School Transport Subsidies and School Choice: Evidence from English Secondary Schools

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Abstract

This paper examines a policy reform occurred in England in 2008, which provided monetary incentives to low SES students to attend further away schools. In particular, the policy supplied free transport to any of the three closest schools at a distance of at least two miles from home. A simple model shows that while this policy should create incentives for low SES student to attend further away schools, its effect on the quality of the school attended is ambiguous, as constrained parents might be induced to enrol children into more distant but lower quality schools in order to benefit from the subsidy. Using confidential panel school micro data, providing information on the postcode of both schools and students' residence, I identify the effect of the policy on school choice through a difference-in-difference approach, comparing low SES students living in postcodes eligible for treatment in the post reform period (i.e. with at least one of the 3 closest schools over 2 miles) with those ineligible (i.e. those for whom the three closest schools are all below 2 miles). Consistent with the intended objectives of the policy, I find strong evidence of an increase in enrolment into more distant schools. Interestingly, though, there is no improvement in the quality of school attended.

Keywords: Schools Choice, Education Expenditures, Busing

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1 Introduction

The scarce availability of transport modes affects school choice, especially among low income families. According to the National Transport Survey (NTS)[1], in 2009 more than 50% of households in the bottom quintile of the income distribution did not own a car or van, compared with only 10% in the top income group. Low rates of car ownership imply that families will need to rely on public transports if their children are enrolled in schools beyond walking distance, with significant impacts on both the time and monetary cost of attending school.[2]

The focus of this paper is a unique policy innovation which occurred in England in 2008 (Free Transport policy), providing monetary incentives to low income students to attend further away schools. Although transport subsides have always existed in the UK, in 2008 they became particularly generous for low SES students (i.e. whose parents are in receipt of benefits). In the specific, it extended the right to free transport to any of the three closest schools at a distance of at least two miles and no more than six miles from home. The policy explicitly aimed at increasing access for low SES families to high quality schools and reduce segregation, which in the England directly follows from de facto residential segregation and distance-based school admission criteria.[3]

There is plenty of evidence on how students benefit from higher quality schools in terms of test scores, decrease in drop out rates and non-cognitive outcomes. A large body of recent

[1]The NTS is the primary source of data on personal travel patterns in Great Britain. The NTS is an established household survey which has been running continuously since 1988. It is designed to monitor long-term trends in personal travel and to inform the development of policy. The survey collects information on how, why, when and where people travel as well as factors affecting travel (e.g. car availability and driving licence holding). https://www.gov.uk/government/collections/national-travel-survey-statistics

[2]On average, tickets fares for children aged under 16 are £1 for a single short journey, £1.20 for a medium length journey and £1.40 for a long journey.

[3]Despite being the first intervention of its kind, the rationales of the Free Transport policy closely resemble US desegregation policies, aiming at reducing school segregation of racial minorities (especially of Black students). In the United States secondary state education is universally available and based on free parental choice; however, schools are highly segregated due to residential clustering (differently from England however, high quality education in the US is mostly provided privately trough independent institutions which can freely set their own admission criteria). Past literature connected the implementation of school desegregation with a number of positive outcomes. Guryan (2004) finds a 3 percentage points reduction in drop out rates for Black students, while no effect is found for White students. Similarly, Reber (2010) shows that schools desegregation increased graduation rates among Black students by 15 %. Ashenfelter et al. (2005) report the positive effect of desegregation on long term outcomes of Black students, finding that Blacks who finished their schooling just before effective desegregation occurred fared poorly compared to Blacks who followed behind them in school by just a few years. Finally, Billings and Rockoff (2014) show that the rezoning following the end of busing sensibly widened racial inequality despite the effort of local schools to mitigate the impacts of increased segregation through an increase in the resources invested in education. Students reassigned to high minority schools displayed persistently lower grades at graduation, lower college attendance and higher crime rates.

literature focuses on the impact of the newly introduced charter schools in the US. These schools emphasize traditional reading and math skills, extended instruction time and selective teachers hiring. Abdulkadiglu et al. (2011) show that oversubscribed charter schools in Boston increase the test scores of low-income students by a third of a standard deviation a year - enough to eliminate the black-white test score gap in a few years of attendance. Similar effects have been found in New York City (Dobbie and Fryer, 2011). More recently, Abdulkadirglu et al. (2014) find that Boston charter attendance boosted SAT scores sharply, along with the probability of taking an Advanced Placement exam.[4][5]

As in the US, England school admission policies are not based on geographic zoning, implying that students could potentially apply and attend any secondary school of the country. Nonetheless, low income students usually attend schools of sensibly lower quality compared to the national average. This follows, on one side, from the segregation of low income students into poor neighbourhoods supplied by low quality schools and, on the other side, from distance-based admission policies for oversubscribed schools. Gibbons et al. (2012) provide insightful evidence of the value English families attach to the availability of good schools nearby: using a regression discontinuity approach, they show that a one standard deviation increase in the school's value added or raw test scores increases house prices by 3%.[6] Whether the introduction of free transport does not affect the likelihood of admission to a popular school, it reduces the cost of attending further away institutions, de facto expanding the available choice for constrained families. Empirical evidence shows that an increase in school choice has a positive impact on students' academic performance. Among the others, Lavy (2010) explores the effect of the end of inter-district busing in Tel-Aviv public schools. Similarly to the US, before 1994 students' assignment to secondary schools was motivated by social and ethnic integration and included busing of some pupils across the city's schooling districts. The 1994 programme terminated the previous system and granted families access to all secondary schools, both within and outside the district. He finds that students affected by the end of busing displayed lower drop out rates and

[4]The tests are the culmination of year long Advanced Placement courses. Many colleges and universities in the U.S. grant credits or advanced placement based on AP test scores; those in over twenty other countries do likewise.

[5]For additional evidence on the benefits on charter schools see also Hoxby and Murarka (2009), Dobbie and Roland G. Fryer (2011) and Abdulkadiglu et al. (2011).

[6]For additional evidence on the link between housing market prices and school quality see also Black (1999), Hoxby (2000), Rothstein (2006) and Fack and Grenet (2010).

significantly higher cognitive achievement than others. Moreover, also non academic outcomes, such as students' satisfaction and social acclimation, improved as a result of the better match between students and schools. Cullen et al. (2005) explore the impact of school choice on student outcomes in the context of open enrollment within the Chicago Public Schools (CPS). Roughly half of the students opt out of their assigned high school to attend a different CPS school, and these students are much more likely than those who remain in their assigned schools to graduate.

Though empirical evidence suggests that an increase in schools availability should improve families' choice, the effect of introducing free transport conditioning on school distance is ambiguous. A simple model shows that while this policy should create incentives for low SES student to attend further away schools, its effect on the quality of the school attended is less clear. Intuitively, when available schools differ widely in terms of quality the policy should not have any effect on choice, as parents would already enrol their children in the best school regardless of the subsidy. Free transport, however, may have an effect when the difference in the quality is not very pronounced. Interestingly, the policy may have the undesired outcome of inducing constrained parents to opt for further away schools even if the quality is lower than the nearest one in order to benefit from the subsidy.

This paper explores the effects of selective transport subsidies on families' school decision in the transition from primary to secondary school. Using a unique dataset on the universe of England's students providing information on both pupils' postcode of residence and school history, I identify the effect of the policy on school choices through a difference-in-difference approach, comparing low SES students living in postcodes eligible for treatment in the post reform period (i.e. with at least one of the 3 closest schools over 2 miles and below 6 miles) with those ineligible (i.e. those for whom the three closest schools are all below 2 miles). As the programme is based on walking distances, I computed the shortest route between pupils' postcodes and schools' postcodes using the Geographic Information System (GIS). Furthermore, I use students' postcodes measured prior to the entrance in secondary school (i.e. in their last year of primary school), to address endogenous relocation resulting from the policy change.

Consistent with the intended objectives of the policy, I find strong evidence of an increase in the probability of enrolling into more distant schools of the order of 2%. The effect on the quality of the school attended, however, is striking, with the quality of the school attended declining by

0.012 standard deviations in the post programme period. Estimates are less clear with respect to the quality of the school chosen, the effect being negative or zero at the most, depending on the definition of quality and the regression specification. I also find evidence of low income families enrolling their children into schools with a higher proportion of White British and low income students, suggesting that they attach some value to schools' pupil composition.

Overall though, the introduction of free transport does not seem to yield the desired effect of improving the quality of the school attended by low SES students.

2 Background

This paper focuses on public school students in their transition from primary to secondary school. Compulsory primary education in England runs from age 5 to age 16.[7] The National Curriculum is divided into four Key Stages: Key Stage 1, going from age 5 to 7, Key Stage 2, going from age 7 to age 11, Key Stage 3 going from age 11 to age 14 and Key Stage 4, from age 14 to age 16.[8]

In the Spring at the end of each Key Stage (KS) students are assessed in three compulsory subjects, Mathematics English and Science, either by teacher assessment (in Key Stage 1 and Key Stage 3) or by standard national tests (SATS, in Key Stage 2).[9] At the end of KS4, though not mandatory, most of the students take the General Certificate of Secondary Education (GCSE),[10] the minimum requirement being to sit national exams in Mathematics, English and Science.[11]

School admission to both primary and secondary schools is based on the principle of free parental choice: parents can apply to any school, regardless of their Local Authority of residence (LA, roughly comparable to New York City's Boroughs) .

The only limit to parents' free choice is oversubscription of most popular schools. In this case admissions are to be determined on the basis of the schools' own criteria, which must be non

[7]There is no grade retention in England, so age corresponds to school grade.

[8]A second route available to students consists of a three tier track with students enrolling in primary school at age 6-9, in middle school at age 9-13 and in secondary school from then on. However, even if very popular in the 80's, the number of middle schools started declining already in the early 90's and nowadays only a negligible fraction of students follows this path (roughly 5% of the whole population).

[9]Evaluation of Key Stage 3 become teacher assessed in the academic year 2008/2009.

[10]Roughly 95% of students in Key Stage 4 take the final exams.This is also an essential requirement to access higher education. Moreover, virtually all universities set requirements on additional subjects to be taken at the GCSE, as well as on minimum grades.

[11]To pass the GCSE all students are required to take the exam in first level(*core*) science (Single Award). Students can also choose to pursue a Double Award (*core* and *additional*) or a Triple Award (biology, chemistry and physics).

discriminating according to the Department of Education's (DfE) guidelines. Most schools give priority to: 1)pupils with special education needs (SEN), 2)students who have siblings already at the school and 3)students who live close. Some schools, namely grammar schools, may select students on the basis of their ability; however, the share of these schools is negligible.

Every year LAs' websites publish an up-to-date list of the schools available within their boundaries, along with all the steps needed to complete the application process.[12] Every school is then required to publish on their websites detailed information on their past performances ("performance tables"), typically Key Stage 2 and Key Stage 4 attainment measures, and additional statistics, such as the pupil/teacher ratio and pupils' ethnic composition. Even if the criteria to complete the performance tables have been reviewed almost every year, measures of pupils' achievement in both Mathematics and English have always been included. Additional to the performance tables, schools' websites must include a link to Ofsted's website, an independent body producing detailed reports on perceived schools' quality on the basis of students' and parents' satisfaction. [13]

This study focuses on a unique policy change that occured in 2008 (Free Transport policy), aiming at increasing choice of low income families through the provision of free transport. Since 1996 introduced the duty for Local Authorities to provide free transport to students aged 11-16 years old attending their nearest available school provided this is more than 3 miles and less than 6 miles of walking distance from their home.[14] Assistance from LAs could take different forms: school buses (" yellow buses") to free tickets for public transports, private cars and taxis or car mileage bonuses for parents.[15]

In 2008, the Free Transport policy extended the benefit for low income students aged 11-16 to any of their *three* nearest schools, being between 2 and 6 miles walking distance from their homes. In order to be eligible for the programme, parents need to be in receipt of benefits.[16]

[12]Applications open the Fall before the student is due to school. Families need to submit their completed application (online or on paper) by the 15th of January for primary schools and 31st of October for secondary schools, including at least three and a maximum of five options. Results of the application will be confirmed by the 16th of April for primary schools and by the 1st of March for secondary schools.

[13]All past reports can be consulted at www.ofsted.gov.uk

[14]To the best of my knowledge, the vast majority of Local Authorities employ the Geographic Information System (GIS) to compute the walking distance. Usually Local Authorities also provide a free of charge service through which parents can compute the home to school distance in a similar way.

[15]Local Authorities have the discretionary power to provide travel arrangements to non eligible students, usually charging a fee, but priority is to be given to eligible children.

[16]Benefits include: income-based Jobseekers Allowance, Income-related Employment and Support Allowance,

These are the same benefits required for the free school meal status (FSME, free lunch in the US). Parents need to apply to their Local Authority and provide initial evidence of their benefits ; the Local Authority will than be in charge of verifying the subsistence of the eligibility status on a yearly basis.[17]

This policy change gives the unique opportunity to assess how increasing parents' school choice by lowering the cost of travelling improves access to high quality schools for disadvantaged families. As in the US, the local government is in charge of financing state-schools and schools' quality typically mirrors neighbourhoods' wealth, with large variation in the quality of education supplied. Moreover, families themselves are likely to endogenously move close to high quality schools, as this increases the chance of securing a place, along with lowering both the monetary and non-monetary costs of home to school travel. As a result, both primary and secondary schools are highly segregated, with minorities and low income students clustering in poor quality neighbourhoods and schools.

3 Data

In this paper I use the Pupil Level Annual Census (PLASC) , carried out every year at the end of January. This is a Census of English public school pupils, covering roughly 95% of the whole population and include information on student demographics such as gender, ethnicity, language spoken at home, special education need status, eligibility for free school meals, pupils' postcode and the unique identifier of the school attended.[18] [19] I focus on students in their first year of secondary school for the period 2005-2011.[20] As families may endogenously relocate in response to the policy, I use geographic information from the last year of primary school.

I use administrative data on schools for the same years, which report the exact address of schools' establishments to match each pupil to her three nearest secondary schools, determined on

Support under Part VI of the Immigration and Asylum Act 1999, Child Tax Credit (provided one is not also entitled to Working Tax Credit and have an annual gross income of no more than £16,190)and the guaranteed element of State Pension Credit.

[17]Local Authorities are asked to publish detailed information on how the eligibility for free transports would be assessed and what kind of assistance they would be providing.

[18]The are 900,609 postcodes in my data. A postcode includes roughly 20 households (a block) located on the same side of the street and identifies on average 2 students per year in my data.

[19]About 5% of English students is enrolled in private schools (*independent schools*).

[20]As we are interested in the transition between primary and secondary education, we exclude from the analysis the small fraction of students (roughly 5%) enrolled in middle schools.

the basis of linear distance ("crow flies") from the student's preassigned postcode. To determine eligibility for free transport, I measure the walking distance from the pupil's postcode to each of the three nearest schools using the Geographic Information System (GIS), which computes the shortest route available excluding motorways and major roads.

I additionaly use data on students' test scores from the National Pupil Database (NPD) to obtain a measure of the quality of school attended. The data include information on individual GCSE test scores in all subjects for the years 2002-2012. I define school quality as the average of English and Math test scores in the year of application to secondary school (i.e. in the last year of primary school) and standardize it yearly to have a mean of zero and a unit standard deviation.[21]

3.1 Schools' characteristics

There are 4,316 secondary schools in England in the period of my analysis. Panel A of table 1 reports schools' basic characteristics. Among them, almost 40% are community schools, which are run and financed directly by the local government.[22] On average each school enrols roughly 170 new students every year, going from a minimum of 85 in the bottom decile of the distribution to almost 300 in the largest schools.

The last row of Panel A reports statistics on school quality, defined as the average GCSE test scores in mathematics and English standardized yearly. The top 10% of schools performs 1.5 standard deviations better than the average and 2.5 standard deviations above the bottom decile.

Panel B displays schools pupils' composition. In the average establishment 79% of first year students are White British, above 88% speak English as a first language and roughly 17% of them is eligible for free school meals. As for new enrolment, however, students' characteristics differ widely among schools, showing that there is substantial sorting of pupils across schools based on ethnicity and parental income. The fraction of White British students goes from 16%

[21] As the the application process typically takes place one year before students are due to school, I consider as the relevant quality the test scores taken in that year.

[22] There are several types of secondary schools in England, which differ for the degree of freedom in setting their own curriculum. The most common are: community schools, controlled by the local council; foundation schools, with slightly more freedom than community schools; voluntary controlled and voluntary aided school, run by a foundation or a trust and academies, comparable to US charter schools.

in the bottom percentile to a maximum of over 98% in the most "White" schools. Very similar patterns can be observed with respect to English speakers: in 10% of the schools the proportion of students speaking English as a first language is in the order of 35%, while in the top 10% of the distribution is virtually 100%.

Lastly, there is substantial variation in students' family income as well. In the most wealthy schools, the percentage of FSME pupils is only, 2%, being well below the national average of 18%. On the other hand, more disadvantaged schools count almost 50% of pupils eligible for free school meals.

Overall, these figures show that there is large variation in the quality and characteristics of schools, including ethnic and income composition.

In the next section I am going to discuss the main characteristics of the students' population used in this analysis.

3.2 Students' characteristics

Income and distance from schools jointly determine eligibility for the programme. I use students' FSME status it as the proxy for income eligibility and focus on them only.[23]

After excluding students who are not FSME, there are 589,862 students starting secondary school during the period of the analysis.

Panel A of table 3 reports the basic characteristics of my sample. The first column reports statistics for the whole sample, the second for eligible students (treatment group, i.e. whose second school is between 2 and 6 miles from home) and the last for non eligible ones (control group).

Treatment students are more likely to be White British and to speak English as a first language compared to the rest of the population: 86% of them report to be of White British ethnicity and 94% speaks English as a first language, compared to 61% and 74% of control. Not surprisingly, just above 4% of them is living in London, roughly 20 percentage points less than

[23]There are some caveats in using FSME as a proxy for low income status. Due to the social stigma associated to the status of FSME, compliance of eligible children is relatively low. According to a study conducted by the Social and Economic Research (2012), just above 70 percent of entitled students apply for free school meals. Children entitled for FSM eat school-prepared lunches, while other pupils have bring their own food. Moreover, study reports that due to schools' lack of space, often FSME children have to eat separately from other pupils. This arise a the social stigma associated to FSME status and results in relatively low compliance.

other English pupils. Overall, the programme seems to target mainly English native students who live in relatively low density areas.

Figure 1 shows the distribution of students by distance to the two nearest school from home. The majority of students have at least two schools within 2 miles, with only roughly 10% of them having to travel more to reach the first available school. However, more than 20% of FSME students have the second nearest school above two miles from home, meaning that they would be eligible for free transport if attending that school. Panel B of table 3 shows the statistics relative to school availability and choice. The average distance to the nearest school is 1.3 miles and 2.4 miles to the second nearest, increasing to 1.5 and 3 miles for the sample of eligible students.[24] Overall, 86% of control and 75% of treatment students have at least one school below 2 miles walking distance from home.

Most students attend either the nearest or the second nearest school from home: more than 70% of treatment attend one of these two schools, compared to 63% of other pupils. Interestingly, eligible students attend schools that are, on average, of higher quality that the control group, being in the order of 0.09 standard deviations better than those attended by other students.

Figure 2 shows the distribution of the quality of the nearest and the second nearest schools by distance to the second nearest school (i.e. the programme eligibility variable). Strikingly, the second nearest school is always of higher quality than the nearest one, the gap being increasing in distance. Even more interestingly, quality of both schools is decreasing with distance as long as pupils live within 2 miles from the school and it increases sharply above the 2 miles threshold. Overall, there seems to be room for the Free Transport policy to improve the choice of school among eligible students: the average standardized test scores of the nearest school are in the order of -0.02 for eligible students and 0.14 for non eligible, while the same figures for the second nearest school are in the order of 0.18 for eligible students compared to 0.14 for non eligible.

[24] 3 miles being the "statutory walking distance" for non eligible students and 2 miles the "statutory distance for low income students, i.e. the maximum distance students are expected to walk to school according to the Dfe.

4 A simple model

The rest of this section introduces a simple model of school choice. To avoid confounding effects, I am going to restrict to FSME students whose nearest school is within 2 miles.[25] Moreover, I assume families can only choose among the two nearest schools from home.[26]

For the typical family the underlying utility of going to either of the two schools is given by

$$U_{tj}(S_1) = Q_t j - \beta_1 dist_j + e_{tj}$$

Where S_j denotes the j nearest school, Q_j is a measures of the school's quality, $dist_j$ is the distances in miles from the schools and e_j is an idiosyncratic error term. The parameter β_1 captures the total cost per mile of travelling to the school, embodying both the monetary costs of transport and the leisure loss. Focusing only on the two nearest schools, the family will choose to enrol her kid into the nearest school (S_1) or second nearest (S_2) whenever the overall utility gain is higher than for the other school. Thus, in each given year, a typical family will choose to enrol their children into the nearest secondary school if

$$P_t(S_1) = P_t(U(S_1) > U(S_2)) = F(Q_1 - Q_2 - \beta_1(dist_1 - (1-\alpha)dist_2))$$

Where F is the cumulative distribution of $e_2 - e_1$. The parameter α captures the subsidy of the Home to School transport policy: $\alpha = 0$ if $t = t_0$ or if $t = t_1$ and $dist_2 \leq 2$, and $0 \leq \alpha \leq 1$ if $t = t_1$ and $2 \leq dist_2 \leq 6$.

The main implications of the model are:

1. $\frac{\partial P_t(S_1=1)}{\partial \alpha} \leq 0$: the reduction in the cost of distance to S_2 has a negative impact on attendance of S_1;

2. $\frac{\partial P_t(S_2=1)}{\partial \alpha} \geq 0$: the reduction in the cost of distance to S_2 has a positive impact on attendance of S_2;[27]

[25] The policy decreased the threshold for free transport to the nearest school from 3 to 2 miles. This may somehow alter the incentives to attend the nearest school.

[26] In England between 60% and 70% of students attend one of the two nearest schools. The share is even higher when considering low income pupils. See table 2 for detailed statistics.

[27] $P_t(S_2 = 1) = 1 - P_t(S_1 = 1)$ by construction.

3. $\frac{\partial P_t(S_1=1)}{\partial \alpha \partial dist_1} \leq 0$ if $P_t(S_1 = 1)>0.5$ and $\frac{\partial P_t(S_1=1)}{\partial \alpha \partial dist_1} \geq 0$ if if $P_t(S_1 = 1)<0.5$: the negative effect on S_1 attendance is increasing in distance from S_1 as long as the fraction of students attending the nearest school is more than one half and decreasing otherwise. Assuming that, on average $Q_1 = Q_2$ and as $dist_2 \geq dist_1$ by construction, it follows that at t_0 $P_t(S_1 = 1)$ has to be above one half, implying $\frac{\partial P_t(S_1=1)}{\partial \alpha \partial dist_1} \leq 0$.

The second relevant question concerns the effects of this change of behaviour on the average quality of the school attended by eligible pupils. By the law of total probabilities, the expected quality can be written as

$$E_t(Q) = Q_1 P_t(S_1 = 1) + Q_2 P_t(S_2 = 1)$$

The overall effect on quality of school attended by eligible students crucially depends on Q_1 and Q_2 and on the distance to the two school. In particular, parents will opt for the second nearest school whenever $Q_2 - Q_1 > (1-\alpha)dist_2 - dist_1$, i.e. when the gain in quality from attending the further away school more than offsets the difference in costs. Intuitively, families for which the second nearest school is of far higher quality than the nearest one and for which the difference in the distances is not too large, are not going to be affected by the policy, as they would have enrolled their children in the further away school regardless of the subsidy. The programme is going to have an effect on choice only on students who would have enrolled into their nearest school in the absence of the subsidy and for which:

1. $Q_2 > Q_1$ and the subsidy is generous enough to compensate for the difference in the distances;

2. $Q_2 < Q_1$ and the subsidy is generous enough to compensate for both the difference in distances and the decrease in school quality.

   What emerges from this simple analysis is that the effect of the selective subsidies introduced by the Free Transport policy could potentially have no effect on the quality of the school attended by low income students or, in the worst case scenario, even lead to the unintended outcome of a decrease in the quality of education.

5 Empirical strategy

My identification strategy relies on a cross sections difference-in-difference (DD) estimation comparing secondary school's choice of eligible and non eligible students before and after the programme. With no great loss of generality, I focus on students whose nearest schools is within 2 miles from home. Moreover, I am going to assume that pupils can only choose between the nearest and the second nearest school. Table 1 summarizes the source of variation I am going to exploit for the identification strategy.

The regression I am going to estimate is the following

$$y_{ipt} = \beta_0 + \beta_1 T_{ip} + \beta_2 (T_{ip} * post) + \eta_t + e_{ict} \tag{1}$$

where y_{ipt} is the outcome variable for individual i in cohort t living in postcode p, T_{ip} is a "treatment dummy", indicating whether the student took up free transport, *post* is an indicator for the post policy period, η_t is a cohort fixed effect and ϵ_{it} is a normally distributed error. As I do not observe whether eligible students take up the programme, I am going to estimate equation 1 in reduced form, using the eligibility status of the postcode as an instrument for treatment

$$y_{ipt} = \beta_0 + \beta_1 D_p + \beta_2 post + \beta_3 (D_p * post) + \eta_t + \epsilon_{it} \tag{2}$$

Where D_p is an indicator for whether student's postcode is eligible for free transport and the β_3 parameter captures the effect of the programme.

As school closures and school openings may alter the composition of treated and control postcodes, I restrict the analysis to the roughly 70% of postcodes which did not experienced school openings and closures.

6 Results

6.1 The effect of the policy on the choice of school

Table 4 shows estimates of the effect of the programme on the probability of attending each of the two nearest or any other school for a number of different specification:(1) controlling for time

fixed effects, Local Authority fixed effects and students' background characteristics interacted with time; (2) also controlling for a 2nd order polynomial of distance to the second nearest school; (3) including a 2nd order polynomial of distance to the nearest school; (4) including a dummy for whether the second nearest school is above 6 miles interacted with time; (5) controlling for time fixed effects, postcode fixed effects and students' background characteristics interacted with time and (6) also including a dummy for whether the second nearest school is above 6 miles interacted with time.

Row 1 reports the coefficients on the probability of attending the nearest school from home. On average, when controlling for Local Authority fixed effects, eligible students are between 1.9% and 2.1% less likely than others to attend the nearest school when the second nearest school is eligible for free transport; estimates being significant and robust to the inclusion of additional controls. Columns 4 to 6 include postcode fixed effects. Though this specification is highly demanding, the coefficients are close to the ones estimated using Local Authorities fixed effects, with a negative impact on the probability of attending the nearest school of the order of 1.5%.

Row 2 shows the same estimates for the probability of attending the second nearest school. Results are positive of the order of 1%. As before, estimates are robust to different specifications.

Row 3 report the estimates for the probability of attending all other schools, with no limit of distance from home. The effect on the probability of attending more distant schools than the second nearest is virtually zero across all specifications.

6.2 The effect of the programme on the quality of the school attended

The second relevant question is what effect this shift in school choice has on the average quality of the school attended by students affected by the programme.

Table 5 shows the estimates of equation 2 for the same specifications of table 4 on the standardized quality of school attended. I define school's quality in two alternative ways: (1) as the average for the whole period (2005-2011) of the Mathematics and English test scores of the secondary schools' exiting cohort and (2) as the average of the Mathematics and English test scores at baseline year (2005) of the secondary schools' exiting cohort. I standardize it to have a mean of zero and a standard deviation of one, such that the average school has quality equal to zero.

Estimates show that treated students do not choose higher quality schools with respect to the pre policy period. On average, attended school's quality is between 0.006 and 0.012 standard deviations *worse* than in the pre policy period; however, estimates are not robust across different specifications.

Though the magnitude of the coefficient is rather small, these results are still striking. One potential explanation is that, as low income families are more likely to be constrained, a selective subsidy may induce them to choose farther away schools even with no benefit on quality.

Moreover, families' access to high quality schools may be rationed. Top schools are typically very popular and there is high competition for securing a place. In this sense, it might be that eligible students are de facto able to enrol in distant schools only as long as they are not very appealing. In this case, we could observe a decline in the average quality of school attended following the introduction of the Home to School transport programme.

So far I have assumed that the only measure of school quality is given by students' standardized test scores. Nonetheless, other characteristics may also be relevant in the choice of the school. In particular, families may care about the social composition of the school their children attend.

Rows 3 to 5 of table 5 report the estimates of equation 2 for schools' students composition, measured as the percentage of White British students, the percentage of FSME and the percentage of native English speakers. Similarly to school's quality, all the three variables are constructed as a mean for the whole period of last year students' characteristics and are hence based on pupils who were not affected by the policy.

Row 3 reports the estimates on the proportion of White British students in the school. Families affected by the policy enrol their children to schools that have on average 1.5 percentage point more White British students, estimates being significant and robust across specifications.

Interestingly, a significant and positive, though rather small, effect is found also on the proportion of students eligible for free school meals (row 4). Students eligible for free transport enrol in schools with a 0.6 percentage point higher fraction of pupils in receipt of free school meals.

Finally, row 5 report the estimates on the percentage of native English speaker students. All estimates are positive, but small and not significant. However, this may also result from the

small variation in the fraction of English speakers, as virtually the totality of students report English as their native language.

6.3 Non linear effects

According to the theoretical model presented above, the effect of the programme should be larger the higher (in terms of distance) is the cost of travelling to the nearest school, holding constant the distance to the second nearest school.

Columns 1 and 2 of table 6 shows the estimates of equation 2 on two separate regression by distance to the nearest school (i.e below 1 mile or between 1 and 2 miles). I revert to most saturated specification as in column 6 of table 4. Column Row 1 reports the estimates for the probability of attending the nearest school. Estimates are very close to zero and not significant for students living below 1 mile from the nearest school, but in the order of -2% and significant for those living more than 1 mile from the nearest school. Row 2 reports the coefficients for the probability of attending the second nearest school: estimates are small and not significant for students leaving closer than 1 mile to the nearest school, while a positive effect in the order of 1.1% and of the threshold of significance is found for those whose nearest school is above 1 mile from home. Consistent with the theoretical model, after the introduction of free transport some families will find more convenient to enrol their child in a more distant school; the effect being larger the higher the distance to the nearest school.

6.4 Heterogeneous effects

The remaining columns of table 6 report estimates of the probability of attending each of the nearest schools separated by quality of available schools, region of residence and Local Authorities Income Deprivation Affecting Children Index (IDACI) for the same specifications of column 6 of table 4.[28]

Columns 3 and 4 of table 6 show the estimates for (1) the subsample of students living in postcodes for which the second nearest school is of higher quality than the nearest and (2) the subsample of students living in postcodes for which the second nearest school is of lower quality than the nearest. I use the quality measure of row 2 of table 5, results being robust to

[28]The Index measures locally the proportion of children living in low income households.

the alternative definition. According to the simple model introduced above, both subsample of students may respond to the policy when the transport subsidy is high enough. Interestingly, both coefficients in column 3 and 4 are negative, however, only the one on pupils whose second nearest school is of lower quality compared to the nearest one is statistically significant at the standard levels. Similarly, the probability to attend the second nearest school increases significantly only for the second subsample of students (in the order of -1.6%). No effect is found on the probability of attending other schools. This helps shading light on the negative estimates obtained in the previous sections: the only effect of the Free Transport programme comes fro those students who are "bribed" to enrol into lower quality schools by the monetary incentive of the subsidy.

Unfortunately, the data at hand do not allow to provide conclusive evidence on why students who would benefit from moving to the further away school do not indeed respond to the policy. This can be due to either the high demand for good schools, meaning that some pupils maybe excluded from high quality schools due to oversubscription, or because the subsidy is not generous enough to make families living in those postcodes move to the further away school.

Columns 5 and 6 investigate heterogeneous based on the region of residence. I define "urban" and "rural" areas according to the 2011 UK Census classification. Rural areas are more likely to be characterized by a less widespread coverage of public transports, meaning that, compared to urban areas, the time cost of travelling to school would be generally higher. As discussed in the previous sections, most Local Authorities conformed to the Free Transport policy introducing a service of school buses collecting pupils directly from their homes. This sensibly reduced not only the monetary cost of travelling to school by public transport, but also the time cost, especially for families living in less populated areas. As expected, the only effect of the policy can be found in less dense regions: pupils living in rural areas are 2.4% less likely to attend their nearest school and 1.3% more likely to enrol in the second nearest, while virtually no effect is found for students living in urban areas.

Finally, columns 7 and 8 report result for two separate regression for Local Authorities with a IDACI score below (less deprived) or above the median (most deprived). Though coefficients are negative in both regression, the effect is significant only for students living in most deprived areas and in the order of -1.7%. Estimates on the probability of attending the second nearest school are also higher and (close to) significant only for IDACI scores above the median. Overall,

this suggests that the programme has a larger effect in those areas where children are more likely to live in low income families. This is consistent with the intuition that only constrained families respond to the monetary incentives of the subsidy, while wealthier ones will be more likely to enrol their children into the best school regardless of free transport.

6.5 Potential threats to the consistency of the estimates

There are at least two potential sources of endogeneity thratening the validity of the results.

First, the fraction of students eligible for free school meals should not be endogenously correlated with treatment. As eligibility is based on the home-to-school distance, different trends in FSME may alter the composition of treated and control groups. If this process is not random, estimates could be biased. Column 1 of able 7 reports estimates of equation 2 on the students' FSME status for the whole sample (i.e including also non FSME students) for the same specification of column 6 of table 4. All estimates are virtually zero and not significant, suggesting that there are not different trends in FSM eligibility by distance to the second nearest school.

Second, time trends in the quality of schools available to treatment and control should not differ. I defined quality as a time invariant measure, highly reducing the risk of endogeneity; however, there might still be compositional effects undermining the validity of the results. If this is the case, estimates of equation 2 might be biased. Columns 2 to 5 of table 7 present the results on the quality of, respectively, the nearest and the second nearest schools using the same quality definitions of table 5. Estimates are very close to zero and not significant for both schools.

6.6 Falsification test

As an additional way to check the validity of the identification assumption, in this section I present a number of falsification tests.

The top panel of table 8 reports regressions of the probability of attending the nearest, the second nearest or any other school and of the quality of the school attended redefining the treatment group as students who live between one and two miles from the second nearest school and the control group all other students. In principle, pupils living less than two miles from the second nearest school should not be eligible for free transport and I should find no effect of the programme on their choices. Columns 1 to 3 shows estimates for the choice of the school

attended. I find no evidence of an effect of the Free Transport programme on the choice of school of students living below two miles: estimates are virtually zero and not significant for all specifications. Columns 4 and 5 report estimates on the quality of the school attended as defined in table 6. Again, all estimates are close to zero and not significant at the standard levels.

The second panel of table 8 report estimates for the non FSME students. As non low income students do not entitle for free transport, there should be no effect of the programme on their choice of school. Reassuringly, all estimates are close to zero and non significant at the standard levels.

Overall, even if this falsification test does not provide conclusive evidence of the validity of the identification strategy, it lends some support to the findings of the previous sections.

7 Summary and Conclusions

This paper investigates how the provision of free transport to attend further away schools affects the choice of school of low income families. I exploit a unique policy change occurred in England in 2008, which expanded the right to free transport for low SES to any of the three nearest school to home, subject to distance thresholds. While a simple theoretical model shows that monetary incentives should push families to enrol their children in more distant schools, the effect on school quality is ambiguous, as constrained parents may be induced to select further away schools even at the cost of quality in order to benefit from the subsidy.

Using confidential data for the period 2005-2011 providing the postcode of the universe of English students during their transition from primary to secondary school, I identify the effect of the programme through a difference-in-difference approach, comparing low SES students living in eligible postcodes in the post reform period with those ineligible. As the Free Transport policy is based on walking distances, I computed the shortest available route for each pupil using the Geographic Information System (GIS).

Results show that, consistently with the predictions of the model, students eligible for free transport enrol into more distant schools; the effect being larger the more distant the nearest school and the more deprived the region of residence. However, the programme does not seem to lead to the intended outcome of improving the quality of the school attended by low SES

students: the effect on the quality of the school attended is negative and robust to alternative definitions of quality. Interestingly, parents seem to enrol their children into schools displaying a higher proportion of White British and low SES students, suggesting that families may value schools' characteristics other than test scores.

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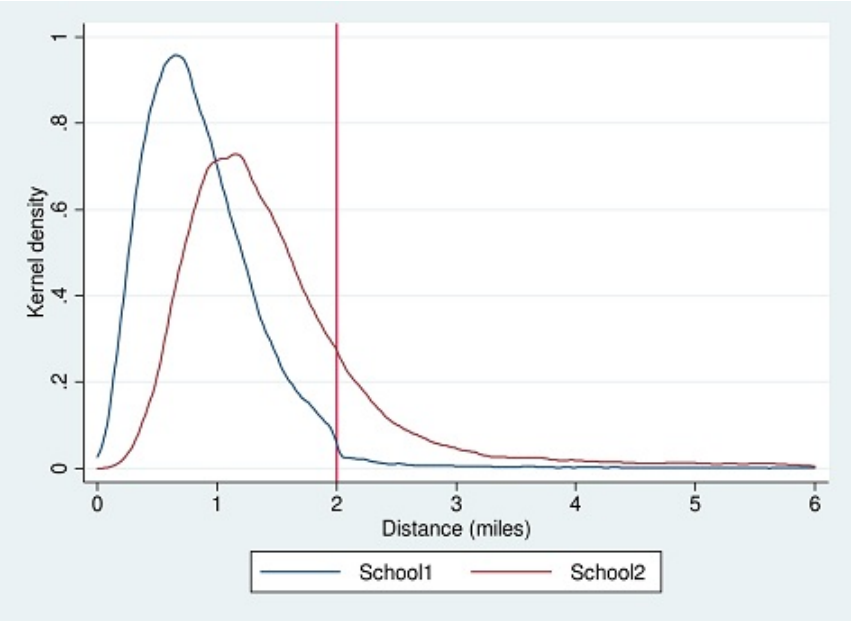
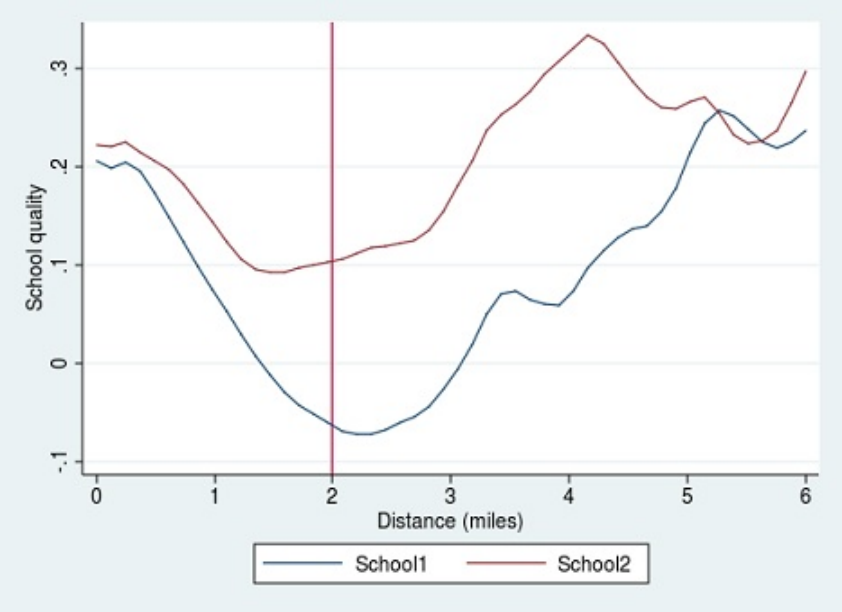
Tables and figures

Figure 1: Students' distribution by distance to school



Notes: Author's calculations on PLASC data for the period 2005-2011.

Figure 2: School quality distribution by distance to the second nearest school



Notes: Author's calculations on PLASC data for the period 2005-2011.

Table 1: Subsidy to attend second nearest school

	$dist_2 \leq 2$	$2 < dist_2 < 3$	$3 < dist_2$
Before	**NO**	**NO**	**Only if rejected at S_1**
After	**NO**	**YES**	**YES**

Table 2: Schools' characteristics

	All schools	Bottom decile	Top decile
Panel A: Schools			
Number of schools	4,316		
Community schools (%)	38.95		
Academies (%)	4.75		
Foundation schools (%)	18.00		
Voluntary schools (%)	1.78		
Other schools (%)	36.52		
Number of new enrolments	171.22	85.63	297.15
Average exit cohorts' test scores	0.18	-0.82	1.67
Panel B: Students' composition			
White British (%)	79.22	15.77	98.24
FSME (%)	17.07	2.17	48.13
Females (%)	49.06	18.16	86.38
English speakers (%)	88.55	35.4	99.97

Notes: Author's calculations on PLASC data. The table reports summary statistics for the period 2005-2011. Quality of school has been standardized yearly to have a mean of zero and a unit standard deviation.

Table 3: FSME students' characteristics

	All	Eligible	Non eligible
Panel A: Demographics			
White British (%)	66.54	86.44	61.71
White Other (%)	2.17	1.06	2.44
Pakistani (%)	4.06	1.15	4.79
Indian (%)	1.07	0.39	1.23
Bangladeshi (%)	2.33	0.42	2.81
Black African (%)	4.27	1.17	5.00
Other ethnic group (%)	19.56	9.36	22.02
Females (%)	49.42	49.08	49.51
English speakers (%)	78.24	94.30	74.31
Living in London (%)	21.84	4.72	26.14
Panel B: Available schools			
Distance to nearest school (miles)	1.03	1.57	0.90
Distance to second nearest school (miles)	1.83	3.03	1.54
Distance to nearest school<=2 miles (%)	92.85	74.84	97.22
Attending nearest school (%)	44.26	59.43	40.64
Attending second nearest school (%)	17.36	10.98	18.94
Quality of school attended	0.007	0.08	-0.01
Quality of nearest school	0.05	0.03	0.05
Quality of second nearest school	0.14	0.18	0.14
N	589,862	112,792	466,900

Notes: Author's calculations on PLASC data. The table reports summary statistics for the period 2005-2011. Eligible students are defined as FSME individuals having the second nearest school between 2 and 6 miles from home.Quality of school has been standardized yearly to have a mean of zero and a unit standard deviation.

Table 4: Effect of the policy on the probability of attending the two nearest schools

	[1]	[2]	[3]	[4]	[5]	[6]
ATTEND:						
1. School 1						
$dist_2 * post$	-0.019**	-0.019**	-0.019***	-0.021***	-0.015*	-0.015*
	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
2. School 2						
$dist_2 * post$	0.011***	0.011**	0.011**	0.012***	0.009*	0.009*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
3. Other schools						
$dist_2 * post$	0.008	0.008	0.009	0.009	0.006	0.006
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Time Fixed Effects	X	X	X	X	X	X
LA Fixed Effects	X	X	X	X	X	X
Additional controls	X	X	X	X	X	X
$dist_2$		X	X	X	X	X
$dist_1$			X	X	X	X
$dist_2 >$ 6*time				X		X
Postcode Fixed Effects					X	X
N	360,230	360,230	360,230	360,230	360,230	360,230

Notes: OLS estimates. Clustered (at the Local Authority level) standard errors in parenthesis. Treatment group is defined as pupils with the second closest school between 2 and 6 miles from home. Distance from school is measured as the shortest route between pupils' postcode in Year 6 and secondary school's postcode attended in Year 7. Controls include gender, a dummy for whether the pupil defined herself as "White British" and a dummy for being English native speaker. Controls for distance are polynomials of the 2nd order.

Table 5: Effect of the policy on the quality of the school attended

	[1]	[2]	[3]	[4]	[5]	[6]	N
SCHOOL QUALITY:							
1. Test scores (whole period)							
$dist_2 * post$	-0.006	-0.006	-0.006	-0.007	-0.012	-0.012*	358,351
	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	
2. Test scores (2005)							
$dist_2 * post$	-0.000	-0.001	-0.000	-0.002	-0.015*	-0.015*	348,573
	(0.008)	(0.008)	(0.008)	(0.008)	(0.006)	(0.006)	
3.% White British							
$dist_2 > 2$	1.541**	1.549**	1.550**	1.549**	1.493*	1.542*	350,566
	(0.583)	(0.581)	(0.582)	(0.592)	(0.678)	(0.685)	
4. % FSME							
$dist_2 > 2$	0.609*	0.604*	0.601*	0.657*	0.536*	0.573*	350,566
	(0.256)	(0.253)	(0.253)	(0.257)	(0.284)	(0.287)	
5. % English							
$dist_2 > 2$	0.457	0.463	0.463	0.464	0.439	0.454	350,566
	(0.279)	(0.278)	(0.279)	(0.290)	(0.311)	(0.318)	
Time Fixed Effects	X	X	X	X	X	X	
LA Fixed Effects	X	X	X	X	X	X	
Additional controls	X	X	X	X	X	X	
$dist_2$		X	X	X	X	X	
$dist_1$			X	X	X	X	
$dist_2 > 6$*time				X		X	
Postcode Fixed Effects					X	X	

Notes: OLS estimates. Clustered (at the Local Authority level) standard errors in parenthesis. Treatment group is defined as pupils with the second closest school between 2 and 6 miles from home. Distance from school is measured as the shortest route between pupils' postcode in Year 6 and secondary school's postcode attended in Year 7. Controls include gender, a dummy for whether the pupil defined herself as "White British" and a dummy for being English native speaker. Controls for distance are polynomials of the 2nd order.

Table 6: Non linear and heterogeneous effects

	BY DIST$_1$:		**BY QUALITY:**		**BY REGION:**		**BY IDACI:**	
	$Dist_1 < 1$	$Dist_1 > 1$	$Q_1 < Q_2$	$Q_1 > Q_2$	Urban	Rural	Bottom 50%	Top 50%
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
1. School 1								
$dist_2 * post$	-0.007	-0.022*	-0.010	-0.021*	0.003	-0.024**	-0.014	-0.017*
	(0.008)	(0.008)	(0.008)	(0.009)	(0.005)	(0.007)	(0.010)	(0.008))
2. School 2								
$dist_2 * post$	0.003	0.011	0.003	0.016*	0.004	0.013*	0.006	0.008
	(0.004)	(0.006)	(0.005)	(0.007)	(0.006)	(0.005)	(0.008)	(0.004)
3. Other schools								
$dist_2 * post$	0.004	0.010	0.007	0.005	0.009	0.009	0.001	0.010
	(0.007)	(0.009)	(0.008)	(0.008)		(0.008)	(0.008)	(0.008)
Time Fixed Effects	X	X	X	X	X	X	X	X
LA Fixed Effects	X	X	X	X	X	X	X	X
Additional controls	X	X	X	X	X	X	X	X
$dist_2$	X	X	X	X	X	X	X	X
$dist_1$	X	X	X	X	X	X	X	X
$dist_2 >$ 6*time	X	X	X	X	X	X	X	X
Postcode Fixed Effects	X	X	X	X	X	X	X	X
N	252,906	107,324	203,948	154,093	92,884	241,948	244,241	115,989

Notes: OLS estimates. Clustered (at the Local Authority level) standard errors in parenthesis. Treatment group is defined as pupils with the second closest school between 2 and 6 miles from home. Distance from school is measured as the shortest route between pupils' postcode in Year 6 and secondary school's postcode attended in Year 7. Controls include gender, a dummy for whether the pupil defined herself as "White British" and a dummy for being English native speaker. Controls for distance are polynomials of the 2nd order.

Table 7: Programme correlation with FSME status and available schools' quality

	FSME STATUS:	**SCHOOL$_1$ QUALITY:**		**SCHOOL$_2$ QUALITY:**	
		Test scores (whole period)	Test scores (2005)	Test scores (whole period)	Test scores (2005)
	[1]	[2]	[3]	[4]	[5]
$dist_2 * post$	0.003	0.003	0.000	0.001	0.000
	(0.002)	(0.004)	(0.000)	(0.003)	(0.001)
Time Fixed Effects	X	X	X	X	X
LA Fixed Effects	X	X	X	X	X
Additional controls	X	X	X	X	X
$dist_2$	X	X	X	X	X
$dist_1$	X	X	X	X	X
$dist_2 > 6$*time	X	X	X	X	X
Postcode Fixed Effects	X	X	X	X	X
N	1,617,441	252,906	252,906	252,906	252,906

Notes: OLS estimates. Clustered (at the Local Authority level) standard errors in parenthesis. Treatment group is defined as pupils with the second closest school between 2 and 6 miles from home. Distance from school is measured as the shortest route between pupils' postcode in Year 6 and secondary school's postcode attended in Year 7. Controls include gender, a dummy for whether the pupil defined herself as "White British" and a dummy for being English native speaker. Controls for distance are polynomials of the 2nd order.

Table 8: Falsification test

	ATTEND::			SCHOOL QUALITY:	
	School$_1$	School$_2$	Other schools	Test scores (whole period)	Test scores (2005)
	[1]	[2]	[3]	[4]	[5]
TREATMENT=DIST$_2$>1:					
$dist_2 * post$	0.002	-0.003	0.001	-0.001	-0.002
	(0.004)	(0.003)	(0.005)	(0.005)	(0.005)
N	360,230	360,230	360,230	358,351	339,425
NON FSME SAMPLE:					
$dist_2 * post$	-0.006	0.002	0.003	-0.001	-0.002
	(0.003)	(0.002)	(0.003)	(0.004)	(0.004)
N	1,173,735	1,173,735	1,173,735	1,162,741	1,119,225
Time Fixed Effects	X	X	X	X	X
LA Fixed Effects	X	X	X	X	X
Additional controls	X	X	X	X	X
$dist_2$	X	X	X	X	X
$dist_1$	X	X	X	X	X
$dist_2 > 6$*time	X	X	X	X	X
Postcode Fixed Effects	X	X	X	X	X

Notes: OLS estimates. Clustered (at the Local Authority level) standard errors in parenthesis. Treatment group is defined as pupils with the second closest school between 2 and 6 miles from home. Distance from school is measured as the shortest route between pupils' postcode in Year 6 and secondary school's postcode attended in Year 7. Controls include gender, a dummy for whether the pupil defined herself as "White British" and a dummy for being English native speaker. Controls for distance are polynomials of the 2nd order.