lower than students in non-selective schools. For students who only attended a grammar school at KS5, their odds of attending elite universities are slightly reduced but marginally higher (1.23) than pupils in non-selective schools.

Findings about the link between pupils' family backgrounds and HE participation in selective and non-selective LAs

Previous sections have evaluated the different outcomes of attending grammar and non-selective schools. This section directly considers the link between family backgrounds and pupils' post-18 destination in various types of LAs.

Table 6. Logistic regression models of Russell Group universities participation.

Variables	Model 5	Model 6		Model 7		Model 8	
	Control	Control		Control		Control	
KS2 baseline variables	Yes	Yes		Yes		Yes	
KS4 baseline variables				Yes		Yes	
KS5 baseline variables						Yes	
		Predictive results					
School type (in grammar schools or not)	–	B	Exp(B)	B	Exp(B)	B	Exp(B)
Both KS4 and KS5	–	0.319	1.376	0.319	1.376	0.084	1.087
KS4 only	–	−0.683	0.505	−0.683	0.505	−0.275	0.76
KS5 only	–	0.447	1.564	0.447	1.564	0.203	1.225

The analysis first presents the correlation between pupils' attainment at different key stages (Table 7). For pupils in non-selective LAs, the correlation coefficient between KS2 and KS4 attainment is 0.56. It is weaker for KS2 and KS5 performance, which is 0.48. In contrast, the patterns in selective LAs reveal a closer connection between attainment at different stages. The correlation coefficient is 0.59 between KS2 and KS4 performance and 0.53 between KS2 and KS5 performance. Overall, the correlation between any two stages is stronger in selective LAs than in non-selective areas. This means that pupils who perform higher at earlier ages in selective LAs are also more likely to have better attainment at the end of secondary education than those in non-selective LAs. The stronger correlation between different stages means pupils at an initial disadvantage and with low early-age performance are less likely to catch up at later stages in selective LAs.

Then, the analysis presents the correlation between pupils' attainment at different key stages in FSM student groups (Table 8). For pupils in non-selective LAs, the correlation coefficient between KS2 and KS4 attainment is 0.43. It is slightly weaker for KS2 and KS5 performance, which is 0.36. Similarly, patterns in selective learning outcomes reveal a closer relationship between outcomes at different stages. The correlation coefficient is 0.45 between KS2 and KS4 performance and 0.41 between KS2 and KS5 performance. Generally, the correlation between any two stages in selective LAs is more substantial than in non-selective regions.

In addition to revealing the correlation figures, the results of the logistic regression models predicting pupils' HE participation patterns are also presented (Table 9). While in non-selective LAs, knowing pupils' family backgrounds and attainment at KS2 increases the prediction accuracy of the model by 8.30%, the coefficient for selective LAs is slightly higher, which is 8.90%. When the total unexplained variance is taken into account, KS2 pupil-level variables in non-selective LAs constitute 19.50% of the unexplained part. In contrast, the rate in selective LAs is 18.10%. Therefore, the models indicate that early-age backgrounds have a more substantial role in predicting the rate of HE participation in selective LAs than in non-selective LAs.

Although the difference in HE participation between the two types of LAs seems minor, the results of attending the Russell Group universities are more obvious (Table 10). Adding KS2 pupil-level variables increases the prediction accuracy by only 0.20% in non-selective LAs, but the rate for selective LAs is 1.20%. Considering the total unexplained variation in both areas, KS2 pupil-level variables account for 3.50% of the unexplained part in non-selective LAs and 5% in selective LAs. Therefore, in selective LAs, the link between pupils' KS2 baseline variables and post-18 destination is stronger than in non-selective LAs. The patterns are consistent both in terms of the general HE participation rate and the rate of elite university attendance.

Table 7. Correlation of attainment at different key stages in selective and non-selective Las.

	KS2 attainment	KS4 attainment	KS5 attainment
Non-selective LAs			
KS2 attainment	1	0.56	0.48
KS4 attainment	–	1	0.59
KS5 attainment	–	–	1
Selective LAs			
KS2 attainment	1	0.59	0.53
KS4 attainment	–	1	0.62
KS5 attainment	–	–	1

Table 8. Correlation of attainment at different key stages in selective and non-selective LAs for FSM students.

	KS2 attainment	KS4 attainment	KS5 attainment
Non-selective LAs			
KS2 attainment	1	0.426	0.358
KS4 attainment	0.426	1	0.447
KS5 attainment	0.358	0.447	1
Selective LAs			
KS2 attainment	1	0.444	0.409
KS4 attainment	0.444	1	0.474
KS5 attainment	0.409	0.474	1

To conclude, the analysis above has demonstrated that attending selective schools has mixed effects on their pupils. While attending selective schools is associated with some advantages in HE participation for some pupils, such as those who stayed until the end of KS5, it brings disadvantages for those who left selective schools before the end of KS5 (this group is also overrepresented by FSM pupils). The educational benefits and the costs of failure of attending grammar schools are therefore distributed unevenly among pupils. Unlike this mixed effect, we also noticed that the connection between pupils' backgrounds and later destinations is consistently closer under selective systems than non-selective systems. This means separating pupils into different secondary schools according to their early-age academic ability may tighten the connection between earlier and later attainment and the link between early-age backgrounds and later destinations. While the broader social contexts may influence the differentiated patterns between the two types of LAs within each area, the evidence did not suggest that the selective system is more equitable at redistributing educational resources than a non-selective system.

Conclusion

For pupils who stayed in grammar schools during both KS4 and KS5 or only KS5, attending grammar schools positively affects their future participation in HE and elite universities. When the existing differences are controlled, the initial advantages of grammar schools in attending HE and the Russell Group substantially reduce. As more control variables

Table 9. Predictive accuracy of logistic regression models of HE participation in selective and non-selective LAs.

Variables	Percentage correctness	Percentage of remaining variation explained
Selective LAs		
Base figure	54.7	–
KS2 pupil variables	63.6	8.9
KS4 pupil variables	66.1	2.5
KS5 pupil variables	72.8	6.7
Overall	72.8	18.1
Non-selective LAs		
Base figure	52.8	-
KS2 pupil variables	61.1	8.3
KS4 pupil variables	64.3	3.2
KS5 pupil variables	72.3	8
Overall	72.3	19.5

Table 10. Predictive accuracy of logistic regression models of attending the Russell Group universities in selective and non-selective LAs.

Variables	Percentage correctness	Percentage of remaining variation explained
Selective LAs		
Base figure	81.9	–
KS2 pupil variables	83.1	1.2
KS4 pupil variables	85.1	2
KS5 pupil variables	86.9	1.8
Overall	86.9	5
Non-selective LAs		
Base figure	85.5	–
KS2 pupil variables	85.7	0.2
KS4 pupil variables	87.1	1.4
KS5 pupil variables	89	1.9
Overall	89	3.5

are added, the estimated value of grammar school decreases gradually, but the advantage still exists to some extent for this group. In contrast, pupils who left grammar schools before KS5 (this group is overrepresented by FSM pupils), are no more likely to continue to post-18 education than pupils in non-selective schools, as the analysis reveals their substantial disadvantages in HE participation. This suggests the potential risk of the selection system, even for high-performing pupils who initially pass the selection of grammar schools.

The findings thus reveal that the educational benefits and the costs of failure of attending grammar schools are distributed unevenly among pupils. The pattern is compounded by the fact that grammar schools are already overrepresented by socially advantaged pupils (Allen et al., 2017; Lu, 2018). This implies that the academic selection at the age of 11 may reinforce the influence of family backgrounds on HE participation. The pattern is also confirmed by the link between pupils' early-age attainment and later performance. Compared with pupils in non-selective LAs, the attainment of pupils at KS4 and KS5 in the selective LAs is more closely related to their earlier performance at KS2. Pupils with higher performance in the early stage are also more likely to get better grades at the end of secondary education in selective LAs. Similarly, students with initial disadvantages and lower performance in the early stage have difficulty in catching up in the later stage under the selective system. A consistent pattern was also observed in the FSM group. The pattern is repeatedly confirmed by the stronger predictive ability of pupils' early-age backgrounds on their HE participation patterns in selective LAs than in non-selective LAs.

Overall, the evidence does not support the claim that academic selection and the proposed meritocratic system would narrow the attainment gap and promote social mobility. Conversely, we believe the selective system may perpetuate or even reinforce social inequalities. The findings are contrary to some previous studies showing how a selective system provides more opportunities for low SES pupils (e.g. Mansfield, 2019), but consistent with others suggesting that selection based on performance in ability tests can be a covert way of social selection and a proxy for selection by social class (Andrews et al., 2016; Gardner & Cowan, 2000; Nye, 2016; Sibieta, 2016). This indicates that academic selection cannot be regarded as a mechanism to promote the educational opportunities of most lower-class and even middle-class children. Our study also implies that policies relying on expanding grammar schools (or the selection system) are unlikely to

promote social equity and mobility. A more comprehensive compulsory education would allow the state education system more time to compensate for the initial disadvantages of pupils with low attainment at early ages.

Limitations

As with all research using secondary population data, there are issues with the data quality that must be acknowledged. For example, pupil background variables, such as FSM, can change over time as our study covers an extended period (although we included FSM status at three stages). Pupils eligible for FSM in one period may not be eligible in another period. This could be due to the temporary unemployment of their parents. Changes in FSM eligibility criteria also mean that those who were previously not eligible may become eligible in later years. Also, as FSM status needs to be reported by the parents, some low-income families may be eligible but do not declare. FSM is not a reliable measure of family income. Perhaps a better measure would be long-term disadvantage, i.e. pupils who are eligible for FSM throughout their time in school.

For a more accurate evaluation, more variables are needed to control for pre-existing differences since grammar schools might be selective in terms of social class, parental education and/or income, dimensions that cannot be captured in our current variables due to data limitation. More direct measures of parental backgrounds, such as parents' educational background, qualifications, types of universities attended, and household income, would be needed to account for the cultural capital background of the pupils. These measures are currently not available on the national pupil database.

Future research, therefore, could consider linking NPD with household survey data to get a more granular assessment of household conditions. We also believe if we have access to a more robust proxy variable of household condition (instead of entering a set of background variables), it would be helpful to include interaction terms in future studies as well. Lastly, as we mainly use logistic regression in this study, we believe a more systematic discussion on how the estimation differs when we use different regression techniques would be meaningful.

Notes

1. Key Stage 3 refers to the first three years of secondary school education in England and Wales for pupils aged 11 to 14.
2. Key Stage 2 is the last year of primary school and refers to the four years of primary school in England and Wales, generally known as Year 3 to Year 6 when the pupils are aged between 7 to 11 years.
3. Key Stage 2 cohort refers to those in the last year of primary education when children are aged 10 to 11. Key Stage 4 cohort refers to those in the last year of secondary education when children are aged 15 to 16. Key Stage 5 cohort are those in the last year of post-secondary education (aged 17 to 18).
4. The IDACI Score indicates the proportion of children living in income-deprived families. Each school has a grade, the average IDACI score for all enrolled students. The IDACI scores of these schools are ranked from high to low and are divided into five equal parts to represent the overall poverty level. Quintile 1 refers to the school with the lowest IDACI score of 20% (the poorest level, level 5), and quintile 5 refers to the school with the highest 20% (the lightest level, level 1).

5. The FSM indicates how many students in a school come from low-income families. The higher the number, the more students from low-income families in the school.
6. School Action refers to the provision of additional support for children by schools from existing staff or resources. This may include providing children with group work on specific subjects, watching learning guidance, or obtaining additional assistance from teaching assistants in the classroom, with the support of teachers or teaching assistants. School Action Plus includes hiring external experts (educational psychologists and professional teachers). Teenagers can also receive regular support from learning support assistants or teaching assistants.
7. The Russell Group university refers to 24 world-class, research-intensive universities with substantial social, economic and cultural impacts locally, across the UK and around the globe.

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Appendices

Appendix 1. Detailed logistic regression models of HE participation

VARIABLES	Model 1		Model 2		Model 3		Model 4	
	B	Exp (B)	B	Exp (B)	B	Exp (B)	B	Exp (B)
EAL	0.392	1.479	0.379	1.46	0.254	1.289	0.129	1.137
ETHNIC								
AOEG	0.565	1.759	0.494	1.639	0.331	1.393	0.2	1.222
ASIA	0.697	2.009	0.625	1.869	0.551	1.735	0.563	1.757
BLAC	0.916	2.5	0.854	2.348	0.831	2.295	0.789	2.2
CHIN	1.271	3.564	1.1	3.005	0.889	2.432	0.772	2.164
UNCL	0	1	−0.037	0.963	−0.015	0.985	−0.063	0.939
MIXED	0.295	1.342	0.272	1.313	0.237	1.268	0.238	1.269
FSM	−0.22	0.802	−0.193	0.825	−0.12	0.886	−0.062	0.94
IDACI	−0.845	0.429	−0.69	0.501	−0.498	0.608	0.16	1.174
ENGLISH TOTAL MARK	0.029	1.03	0.025	1.026	0.013	1.013	0	1
MATH TOTAL MARK	0.015	1.015	0.012	1.012	0.002	1.002	−0.001	0.999
SCIENCE TOTAL MARK	0.013	1.013	0.012	1.013	0.005	1.005	−0.002	0.998
GENDER	0.259	1.295	0.248	1.282	0.064	1.066	0.021	1.021
MONTH AGE	−0.018	0.982	−0.017	0.983	−0.015	0.985	−0.004	0.996
SEN								
ACTION	0.013	1.013	−0.021	0.98	−0.036	0.964	−0.054	0.948
ACTION PLUS	0.046	1.047	0.005	1.005	−0.026	0.975	−0.077	0.925
STATEMENT	0.123	1.13	0.092	1.097	0.095	1.099	−0.016	0.984
KS4 GCSE CAPPED					0.015	1.016	0.006	1.006
KS4 FSM					−0.049	0.952	−0.08	0.923
A-LEVEL TOTAL POINT SCORE							0.003	1.003
NUMBER OF FACILITATING SUBJECTS IN A-LEVEL							0.051	1.053
KS5 FSM							0.253	1.288
SCHOOL TYPE (IN GRAMMAR SCHOOLS)								
BOTH KS4 AND KS5			0.741	2.097	0.415	1.514	−0.011	0.989
KS4 ONLY			−0.919	0.399	−0.668	0.513	−0.221	0.802
KS5 ONLY			0.697	2.008	0.3	1.349	−0.144	0.866

Appendix 2. Detailed logistic regression models of the Russell Group universities participation

VARIABLES	Model 5		Model 6		Model 7		Model 8	
	B	Exp (B)	B	Exp (B)	B	Exp (B)	B	Exp (B)
EAL	0.407	1.502	0.15	1.161	0.15	1.161	0.041	1.042
ETHNIC								
AOEG	0.623	1.864	0.139	1.149	0.139	1.149	−0.006	0.994
ASIA	0.581	1.788	0.205	1.228	0.205	1.228	0.186	1.205
BLAC	0.686	1.986	0.426	1.531	0.426	1.531	0.451	1.57
CHIN	1.187	3.277	0.563	1.756	0.563	1.756	0.507	1.661
UNCL	0.145	1.157	0.129	1.138	0.129	1.138	0.124	1.132
MIXED	0.35	1.419	0.24	1.272	0.24	1.272	0.234	1.264
FSM	−0.273	0.761	−0.089	0.915	−0.089	0.915	0.001	1.001
IDACI	−1.841	0.159	−1.095	0.335	−1.095	0.335	−0.477	0.621
ENGLISH TOTAL MARK	0.053	1.055	0.023	1.023	0.023	1.023	0.014	1.014
MATH TOTAL MARK	0.044	1.045	0.012	1.012	0.012	1.012	0.005	1.005
SCIENCE TOTAL MARK	0.047	1.048	0.015	1.016	0.015	1.016	0.003	1.003
GENDER	0.134	1.143	−0.212	0.809	−0.212	0.809	−0.073	0.93
MONTH AGE	−0.033	0.968	−0.024	0.976	−0.024	0.976	−0.007	0.993
SEN								
ACTION	−0.049	0.952	−0.069	0.933	−0.069	0.933	−0.061	0.941
ACTION PLUS	0.001	1.001	−0.003	0.997	−0.003	0.997	0.01	1.011
STATEMENT	0.362	1.436	0.397	1.487	0.397	1.487	0.31	1.364
KS4 GCSE CAPPED			0.033	1.034	0.033	1.034	0.016	1.016
KS4 FSM			−0.044	0.957	−0.044	0.957	0.009	1.009
A-LEVEL TOTAL POINT SCORE							0.003	1.003
NUMBER OF FACILITATING SUBJECTS IN A-LEVEL							0.516	1.675
KS5 FSM							0.003	1.003
SCHOOL TYPE (IN GRAMMAR SCHOOLS)								
BOTH KS4 AND KS5			0.319	1.376	0.319	1.376	0.084	1.087
KS4 ONLY			−0.683	0.505	−0.683	0.505	−0.275	0.76
KS5 ONLY			0.447	1.564	0.447	1.564	0.203	1.225