The association between attending a grammar school and children's socio-emotional outcomes. New evidence from the Millennium Cohort Study.

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August 2018

Several areas in the UK allocate children to secondary schools based on exam results at age 11. While many studies have investigated how attending academically selective schools affects pupils' subsequent educational attainment, we know very little about how grammar attendance affects other outcomes, such as pupils' self-confidence, academic self-esteem and aspirations. We investigate this by applying propensity score matching techniques to rich data from the Millennium Cohort Study. Results show that attending a grammar school has very little impact upon pupils' socio-emotional outcomes. Expanding grammar schools is therefore unlikely to benefit pupil in this respect.

Key Words: Grammar schools, socio-emotional outcomes.

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1. Introduction

In academically selective schooling systems, exam results determine which school a pupil will attend. In the UK, a selective education system was introduced in England, Wales and Northern Ireland after the Second World War. In the 1960's and 70's, selection was scaled back substantially in England and Wales, though not in Northern Ireland (Gallagher and Smith, 2000). As a result, selective 'grammar' schools now only educate around five percent of secondary school pupils in England (Department for Education, 2017). More recently, however, the UK government has made a number of proposals for increasing the use of selection in the school system in England. In 2018, for example, £50 million of funding was released to enable existing grammar schools to expand (Department for Education, 2018).

Plans to expand selection at age 11 have prompted a renaissance in research investigating how gaining entry into grammar schools affects pupils' life chances (Cribb *et al*., 2013; Burgess *et al*., 2014; Allen and Bartley, 2017; Burgess *et al*., 2017). One strand of this literature has considered whether children who attend grammar schools have higher subsequent educational attainment. Some of these studies suggest that gaining entry into a grammar school has non-trivial benefits. For instance, Guyon et al. (2012) found that expanding selective schools in Northern Ireland in 1989 improved pupil attainment. Likewise, Sullivan and Heath (2002) used data on a cohort of pupils born in 1958 and found grammar school pupils achieved superior educational outcomes relative to their comprehensive school peers. Studies using more recent data, by contrast, have found little or no benefits in terms of later academic attainment (Gorard and Siddiqui, 2018; Smith-Woolley *et al*., 2018). Research also shows that non-selective schools near to grammar schools have lower levels of attainment (Atkinson *et al*., 2006).

While important, academic outcomes are not the only ways in which gaining, or failing to gain, entry into grammar schools affects pupils. In particular, research suggests a number of ways in which social-emotional or non-cognitive skills might also be affected by selection. Failure to get into grammar school may have a long-term scarring effect upon young people's self-confidence, well-being and self-esteem (Ahmavaara and Houston, 2007; Gallagher and Smith, 2000; Remedios et al, 2005). This has been supported by extensive qualitative research with teachers in Northern Ireland, which found that pupils who did not gain entry into selective schools were affected in a number of ways: "their reluctance to speak in class; their lack of motivation and attitude to work; the low targets that they set for themselves; and, in many cases, the increased incidence of discipline problems" (Byrne and Gallagher (2004, p.171). This was attributed directly to the experience of the selection process.

Selection may also have indirect effects on socio-emotional outcomes. For example, entry into a grammar school will change a child's peer group. Previous work has illustrated how high-achieving peers can positively influence personality traits (Comi *et al*., 2017) which are themselves important predictors of outcomes in later life (Borghans *et al*., 2008). Peer groups also provide a reference point against which pupils judge their own ability. Research from both psychology (e.g. Marsh and Parker, 1984) and economics (Murphy and Weinhardt, 2016) into 'Big Fish Little Pond' effects finds that grammar school pupils may actually develop *lower* levels of academic self-concept and self-efficacy, as their main reference point will be their high-achieving peers. Grammar and non-grammar pupils may also be exposed to different levels of bullying, peer pressure and misbehaviour (Gallagher and Smith, 2000; Byrne and Gallagher, 2004) which may in turn influence young people's mental health (Basu *et al*., 2014). Byrne and Gallagher (2004) provide one such example, with the concentration of low attaining pupils in non-selective schools creating an anti-authority culture which negatively affected behaviour. The combination of the factors above provides clear reasons to believe that gaining entry into a grammar school may have an impact upon young people's socio-emotional outcomes.

We add to the existing evidence by investigating how grammar attendance affects children's social and emotional skills, including school engagement, academic well-being, peer relationships, self-esteem, aspirations for the future and mental health. To trail our key results, we find very little evidence that attending a grammar school has a positive effect upon young people's social-emotional outcomes at age 14. This holds true in both England and Northern Ireland, for a wide variety of measures (attitudes towards school, behaviour, mental health and wellbeing, aspirations and expectations) and is robust to a wide range of sensitivity analyses. We hence challenge the conventional wisdom that gaining access to a grammar schools is really the make or break turning point for children that it is often made out to be. Looked at from another perspective, our results suggest that the current plan to expand grammar schools is unlikely to benefit pupils in terms of socio-emotional outcomes.

The paper now proceeds as follows. Section 2 provides a brief overview of the grammar school system in England and Northern Ireland. Section 3 outlines the Millennium Cohort Study (MCS) dataset, with our propensity score matching approach discussed in section 4. Results are then presented in section 5, with conclusions and a discussion of implications for research and policy in following in section 6.

2. The grammar school system in England and Northern Ireland

Academic selection in the United Kingdom refers to the grammar school system. At the start of their final year of primary school, at age 10 or 11, families have the option of entering their child for the grammar school entrance test. This is known as the 11-plus test in England and the 'transfer test' in Northern Ireland. These tests typically assess children's ability in three subjects (English, mathematics and reasoning skills) with a sufficiently high score required for the child to be allowed access to a grammar school. Those children who do not pass, or whose parents choose to not enter them for this test, do not have access to this academically selective track. Children who enter grammar school then typically remain in this track throughout secondary education (from ages 11 to 16); movement to and from a grammar to a non-grammar school is rare. By international standards, this form of academic selection is early (the average age of selection amongst OECD countries is 14) and binding in the sense that there is little opportunity to move into the grammar school track once in secondary school (OECD, 2013).

This system of between-school academic selection is the norm across the whole of Northern Ireland. In England, however, the situation is more complex. Although the grammar school system was in place across the whole of England until the mid-1960s, the government then issued a directive encouraging local education authorities to move to a non-selective, comprehensive school system. Academic selection was quickly disbanded across large parts of the country, with only around 200 grammar schools remaining, educating around five percent of England's pupils by the end of the 1970s (Andrews *et al.*, 2016). There are ten Local Education Authorities (LEAs) in England where a fully academically selective schooling system remains[1]. Moreover, a number of 'isolated' grammar schools still exist in other parts of England (i.e. single grammar schools within a largely comprehensive area, with no other selective schools around). Figure 1 illustrates how England's 163 remaining grammar schools are distributed across the country (left-hand panel) along with the home location of the children who attend (right-hand panel). Darker shading indicates more intense concentration of academic selection.

<< Figure 1 >>

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[1] The 10 fully selective LEAs in England are Bexley, Buckinghamshire, Kent, Lincolnshire, Medway, Slough, Southend-on-Sea, Torbay, Trafford and Sutton.

3. **Data**

The Millennium Cohort Study (MCS) is a nationally representative longitudinal study of UK children (https://www.cls.ioe.ac.uk/page.aspx?sitesectionid=851). A stratified, clustered survey design was used, with geographic areas (electoral wards) selected as the primary sampling unit, and then households with newly born children randomly selected from within sampled electoral wards (see Plewis, 2004 for further details). Six sweeps have been conducted between 2000 and 2015, when children were 9 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 (11,695 in England and 1,955 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 (England) and 43 percent (Northern Ireland) respectively.

Children and their parents completed the fifth wave of the MCS survey at age 11; when the majority of pupils were in Year 6 (i.e. the year before children enter grammar school). Most of the surveys were completed between February and July 2012, as children in England were completing Year 6, and after they would have taken the eleven-plus test (typically between September 2011 and January 2012). Within the age 11 survey, parents of cohort members were asked:

"*Thinking about all of the schools you applied to, which of these types of schools did you apply to?*" with "Grammar school" being one of the response options.

Note that families typically only apply to grammar schools *after* the results of the entrance test are known. With respect to this paper, this would imply that families would only apply to a grammar school if their child has passed the entrance test. Consequently, parental reports of whether they applied to a grammar school should act as a good proxy for whether their child sat and passed this test. Therefore, throughout our analysis, we restrict the sample to only those pupils whose families applied for them to attend a grammar school. This should, in turn, help us to rule out potential confounding differences between grammar and non-grammar school pupils, and aid in our estimation of the average treatment effect on the treated (ATT). In doing so, the sample size available for analysis is restricted to 883 children in England and 733 in Northern Ireland. Approximately 40 percent of these children then went on to attend a grammar

school in England, and 78 percent in Northern Ireland[2]. Appreciating that this restriction clearly reduces the pool of observations available to match grammar school pupils to, we also present alternative results in the online supplementary material where this sample restriction is no longer made (see Appendix G).

<u>Matching variables</u>

The propensity scores matching approach we employ relies on a selection on observables assumption. That is, it requires us to match grammar and non-grammar pupils on all the variables which determine treatment assignment and influence our outcome measures. Although this is in general a strong assumption, our data is extremely rich and therefore well suited to the task. In this section we describe the extensive set of matching variables employed, including pre-test outcome measures and variables likely to determine who ends up being assigned to grammar schools, including prior attainment and parental school preferences.

When the MCS cohort were age 11, their parents were also asked a series of questions relating to school choice. This included a question asking them *"Which of these factors were important in choosing a secondary school?"* with example response options being "School is near to home" and "Academic reputation". Parents were also 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?"* with example response options being "Arranged extra tuition or coaching for child" and "Moved home". Together this means we have access to detailed information on the factors associated with parental school choice and the actions they have taken to try and get their children into their preferred secondary school. This information will play a critical role in our construction of an appropriate counterfactual within our propensity score matching models (see section 4 for further details).

MCS cohort members have completed a number of cognitive tests. Specifically, these tests are: Naming vocabulary (ages 3 and 5); Pattern construction (ages 5 and 7); Picture similarities (age 5); Word reading (age 7); Progress in Maths (age 7); Verbal similarities (age 11); Spatial working memory (age 11). Together, these capture children's abilities in English, mathematics, verbal and non-verbal reasoning – all the areas typically assessed as part of the grammar school

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[2] Restricting the sample to applicants leads to a relatively small sample size for non-grammar school children in the case of Northern Ireland. We have therefore produced an alternative set of estimates for Northern Ireland where we do not make this sample restriction, and include both applicants and non-applicants within our matching models. This leads to a much larger pool of non-grammar school pupils that we can match grammar school pupils to. These alternative results are provided in the online supplementary material (see Appendix G). This alternative approach does not lead to substantial changes to the conclusions reached.

entrance exam (Allen, Bartley and Nye, 2017). Hence, we are able to account for the key factors which determine entry into grammar schools, amongst the sub-set of children who apply. Moreover, by being able to control for children's performance on up to nine different tests, taken at four different ages, the scope for measurement error affecting our results is limited.

As part of the age 11 survey, young people were also asked a battery of questions capturing their attitudes towards school, along with a number of modules designed to capture their social-emotional characteristics. Academic self-concept was measures by three questions, such as "*I am good at English*". School motivation/engagement was measured by a series of five questions, such as "*How often do you try your best at school*". Well-being was measured by six questions, such as "*How do you feel about the following parts of your life? Your friends.* Academic well-being was measured by children's responses to two questions capturing how positive children are about their school work and the school they go to, such as "*How do you feel about the following parts of your life? Your school work.* Self-esteem was measured by the Rosenberg Scale, using questions such as "*I am able to do things as well as most other people.*" Behaviour was measured using the Strengths and Difficulties Questionnaire, which is a widely used scale capturing children's behavioural problems across five dimensions. The online supplementary materials (Appendix A) provides the full list of questions within each of our outcome scales.

Age 14 outcome measures

A number of the outcome scales children completed at age 11 were also repeated in the age 14 survey, including the academic self-concept, well-being, academic well-being, self-esteem and SDQ scales. Hence for these specific measures we have information available in the final year of primary school, and again three years into secondary school. Moreover, we also have access to additional outcome measures within the age 14 survey. We group these under several categories, all of which, as argued in the introduction, are plausibly influenced by whether the child gains entry into a grammar school.

The first outcome is young peoples' expectation and aspirations. We consider the impact of attending a grammar school upon their response to the question '*How likely do you think it is that you will go to university*?' This was reported on a continuous scale (ranging from 0 to 100%), which we have standardised to have mean 0 and standard deviation 1. We also consider the impact of attending a grammar upon response to the question '*When you grow up what would you like to be*?' This has been recoded into occupational categories within the MCS

dataset, which we have dichotomised into a binary variable. This takes the value of 1 if the child responded with a professional job and 0 otherwise (including if they gave a vague response or said that they do not know).

The second outcome we investigate is attitude towards school. Specifically, we explore the association between grammar school entry and the following attitudinal variables (many of which have already been described in the section on matching variables above):

- *Academic self-concept.*
- *School motivation / engagement.*
- *Academic well-being.*
- *Friends behaviour in school.* A scale based upon children's response to the following two questions: '*How many of your close friends work hard at school?*' and '*How many of your close friends get into a lot of trouble at school?*'. Responses are on a four-point scale – all of them, most of them, some of them and none of them.
- *Importance of qualifications.* Children's responses to the following question on a five-point scale: '*How much do you agree or disagree that nowadays you need qualifications in order to get a job worth having?*'
- *Truancy.* A binary variable based upon children's responses to a question asking whether they have missed school at any point over the last 12 months without parental permission.

The third outcome is mental health and wellbeing. Specifically, we consider the relationship between grammar school attendance and the following socio-emotional outcomes (many of which have already been described in the section on matching variables above):

- *Mental health scale.* A scale based upon children's response to 13 statements, all on a three-point scale (not true, sometimes, true). For example, '*I thought I could never be as good as other kids*'. See online supplementary materials (Appendix A) for further details.
- *Well-being.*
- *Rosenberg self-esteem scale.*
- *Bullying.* Children's responses on a six-point scale to the two questions: '*How often do other children hurt you or pick on you on purpose?*' and '*How often have other children sent you unwanted or nasty emails, texts or messages or posted something nasty about you on a website?*'
- *The Strengths and Difficulties Questionnaire (SDQ) behavioural scale.*

The fourth outcome is parental aspirations. If a child fails to get into a grammar school, then their parents may adjust their expectations for what their offspring will do in the future. For instance, if their child has failed to get into a grammar school, they may revise their beliefs about whether they are likely to continue in school beyond the compulsory leaving age, and

whether they will go on to university. Parents may also adjust their willingness to continue certain educational investments, such as paying for private tuition. We explore such possibilities through the three age 14 outcome variables. First, *Parental post-16 expectations* measured by a binary variable indicating whether a parent wants their child to continue in education past age 16. Second, *Parental university expectations* measured by a binary variable indicating whether a parent wants their child to attend university. Third, *Receiving tutoring at age 14* indicating whether a parent is providing private tutoring for their child.

For completeness, we also look at a measure of English vocabulary at age 14. This was collected through a short (four minute) test academic which required pupils to choose a word meaning the same or nearly the same from a list of five alternatives. Twenty words were included in the task and these got more difficult as the task progressed.

4. Methodology

We use propensity score matching (PSM) to estimate the impact of gaining entry into a grammar school upon children's outcomes. This method essentially matches each grammar school pupil to an equivalent non-grammar school pupil, who is similar in terms of a number of observable characteristics. The outcomes of 'treatment' (grammar) and 'control' (matched non-grammar) pupils are then compared to estimate the impact of attending grammar schools upon young people's lives.

When implementing this methodology, we first restrict the MCS sample to only those children whose families applied for them to attend a grammar school. This leaves a pre-matching sample of 883 children in England and 733 children in Northern Ireland. Nearest neighbour matching is then used, with a tight restriction set on the caliper to 0.005, to create the matched control group. Within the PSM model, we include a wide range of variables described in the previous section. A full list of the variables included in our matching models can be found in Supplementary Table 1 (England) and Supplementary Table 2 (Northern Ireland). Formally, the logistic regression model underlying the PSM matching is specified as:

$$log\left(\frac{\pi(G)}{1-\pi(G)}\right) = \alpha + \beta_1.D + \beta_2.A^7 + \beta_3.S^7 + \beta_4.A^{11} + \beta_5.S^{11} + \beta_6.P + \beta_7.T$$

Where:

$\pi(G)$ = The probability of attending a grammar school (G = 1 grammar; G = 0 non-grammar)

D = A vector of demographic characteristics such as gender and parental income

A^7 = Measures of children's academic achievement up to age 7

S^7 = Children's socio-emotional measures at age 7

A^{11} = Measures of children's academic achievement up to age 11

S^{11} = Children's socio-emotional measures at age 11

P = Parental school preferences measured at age 11

T = Whether the child received tutoring at age 11

Multiple imputation by chained equations has been used to take into account of missing covariate data. These models are estimated separately for England and Northern Ireland. This means that grammar school children in England can only be matched to non-grammar school children in England (and likewise for Northern Ireland). The notes to Supplementary Figure 1, along with the online supplementary materials (Appendix B and C), provides details about the number of children who are dropped due to not having a suitable match (e.g. treatment pupils for whom no comparable control pupil could be found). The online supplementary materials (Appendix B and C) also show the final sample size for our different analyses, which are typically around 650 observations in England and 500 observations in Northern Ireland.

<< Supplementary Figure 1 >>

It is standard in the PSM literature to present 'balance tests', comparing the characteristics of the two groups, after the matching has taken place. These are presented in Supplementary Tables 1 (England) and 2 (Northern Ireland) below. As anticipated, before matching has taken place, grammar school pupils are rather different to their non-grammar school peers. Specifically, they tend to have higher levels of prior academic achievement, come from more advantaged socio-economic backgrounds and have stronger socio-emotional skills. However, after matching upon the propensity score, the two groups are much more comparable, particularly in the case of England. For instance, as evidenced by the small effect size differences, the matched samples are very similar in terms of prior academic ability scores, parental school preferences and socio-economic background. Consequently, our interpretation of Supplementary Table 1 is that the matching process for England appears to have 'balanced' the grammar and non-grammar school groups reasonably well, including across a wide range of age 11 cognitive and socio-emotional outcomes.

<< Supplementary Table 1 >>

Although matching has undoubtedly improved the comparability of the grammar and non-grammar groups within the Northern Irish data, it is nevertheless clear that some differences do remain. For instance, after matching, the grammar school group continue to have higher levels of school engagement, parents who tend to help their children more with their homework and who placed more importance upon reputation when choosing a secondary school than their non-grammar school peers. On the other hand, the two groups are now reasonably well-balanced in terms of prior academic achievement results, with there actually being some small advantages on some of these to the non-grammar school group (e.g. age 7 maths and English scores). Together, our interpretation of Supplementary Table 2 is that the matching process has worked satisfactorily in Northern Ireland. However, we note that some caution is required, given that some non-trivial differences between grammar and non-grammar school pupils remain.

<< **Supplementary Table 2** >>

The following section presents our results, where we compare age 14 outcomes between grammar school pupils and their matched controls. All continuous measures (e.g. WORD vocabulary scores, SDQ scores) have been standardised to have mean 0 and standard deviation 1. The direction of each scale has also been changed, so that higher values refer to 'better' outcomes. All estimates for continuous variables are therefore effect sizes. Results for binary outcomes are, on the other hand, presented in terms of proportional differences[3].

5. Results

Table 1 presents the results for England. We present results from our preferred specification (Model 1), which controls for a wide range of measures up to age 11. We also present results when our matching models only include achievement controls up to age 7, rather than age 11, in Model 2. This avoids any potential endogeneity of age 11 scores to grammar entry.[4] The results highlight a clear and consistent message; across a wide range of outcomes there is little benefit of gaining entry into a grammar school. The vast majority of estimates are small in terms of magnitude. For instance, in Model 1, there is no evidence that grammar school children are more engaged in their school work (effect size 0.01), are more likely to expect to go to

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[3] For instance, a value of 0.05 for a binary measure would indicate that grammar school pupils are five percentage points more likely to experience the outcome in question than their matched non-grammar peers.

[4] For example, children and their families will already know whether they will be going to a grammar school by the time they sit their Key Stage 2 tests. If going to a grammar school has 'anticipatory effects' (e.g. parents deciding to continue investing in private tuition if their child gains entry to grammar school, but end it if they do not) then Key Stage 2 test scores may be potentially endogenous.

university (effect size 0.01). Similar results hold for aspirations towards a professional job (-1 percentage point), academic self-concept (effect size -0.15) and SDQ scores (effect size 0.02). Indeed, the only outcome with a sizeable effect is teenagers' self-esteem, though this actually seems *worse* for grammar school pupils. The one exception is our measure of vocabulary skills, for which grammar school pupils perform better (effect size 0.16) than the matched comparison group. In sum however, Table 1 therefore suggests that gaining access to a grammar school proffers little, if any, advantage in terms of the socio-emotional outcomes that are the main focus of this paper.

<< Table 1 >>

Analogous results for Northern Ireland can be found in Table 2. Again, most of the coefficients are close to zero, indicating that there is little or no difference between the two groups. Academic self-concept (i.e. children's responses to questions such as '*I am good at maths*') is a notable exception, with grammar school pupils having *worse* outcomes than their matched peers (effect size = -0.38). This could be due to big-fish little-pond effects (Marsh and Parker 1984), with young people referencing their own ability against their school peers. On the other hand, Northern Irish parents are six percentage points more likely to continue to pay for their child to have private tuition (particularly in mathematics) than their matched comparators. Hence there is some suggestion that parents are somewhat more likely to continue to pay for educational investments for their offspring if they attend a grammar school. Yet the above should not distract from the central message of Table 2; similar to the results for England, attending a grammar school does not seem to offer substantial advantages to those young people who gain entry (at least in the short run).

<< Table 2 >>

We test the robustness of these results in several ways. First, we varied the length of the caliper from 0.001 to 0.009, which varies the number of grammar school pupils for whom a comparable match can be found. These alternative results for England can be found in Supplementary Table 3 and in online Appendix H for Northern Ireland. The results are very similar and do not change our interpretation or conclusions.

<< Supplementary Table 3 >>

Prior results have relied on multiple imputation and the associated missing at random assumption. The online supplementary materials (Appendix G) consider whether our findings

change when implementing a complete-case analysis. Again, there is minimal change to our results in either country. We also check whether our results are affected by the potential for those who fail to gain entry to grammar schools to attend a private school instead. When removing those children who go on to attend a private secondary school from the sample (online Appendix E), we continue to find very few sizeable effects across our outcomes, and the majority of these favour attending non-grammar schools. Finally, we investigate whether the results hold when only using pupils in fully selective education areas (online Appendix D). The results are again very similar.

6. Discussion and Conclusion

Although often characterised as having a 'comprehensive' secondary schooling system, in parts of the United Kingdom the education system remains highly selective. In Northern Ireland and certain parts of England, children are tracked into different schools at age 11 based upon their performance on a high-stakes test, which many believe to be a critical determinant of young people's future lives. But how much of an advantage does gaining entry into an academically-selective grammar school really bring? A number of previous studies have considered the effect of grammar school attendance on pupil attainment (Sullivan and Heath, 2002; Guyon *et al.*, 2012). However, little consideration has thus far been paid to the impact upon wider aspects of young people's lives that are of great importance to children and parents when they are choosing a secondary school.

This paper has utilised detailed, nationally representative survey data to investigate whether attending a grammar school affects pupils' socio-emotional outcomes. The richness of the Millennium Cohort Study data allowed us to match grammar school pupils to non-grammar pupils on several important pre-test outcome measures, as well as a wide range of characteristics likely to determine treatment assignment, such as prior attainment and parental school preferences. This makes the selection on observables assumption - necessary to identify the impact of grammar attendance – unusually well justified in this case. Together, we believe that this adds new and important detail to the on-going debates about the merits of grammar schools, and the pros and cons of academically-selective education systems more generally.

Against the conventional wisdom, we find little evidence that gaining entry into a grammar school has a positive impact upon young people's socio-emotional outcomes. For instance, three years into their time at secondary school, grammar pupils seem to have similar levels of engagement and self-confidence in school, as well as aspirations and expectations for the

future, as their matched (non-grammar) peers. This holds true across two rather different settings (England and Northern Ireland), with quite different counterfactuals, and is robust to the wide array of sensitivity analyses we have conducted. This leads us to an important conclusion: in terms of socio-emotional outcomes, gaining entry into a grammar school may actually not be as important as many assume. Having said that, it is worth noting that on the one measure of academic outcomes we have access to – a short English vocabulary test – we do find some positive impact of attending a grammar school.

Our findings contrast with those from existing research in Northern Ireland. In particular, Byrne and Gallagher (2004) found that failing to gain entry to selective schools harmed the motivation, academic self-concept and aspirations of pupils – based upon interviews with teachers and school leaders in Northern Ireland. Our results, based on comparisons between otherwise very similar grammar and non-grammar pupils, suggest this is not the case in either England or Northern Ireland at present. There are a number of potential explanations for these divergent results. Interestingly, Gallagher and Smith (2000, p.12) report that quantitative surveys of pupils in Northern Ireland at the time found "few differences in the attitudes [to school] held by grammar and secondary pupils." This is consistent with our results and suggests perhaps that teachers' perceptions of the negative effects of failing to gain entry to grammar were out of line with how pupils actually experienced the process.

We have also been able to shed light on previous research investigating the impact of selective schools on academic outcomes. As previously discussed, a number of papers have found a positive impact of grammar attendance on pupils' subsequent academic attainment (Guyon *et al*., 2012; Sullivan and Heath, 2002). Our paper suggests that this is unlikely to be the result of (i.e. is not mediated by) grammar schools improving attitudes to school, academic self-concept, aspirations, and so on. Rather, any increase in attainment from attending a grammar school must come from other sources, more directly related to teaching and learning. However, a number of more recent papers which control for a wider range of pupil socio-economic and genetic differences, find little or no impact of attending grammar schools (Smith-Wooly, 2018; Gorard and Siddiqui, 2018). Our results are consistent with these papers, and show another way in which grammar schools do not benefit pupils. Moreover, they help explain why grammar schools do not improve academic attainment – they do not improve pupils' engagement with school.

These findings do, of course, need to be considered in light of the limitations of this research. First, despite the many important advantages of the MCS dataset, the sample size available for our analysis is limited. However, the fact that we have produced similar results using two separate samples (England and Northern Ireland), and with most point estimates around zero or even negative, we do not believe it likely that an increase in statistical power would alter our substantive conclusions. Second, at the time of writing, data is only available for short-run (age 14) measures of socio-emotional outcomes. Our one measure of attainment – the vocabulary test – is also low-stakes and very short. An important direction for future research is for longer-term outcomes to also be considered, including higher-quality and higher-stakes academic measures (e.g. GCSE grades, university entry), labour market outcomes, as well as the key socio-emotional competencies investigated in this paper. Finally, the limited sample size available for certain sub-groups (e.g. low-income pupils who attend a grammar school) means we have been unable to explore potential heterogeneous effects. Although this is clearly an important and policy-relevant issue, we unfortunately cannot provide a credible investigation into such effects due to the MCS sample size.

Despite these limitations, we nevertheless believe this paper has helped to further the debate upon the impact of grammar schools. Many parents and families place great emphasis upon their child getting a place at a grammar school, in the belief that this will have a substantial impact upon their future well-being. However, our analysis has shown how many of the things parents hold most dear (their children's well-being, aspirations and behaviour) are largely unaffected by going to a grammar school.

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Table 1. The association between attending a grammar school and children's outcomes in England

Outcome	Model 1		Model 2	
	Beta	**SE**	**Beta**	**SE**
Attitudes towards school				
Academic self-concept scale	-0.15	0.12	-0.05	0.10
School engagement scale	0.01	0.11	0.02	0.09
Academic well-being	-0.01	0.11	0.06	0.09
Friends behaviour at school	-0.06	0.12	0.01	0.10
Believe qualification needed to get a good job (Ref: No)	-0.05	0.04	-0.06	0.03
Played truant (Ref: No)	-0.04	0.03	-0.02	0.02
Mental health, well-being and self-esteem				
Mental health scale	-0.10	0.12	-0.02	0.10
Well-being scale	-0.04	0.12	-0.01	0.10
Self-esteem scale	**-**0.20	0.12	-0.11	0.10
Bullied	-0.08	0.11	-0.06	0.09
SDQ scale	0.02	0.10	0.01	0.09
Young people's aspirations and expectations				
Go to university scale	0.01	0.08	0.01	0.07
Aspire to work in a professional job (Ref: No)	-0.01	0.07	0.01	0.06
Parental aspirations and investments				
Parent thinks will stay in school post 16 (Ref: No)	0.02	0.02	0.03	0.02
Parent thinks will go to university (Ref: No)	-0.01	0.05	0.03	0.05
Receives tutoring (Ref: No)	0.00	0.04	0.00	0.04
Receives English tutoring (Ref: No)	0.01	0.03	0.00	0.03
Receives maths tutoring (Ref: No)	0.02	0.04	0.02	0.03
Academic achievement				
English vocabulary scale	0.16	0.13	0.26	0.11
Controls				
Demographic characteristics	Yes		Yes	
Achievement measures age 7	Yes		Yes	
Socio-emotional measures age 7	Yes		Yes	
Achievement measures age 11	Yes		-	
Parental school preferences age 11	Yes		-	
Tutoring and homework help age 11	Yes		-	
Socio-emotional measures age 11	Yes		-	

Notes: Effect for binary variables refers to a proportional increase. Effect for continuous outcome variables refer to effect sizes. Negative coefficient indicates worse outcomes for grammar school pupils than their matched non-grammar school peers. Model 1 refers to our preferred specification, with the PSM model including all covariates measured up to age 11, caliper set to 0.05, and matching to the two nearest neighbours. See online supplementary materials (Appendix B) for details on number of observations on and off common support.

Table 2. The association between attending a grammar school and children's outcomes in Northern Ireland (main specification)

Outcome	Model 1		Model 2	
	Beta	SE	Beta	SE
Attitudes towards school				
Academic self-concept scale	-0.38	0.17	-0.05	0.15
School engagement scale	-0.28	0.18	-0.10	0.15
Academic well-being	-0.25	0.18	-0.08	0.15
Friends behaviour at school	-0.07	0.21	0.10	0.17
Believe qualification needed to get a good job (Ref: No)	-0.03	0.07	-0.01	0.06
Played truant (Ref: No)	0.00	0.04	-0.01	0.03
Mental health, well-being and self-esteem				
Mental health scale	-0.25	0.19	-0.15	0.17
Well-being scale	-0.14	0.17	-0.11	0.15
Self-esteem scale	-0.24	0.18	-0.19	0.16
Bullied	0.07	0.17	-0.08	0.14
SDQ scale	-0.11	0.15	-0.14	0.13
Young people's aspirations and expectations				
Go to university scale	0.00	0.17	0.20	0.14
Aspire to work in a professional job (Ref: No)	-0.19	0.12	-0.04	0.09
Parental aspirations and investments				
Parent thinks will stay in school post 16 (Ref: No)	0.00	0.05	0.05	0.04
Parent thinks will go to university (Ref: No)	0.13	0.10	0.16	0.08
Receives tutoring (Ref: No)	0.06	0.02	0.06	0.02
Receives English tutoring (Ref: No)	0.00	0.01	0.00	0.01
Receives maths tutoring (Ref: No)	0.06	0.01	0.06	0.01
Academic achievement				
English vocabulary scale	-0.11	0.17	0.34	0.14
Controls				
Demographic characteristics	Yes		Yes	
Achievement measures age 7	Yes		Yes	
Socio-emotional measures age 7	Yes		Yes	
Achievement measures age 11	Yes		-	
Parental school preferences age 11	Yes		-	
Tutoring and homework help age 11	Yes		-	
Socio-emotional measures age 11	Yes		-	

Notes: Effect for binary variables refers to a proportional increase. Effect for continuous outcome variables refer to effect sizes. Negative coefficient indicates worse outcomes for grammar school pupils than their matched non-grammar school peers. Model 1 refers to our preferred specification, with the PSM model including all covariates measured up to age 11.

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

(a) Location of grammar schools   **(b) Where grammar school pupils live**
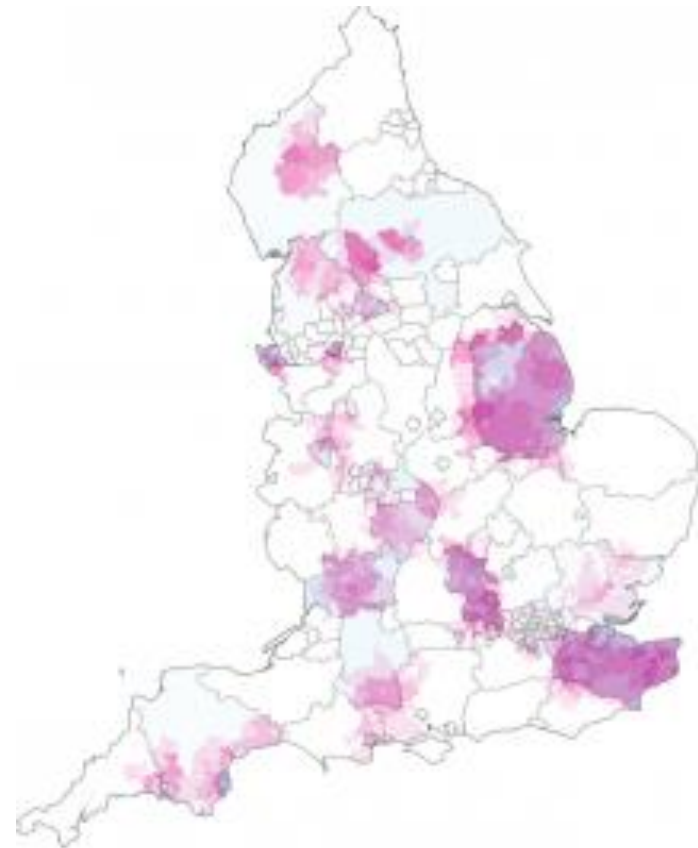
Notes: Based upon Allen (2016). Darker shading refers to a greater concentration of grammar schools (panel a) or proportion of pupils who attend a grammar school.

Supplementary Table 1. Covariate balance before and after matching in England

	Before matching			After matching		
	Grammar	**Non-grammar**	**Effect size difference**	**Grammar**	**Non-grammar**	**Effect size difference**
Age 11 SWM strategy	32.08	34.22	-0.36	32.45	32.54	-0.01
Age 11 SWM total errors	24.53	32.68	-0.43	25.92	25.68	0.01
Age 7 English vocabulary	133.83	123.02	0.36	133.27	132.70	0.02
Age 7 pattern construction	125.85	115.71	0.60	124.19	125.67	-0.09
Age 7 maths scores	109.22	102.09	0.46	108.63	108.38	0.02
Age 5 picture similarities	86.77	83.20	0.31	86.54	87.06	-0.05
Age 5 naming vocabulary	115.23	106.89	0.51	114.10	116.05	-0.12
Age 5 pattern construction	96.41	89.09	0.38	95.53	97.32	-0.09
Age 3 Bracken school readiness	114.18	106.41	0.48	112.76	112.61	0.01
Age 3 naming vocabulary	80.36	69.47	0.62	78.19	79.13	-0.05
Coaching for entrance test age 11	0.59	0.30	1.24	0.54	0.45	0.39
Other steps taken to get into chosen school	0.10	0.16	-0.18	0.12	0.11	0.01
Parental help with homework age 11	2.77	2.52	0.27	2.72	2.69	0.03
Homework a priority age 11	1.67	1.59	0.08	1.70	1.71	-0.01
Home tutor in English age 11	0.34	0.37	-0.09	0.35	0.33	0.06
Home tutor in maths age 11	0.33	0.40	-0.18	0.35	0.32	0.06
School choice: Child wanted to attend	0.76	0.62	0.29	0.74	0.74	0.00
School choice: Close to home	0.30	0.38	-0.16	0.32	0.30	0.02
School choice: Child's friends attending	0.15	0.17	-0.05	0.17	0.18	-0.02
School choice: Siblings attend	0.15	0.23	-0.17	0.18	0.12	0.12
School choice: Relative attend	0.05	0.06	-0.03	0.06	0.05	0.04
School choice: Reputation	0.90	0.78	0.25	0.89	0.87	0.04
School choice: Discipline	0.21	0.23	-0.04	0.22	0.24	-0.06
School choice: Extra-curricular activities	0.37	0.38	-0.02	0.39	0.41	-0.04
School choice: Specialist curriculum	0.19	0.15	0.12	0.20	0.13	0.20
School choice: Facilities	0.48	0.45	0.05	0.50	0.50	0.00
School choice: Good impression	0.75	0.61	0.28	0.71	0.71	-0.01
School choice: Religion	0.05	0.09	-0.16	0.05	0.04	0.06
School engagement scale age 11	0.25	0.20	0.05	0.26	0.36	-0.10
Academic self-concept scale age 11	0.54	0.24	0.30	0.47	0.57	-0.10
Well-being scale age 11	0.19	0.03	0.17	0.19	0.25	-0.06
Academic well-being scale age 11	0.33	0.10	0.22	0.31	0.38	-0.07
Self-esteem scale age 11	0.26	0.10	0.15	0.22	0.39	-0.17
SDQ total scores age 11	-0.44	-0.19	-0.24	-0.42	-0.46	0.04
Academic enjoyment age 7	1.51	1.49	0.03	1.51	1.52	-0.01
Well-being age 7	1.16	1.23	-0.24	1.17	1.15	0.07
School-engagement age 7	2.38	2.38	0.01	2.39	2.39	-0.02
SDQ total scores age 7	5.38	7.13	-0.31	5.57	5.43	0.03
Verbal similarities score age 11	129.66	124.36	0.32	129.07	129.15	0.00
Equivalised household income	4.97	3.91	0.52	4.77	4.97	-0.10
Mother NVQ level 1	0.03	0.04	-0.04	0.03	0.02	0.02

Mother NVQ level 2	0.22	0.21	0.01	0.22	0.26	-0.08
Mother NVQ level 3	0.09	0.10	-0.02	0.08	0.08	-0.01
Mother NVQ level 4	0.45	0.33	0.26	0.43	0.39	0.10
Mother NVQ level 5	0.16	0.11	0.22	0.18	0.19	-0.07
Gender	0.49	0.49	0.01	0.50	0.57	-0.13
Ethnicity: Mixed	0.06	0.05	0.04	0.07	0.05	0.08
Ethnicity: Indian	0.07	0.13	-0.43	0.09	0.08	0.08
Ethnicity: Pakistani or Bangladeshi	0.05	0.14	-0.39	0.05	0.05	0.00
Ethnicity: Black	0.02	0.09	-0.41	0.02	0.03	-0.03
Ethnicity: Other	0.09	0.12	-0.15	0.09	0.08	0.03

Notes: Figures based upon our model preferred specification. This is using 'model 1', the sample having been restricted to families who applied for their child to attend a grammar school, the caliper set at 0.005, with the two nearest neighbours chosen. Standard deviation used in the effect size calculation is based upon all MCS children in England.

Supplementary Table 2. Covariate balance before and after matching in Northern Ireland

	Before matching			After matching		
	Grammar	Non-grammar	Effect size difference	Grammar	Non-grammar	Effect size difference
Age 11 SWM strategy	34.43	35.90	-0.26	34.62	34.95	-0.06
Age 11 SWM total errors	33.16	44.49	-0.59	34.15	34.93	-0.04
Age 7 English vocabulary	113.30	97.11	0.50	111.87	116.91	-0.16
Age 7 pattern construction	123.02	116.66	0.34	122.74	123.03	-0.02
Age 7 maths scores	105.37	99.12	0.40	104.98	107.98	-0.19
Age 5 picture similarities	88.00	85.03	0.22	87.73	86.57	0.08
Age 5 naming vocabulary	115.01	109.63	0.32	113.95	113.17	0.05
Age 5 pattern construction	94.17	88.09	0.30	94.11	92.27	0.09
Age 3 Bracken school readiness	108.43	102.60	0.37	107.95	107.00	0.06
Age 3 naming vocabulary	82.18	77.55	0.30	81.62	83.57	-0.13
Coaching for entrance test age 11	0.25	0.13	0.36	0.24	0.20	0.13
Other steps taken to get into chosen school	0.13	0.13	0.00	0.13	0.11	0.05
Parental help with homework age 11	2.73	2.44	0.29	2.71	2.49	0.21
Homework a priority age 11	1.26	1.18	0.13	1.26	1.20	0.10
Home tutor in English age 11	0.31	0.18	0.35	0.30	0.24	0.16
Home tutor in maths age 11	0.32	0.22	0.24	0.30	0.24	0.16
School choice: Child wanted to attend	0.86	0.88	-0.03	0.89	0.84	0.12
School choice: Close to home	0.32	0.31	0.01	0.30	0.39	-0.19
School choice: Child's friends attending	0.32	0.36	-0.08	0.31	0.37	-0.12
School choice: Siblings attend	0.35	0.31	0.09	0.34	0.29	0.11
School choice: Relative attend	0.26	0.20	0.13	0.25	0.23	0.04
School choice: Reputation	0.82	0.67	0.32	0.79	0.69	0.21
School choice: Discipline	0.24	0.28	-0.08	0.25	0.24	0.02
School choice: Extra-curricular activities	0.49	0.47	0.04	0.48	0.37	0.24
School choice: Specialist curriculum	0.11	0.14	-0.11	0.11	0.07	0.13
School choice: Facilities	0.50	0.56	-0.11	0.50	0.47	0.07
School choice: Good impression	0.66	0.66	0.00	0.67	0.62	0.09
School choice: Religion	0.20	0.13	0.20	0.20	0.15	0.14
School engagement scale age 11	0.23	0.16	0.06	0.18	-0.01	0.18
Academic self-concept scale age 11	0.06	-0.15	0.20	0.02	-0.05	0.07
Well-being scale age 11	0.25	0.22	0.03	0.23	0.13	0.10
Academic well-being scale age 11	0.26	0.06	0.20	0.24	0.13	0.11
Self-esteem scale age 11	0.15	0.10	0.05	0.15	0.12	0.04
SDQ total scores age 11	-0.48	-0.13	-0.36	-0.47	-0.40	-0.07
Academic enjoyment age 7	1.61	1.59	0.04	1.61	1.63	-0.04
Well-being age 7	1.16	1.21	-0.18	1.15	1.17	-0.07
School-engagement age 7	2.39	2.37	0.04	2.38	2.39	-0.02
SDQ total scores age 7	5.16	7.27	-0.38	5.23	5.31	-0.01
Verbal similarities score age 11	129.40	123.53	0.36	128.79	130.41	-0.10
Equivalised household income	4.04	2.95	0.70	3.88	3.80	0.05
Mother NVQ level 1	0.03	0.10	-0.27	0.04	0.02	0.07
Mother NVQ level 2	0.24	0.33	-0.18	0.25	0.23	0.03
Mother NVQ level 3	0.09	0.09	0.02	0.09	0.10	-0.07
Mother NVQ level 4	0.41	0.23	0.43	0.38	0.39	0.00
Mother NVQ level 5	0.16	0.08	0.30	0.16	0.19	-0.10
Gender	0.50	0.55	-0.09	0.50	0.44	0.12
Index of multiple deprivation	6.11	4.94	0.41	5.99	5.61	0.13
Main parental respondent Catholic	0.41	0.43	-0.04	0.44	0.42	0.04

Partner Catholic	0.32	0.24	0.19	0.34	0.37	-0.06

Notes: Figures based upon our model preferred specification. This is using 'model 1', the sample having been restricted to families who applied for their child to attend a grammar school, the caliper set at 0.005, with the two nearest neighbours chosen.

Supplementary Table 3. Robustness of estimates for each outcome variable to choice to caliper length in England

Caliper	Academic self-concept	Go to university	Mental Health	Parent expects stay in school	Parent thinks university	Self-esteem	SDQ	School engagement	Receives tutoring	Well-being	Vocab skills
0.001	-0.17	-0.03	-0.09	0.02	-0.05	-0.22	-0.02	-0.03	0.02	-0.06	0.10
0.002	-0.17	-0.01	-0.07	0.02	-0.03	-0.21	-0.01	-0.02	0.01	-0.06	0.14
0.003	-0.17	0.00	-0.06	0.02	-0.02	-0.18	0.00	0.01	0.00	-0.03	0.16
0.004	-0.16	0.01	-0.08	0.02	-0.02	-0.18	0.02	0.02	0.00	-0.03	0.17
0.005	-0.15	0.01	-0.10	0.02	-0.01	-0.20	0.02	0.01	0.00	-0.04	0.16
0.006	-0.15	0.02	-0.11	0.01	0.00	-0.21	0.02	0.01	0.00	-0.04	0.18
0.007	-0.13	0.02	-0.11	0.01	0.00	-0.21	0.02	0.00	0.00	-0.04	0.17
0.008	-0.13	0.02	-0.11	0.01	0.01	-0.22	0.02	0.00	0.00	-0.03	0.18
0.009	-0.11	0.02	-0.11	0.01	0.01	-0.22	0.02	0.00	0.00	-0.03	0.19

| Caliper	Academic well-being	Bullied	Friends behaviour at school	Aspire to professional job	Need qualifications	Played Truant	Approx # of grammar pupils on support
0.001	-0.01	-0.07	0.02	0.00	-0.03	-0.04	107
0.002	-0.02	-0.04	0.00	0.00	-0.04	-0.04	166
0.003	0.00	-0.06	-0.04	0.00	-0.04	-0.04	202
0.004	0.00	-0.08	-0.05	-0.01	-0.05	-0.04	222
0.005	-0.01	-0.08	-0.06	-0.01	-0.05	-0.04	236
0.006	-0.01	-0.09	-0.06	-0.01	-0.05	-0.04	249
0.007	-0.01	-0.10	-0.06	-0.01	-0.05	-0.03	258
0.008	-0.01	-0.10	-0.07	-0.01	-0.06	-0.03	263
0.009	0.00	-0.09	-0.07	-0.01	-0.06	-0.03	266

Notes: Approximate number of grammar school pupils on support refers to the average number of on-support observations taken across the outcomes. Estimates refer to effect sizes for continuous variables and proportion differences for binary outcomes. Negative coefficient indicates worse outcomes for grammar school pupils than their matched non-grammar school peers.

Supplementary Figure 1. A comparison of estimated propensity scores across treatment and control groups (preferred specification)

(a) England
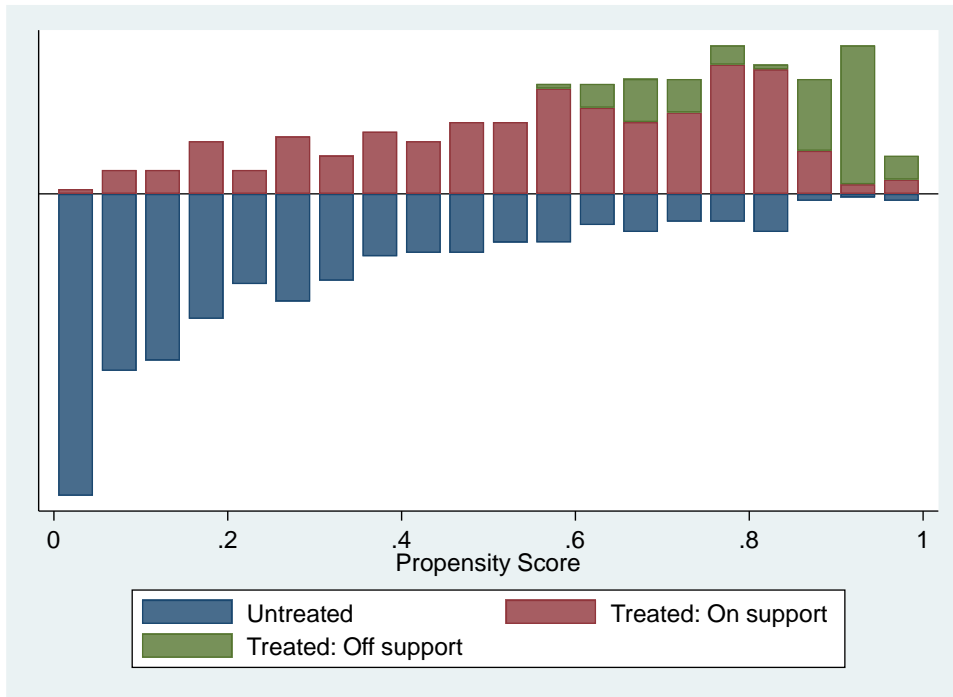
(b) Northern Ireland
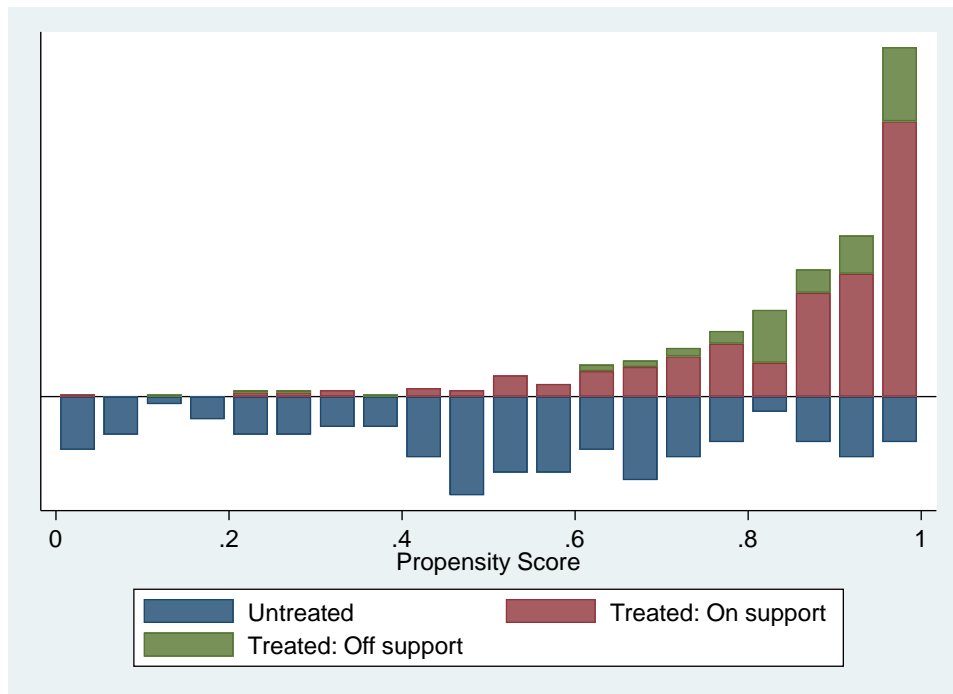
Notes: Graphs based upon first multiply imputed dataset, with caliper set to 0.005 and two nearest neighbours. Matching model includes all MCS cognitive tests taken up to age 11. See the online supplementary materials, Appendix B and Appendix C, for further