

Why do so few low and middle-income children attend a grammar school? New evidence from the Millennium Cohort Study

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Selective education is a controversial issue in the United Kingdom. While some policymakers believe selection-by-ability is the key to enhancing social mobility, others argue that it only has negative effects upon disadvantaged children's prospects in life. One issue where there does seem to be consensus, however, is in the need to get more children from low and middle-income backgrounds into grammar schools. In this paper we consider the mechanisms that are likely to drive the relationship between household income and grammar school entrance rates. Presenting new evidence for England and Northern Ireland, we find stark differences in grammar school entrance rates according to family income. Although differences in prior academic achievement can partly explain these gaps, other key factors, such as private tuition, also play an important role.

Key Words: Grammar schools, selective education, private tuition.

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1. Introduction

Selective education within the United Kingdom remains a contentious issue. Prior to the 1960s, England had an academically-selective grammar school system, where 11-year-old pupils were segregated into different schools depending upon their performance in an aptitude test (known as the eleven-plus). Although this system was replaced in large parts of the country during the 1960s and 1970s, it was never completely phased out. Consequently, around 160 grammar schools, educating approximately five percent of pupils, remain in England today. Moreover, in other parts of the United Kingdom (most notably Northern Ireland) the grammar school system remains firmly in place. Hence, despite often being characterised as a comprehensive education system, with low levels of between-school tracking, the use of segregation-by-ability actually varies greatly across the UK. While in most parts of the country selective education ended almost half a century ago, in other parts it remains prevalent.

Despite being phased out in most of the UK, grammar schools retain support among some policymakers, who argue that they will increase social mobility. These proponents have become more vocal in the last eighteen months, since Theresa May, a supporter of selective education, became Prime Minister. Whether grammar schools do indeed provide low and middle-income pupils with better life opportunities is however, open to debate. Indeed, a wide-ranging literature (both within the UK and internationally) suggests that this may not be the case (Hanushek and Woßmann 2006; Burgess, Dickson and Macmillan 2014; Burgess, Crawford and Macmillan 2017). One often cited reason is that not enough low and middle-income children gain entry into grammar schools, and are hence unable to reap the rewards that attending such a selective school may bring. For instance, recent research has illustrated how just three percent of pupils eligible for Free School Meals (FSM) are educated in a grammar school in England, despite accounting for 13 percent of the pupil population (Andrews, Hutchinson and Johnes 2016). If low- and middle-income children are to benefit from grammar schools, more of them will need to attend them. Yet we currently know surprisingly little about the relationship between family background and grammar school attendance in contemporary times¹. Indeed, there is currently very little quantitative research into the potential mechanisms that drive the relationship between family income and grammar school attendance.

¹ Previous work has considered this issue using data from the 1958 National Child Development Study (e.g. Sullivan and Heath 2002). However, these children would have been entering grammar schools in the late 1960s, with limited policy relevance for any plans to expand grammar schools today. For instance, the phenomenon of widespread and intensive private tutoring may be more significant now than for earlier cohorts.

This paper addresses this gap in the literature using the Millennium Cohort Study (MCS) – a contemporary cohort of children born around 2000/2001. Such cohort data allows us to conduct a more detailed investigation of the factors associated with grammar school entry than is possible with other resources (such as the National Pupil Database). Using these data, we present a detailed investigation into the link between household income and grammar school attendance rates. The rich array of information collected on the children in the MCS means we are also able to consider, for the first time, a range of potentially important mediating factors driving this relationship. For instance, are low and middle-income families less likely to apply for their child to attend a grammar school, even when they are of the same academic ability as their high-income peers? Is this to do with differences in their school preferences, including the extent to which they value schools with good grades? Might this be related to the aspirations and expectations they hold for their child’s future, such as whether they hope that they will go on to obtain a university degree? And what about the role of coaching for the entrance test – does this offer a substantial advantage to affluent families who are looking for their child to gain entry? Each of these factors will be considered in our analysis, providing the most detailed investigation to date into the factors driving socio-economic differences in grammar school attendance rates. Moreover, we provide evidence for two separate jurisdictions within the United Kingdom (England and Northern Ireland) enabling us to establish whether similar relationships hold across these quite different institutional settings.

To trail our key findings, our results highlight how there are stark differences in grammar school entrance rates according to family income. This association between family income and grammar attendance persists even after controlling for prior attainment at age 7. We find that these socio-economic gaps in grammar attendance are partially accounted for by parental preferences and the use of private tutors.

The paper now proceeds as follows. In section 2 we discuss a variety of potential mechanisms through which parental income and grammar school entrance may be related. The Millennium Cohort Study (MCS) is then described in section 3, with our empirical methodology following in section 4. Section 5 presents our estimates of the relationship between family income and grammar school attendance rates and explores mediators of this relationship. Conclusions then follow in section 6.

2. What mechanisms might drive the relationship between family income and grammar school attendance?

Prior achievement

There is a substantial literature in the UK and internationally documenting large disparities in academic achievement between socio-economic groups (Jerrim and Vignoles 2013). It is widely recognised that these disparities emerge early, being visible as young as age 3. Hence by the time secondary-school choices are made, low and middle-income children will have significantly lower levels of academic achievement than their high-income peers. Lower-income families may reason that the chances of their offspring passing the entrance exam are likely to be low, and so therefore decide not to enter them to take this test. Alternatively, even if lower income families apply to a grammar school, their lower academic attainment means that they are less likely to pass the entrance test. Regardless of which of the above holds true, prior achievement is likely to be a critical factor in the grammar school application and entry process.

Parental school preferences

When applying to a secondary school, high-income parents may place more emphasis on certain qualities than their low and middle-income peers. For instance, affluent families may be particularly keen for their offspring to attend a school which has a strong track record of high grades and which can offer pupils a wide-range of extra-curricular activities (Burgess et al 2015). Lower and middle-income families, on the other hand, may prefer their child to attend the nearest school and to maintain their existing friendship groups (National Foundation for Educational Research 2016). Likewise, lower socio-economic groups may associate grammar schools with tradition, middle-class values and elitism, creating a social barrier that stops them from applying to a grammar school (Sutton Trust 2013). This may in-turn partially explain why there continues to be a relationship between household income and grammar school attendance rates, even after socio-economic differences in young people's skills have been taken into account.

Location / distance

Rather than having different preferences about the qualities of a school, lower and middle-income families may struggle to gain access due to issues of distance (National Foundation for Educational Research 2016). These are likely to operate through two inter-related channels. First, house prices tend to be higher in neighbourhoods surrounding higher quality schools (Gibbons and Machin 2008). Hence higher-income families may be more likely to live within

an easily commutable distance of a grammar school. Second, affluent families are better able to cope with the costs of their children having to commute to school (e.g. being able to afford bus passes or train tickets). Geographical factors may therefore be partly responsible for the association between household income and grammar school attendance.

Parents and teachers recognition of academic potential

Low and middle-income parents, who are less likely to have attended grammar school themselves, may be less likely to correctly identify the potential of their high-achieving child, lacking the understanding that they have what it takes to gain entry and to succeed at such a school. Similarly, teachers in primary schools with more disadvantaged intakes may have less experience in advising (and encouraging) parents with regards to the grammar school admissions process. Indeed, qualitative research by the Sutton Trust has suggested that “*some primary school teachers do not think that grammar schools are suitable for children from poorer families*” and that some lower-income parents “*might prefer a more ‘rounded’ education for their child*” (Sutton Trust 2013). The relationship between household income and grammar school entry may consequently partly reflect parents and teachers miss-judging some children’s academic potential, while also being less likely to encourage lower income families to go down the selective education route.

Aspirations / expectations for their offspring

An extensive literature has illustrated how educational and occupational aspirations are linked to young people’s academic attainment (Khattab 2015). With regards to grammar school access, it may be that low and middle-income parents have different education and career aspirations for their offspring (Schoon and Parsons 2002). They may, for instance, be less likely to want or expect their child to enter university or to work in a professional job (Goodman, Gregg and Washbrook 2011). This in turn may mean that they are less likely to apply for a grammar school place for their child. Alternatively, these lower aspirations may be internalised by their child, leading low and middle-income pupils to be less likely to want to go to a grammar school (which then makes their parents less likely to apply). Such possibilities are consistent with previous qualitative research which found that headteachers felt “*families from disadvantaged backgrounds had lower educational aspirations for their children*” – which in turn makes them less likely to apply for a grammar school place (Sutton Trust 2013).

Coaching / tutoring for the entrance examination

One way high-income families might use their resources to gain an advantage is by paying for tutoring (or coaching) services that specifically target the grammar school entrance exam. The admission tests typically involve a mathematics, English and non-verbal reasoning component, and include material that is not aligned with the national curriculum taught in English and Northern Irish schools. There are several companies which explicitly market their services at helping children to pass this selection test², often involving a degree of helping familiarise and train young people specifically for this exam. These services, however, do not come cheap and are likely to be disproportionately used by families with higher incomes (Kirby 2016; Ireson & Rushforth 2011). Consequently, such services are likely to help high-income families gain a place at grammar schools over lower and middle-income groups, even when their children are of equal academic potential.

3. Data

In order to provide some empirical evidence on the importance of these different channels, we use data from the Millennium Cohort Study (MCS), which is a rich, nationally representative longitudinal study of UK children. The MCS uses a stratified, clustered survey design, with geographic areas (electoral wards) selected as the primary sampling unit, and then households with newly born children randomly selected from within them (see Plewis 2004 for further details). Six sweeps have been conducted between 2000 and 2015, when children were nine months, 3, 5, 7, 11 and 14 years old. Parents, children and their teachers have been interviewed within the various sweeps. Of the 18,819 cohort members who participated at nine months (of which 11,695 were in England and 1,955 were in Northern Ireland), 11,726 remained in the study at age 14 (7,739 in England and 1,115 in Northern Ireland). This reflects attrition rates of 34 percent in England and 43 percent in Northern Ireland respectively. We apply the MCS response weights throughout our analysis to adjust for non-random non-response.

Defining ‘selective education areas’ in England

Whereas Northern Ireland has a completely selective education system, the distribution of England’s 163 grammar schools across the country is highly uneven. Ten of the 152 local education authorities (LEAs) in England are considered to be ‘wholly selective’ by the Department of Education, and between them contains the majority of grammars schools in the

² See, for instance, <http://www.11plusguide.com/11-plus-exam-preparation/11-plus-private-tutors/kent-11-plus-tutors/>

country³. However, children often cross over local borders to attend these schools, meaning around a quarter of the grammar school intake actually live in a different LEA to their school (Allen 2016). In addition, there are a number of ‘isolated’ grammar schools spread across England, located in areas where the vast majority of schools are comprehensive. Figure 1 illustrates this situation, with the left-hand panel highlighting the concentration of selective schools across England, and the right-hand panel the home location of pupils who attend such schools (Allen 2016). This helps demonstrate two key points. First, that many pupils travel across borders to attend a grammar school. Second, that a non-trivial proportion of pupils in England (approximately ten percent) effectively belong to a selective education system.

The main implication of Figure 1 for this paper is how we define ‘selective education areas’ in England, and consequently the restrictions that we place upon the MCS sample. We follow two approaches. The first is to simply concentrate upon the ten fully selective LEAs only. This has the advantage of being a clean and clear definition, and we can be sure that these children truly live in an area with a selective schooling system. On the other hand, it ignores children who travel across borders and those who live near one of the isolated grammar school. It also reduces our sample size. Our second approach is to therefore extend our definition to include the ten selective LEAs plus any child who lives in a Middle Super Output Area (MSOA) where at least ten percent of children attended a grammar school over the last five years⁴. This has the advantage of including pupils who travel across LEA borders and who live near an isolated grammar school, though at the expense of our definition of a ‘selective education area’ becoming less clear cut. Consequently, the sample size available for England ranges from 675 (definition 1) to 1,095 (definition 2), in addition to the 1,220 MCS children who live in Northern Ireland. We report results following the second (less restrictive) definition in the main body of the paper, with Appendix C reporting alternative results using the first (more restrictive) definition. Key substantive results remain largely unchanged regardless of the definition used.

³³ ‘Wholly selective’ is based upon having a high concentration of grammar schools (House of Commons 2017). According to the Department for Education, the 10 fully selective LEAs in England are Bexley, Buckinghamshire, Kent, Lincolnshire, Medway, Slough, Southend-on-Sea, Torbay, Trafford and Sutton.

⁴ Middle Super Output Areas (MSOAs) are small geographic areas within England. The minimum population within an MSOA is 5,000 individuals, maximum of 15,000 individuals, with a mean of 7,200. In total, England can be divided into 6,781 separate MSOAs.

Private schooling

An additional challenge is that high-income families may decide to send their child to a private independent school, particularly if they fail to pass the grammar school entrance test. This is not such a problem in Northern Ireland where the independent school sector is extremely small. It is, however, more of an issue in England, where around seven percent of the population attend a fee-paying school, with this percentage much higher amongst high-income groups.

Within our data analysis, there are three ways to deal with children who attend a private secondary school:

- (i) Exclude any child who attends a private secondary school from the analysis
- (ii) Model the probability of attending either a grammar school or a private school
- (iii) Estimate a multi-nominal logistic regression model, with non-grammar state schools, grammar schools and independent schools as three separate groups.

We use all three approaches in this paper to test the robustness of our results. Approach (i) is used when we present our main results, with alternative estimates following approach (ii) provided in Appendix D and approach (iii) in Appendix B. Most of our main results remain unchanged whichever approach is used.

Measurement of family income

Family income has been measured in different ways across the MCS sweeps. Typically, a single banded question was used, in addition to a number of supplementary questions. This included questions about gross or net earnings, earnings from second jobs and occasional employment, self-employed income and a range of benefits (e.g. housing benefit, child benefit, jobseekers allowance). Where families refused to provide this information (typically ten percent of cases or less) the Centre for Longitudinal Studies (the survey organisers) have imputed this information. See Hansen 2014 for further details. Modified OECD scales have then been used by the survey organisers to create a weekly equivalised income variable within each sweep.

The problems of dealing with income measured at a single point in time have been widely discussed in the intergenerational income mobility literature (Blanden, Gregg and Macmillan 2013). It has therefore become standard practise in social mobility research to create 'permanent' income measures, where household income is averaged across all available survey sweeps (Jerrim, Choi and Simancas 2016). This is also the approach we take in this paper,

creating a long-run average household income measure by averaging the weekly equivalised income variable across the age nine months, three-year, five-year and seven-year survey rounds⁵. The mean of this weekly equivalised household income variable is £396 in England and £292 in Northern Ireland, with standard deviations of £212 and £156 respectively. In our analysis, we divide children into family-income quartiles using this permanent income measure.

Grammar school attendance

In the age 14 sweep of the MCS, parents were asked to name their child's school. Using this information, it is possible to identify whether the child is studying in a grammar school at age 14 or not. This is a binary indicator, taking a value of one for grammar school and zero otherwise. Note that in England children classified as non-grammar school pupils could be attending a 'secondary modern' or a comprehensive school (recalling that we have excluded private secondary school pupils in our main analysis). In Appendix D we provide alternative estimates where we consider the relationship between family income and the probability of attending *either* a grammar school *or* a private school.

Measures of cognitive skills

One of the key strengths of the MCS is that cohort members have completed a number of cognitive tests throughout childhood. In our models that control for prior achievement, we focus upon the tests taken at ages 3, 5 and 7 – long before the grammar school application process has begun. Specifically, these tests are:

- Naming vocabulary (ages 3 and 5)
- Pattern construction (ages 5 and 7)
- Picture similarities (age 5)
- Word reading (age 7)

Although the MCS also contains a number of cognitive assessments taken at age 11, and prior to grammar school entry, we view these as potentially endogenous – children's scores on these tests may have been affected by parental decisions to apply to grammar schools (e.g. via paying for extra tuition to increase their chances of passing the entrance test)⁶. Hence we do *not* control

⁵ We do not include the age 11 survey round data, as the income data seems to have been coded differently to the previous sweeps.

⁶ The additional achievement measures available at age 11 measure pupils' verbal similarities and spatial working memory, along with performance in the Key Stage 2 national examinations (England only).

for these in our primary analysis. However, in Appendix A we do present results from a robustness test, illustrating how our parameter estimates change if the MCS test measures at age 11 are also controlled⁷.

Parental school preferences

When their child was in the final year of primary school, parents were asked about their secondary school preferences. This included the question: “*Which of these factors were important in choosing a secondary school?*” (yes/no). They were asked about each of the following issues in turn, and then asked which they felt was the most important:

- (a) Child wanted to go there;
- (b) School is near to home;
- (c) His/her friends intending to go there;
- (d) His/her brother/sister goes there;
- (e) Other relative goes there;
- (f) Academic reputation;
- (g) Strong discipline policy;
- (h) Good extra-curricular activities;
- (i) School has specialist curriculum;
- (j) Good facilities;
- (k) General good impression;
- (l) Religious grounds.

Within our analysis, we are therefore able to investigate how strongly the above are associated with parental income within selective education areas, and the extent that these parental school preferences mediate the relationship between income and grammar school attendance.

The measures parents take to get their child into a grammar school

In the age 11 survey, the cohort member’s parents are also asked a series of questions about the steps they have taken to get their child into the school of their choice. Specifically, they were asked “*which, if any, of the steps on this card did you take in order to help improve your child’s chance of getting into a particular secondary school?*”:

- (a) Moved home;

⁷ In additional analyses, we have also included control for children’s Key Stage 2 test scores in England, and found very little change to the results reported in Appendix A.

- (b) Short-term renting;
- (c) Used the address of a relative or friend;
- (d) Got child into a particular primary school;
- (e) Arranged extra tuition or coaching for child;
- (f) Arranged for extra curricula activities for child;
- (g) Joined a church or place of worship;
- (h) Asked someone with influence in the process to recommend your child;
- (i) Other steps

Of the above, our main interest in this paper is point (e) – the use of extra tuition⁸. Some additional information on this point is also available, with parents asked if their child has attended additional lessons in English, mathematics and science. (Note that English and mathematics are subjects typically included in grammar school entrance tests, while science is not). This enables us to explore a range of different strategies high-income parents living within selective education areas use to increase their offspring's chances of gaining entry to grammar school, over and above their low and middle-income peers.

Parental views on their children's behaviour and academic skills

Parents were asked to report their views on various aspects of the cohort member's academic skills and behaviour. With regards the former, parents were asked if the child had difficulty at school in mathematics, reading and writing on a three-point scale (no difficulty, some difficulty and great difficulty). Likewise, parents also completed the Strengths and Difficulties Questionnaire (SDQ) on behalf of their child across a number of survey sweeps. This captures parental views on their child's non-cognitive skills and behavioural attributes, including their social skills, ability to concentrate and conduct problems. In our analysis we add controls for parent reported SDQ scores and views of their child's academic difficulties when children were age seven.

Primary school teacher's views on the child's behaviour and academic skills

In the age 7 MCS sweep, primary school teachers were asked to rate the cohort member's academic ability in eight areas, including speaking and listening, reading, writing, science and mathematics. This was done on a five-point scale, from well below average to well above average. They also completed the Strength and Difficulties Questionnaire (SDQ) reflecting

⁸ For most of the other options, the number of families in selective education areas who said they used such steps was small. It was therefore not possible to conduct any meaningful analysis using these other categories.

their views on the child's behaviour and socio-emotional skills. It is therefore possible for us to include this information in our analysis information, and investigate whether this helps to explain the relationship between family income and grammar school attendance.

4. Methodology

A set of sequential binary response models will be estimated separately for England and Northern Ireland, investigating the link between household income and grammar school entrance. These will attempt to 'explain' (in a statistical sense) why children from high-income families are more likely to attend a grammar school than their low and middle-income peers. Formally, this model is specified as:

$$A_{ij} = \beta_1 \cdot Inc_i + \beta_2 \cdot S_i + \beta_3 \cdot Tutor_i + \beta_4 \cdot P_i + \beta_5 \cdot V_i + \beta_6 \cdot T_i + \beta_7 \cdot E_i + G_j \quad (1)$$

Where:

A_{ij} = Whether cohort member i attends a grammar school (0 = no; 1 = yes).

Inc_i = A set of dummy variables referring to permanent family income quartile.

S_i = Prior academic achievement of child i , as measured by the MCS tests up at age seven.

$Tutor_i$ = A vector of variables capturing the extent to which the child has received private tutoring.

P_i = A vector of dummy variables capturing parental school preferences.

V_i = Parental views on child i 's cognitive and non-cognitive skills.

T_i = Primary school teacher views on child i 's cognitive and non-cognitive skills.

E_i = Parental educational expectations for child i .

G_j = Geography fixed effects.

i = Cohort member i .

j = Local area j .

In all models, the complex MCS design (clustering, stratification and weighting) will be taken into account by making the appropriate adjustment to the parameter estimates and the standard errors. This is executed via the Stata survey ('svy') command (Ketende and Jones 2011). Multiple imputation using chained equations (MICE) has been used, where possible, to account

for missing covariate data. For most covariates, the amount of missing data is modest (typically less than 10 percent), with the exception of the information provided by cohort members primary school teachers (T_i) where the proportion is much higher (around a third of observations in the case of Northern Ireland).

This model will be built up sequentially, adding sets of control variables one at a time. Our key interest is in the parameter β_1 – how strong is the relationship between household income and grammar school entry, conditional upon the other factors included in the model.

The first model will include household income (I) as the only covariate. This will illustrate the unconditional association between income and grammar school entry via all the potential mechanisms set out in section 2 (i.e. this model will quantify the ‘raw’ socio-economic gap in entrance rates that subsequent models will attempt to explain). A set of controls for the MCS cognitive achievement measures (described in section 3) will then be added as controls in model 2. This set of achievement tests have all been completed by age seven, hence well before the grammar school application process has begun. We do not include the age 11 measures as they are potentially endogenous – i.e. they may be affected by the grammar school application decision itself⁹. Our primary interest is in the change between β_1^{M1} and β_1^{M2} – how much does prior achievement explain the link between household income and parental decisions of whether to apply to a grammar school. Yet we are also interested in whether $\beta_1^{M2} = 0$; after conditioning upon children’s achievement, does any residual association between income and grammar school attendance remain?

Assuming that there does remain a positive and significant association, model M3 will then include local geography (local education authority or electoral ward) fixed effects (G). These fixed effects will to some extent pick up the effects of distance, but also other local neighbourhood factors, such as local area deprivation and the quality of local primary schools. Nevertheless, after estimating model M3, both prior achievement and local neighbourhood factors will have been stripped out of β_1 , allowing us to explore the other potential mechanisms in detail.

The fourth model will then add controls for coaching for the entrance exam and additional private tuition. The impact this has upon the income parameter estimates (β_1) will enable us to

⁹ Nevertheless, online Appendix A illustrates the robustness of our results to including age 11 achievement test scores as additional controls. This has little impact upon the substantive conclusions that we reach.

quantify the advantages that high-income families gain in the race for a grammar school place by purchasing these additional educational services (over and above the role of prior achievement and local area characteristics).

The fifth and sixth model focus upon the role of parental school preferences. In model M5, we shall concentrate upon parental concern for sending their child to a school with good grades. Model M6 then controls for the full range of parental secondary school preference controls discussed in section 3. Such factors are, of course, potentially endogenous, and may reflect children's achievement rather than determining future attendance at a grammar school. Nevertheless, the change between β_1^{M4} , β_1^{M5} and β_1^{M6} will provide some evidence on the relationship between parental school preferences and the income-grammar attendance relationship.

The next two models add controls for parent (M7) and teacher (M8) views of the child's cognitive and non-cognitive skills. As discussed in section 2, it could be that low and middle-income parents (and their child's teachers) are less likely to recognise their child's suitability for grammar school than higher-income families. Comparing β_1^{M6} to β_1^{M7} and β_1^{M8} will provide some evidence as to whether this is indeed the case. Likewise, the final model will control for parental educational aspirations, capturing the extent to which socio-economic differences in this variable can account for any of the remaining association between family income and grammar school entrance.

Linear probability models (OLS regression with a binary response variable) will be used when following this sequential modelling process. Our preference for estimating linear probability models over some potential alternatives (e.g. logit or probit models) is due to the known methodological problems with comparing logistic regression parameter estimates across nested models (Mood 2010). Specifically, any change in parameter estimates could be owing to either 'confounding' or 'rescaling', with only the former of substantive interest. This is a particularly important point given the modelling approach we outline above. Linear probability model estimates are not affected by this problem, provide unbiased and consistent estimates of the average effect (Mood 2010:78; Wooldridge 2002:454). They also have the advantage of being simple to interpret, with parameter estimates directly capturing marginal effects (probability differences). Nevertheless, in online Appendix B we illustrate that our key substantive results continue to hold if logistic regression models are estimated instead.

5. Results

Northern Ireland

To begin, Figure 2a illustrates the bivariate relationship between permanent family income and grammar school attendance in Northern Ireland. The association is positive and linear above the 25th percentile. There is, for instance, around a 20 percent chance of all children below the 25th percentile attending a grammar school. This probability then steadily increase, up to around 40 percent at the 50th percentile and around 70 percent at the 90th percentile. There is hence evidence of a steady incline in grammar school attendance rates as family income increases.

<< **Figure 2** >>

These results are formalised in model 1 (see Table 1), where the link between family income and grammar school attendance is estimated including just basic demographic controls. Compared to the lowest income quartile (reference group), young people's whose families are in the third income quartile are around 30 percentage points more likely to attend a grammar school. This increases to a 53 percentage point gap when one compares the top and bottom income quartiles.

<< **Table 1** >>

To what extent is this result a reflection of differences in children's prior academic achievement between family income groups? Model 2 addresses this issue by adding a host of academic achievement controls up to when children are age 7¹⁰. The estimated income parameters fall almost by half, with the difference between children in the bottom two quartiles no longer statistically significant. On the other hand, there continues to be a substantial socio-economic grammar school entrance gap even after prior academic achievement has been controlled. Specifically, those in the top income quartile are still 33 percentage points more likely to attend a grammar school than their peers in the lowest income group. Results from model 2 therefore indicate how a number of able children from disadvantaged family backgrounds do not attend a grammar school.

The third model (M3) adds in additional controls for local area (electoral ward) fixed effects. Interestingly, the inclusion of these fixed effects helps to further explain some of the socio-

¹⁰ Appendix A includes controls up to age 11 in model M2 instead, with the estimated income parameter in M2 falling slightly in both Northern Ireland and England.

economic gap in grammar school entrance rates in Northern Ireland, particularly the difference between families in the top income quartile and the other income groups. Specifically, the estimated parameter for the top income quartile has fallen by a further eight percentage points (from 33 to 25 percentage points). A similar, though smaller, drop also occurs for the third quartile (18 to 15 percentage points). Our interpretation is that this suggests distance and local community factors (potentially including religion) is helping to exacerbate socio-economic inequalities in grammar school access in Northern Ireland. Despite this, the top income quartile parameter is still 25 percentage points, so there remains large socio-economic gaps in access to grammar schools in Northern Ireland.

What else, other than location and prior achievement, can explain this gap? Table 2 provides some descriptive evidence on the steps high-income parents take to get their child into their chosen school. The key factor that comes shining through is private tuition, with high-income families much more likely to use tutoring/coaching to get their child into the school of their choice. Specifically, families are around six to seven percentage points more likely to report using private tutors as a method of gaining access to a particular school for each £100 increase in family income. Moreover, high-income families are also selective in the subjects that their offspring are tutored in. Note, for instance, how there is a significant seven percentage point increase in English and mathematics tuition per £100 increase in family income, but essentially no association in science. This is consistent with the content of grammar school entrance tests, which do not include science, but have a strong English and mathematics component. Together, this points towards private tuition being a key tactic which high-income parents use to maximise their child's chances of getting a place at a grammar school.

<< **Table 2** >>>

But does this tactic actually work? Table 2 panel (b) provides some descriptive evidence on this point, illustrating the unconditional association between receiving coaching/tuition and grammar school entrance rates. It illustrates how almost 80 percent of children in Northern Ireland who received coaching/tuition for the entrance test gained entry into a grammar school, compared to just 40 percent of those who did not receive any coaching/tuition. This result continues to hold even when we enter these private tuition variables into our grammar school access model (Model 4 in Table 1), which conditions upon prior achievement and local area characteristics. Specifically, parents who said that they used coaching to get their offspring into their chosen school, and who paid for private maths and English tuition, were around 18

percentage points more likely to get their child into a Northern Irish grammar school (conditional upon the host of other variables already included in the model)¹¹. In other words, paying for private tutoring is strongly associated with children's chances of going to a grammar school, over and above young people's academic ability. As high-income families are disproportionately likely to pay for private tutors, the income parameter estimates in Table 1 fall between Model 3 and Model 4; from around 25 percentage points down to around 22 percentage points with respect to the highest income group. We therefore find some evidence that equalising access to private tutoring may be an effective policy lever to increase the number of low and middle-income children at Northern Irish grammar schools.

The next factor we add into our grammar school entrance model is parental school preferences. However, before discussing these results, we provide some descriptive evidence on how such preferences vary with family income in Table 3.

<< Table 3 >>

Parental income has a strong and significant association with a number of school preferences. Two of the most notable are good examination results and a general good impression of the school. Specifically, in Northern Ireland, each £100 increase in weekly income leads parents to express a nine percentage point increase in good school examination results and a five percentage point increase in good impression of the school. The two other factors which high-income parents tend to value more than lower-income parents in Northern Ireland are school facilities and the provision of extra-curricular activities. Together, the results in Table 3 therefore leads us to the conclusion that high income parents in Northern Ireland have particularly strong preferences for schools with a good reputation and whose pupils get good grades.

What happens when these variables capturing parental school preferences are included in our grammar school entrance model? Again, the income parameter estimates drop, with parental school preferences having roughly the same association as the variables capturing private tuition. For instance, the difference between the top and bottom income groups in Table 1 has fallen by a further four percentage points between Model 4 and Model 5 (which includes parental school preferences for a school with good grades as the only additional control). Interestingly, no further change in the income parameter estimates occurs between Model 5

¹¹ These results are not formally reported, but the joint impact of the private tutoring variables included in the model are statistically significant. The full set of parameter estimates are available from the authors upon request.

and Model 6, when the full range of parental school preference variables (as reported in Table 3) are also added into the model. Nevertheless, a number of parental school preferences are clearly associated with parental income, and can together explain a non-trivial amount of the grammar-school access gap.

The next two models include additional controls for parents' (Model 7) and teachers' (Model 8) views of their child's cognitive and non-cognitive skills. Together, these variables help to further explain why high-income families are disproportionately likely to attend a grammar school. Specifically, the high-income parameter estimate falls from 18.2 percentage points in Model 6 to around 14.5 percentage points in Model 8. Hence parent and teacher views of children's strengths and weaknesses does make some contribution to the socio-economic gap in grammar school attendance rates (over and above independent measures of children's actual academic ability).

The final model (Model 9) additionally includes a control for parental educational expectations for the child; a factor which previous qualitative work has suggested may help to explain socio-economic differences in grammar school attendance rates (Sutton Trust 2013). In Northern Ireland, we find no evidence that this is the case, with the family income parameter estimates in Table 1 hardly change between Model 8 and Model 9.

The other important point to note from Model 9 is that, even after an extensive range of controls have been included, a residual association between parental income and grammar school attendance remains. In other words, there exists other unobserved factors not included in our models which help to drive this relationship. This is particularly true with respect to the high-income group, where we have only been able to explain approximately 70 percent of the socio-economic gap. Therefore, around a third of the 'raw' income-entrance gap remains unexplained.

England

In Table 4 we present results from our grammar school access model for England, analogous to the Northern Irish results presented in Table 1. This is accompanied by Figure 2b, which illustrates the unconditional relationship between family income percentile and the probability of attending a grammar school in England.

<< **Table 4** >>

The first notable feature of these results is that the family income gradient in grammar school attendance is not as steep in selective areas of England as in Northern Ireland. For instance, the raw (unconditional) gap between the high and low income groups is around 35 percentage points in England, compared to more than 50 percentage points in Northern Ireland. Indeed, in England, only around 40 percent of children from high-income families in selective areas attend a grammar school, compared to around 70 percent of high-income children in Northern Ireland. We put this difference down to the different structure of the education system in these two countries and, in particular, the quite different counterfactuals to attending a grammar school. Specifically, failure to gain entry into a grammar school in Northern Ireland means that children will enter the equivalent of ‘secondary modern’ (i.e. a school track designed specifically for lower academic achievers, with greater proportions of children from lower socio-economic backgrounds). The same is not true in England due to (a) the opportunity to travel across local education authority borders to attend a comprehensive school and (b) the presence of a more extensive independent (private) school sector¹². Consequently, high-income parents in England have more viable alternative school options available than parents in Northern Ireland, with it therefore making sense that the socio-economic gradient in grammar school attendance is not quite as steep.

Returning to estimates from the grammar school access model for England presented in Table 4, a number of consistent findings with the Northern Irish results emerge. For instance, note how prior academic achievement explains a substantial proportion of the grammar school access gap between high and low-income children. Specifically, the high-income parameter estimate falls by just over one-third, from around 36 percentage points in Model 1 to around 21 percentage points in Model 2, once prior achievement controls through to age 7 are included. Nevertheless, as in Northern Ireland, substantial differences between income groups remain even conditional upon children’s prior achievement.

Although the inclusion of local education authority fixed effects in Model 3 does little to change our results, we do find evidence that private tutoring and coaching for school entrance test plays a pivotal role in explaining socio-economic differences in grammar school

¹² Recall that we have excluded children who go on to attend a private secondary school in England. We have created an alternative version of Figure 2 for England where we illustrate the link between family income and the probability of attending *either* a private or independent school. The income gradient then becomes somewhat steeper in England; around 50 percent of high-income children attend either a grammar or a private school. This alternative graph is available from the authors upon request.

attendance. Table 5 presents descriptive evidence on this issue, with panel (a) illustrating how every £100 in weekly equivalised household income is associated with a six percentage point increase in the probability that the child receives coaching for the entrance test, and an extra four to five percentage point increase in private maths and English tuition. Moreover, note how the same is not true for tutoring in science, which is not part of the grammar school entrance test, and that the relationship between family income and private tuition is a lot shallower in comprehensive education areas in England (as compared to selective education areas). This is complemented by Table 5b, which illustrates how coaching for the entrance test is almost a prerequisite for gaining access to grammar school; almost three-quarters of children living in a selective area who were coached to pass the test gained entry, compared to only 14 percent of those who were not coached. Together, these factors combine to drive a large decline in the high-income parameter estimate between Model 3 and Model 4; private tutoring is a key reason why academically able low and middle income pupils are less likely to attend a grammar school than their high-income peers. Specifically, the difference between high and low income pupils in grammar school entrance rates falls from around 24 to 13 percentage points after private tutoring has been taken into account¹³. This is larger reduction in the high-income parameter estimates than in Northern Ireland.

Otherwise, the inclusion of additional controls does relatively little to further reduce the household income parameter estimates¹⁴. Table 6, for instance, illustrates how most parental school preferences in selective education areas in England do not vary substantially with household income, with the exception of good exam results and general impressions of the school (with this result continuing to hold if we control for children's level of academic achievement). Consequently, their inclusions within Models 5 and 6 do relatively little to change our results. Likewise, the high-income parameter estimate does not decline much after we control for parent and primary school teacher views of the child's behaviour and academic abilities (Models 7 and 8) or after inclusion of parental educational expectations for their offspring (Model 9). Consequently, even after we include a full set of quite extensive controls,

¹³ Note that the full set of parameter estimates from model 4 illustrates how children who receive coaching for the entrance test and private tutoring in English and mathematics are around 50 percentage points more likely to attend grammar school than those who do not. In other words, the key finding from Table 5b continue to hold, even after prior achievement, local education area and family background factors have been controlled.

¹⁴ Appendix B suggests that controlling for parental views of their child's behaviour and abilities may be an exception. Specifically, when a multi-nominal logistic regression is estimated, the high-income log-odds (odds ratio) falls from 1.23 (OR = 3.42) to 0.96 (OR = 2.61) between models 6 and 7.

around a third of the raw household income gap in grammar school entrance rates in England remains unexplained.

<< **Table 6** >>

6. Conclusions

Many education systems, particularly within Europe, continue to segregate pupils into different secondary schools based upon their academic potential. Typically, such countries have amongst the most socially segregated schooling systems anywhere in the world (Gutiérrez, Jerrim and Torres 2017), leading to great public policy interest in increasing the proportion of disadvantaged children in the most academically-orientated track. Despite often being characterised as a comprehensive education system, significant parts of the UK still practise such academic selection via grammar schools. Indeed, around one-in-ten children in the UK effectively lives within a selective education area. Consequently, there remains a great deal of interest about the barriers low and middle income pupils face in gaining access to a grammar school, and the potential ways by which the numbers attending may be increased.

Previous research has shown how just three percent of grammar school pupils are eligible for Free School Meals, despite accounting for 13 percent of the national pupil population (Andrews, Hutchinson and Johnes 2016). Moreover, others have shown how lower socio-economic status pupils are less likely to be found in grammar schools than their more advantaged peers, even when they have the same Key Stage 2 test scores (Burgess, Crawford and Macmillan 2017). Yet there remains significant gaps in our knowledge about the potential mechanisms driving the grammar school access gap. For instance, do high and low income families have different preferences regarding the characteristics of the school they wish to send their offspring to? And how much impact does the use of private tutors have on the grammar school access gap?

We have addressed these questions in this paper, providing important new insight into the various factors that stop more low and middle income children from attending a grammar school. Using rich panel data from across two parts of the UK, we illustrate how family income continues to have a strong association with grammar school attendance, even after conditioning upon a wide range of academic achievement measures. This is partially due to factors such as socio-economic differences in parental school preferences, which explain an important proportion of the remaining income-attendance gap (at least in Northern Ireland). However, we also find that a series of other factors, most notably private tuition, play an important role.

Consequently we conclude that there are multiple complex and intertwined reasons why low and middle income children are under-represented at grammar school. Critically, our analysis illustrates how access to grammar schools is far from meritocratic, and is determined by much more than academic ability alone.

Looking across England and Northern Ireland, several consistent findings emerge. In both countries, children from higher income families are much more likely to attend a grammar school than their lower-income peers, with prior academic achievement able to explain less than half of this relationship. Likewise, there is a consistent finding that high-income families in the two countries are more likely to use private tutors than lower income groups, and that this partially explains why young people from more advantaged backgrounds are disproportionately represented within grammar schools. Yet there are also some striking differences, including a steeper income-gradient in grammar school access in Northern Ireland than England, with parental school preferences also appearing to play a more prominent role in Northern Ireland. Together, this highlights how Northern Ireland – with its fully-selective academic system – has larger socio-economic gaps in grammar school access than areas in England with a partially-selective system.

These findings do, of course, need to be interpreted in light of the limitations of this research. First, the MCS sample size is somewhat limited in size, particularly for England once the data has been restricted to selective education areas only. Despite the standard errors surrounding our estimates being reasonably large, the number of observations is still sufficient to identify variables able to account for grammar school access gaps. Second, although we have been able to ‘explain’ (in a statistical sense) a substantial proportion of the income gradient, parameter estimates in our final model specification are still some way above zero. In other words, there continues to be a non-trivial association between family income and grammar school access that we are unable to explain. Consequently, there are likely to be other important variables that we do not observe in the data, which have an impact upon grammar school entrance rates. Finally, our modelling strategy reveals conditional associations only, and do not necessarily capture cause and effect.

Despite these limitations, this paper has advanced our knowledge about access to grammar school in important ways. A combination of lower achievement, differences in parental school preferences and use of private tutors all play a critical role. Therefore, although improving

academic skills of low-income pupils remains key to improving grammar school access, it is not the only lever upon which policymakers may draw.

Given the prominent role of private tutoring in England, this seems a particularly prominent issue for policymakers to address. One option may be for an additional tax to be placed upon such tutoring services, particularly those that try to ‘coach’ children for the 11-plus entrance test. The funds raised could then be used to provide vouchers to low and middle-income families, providing them with subsidised or even free private tuition. Such a scheme would have the dual advantage of lowering the demand for private tutoring from high-income families (due to the additional tax cost), while increasing demand amongst lower-income groups (via the voucher subsidy). This policy option, which would likely be relatively straightforward to implement, would clearly help level the playing field between the rich and poor. Yet it is likely that other initiatives will also be needed, such as promoting the benefits of grammar schools to lower-income families and removing some of the negative stereotypes. Indeed, if governments are really serious about reducing inequality in access to grammar schools, such a multifaceted approach – tackling the various mechanisms uncovered in this paper – may be needed. In the absence of this, low and middle-income pupils are likely to remain severely underrepresented in grammar schools.

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Table 1. The association between family income and grammar school entrance rates in Northern Ireland

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9	
	Beta	SE																
Household income																		
Bottom quartile (Reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Second quartile	11.1%	4.9%	6.4%	4.4%	6.8%	4.4%	6.6%	4.4%	4.6%	4.3%	4.7%	4.3%	3.7%	4.6%	-1.0%	4.3%	-0.5%	4.2%
Third quartile	30.6%	5.5%	18.4%	5.1%	15.3%	4.7%	13.6%	4.6%	10.4%	4.8%	10.5%	4.7%	10.0%	4.8%	<u>8.0%</u>	4.7%	<u>8.6%</u>	4.7%
Top quartile	52.9%	0.5%	33.2%	4.7%	25.0%	4.9%	21.7%	5.0%	17.7%	4.8%	18.2%	4.7%	16.9%	4.9%	14.5%	4.9%	15.3%	4.9%
Controls																		
Gender	Yes																	
Parent religion	Yes																	
Prior achievement	-		Yes															
Election ward fixed effects	-		-		Yes													
Private tutoring/coaching	-		-		-		Yes											
School choice: results important	-		-		-		-		Yes									
School choice: full controls	-		-		-		-		-		Yes		Yes		Yes		Yes	
Parent views on child's ability	-		-		-		-		-		-		Yes		Yes		Yes	
Parent views of non-cog skills	-		-		-		-		-		-		Yes		Yes		Yes	
Teacher's views on child's ability	-		-		-		-		-		-		-		Yes		Yes	
Teacher's views of non-cog skills	-		-		-		-		-		-		-		Yes		Yes	
Parental expectations age 7	-		-		-		-		-		-		-		-		-	Yes
	1,039		1,039		1,039		1,039		1,039		1,039		1,039		1,039		1,039	

Authors' estimates using the MCS data. **Bold** font indicates statistical significance at the five percent level, and *underlined italic* font at the ten percent level. Estimates based upon a linear probability model. Estimates refer to the percentage point increase in the probability of entering to a grammar school. 46 percent of the sample attended a grammar school.

Table 2. The relationship between family income and parental actions to boost their children’s chances of gaining entry into grammar school in Northern Ireland

(a) Relationship between family income and actions parents take to get their child into their chosen school

Action taken	% point change per £100 increase in weekly income	Standard error
Taken entrance exam	6.9% **	0.9%
Extra lessons in Maths	6.7% **	1.0%
Extra lessons in English	6.6% **	0.9%
Arranged tuition / coaching	6.0% **	1.0%
Other steps	3.1% **	1.2%
Attend after school club	-2.2% **	0.8%
Help with homework	-2.0% **	1.0%
Extra lessons in science	0.1%	0.2%

(b) Relationship between coaching and grammar school entrance

	Northern Ireland	
Attend grammar	Not coached	Coached
No	59% (476)	22% (33)
Yes	41% (334)	78% (114)

Notes: All questions in panel (a) are binary (yes/no), with estimates referring to results from a linear probability model where only demographic characteristics have been controlled. ** indicates statistical significance at the five percent level. In panel (b), the number of observations are reported in parentheses, with figures based upon unweighted data. Total number of observations differs from Table 1 due to missing data.

Table 3. The relationship between family income and parental school preferences in Northern Ireland

Reason for choosing school	% point change per £100 increase in weekly income	Standard error
Good exam results / reputation	9.0% **	0.8%
Good range of extra-curricula activities	5.7% **	0.9%
Has good facilities	5.3% **	0.9%
General good impression of school	5.0% **	0.9%
Religious grounds	2.8% **	1.0%
Child wanted to go there	2.6% **	0.8%
Friends intending to go there	2.0% *	1.0%
Nearest school to home	1.4%	1.1%
Has a specialist curriculum	1.1%	0.6%
Strong anti-bullying policy	0.6%	0.9%
Other relative went there	0.3%	0.8%
Other	0.1%	0.1%
Don't know	0.0%	0.0%
Brother/sister goes there	-1.0%	0.9%

Notes: All variables are binary responses (yes/no). * and ** indicate statistical significance at the ten and five percent significant thresholds respectively.

Table 4. The association between family income and grammar school entrance rates in England

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9	
	Beta	SE																
Household income																		
Bottom quartile (Reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Second quartile	14.1%	4.7%	9.1%	4.5%	8.8%	4.3%	<u>7.2%</u>	4.0%	8.3%	4.1%	<u>8.2%</u>	4.3%	<u>7.8%</u>	4.3%	<u>8.2%</u>	4.4%	<u>8.3%</u>	4.4%
Third quartile	20.2%	4.4%	12.1%	4.6%	12.6%	4.8%	<u>6.0%</u>	3.9%	<u>6.5%</u>	3.9%	5.8%	3.9%	6.6%	4.2%	6.3%	4.4%	6.3%	4.4%
Top quartile	35.7%	3.7%	21.0%	3.8%	23.6%	4.5%	12.9%	3.9%	13.4%	3.8%	12.0%	4.0%	12.4%	4.1%	11.7%	4.2%	12.0%	4.2%
Controls																		
Gender	Yes																	
Prior achievement	-		Yes															
LEA fixed effects	-		-		Yes													
Private tutoring/coaching	-		-		-		Yes											
School choice: results important	-		-		-		-		Yes									
School choice: full controls	-		-		-		-		-		Yes		Yes		Yes		Yes	
Parent views on child's ability	-		-		-		-		-		-		Yes		Yes		Yes	
Parent views of non-cog skills	-		-		-		-		-		-		Yes		Yes		Yes	
Teacher's views on child's ability	-		-		-		-		-		-		-		Yes		Yes	
Teacher's views of non-cog skills	-		-		-		-		-		-		-		Yes		Yes	
Parental expectations age 7	-		-		-		-		-		-		-		-		-	
	819		819		819		819		819		819		804		804		804	

Authors' estimates using the MCS data. **Bold** font indicates statistical significance at the five percent level, and *underlined italic* font at the ten percent level. Estimates based upon a linear probability model. Estimates refer to the percentage point increase in the probability of entering a grammar or private school. 24 percent of the sample attended a grammar school and six percent a private school. The remaining 70 percent attend a non-grammar state school. The number of observations declines from 819 in model 6 to 804 in model 7 due to the 'parental views' variables could not be successfully imputed for 15 observations.

Table 5. The relationship between family income and parental actions to boost their children's chances of gaining entry into grammar school

(a) Relationship between family income and actions parents take to get their child into their chosen school

Action taken	Selective		Comprehensive	
	% point change per £100 increase in weekly income	Standard error	% point change per £100 increase in weekly income	Standard error
Extra lessons in English	3.7% **	0.6%	1.7% **	0.4%
Extra lessons in Maths	4.8% **	0.8%	1.7% **	0.4%
Arranged tuition / coaching	5.9% **	0.7%	1.5% **	0.3%
Other steps	0.0%	0.3%	-0.1%	0.2%
Taken entrance exam	6.2% **	1.1%	3.6% **	0.4%
Help with homework	-1.9% **	0.7%	0.2%	0.5%
Extra lessons in science	0.1%	0.3%	0.1%	0.1%
Attend after school club	-1.1%	0.8%	1.1% **	0.3%

(b) Relationship between coaching and grammar school entrance

Attend grammar	England	
	Not coached	Coached
No	86% (567)	27% (42)
Yes	14% (94)	73% (116)

Notes: The number of observations are included in parentheses. Unweighted data. Pupils who go on to attend private school at age 14 excluded from panel (b). Total number of observations differs from Table 4 due to missing data.

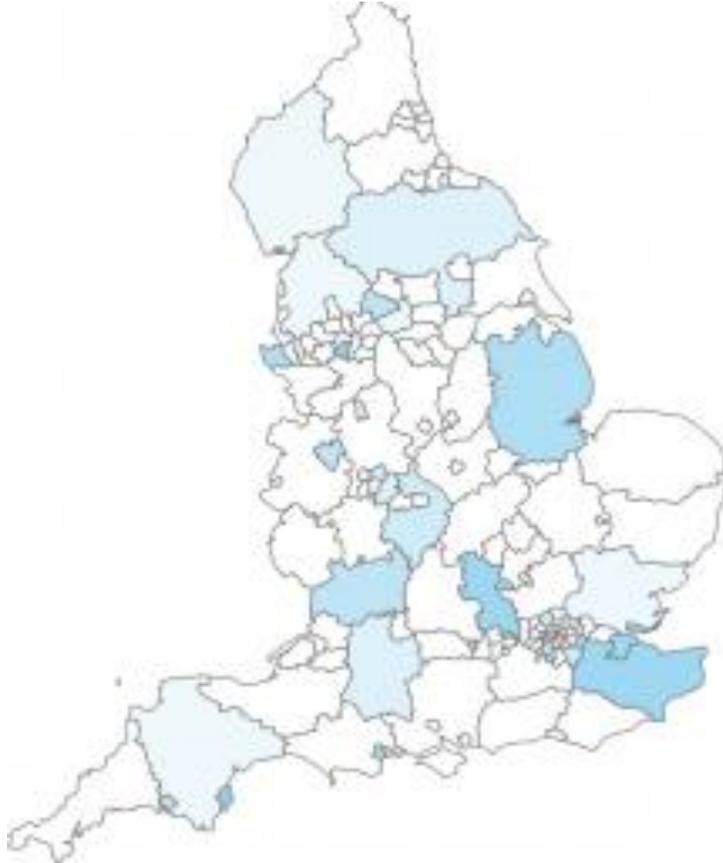
Table 6. The relationship between family income and parental school preferences in England

Reason for choosing school	Selective		Comprehensive	
	% point change per £100 increase in weekly income	SE	% point change per £100 increase in weekly income	SE
Good exam results / reputation	4.4%**	0.8%	6.4%**	0.5%
General good impression of school	4.4%**	0.8%	5.1%**	0.4%
Good range of extra-curricula activities	1.0%	0.9%	4.7%**	0.5%
Religious grounds	1.0%	0.5%	0.8%*	0.5%
Child wanted to go there	0.8%	0.7%	1.9%**	0.5%
Strong anti-bullying policy	0.6%	0.8%	1.1%**	0.5%
Has good facilities	0.2%	0.9%	4.3%**	0.4%
Other	0.0%	0.1%	0%	0.1%
Nearest school to home	-0.5%	0.9%	-0.8%	0.6%
Has a specialist curriculum	-0.9%	0.6%	0.4%	0.4%
Other relative went there	-1.1%	0.4%	-1.6%**	0.3%
Friends intending to go there	-1.2%	0.8%	1.0%**	0.3%
Brother/sister goes there	-1.3%	0.8%	-1.6%**	0.5%

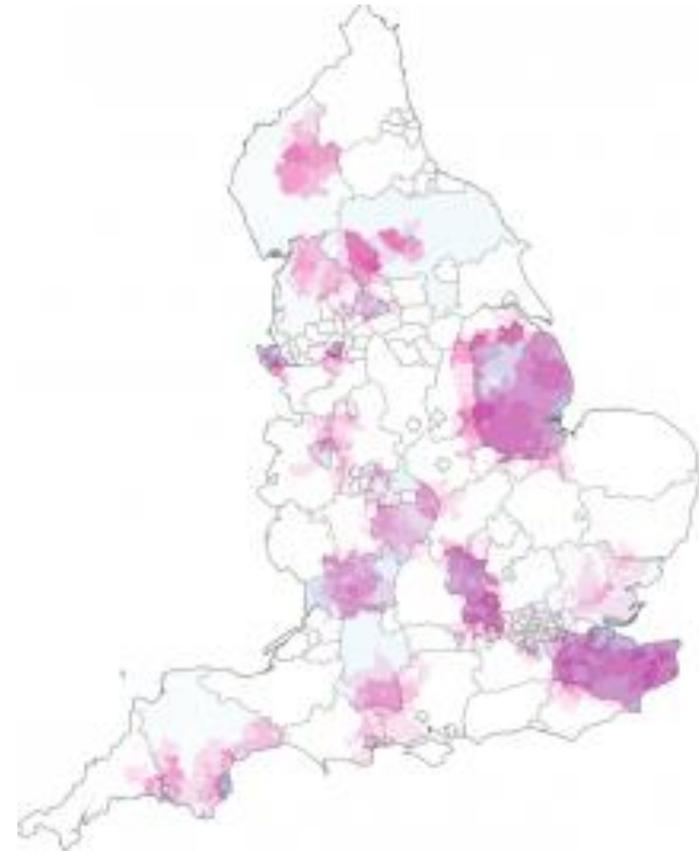
Notes: * and ** indicate statistical significance at the ten and five percent significant thresholds respectively.

Figure 1. The local of grammar schools in England and where their pupils live

(a) Location of grammar schools



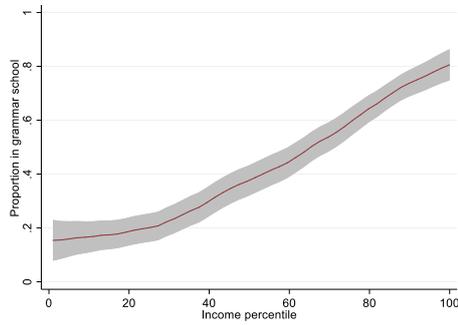
(b) Where grammar school pupils live



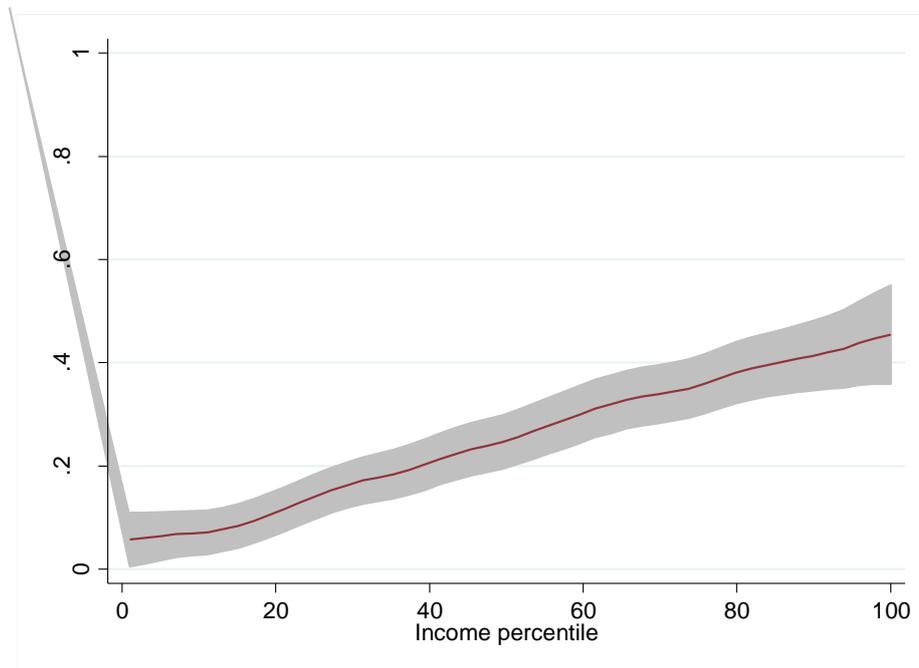
Source: Allen (2016). Notes: Darker shading refers to a greater concentration of grammar schools (panel a) or proportion of pupils who attend a grammar school.

Figure 2. The relationship between permanent family income and the probability of attending a grammar school

(a) Northern Ireland



(b) England



Notes: Authors' calculations using the MCS data. Graph illustrates how the probability of attending a grammar school increases with equivalised weekly family income.

Appendix A. Alternative parameter estimates including academic achievement measures up to age 11 as controls

(a) Northern Ireland

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9	
	Beta	SE																
Household income																		
Bottom quartile (Reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Second quartile	11.1%	4.9%	5.5%	4.3%	5.4%	4.3%	5.2%	4.3%	3.6%	4.3%	3.7%	4.2%	3.2%	4.5%	-0.9%	4.1%	-0.3%	0.4%
Third quartile	30.6%	5.5%	17.0%	5.0%	13.2%	4.7%	11.7%	4.7%	<u>9.1%</u>	4.8%	<u>9.3%</u>	4.8%	<u>9.0%</u>	4.9%	7.4%	4.7%	<u>8.2%</u>	4.7%
Top quartile	52.9%	5.2%	30.2%	4.6%	22.4%	4.6%	19.3%	4.8%	16.1%	4.7%	16.6%	4.6%	15.9%	4.9%	13.5%	4.8%	14.7%	4.8%
Controls																		
Gender	Yes																	
Parent religion	Yes																	
Prior achievement	-		Yes															
Election ward fixed effects	-		-		Yes													
Private tutoring/coaching	-		-		-		Yes											
School choice: results important	-		-		-		-		Yes									
School choice: full controls	-		-		-		-		-		Yes		Yes		Yes		Yes	
Parent views on child's ability	-		-		-		-		-		-		Yes		Yes		Yes	
Parent views of non-cog skills	-		-		-		-		-		-		Yes		Yes		Yes	
Teacher's views on child's ability	-		-		-		-		-		-		-		Yes		Yes	
Teacher's views of non-cog skills	-		-		-		-		-		-		-		Yes		Yes	
Parental expectations age 7	-		-		-		-		-		-		-		-		Yes	
	1,039		1,039		1,039		1,039		1,039		1,039		1,039		1,039		1,039	

(b) England

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9	
	Beta	SE																
Household income																		
Bottom quartile (Reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Second quartile	14.1%	4.7%	9.3%	4.4%	9.0%	4.2%	<u>7.4%</u>	3.9%	8.5%	4.0%	8.3%	4.2%	<u>8.1%</u>	4.2%	<u>8.5%</u>	4.3%	8.6%	4.3%
Third quartile	20.2%	4.4%	12.7%	4.8%	13.2%	4.9%	<u>6.7%</u>	4.0%	<u>7.1%</u>	4.0%	6.2%	4.0%	<u>7.3%</u>	4.3%	7.1%	4.5%	7.2%	4.5%
Top quartile	35.7%	3.7%	19.9%	4.0%	22.2%	4.7%	12.2%	4.0%	12.7%	4.0%	11.3%	4.1%	11.9%	4.3%	11.4%	4.3%	11.7%	4.3%
Controls																		
Gender	Yes																	
Prior achievement	-		Yes															
LEA fixed effects	-		-		Yes													
Private tutoring/coaching	-		-		-		Yes											
School choice: results important	-		-		-		-		Yes									
School choice: full controls	-		-		-		-		-		Yes		Yes		Yes		Yes	
Parent views on child's ability	-		-		-		-		-		-		Yes		Yes		Yes	
Parent views of non-cog skills	-		-		-		-		-		-		Yes		Yes		Yes	
Teacher's views on child's ability	-		-		-		-		-		-		-		Yes		Yes	
Teacher's views of non-cog skills	-		-		-		-		-		-		-		Yes		Yes	
Parental expectations age 7	-		-		-		-		-		-		-		-		Yes	
	819		819		819		819		819		819		804		804		804	

Appendix B. Logistic regression model estimates

(a) Northern Ireland

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9	
	Beta	SE	Beta	SE	Beta	SE	Beta	SE	Beta	SE	Beta	SE	Beta	SE	Beta	SE	Beta	SE
Household income																		
Bottom quartile (Reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Second quartile	0.68	0.30	<u>0.54</u>	0.31	0.50	0.36	0.41	0.37	0.25	0.37	0.22	0.38	0.14	0.44	-0.23	0.45	-0.17	0.45
Third quartile	1.52	0.30	1.16	0.32	1.01	0.35	0.87	0.36	<u>0.65</u>	0.37	<u>0.66</u>	0.37	<u>0.68</u>	0.40	0.47	0.42	0.52	0.42
Top quartile	2.46	0.31	1.82	0.31	1.59	0.34	1.32	0.37	1.03	0.36	1.07	0.36	1.10	0.42	0.96	0.43	1.05	0.44
Controls																		
Gender		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Parent religion		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Prior achievement		-		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Election ward fixed effects		-		-		Yes												
Private tutoring/coaching		-		-		-		Yes										
School choice: results important		-		-		-		-		Yes								
School choice: full controls		-		-		-		-		-		Yes		Yes		Yes		Yes
Parent views on child's ability		-		-		-		-		-		-		Yes		Yes		Yes
Parent views of non-cog skills		-		-		-		-		-		-		Yes		Yes		Yes
Teacher's views on child's ability		-		-		-		-		-		-		-		Yes		Yes
Teacher's views of non-cog skills		-		-		-		-		-		-		-		Yes		Yes
Parental expectations age 7		-		-		-		-		-		-		-		-		Yes
		1,039		1,039		996												

(b) England. State non-grammar versus grammar school.

State non-grammar versus grammar school	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9		
	Beta	SE	Beta	SE	Beta	SE	Beta	SE											
Household income																			
Bottom quartile (Reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Second quartile	1.67	0.68	1.50	0.67	1.39	0.68	1.02	0.73	1.02	0.71	0.98	0.76	0.74	0.75	0.87	0.81	0.86		
Third quartile	2.03	0.65	1.83	0.65	1.74	0.66	0.92	0.68	0.85	0.66	0.79	0.69	0.64	0.66	0.65	0.71	0.62		
Top quartile	2.76	0.63	2.21	0.63	2.30	0.65	1.45	0.66	1.38	0.65	<u>1.23</u>	0.68	0.96	0.68	0.88	0.73	0.88		
Controls																			
Gender	Yes		Yes		Yes		Yes		Yes										
Prior achievement	-		Yes		Yes		Yes		Yes		Yes								
LEA fixed effects	-		-		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Private tutoring/coaching	-		-		-		Yes		Yes		Yes		Yes		Yes		Yes		Yes
School choice: results important	-		-		-		-		Yes		Yes		Yes		Yes		Yes		Yes
School choice: full controls	-		-		-		-		-		Yes		Yes		Yes		Yes		Yes
Parent views on child's ability	-		-		-		-		-		-		Yes		Yes		Yes		Yes
Parent views of non-cog skills	-		-		-		-		-		-		Yes		Yes		Yes		Yes
Teacher's views on child's ability	-		-		-		-		-		-		-		Yes		Yes		Yes
Teacher's views of non-cog skills	-		-		-		-		-		-		-		Yes		Yes		Yes
Parental expectations age 7	-		-		-		-		-		-		-		-		-		Yes
	866		866		866		864		864		864		864		848		847		846

(c) England. State non-grammar versus independent school.

State non-grammar versus grammar school	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9		
	Beta	SE	Beta	SE															
Household income																			
Bottom quartile (Reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Second quartile	<u>1.89</u>	1.01	1.76	1.07	1.61	1.02	1.56	1.06	1.60	1.07	1.51	1.08	1.62	1.20	0.99	1.24	1.25		
Third quartile	1.61	1.06	1.54	1.11	1.38	1.07	1.13	1.06	1.14	1.08	1.08	1.09	0.65	1.32	0.51	1.34	0.41		
Top quartile	4.04	0.99	3.78	0.98	3.68	0.93	3.43	0.92	3.45	0.94	3.44	0.97	3.31	1.08	3.21	1.06	3.47		
Controls																			
Gender	Yes		Yes																
Prior achievement	-		Yes		Yes														
LEA fixed effects	-		-		Yes		Yes												
Private tutoring/coaching	-		-		-		Yes		Yes										
School choice: results important	-		-		-		-		Yes		Yes		Yes		Yes		Yes		
School choice: full controls	-		-		-		-		-		Yes		Yes		Yes		Yes		
Parent views on child's ability	-		-		-		-		-		-		Yes		Yes		Yes		
Parent views of non-cog skills	-		-		-		-		-		-		Yes		Yes		Yes		
Teacher's views on child's ability	-		-		-		-		-		-		-		Yes		Yes		
Teacher's views of non-cog skills	-		-		-		-		-		-		-		Yes		Yes		
Parental expectations age 7	-		-		-		-		-		-		-		-		Yes		
	866		866		866		864		864		864		864		848		847		846

Appendix C. Alternative estimates for England, using the more restrictive definition of selective education areas

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9	
	Beta	SE																
Household income																		
Bottom quartile (Reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Second quartile	17.8%	5.2%	12.4%	5.2%	11.0%	4.8%	9.0%	4.5%	9.6%	4.5%	10.4%	4.7%	9.9%	4.5%	10.9%	4.7%	11.1%	4.6%
Third quartile	27.0%	5.0%	18.1%	4.5%	18.2%	4.9%	10.3%	4.1%	10.4%	4.1%	9.9%	4.1%	11.1%	4.4%	11.3%	4.4%	11.5%	4.4%
Top quartile	38.0%	4.4%	23.5%	3.6%	26.0%	4.7%	16.1%	3.9%	16.6%	3.8%	15.6%	3.8%	16.4%	4.2%	15.8%	4.4%	16.1%	4.3%
Controls																		
Gender	Yes																	
Prior achievement	-		Yes															
LEA fixed effects	-		-		Yes													
Private tutoring/coaching	-		-		-		Yes											
School choice: results important	-		-		-		-		Yes									
School choice: full controls	-		-		-		-		-		Yes		Yes		Yes		Yes	
Parent views on child's ability	-		-		-		-		-		-		Yes		Yes		Yes	
Parent views of non-cog skills	-		-		-		-		-		-		Yes		Yes		Yes	
Teacher's views on child's ability	-		-		-		-		-		-		-		Yes		Yes	
Teacher's views of non-cog skills	-		-		-		-		-		-		-		Yes		Yes	
Parental expectations age 7	-		-		-		-		-		-		-		-		Yes	
	520		520		520		520		520		520		511		511		511	

Appendix D. Alternative estimates for England. Probability of attending *either* a grammar school or a private school.

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9	
	Beta	SE																
Household income																		
Bottom quartile (Reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Second quartile	15.5%	4.5%	9.5%	4.2%	9.1%	4.1%	<u>7.3%</u>	3.8%	8.3%	3.8%	7.9%	4.0%	<u>7.3%</u>	4.1%	<u>7.5%</u>	4.2%	<u>7.7%</u>	4.1%
Third quartile	21.0%	4.4%	12.5%	4.6%	12.8%	4.8%	<u>6.7%</u>	4.0%	<u>7.2%</u>	4.0%	<u>6.7%</u>	4.0%	6.7%	4.4%	6.5%	4.5%	6.5%	4.5%
Top quartile	42.3%	4.4%	26.4%	4.2%	28.9%	4.7%	19.4%	4.3%	19.8%	4.3%	18.9%	4.3%	17.9%	4.5%	17.2%	4.5%	17.6%	4.5%
Controls																		
Gender	Yes																	
Prior achievement	-		Yes															
LEA fixed effects	-		-		Yes													
Private tutoring/coaching	-		-		-		Yes											
School choice: results important	-		-		-		-		Yes									
School choice: full controls	-		-		-		-		-		Yes		Yes		Yes		Yes	
Parent views on child's ability	-		-		-		-		-		-		Yes		Yes		Yes	
Parent views of non-cog skills	-		-		-		-		-		-		Yes		Yes		Yes	
Teacher's views on child's ability	-		-		-		-		-		-		-		Yes		Yes	
Teacher's views of non-cog skills	-		-		-		-		-		-		-		Yes		Yes	
Parental expectations age 7	-		-		-		-		-		-		-		-		Yes	
	866		866		866		864		864		864		848		847		846	