On the Way Down: The Unintended Consequences of School Transport Subsidies

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This version: June 15, 2016

Abstract

This paper provides evidence of the potentially unintended consequences of policies aiming at increasing school choice. I examine a policy reform that 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 students 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. Moreover, over-subscription of best schools, along with distance-based admission criteria, may de facto limit parents' choice to less popular institutions. 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. 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 the school attended.

Keywords: Schools Choice, Education Expenditures, Busing

JEL Classification: I20, I22, I28

*I am particularly indebted to my Ph.D supervisor Marco Manacorda for his guidance. I am indebted for the insightful discussions and useful comments to Ghazala Azmat, Erich Battistin, Francesco Fasani, Barbara Petrongolo, Andrea Tesei and all seminar participants at IZA 18thsummer school, XI Jornadas de Economía Laboral and Queen Mary reading groups. Contact: Barbara Masi, School of Economics and Finance, Queen Mary University of London, Queens Building, Mile End Road, London E1 4NS, UK. Email: **b.masi@qmul.ac.uk**.

1 Introduction

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 a significant impact on both the time and monetary cost of attending school.[2] The high cost of travelling to school, together with distance-based admission criteria, imply that low income students residing in neighbourhoods served by low quality schools de facto do not have access to the best institutions.[3]

Improving access to best schools among disadvantaged students seems to be a promising tool to promote social mobility and decrease segregation. Indeed, though pupils' innate ability and parental background explains a large share of academic achievement, the quality of the school attended is believed to be crucial in determining academic success (Kramarz et al., 2009) and future labour market outcomes. Compelling evidence comes from the newly introduced academy schools in England, which are showed to improve the share of pupils achieving at least five grades in range A*-C in their GCSE/GNVQ (Machin and Vernoit, 2010; Machin and Wilson, 2009). Most recent literature focuses on the impact of the newly introduced charter schools in the US. These schools aim at promoting teaching quality emphasizing traditional reading and math skills, extended instruction time and selective teachers hiring. Abdulkadiroglu 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 per 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, Abdulkadiroglu et al. (2014) show that Boston charter attendance

[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 drivers' 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]In principle, school admission policies are not based on geographic zoning, implying that students could potentially apply to and attend any secondary school in the country. Nonetheless, low income students usually attend the school nearby, which is typically of lower quality compared to the national average. Gibbons et al. (2012) provide compelling evidence of the value that English families attach to the proximity to good schools: 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%.For additional evidence on the link between housing market prices and school quality see also Black (1999), Hoxby (2000), Rothstein (2006), Fack and Grenet (2010) and Machin and Salvanes (2010).

boosted SAT scores sharply, along with the probability of taking an Advanced Placement examination. [4] Similarly, attending selective schools seems to have beneficial effects on both pupils' attainment and future wages (Dearden et al., 2002). [5]

In the past, free transport to school has been used as a tool to improve access to high quality education among low income families, by reducing the cost of travelling to far away institutions. 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 schools further away. Although transport subsides have always existed in the UK, in 2008 they became particularly generous for low socio-economic status (SES) students- i.e. those eligible for free school meals (FSME) or whose parents were in receipt of benefits.[6] More specifically, it extended the right to free transport to any of the three closest schools at a distance of at least 2 miles and no more than 6 miles from home.[7] The policy explicitly aimed at increasing access for low SES families to high quality education

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

[5]However, the literature is not unanimous: other studies proxy school quality by various observable indicators, such as teacher/pupil ratio, teachers' educations and per-pupil expenditures, finding mixed results on the link with students' achievement (Chetty et al., 2011, 2014; Hanushek, 1986, 2003; Krueger, 1999, 2003).

[6]Benefits include: income-based Job-seekers Allowance, Income-related Employment and Support Allowance, 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 has an annual gross income of no more than £16,190)and the guaranteed element of State Pension Credit.

[7]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 through 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 just a few years behind them at school. 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. Concerning studies outside the US, Lavy (2010) studies 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 affected students displayed lower drop out rates and significantly higher cognitive achievement than unaffected children. Moreover, non-academic outcomes, such as students' satisfaction and social acclimation, improved as a result of the better match between students and schools.

with the ultimate goal of improving test scores of disadvantaged students.

Though there is plenty of evidence showing how English pupils from disadvantaged families are disproportionally sorted in poorly performing institutions (Allen, 2007; Allen and Vignoles, 2006; Burgess et al., 2008, 2004, 2010; Fitz et al., 2003; Gibbons and Telhaj, 2007), little is known on whether increased school choice helps in promoting access to high quality education. Past literature exploring parents' preferences revealed that, on average, families do value academic attainment as one of the most important school characteristics, together with pupils' composition and distance. (Burgess et al., 2009; Gibbons and Silva, 2011; Hastings et al., 2005). These findings seem to suggest that expanding low income families' choice set should translate into more disadvantaged students attending high quality institutions. Empirical evidence, however, is disproportionally based on US studies. Among others, Cullen et al. (2005) explore the impact of school choice in the context of open enrolment within the Chicago Public Schools (CPS). Roughly half of the students opt out of their assigned high school to attend career academies and other high-achieving schools, and these students are much more likely to graduate than those who remain in their assigned schools.[8] Similarly, Deming et al. (2014) explore the effect of winning an admissions lottery to attend a public high school in Charlotte-Mecklenburg (CMS), showing that lottery winners are more likely than others to graduate from high school and to attend college, and that the positive impacts of choice are strongly predicted by gains on several measures of school quality.[9] [10] However, there is not unanimous consensus on the positive effects of school choice. For instance, the Moving to Opportunity relocation of low SES families across the US did not did not seem to improve children's educational outcomes, mainly because those moving either could not or chose not to access higher

[8] Cullen and Jacob (2007) examine whether expanded access to sought-after schools in the CPS can improve academic achievement. Using lottery data, they find that winners attend on average higher quality schools than lottery losers. However, they do not find that winning the lottery systematically confers any evident academic benefit.

[9] For additional evidence on the effects of CMS open enrolment see, among the others, Hastings et al. (2006) and Hastings et al. (2007).

[10] A different strand of the literature examines the impact on school choice of school vouchers, which decrease the cost of attending private schools. In 1990 Wisconsin began providing a small number of low income families with vouchers to attend non sectarian private schools. Greene et al. (1996) and 1997 compare the test scores of students who won the lottery with those who lost, finding significant gains in both math and reading scores. Rouse (1998) compares the test scores of students selected to attend a private school with those of all other students from Milwaukee public schools. She finds that the program had a positive impact on math score gains of selected students.[11] Finally, Angrist et al. (2002) explore the effects of a voucher programme in Columbia, offering vouchers which partially covered the cost of private secondary school for students who maintained satisfactory academic progress. Three years after the lotteries, winners were about 10 percentage points more likely to have finished 8th grade, primarily because they were less likely to repeat grades, and scored 0.2 standard deviations higher on achievement tests.

quality schools (De Luca and Rosenblatt, 2010; Ludwig et al., 2013)

Though empirical evidence mostly suggests that an increase in school availability should push families to enrol their children into better schools, the effect of introducing free transport conditional on school distance is ambiguous. A simple model shows that, while such policies should create incentives for low SES student to attend schools further away, their effect on the quality of the school attended is less clear. This comes from two undesired effects. First, some students might be induced to enrol at further away schools in order to benefit from the subsidy, even without a real gain in terms of quality. Second, distance-based over-subscription criteria could limit the choice of schools to lower quality, less popular schools. Indeed, the proximity criterion accounts for up to two thirds of the overall observed difference in the quality of the school attended by different SES groups (Burgess et al., 2010).

This paper explores the effects of selective transport subsidies on families' school decisions 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 differences-in-differences approach, comparing low SES students living in postcodes eligible for free transport 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 eligibility for 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 into 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 at more distant schools, in the order of 2 percentage points. This, however, did not reflect in an improve in quality, with eligible students enrolling at schools between 0.02 and 0.03 standard deviations lower in quality than ineligible ones. Overall, these results suggest that the introduction of free transport did not yield the desired effect of improving the quality of the school attended by low SES students.

This paper unfolds as follows: in sections 2 and 3 I briefly discuss the institutional background and present basic descriptive evidence. Section 4 introduces a simple model of school choice with free transport to school. Sections 5 and 6 present the identification strategy and show results of the effect of the programme on the outcome variables of interest. The last section summarizes and concludes.

2 Background

This paper focuses on public school students in their transition from primary to secondary school. Compulsory primary education in England covers ages 5 to 16.[12] The National Curriculum is divided into four Key Stages: Key Stage 1 (ages 5 to 7), Key Stage 2 (ages 7 to 11), Key Stage 3 (ages 11 to 14) and Key Stage 4 (ages 14 to 16).[13]

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).[14] At the end of KS4, though not mandatory, most of the students take the General Certificate of Secondary Education (GCSE),[15] the minimum requirement being to sit national examinations in mathematics, English and science.[16]

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 (LA) of residence (roughly comparable to New York City's Boroughs).

The only limit to parents' free choice is over-subscription of the most popular schools. In this case admissions are determined on the basis of the schools' own criteria, which must be non-discriminatory according to the Department of Education's 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 by.[17] 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.[18]

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

[13] 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).

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

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

[16] To pass the GCSE all students are required to take the examination 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).

[17] Distance for the purpose of admission is the linear (crow flies) distance between the pupil's house and the school.

[18] Applications open the Fall before the student is due to start school. Families need to submit their completed application (on-line 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.

Parents are provided with very rich information on the characteristics of available schools. In particular, every school is required to publish on its website detailed information on 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.[19]

This study focuses on the unique policy of the Free Transport policy, which aimed at increasing school choice among low income families through the provision of free transport to school. Since 1996 a duty exists for Local Authorities to provide free transport to all students aged 11-16 years old attending their nearest available school, provided this is more than 3 miles (and less than 6 miles) walking distance from their home.[20] Free transport could take different forms: school buses ("yellow buses"), free tickets for public transport, private cars and taxis or car mileage bonuses for parents. The free transport only covers the travels to and from schools for the whole duration of the academic year.[21][22]

In 2008, the Free Transport policy extended the benefit for low income students aged 11-16 to any of their *three* nearest schools over 2 (and below 6) miles walking distance from their homes. In practice, this means that starting from 2008, FSME students with the first closest school below 2 miles but the second or third closest school between 2 and 6 miles could now access free transport to any of the more distant two schools. In order to be eligible for the programme, parents need to be in receipt of benefits- the same criterion required for free school meal status. Parents need to apply to their Local Authority at any time during the academic year and provide initial evidence of their receipt status. The Local Authority would then be in charge of verifying the existence of the eligibility status (on a yearly basis). [23] Rules for non-FSME children remained unchanged, with the

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

[20] 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.

[21] Local Authorities have the discretionary power to provide travel arrangements to ineligible students, usually charging a fee, but priority is to be given to eligible children. The best transport arrangement is assessed on an individual basis by the Local Authority itself.

[22] The Education Act 1996 states "As a general guide, transport arrangements should not require a child to make several changes on public transport resulting in an unreasonably long journey time. Best practice suggests that the maximum each way length of journey for a child of primary school age to be 45 minutes and for secondary school age 75 minutes".

[23] 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.

exception that after 2008 children with the nearest school between 2 and 3 miles became eligible for free transport to the nearest school.

As in the US, schools' quality typically mirrors neighbourhoods' wealth, with large variation in the quality of education supplied. This policy change gives the opportunity to assess how increasing parents' school choice by lowering the cost of travelling improves access to high quality schools among disadvantaged families. To this end, I employ a differences-in-differences identification strategy comparing students eligible for free transport (defined on the basis of distance) with those ineligible before and after the policy. Table 1 shows how the eligible and ineligible groups are constructed. The first two columns report the distance to the nearest and second nearest school respectively, the third and fourth columns report the eligibility for free transport before and after 2008 and the last column reports the percentage of the total sample. For simplicity I restrict the analysis to students who leave less than 2 miles from the nearest school and assume that families can only choose between the 2 nearest schools. The ineligible group is defined as pupils who leave less than 2 miles from the nearest and second nearest school. The eligible group is formed by pupils whose second nearest school is over 2 (and below 6) miles from home. As shown in the last column of the table, overall these two groups count for 91% of the total number of English students.

3 Data

This section describes the data used for the empirical analysis. In what follows I will exclude from the sample students living in London for two reasons. First, since August 2005, all students living or attending a secondary school in London are all entitled to free of charge transport or reduced fares on public transports without distance or income constraints. As such, London Local Authorities were not subject to the duties of the Free Transport policy. Second, London secondary schools display different trends in terms of performance compared to the rest of English schools. Hence, they may not be representative of English secondary schools.

The core dataset used in the analysis is the Pupil Level Annual Census (PLASC), carried out every year at the end of January. This is a Census of English state school pupils, covering roughly 95% of the whole population. It includes information on student demographics such as gender, ethnicity, language spoken at home, special education need status (SEN), eligibility for free school meal, pupils' postcode and the unique identifier of the school attended.[24] There are 900,609 postcodes in my data. A postcode includes

[24] About 5% of English students are enrolled in private schools.

roughly 20 households (a block) located on the same side of a street and identifies on average 2 students per year in the data. I focus on students due to start secondary school, i.e. those that just completed Key Stage 2, in the period 2005-2011.[25]

A concern relates to the time at which the eligibility for free transport is determined. As mentioned above, parents can apply for free transport at any time during the academic year . One may hence worry that families may change address (or manipulate the evidence) in order to gain eligibility for free transport. For instance, parents who have preferences for a school may move address to be eligible for free transport to that school. To temper this concern, I consider students' postcode measured during the last year of primary school, that is, before the eligibility for the programme is assessed.

I use administrative data on schools, which report the exact address of the establishments, to match each pupil to his three nearest secondary schools determined on the basis of linear distance ("crow flies", which determines admission) from the student's postcode of residence. I exclude from the sample of schools the 917 institutes for students with SEN (special schools). First, because these schools often follow a different curriculum from the national one and hence do not report GCSE test scores. Second, because SEN students are subject to a slightly different transport policy. Specifically, additionally to the rules applying to other children, they may be eligible for free transport to any school by reason of their SEN are considered to be unable to walk to school. To determine eligibility for free transport, I measure walking distance from the pupil's postcode to each school using the Geographic Information System (GIS), which computes the shortest route available excluding motorways and major roads. Figure 1 provides an example of how walking distances to school are computed: the straight line reports the linear distance to the second nearest school, while the blue-dotted line reports the shortest walking distance. In the specific case shown in the figure the student would not be eligible for free transport if we were to consider the linear distance; however, he falls into the eligible group when consider walking distance to the school.[26]

Finally, I employ data on students' test scores at KS4 (the 5^{th} year of secondary school) 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. One may worry that schools based in different neighbourhoods

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

[26] As school have some discretionary power in determining the walking route to the school, there is still some risk of measurement error in determining the eligibility for the programme. Specifically, schools consider the "safe" shortest route from the pupil's house to the school, implying that they are allowed to discard some routes when they do not find them safe for the pupil. As the policy does not provide schools with objective criteria to define safety, I am not able to control this.

may experience different trends in performance (for instance because Local Authorities invest more resources in schools based in more deprived areas). If this is the case, even without a change in the choice of school in the post-policy period, we might observe a change in the quality of the school attended as an effect of the program. In order to alleviate this concern, I define school quality as the average of English and mathematics test scores over the whole period of analysis (i.e. 2005-2011) and standardize it to have a mean of zero and a unit standard deviation. It is worth mentioning that this measure is constructed based on the test scores of students who sat the GCSE test before the policy was implemented (2008) and is hence pre-determined.

To better clarify how the data building takes place, consider figure 1.A1 in Appendix A. In October, at the beginning of the last year of primary school (Year 6), families fill the application for secondary school. In January of the following year, at the time of the Census, I observe the residential address of the student and measure the walking distance to each of the two nearest schools. In September the student starts secondary school (Year 7) and, finally, in January I observe the unique identifier for the school attended and assign the corresponding measure of school quality to each student.

3.1 School characteristics

There are 3,323 secondary schools in England in the period of analysis.[27] Panel A of table 2 reports schools' basic characteristics. Among them 50.23% are community schools, which are run and financed directly by the local government.[28] On average each school enrols roughly 147 new students every year, going from a minimum of 2 in the bottom decile of the distribution to almost 300 in the top decile.

The last row of Panel A reports statistics on school quality, defined as the average GCSE test scores in mathematics and English of the whole period standardized so that the average school will have quality equal to zero. The top 10% of schools perform 1.4 standard deviations better than the average and 1.8 standard deviations above the bottom decile.

Panel B displays schools pupils' composition. In the average establishment 80% of first year students are white British, more than 88% speak English as a first language

[27] This number does not account for secondary schools based in London and schools dedicated to special education needs students ("special schools"), which have been excluded from the analysis.

[28] There are several types of secondary schools in England, which differ regarding 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.

and roughly 20% of them are eligible for free school meals. As for the number of new enrolments, students' characteristics differ widely among schools, suggesting that there is significant sorting of pupils across schools based on ethnicity and parental income. The fraction of white British students goes from 16% in the bottom decile to a maximum of over 98% in the most "white" schools. Very similar patterns emerge with respect to English speakers: in 10% of schools the proportion of students speaking English as a first language is in the order of 36%, while in the top 10% of the distribution it is virtually 100%.

Lastly, there is significant variation in students' family income. In the most wealthy schools, the percentage of FSME pupils is less than 2%. This is well below the national average of 20%. On the other hand, FSME pupils account for 56% of students in the most disadvantaged schools.

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

3.2 FSME students' characteristics

Income and distance from schools jointly determine eligibility for the programme. I use students' FSME status as a proxy for income eligibility and in the rest of the analysis I focus exclusively on this population.

There are 416,366 FSME students starting secondary school between academic years 2004/2005 and 2010/2011. Panel A of table 3 reports the basic characteristics of the sample. The first column reports statistics for the whole sample, the second for students eligible for free transport (on the basis of distance) and the last for ineligible students.

Eligible students are more likely to be white British and to speak English as a first language compared to the rest of the population: 87.5% of them report to be of white British ethnicity and 95% are native English, compared to 74% and 84% respectively among the ineligible.

Figure 2 shows the distribution of students by distance to the two nearest school from home. The majority of FSME students have at least two schools within 2 miles, with less than 10% of them having to travel more than 2 miles to reach the closest school. However, more than 15% of FSME students have the second nearest school above 2 miles from home, meaning that post 2008 they would be eligible for free transport. Panel B of table 3 shows the statistics relative to school availability and choice separately for eligible and ineligible students. The average distance among all children to the nearest school is 0.9 miles while the distance to the second nearest is 1.8 miles, increasing to 1 and 2.8

miles respectively for the sample of eligible students.[29]

Most students attend either the nearest or the second nearest school from home: more than 70% of eligible pupils attend one of these two schools, compared to roughly 63% of other pupils. Interestingly, eligible students attend schools that are, on average, of higher quality than the ineligible group (of the order of 1.1 standard deviations more).

Figure 3 shows the distribution of the quality of the nearest and the second nearest schools by distance to the second nearest school for FSME students (i.e. the programme eligibility variable). Strikingly, on average, the second nearest school is always of higher quality than the nearest one, the gap increasing with distance. Even more interestingly, the quality of both schools decreases with distance as long as pupils live within 2 miles from the school and it increases sharply above the 2 miles threshold. The average standardized test scores of the nearest school are in the order of -0.04 for both eligible and ineligible students, while the same figures for the second nearest school are in the order of 0.14 for eligible students and 0.07 for ineligible ones. This suggest two forms of residential segregation. First, FSME students are generally segregated into neighbourhoods served by low quality schools (and surrounded by affluent neighbourhoods with high quality schools). Second, among FSME students, those living in more residential neighbourhoods, and hence more distant from available schools, are surrounded by neighbourhoods served by higher quality schools than other students.[30] Overall, these figures suggest that, by pushing students to enrol at more distant schools, the Free Transport policy could in theory improve the quality of the school attended by eligible students.

4 Predicted effects: an intuition to the underlying model

In this section I provide the intuition from a simple model of school choice (the full version can be found in Appendix B).

For the sake of simplicity, I restrict to FSME students whose nearest school is within 2 miles.[31] Moreover, for consistency with the empirical analysis, I assume families can only

[29] 3 miles being the "statutory walking distance" for ineligible 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.

[30] Figures 4 and 5 provide a visual representation of these two stylized facts for the city of Leeds. Figure 4 maps the difference in quality between the second nearest and the nearest school for all students (on the left) and the proportion of FSME students on the territory (on the right). Figure 5 shows the difference in quality between the second nearest and the nearest school for FSME students only (on the left) and the proportion of FSME students living between 2 and 6 miles from the second nearest school (on the right).

[31] 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.

choose among the two nearest schools from home.[32] However, the implications described in what follows can be easily extended to a setting with more than two schools.

The extension of the free transport subsidy to the second (and third) nearest schools de facto decreases the cost of attending a distant school, expanding the choice of schools available to low SES families. As already mentioned, FSME students are likely to be segregated into low income neighbourhoods with low quality schools. As distance represents a cost both monetary and in terms of travelling time and given distance-based admission criteria, a large share of these students attend the nearby school. The intended objective of the programme was to improve the average quality of the school attended by FSME students, by significantly reducing the cost associated with attending high quality, distant schools.

The first direct outcome of the policy should be to decrease the share of students attending the nearest school to home. Moreover, all else being equal, the effect should be larger the higher the attending cost, i.e. the distance to the nearest school from home, as the savings are higher. Similarly, the probability to enrol at a more distant school should be higher the lower the cost of attending, i.e. the distance to the second nearest school.

On the other hand, the effect of the policy on the average quality of the school attended is a priori ambiguous. Consider a very simplified model where the probability of attending the second nearest school is given by the probability of applying to the school times the probability-conditional of having applied- to being admitted to the school:

$$P(attend_2) = P(applying_2)P(accepted_2|applying_2)$$

The free transport policy affects positively the probability of applying to the second nearest school, while it does not change the probability of being admitted.[33] Hence, we expect to find a positive effect on the probability of attending the second nearest school.

Concerning the quality of the school attended, the effect is a priori ambiguous. Parents who do not live close to any school and decide not to take advantage of the free transport may give up substantial savings. [34] Indeed, they might choose to pay for alternative transport, which could put additional stress on the family budget. Alternatively, they could drive or walk their children to school, but this would be time consuming, with the

[32] 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 3 for detailed statistics.

[33] If anything, if eligible students are clustered in the same neighbourhoods and compete for the same schools, the policy may have a negative effect on the probability of being admitted to distance schools.

[34] One may gather that, given the young age of the pupils under consideration, many of them would have to take public transport even when the school is within 2 miles from home, implying a monetary cost of attending schools even in circumstances where the pupil is not eligible for free transport.

risk of threaten their job. In this sense, some families may decide to take up the free transport even if there is no gain (and potentially even a loss) in terms of quality of the school attended. To gather an intuition of the effects on the quality of the school attended, consider two types of individuals: those who are willing to trade the savings on transport for quality and those who are not. The first ones will apply to the second nearest school even if it is of worse quality compared to the nearest one, while the other ones will apply only if it's of better quality. Depending on the distribution of schools on the territory and the preferences of families the effect could be either positive or negative (or zero). However, over-subscription of good schools distance-based admission priority, suggests that students applying to high quality distant schools are likely not to be admitted. This implies that, as a result of the policy, we should observe a zero, or even a negative effect, on the average quality of the school attended.

5 Empirical strategy

In order to identify the effect of the policy on students' choice, I use a differences-in-differences (DD) strategy. I restrict to FSME students with the first nearest school below 2 miles from home, which account for roughly 93% of the observations. I assume that pupils can only choose between the nearest and the second nearest school. In practice, I compare the choice of eligible students (i.e. FSME pupils with the first school below 2 miles and the second nearest school above 2 miles) and ineligible students (i.e. FSME students with both schools below 2 miles) before (up to 2008) and after the implementation of the policy (2008).

Ignoring other covariates, the model takes the reduced form

$$y_{ipt} = \beta_0 + \beta_1 D_{pt} + \eta_p + \eta_t + \epsilon_{ipt} \tag{1}$$

where D_{pt} is a variable that takes the value of 1 if the second nearest school to student i's postcode is between 2 and 6 miles walking distance in the post policy period, η_p is a postcode fixed effect, η_t are time fixed effects and the β_1 parameter captures the effect of the programme. The outcome variable y_{ipt} is either the probability of attending a given school or the quality of the school attended.

This model derives consistent estimate of the intent to treat parameter under the assumption that, in the absence of the programme, the changes in the outcome variables would have been the same for the eligible and the ineligible postcodes. In other words, the eligibility for the programme should be "as good as random", implying that

$Cov(D_{pt}, \epsilon_{ipt}|\eta_p, \eta_t) = 0$. As mentioned, this may not be the case if there are unobservable *time varying* postcodes' characteristics which are correlated with both the eligibility status D_{pt} and the outcome variable y_{ipt}. This may not be true in two cases.

First, students may self-select into the treatment group in order to benefit from free transport. As mentioned, I alleviate this concern assessing the eligibility for the program based on students predetermined address.

Second, one may be concerned that families endogenously relocate depending on schools availability and preferences. We might hence observe that families living closer to the schools, and hence belonging to the ineligible group, are also more likely to attend the-higher quality -school nearby. If this process is not time invariant, the estimates of the effects of the program may be biased; in other words, the identification assumption assumption $Cov(D_{pt}, \epsilon_{ipt}|\eta_p, \eta_t) = 0$ may not hold. This should not be a big concern when considering low income families, as the price of houses is typically correlated with school quality, making it unlikely for these families to be able to actually move close to the best schools. First, I attempt to temper this concern, probing the robustness of my results to the introduction of individual controls. This suggest that, once I netted out location (i.e. postcode) effects, the eligibility status is not correlated with any (observable) characteristic.

Second, in section 6.3 I estimate equation 1 for the sample of students who leave closer to the 2 miles threshold. This should mitigate both the concern of endogenous relocation near the preferred schools. Finally, I check for the presence of parallel trends. In particular, I check whether, before the introduction of the programme, eligible and ineligible students displayed parallel trends in the outcome variables. Figures 6 and 7 show that, even with a non-restricting specification, the trends are generally parallel before the introduction of the free transport programme.[35]

6 Results

This section begins by showing the overall effect of the program on the choice of school (subsection 6.1). Second, it looks at the effects on the quality of the school attended (subsection 6.2). Third, it checks the identifying assumptions and whether the main

[35] The figures plot the coefficients β_{1t} from the following regression (where η_s=1 if $t = s$):

$$y_{ipt} = \beta_0 + \sum_{s=2004}^{2011} \beta_{1s}(D_p * \eta_s) + \beta_2 D_p + \eta_t + \epsilon_{ipt}$$

where D_p is a variable that takes the value of 1 if the second nearest school to student i's postcode is between 2 and 6 miles walking distance.

findings are robust to the alternative specifications (6.3 and6.4). Finally, it analyses how the effect is heterogeneous, depending on distance and quality of the schools available, neighbourhood deprivation and geographic location (subsections 6.5 and 6.6).

6.1 The effect of the policy on the choice of school

Figure 8 reports the probability of attendance to the nearest school before and after 2008 by distance to the second nearest school. Data only refer to FSME students. Observations on the left of the vertical line (i.e. with distance to the second nearest school less than 2 miles) identify the ineligible group, those on the right (i.e. with distance to the second nearest school greater than 2 miles) the eligible group. The dashed line reports data for the pre-policy period, while the solid line reports data for the post-policy period. The difference between the outcome of the eligible and ineligible groups before and after the policy identifies the effect of the programme. As it is clear, the proportion of eligible students attending the nearest school falls significantly after the implementation of the policy, while it is virtually unchanged for the ineligible group. This suggests that free transport had the effect of decrease the fraction of low income students attending the closest school.

Table 4 shows the corresponding estimates of the effect of the programme on the probability of attending each of the two nearest schools (row 1 and row 2) or any other school (row 3). In the first column I control only for Local Authority fixed effects, time fixed effects and students' background characteristics interacted with time dummies. Background characteristics include: gender, student's first language and a dummy for whether the student identifies himself as "white British". All standard errors are clustered at the Local Authority level. Results show a clear negative, though small, effect of the programme on the probability of attending the nearest school from home, with a coefficient of -0.027 (significant at the 1% level). These results imply that being eligible for the program decreases the probability of attending the nearest school by 2.7 p.p. in the post policy period. The decrease in the probability of attending the nearest school is counterbalanced by a 1.2 p.p. increase in the probability of attending the second nearest school and a 1.6 p.p. increase in the probability of attending other schools.[36]

The specification in column 2 and in column 3 control for potential endogenous sorting within Local Authority. Specifically, families can endogenously choose their residence on the basis of unobserved characteristics which affect both the probability of being eligible for free transport and the choice of the school. In an attempt to control for this, I include

[36]Note that, by construction, the three rows add up to zero.

in the regression a polynomial of the second order for the distance to the second nearest school (column 2) and to the nearest school (column 3). The coefficients are slightly smaller than the ones presented in column 1 and significant, suggesting that there is some degree of endogenous residential choice based on the distance to the schools.

Finally, the specification in column 4 controls for postcode fixed effects. This regression compares eligible and ineligible postcodes in the pre and post-policy period absorbing all time invariant unobservable characteristics of the student's postcode of residence. Though the specification is highly demanding, the estimates on the probability of attending the nearest and the second nearest school remain significant and similar in magnitude, implying a 1.8 p.p. decrease in the attendance of the nearest school and a 1 p.p. increase in the attendance of the second nearest school. Interestingly, the coefficient on the probability of attending other schools remains positive, but is not significant at standard confidence levels.

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

The second question is whether the shift in school choice had any effect on the average quality of the school attended by students affected by the programme.

Table 5 shows the estimates of equation 1 where the dependent variable is the quality of the school attended, using the same specifications as in table 4.[37] I standardize quality on the whole period to have a mean of zero and a standard deviation of one.[38] School quality is by construction time invariant to avoid potential bias of the estimates due to different trends in the quality of the schools attended by the eligible and ineligible groups which happen to be correlated with eligibility. This measure is constructed based on the test scores of students who were not affected by the policy (as they sat the exam before 2008) and are hence pre-determined.

Estimates show that eligible students choose *lower* quality schools with respect to the pre-policy period than ineligible ones. On average, the quality of the school attended is between 0.021 and 0.022 standard deviations worse than in the pre-policy period, results being robust across specifications. This corresponds to a small negative effect of 2% of a standard deviations.

As mentioned in the previous sections, these results suggest that the policy did not have the desired effect of improving the quality of the school attended by FSME students

[37] This measure computes the average quality for the school's existence period. Hence, different spans of time may be considered for schools with different existence periods.

[38] Results do not change if I define quality as the average test scores at baseline year, i.e. at 2005.

for two main reasons. First, some FSME students may decide to move to more distant schools in order to benefit from free transport, even when there is no real gain in quality. Second, as families' access to high quality schools is rationed, eligible students are de facto able to enrol in distant schools only as long as they are not very popular (and presumably high quality). The two effects combined may explain why the policy did not improve the average quality of the school attended.[39]

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 school. Rows 2 to 4 of table 5 report the estimates of equation 1 for schools' student 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 final year students' characteristics and hence are pre-determined measures. Row 2 and row 4 report the estimates of the proportion of white British students and English speakers in the school. Overall, all estimates are very close to zero and not significant. Interestingly, a significant and positive, though rather small, effect is found on the proportion of students eligible for free school meals (row 3): students eligible for free transport enrol at schools with between 0.4 and 0.6 percentage point higher fraction of pupils in receipt of free school meals.

6.3 Robustness checks

As stated in section 5, the identification strategy relies on the assumption that the assignment to the eligible and ineligible group is as good as random. In sections 6.1 and 6.2 I showed that the inclusion of (observable) students characteristics does not alter the coefficients of interest, speaking in favour of the fact that no relevant variable has been omitted in the analysis. However, one may still be concerned that, due to endogenous relocation of families based on school preferences, the eligible and ineligible status may be correlated with other (unobservable) characteristics (such as the value families attach to education) affecting also the outcome variable (e.g. the quality of the school attended). To rule this out, in the first panel of table **??** I estimate equation 1 for the sample of eligible and ineligible students who live close to the 2 miles threshold. By selecting families who display similar preferences in terms of distance to school, I should highly reduce the risk

[39] As the effect is rather small, it may be excessive to talk of a negative effect on the quality of the school attended. Indeed, parents may not be able to observe the difference in quality between the schools available when the numbers are so small. Moreover, families are likely to value school characteristics other than test scores, which are not captured here.

of capturing mechanisms other than the effect of the programme. Specifically, I redefine the eligible group as students as pupils with the first nearest school between 1 and 2 miles from home and the second nearest school between 2 and 3 miles from home. Similarly, the control group is defined as pupils with both the first and the second nearest school between 1 and 2 miles from home. This specification is highly demanding, as it reduces significantly the variation in the eligibility status. Estimates on the choice of school are very close to the ones presented for the unrestricted sample. This suggests that, once washing out the time-invariant postcode effects, relocation does not represent a big concern. Specifically, these results do not seem to support the presence of time varying trends in residential decisions that might explain the results on the choice of school. Estimates on the quality of the school attended, though still negative, are closer to zero compared to the ones on the whole sample.[40] This might be interpreted as evidence of the presence of a downward bias in the main estimate, due to time varying residential choices. However, it is worth mentioning that the sample has been reduced by more than two thirds, implying that the quality of schools available to these students may be significantly different from the one of the whole sample. Moreover, these students are, among those in the eligible group, the ones living closer to the second nearest school. As such, over-subscription may be less an issue for these families and they might have a higher probability to get admitted to good schools compared to students living further away. This could help explaining the smaller results obtained for this sample.

The second panel of table **??** addresses the potential bias raising from endogenous school openings and closures. Specifically, one may worry that school openings and closures may alter the composition of eligible and ineligible postcodes over time. If this process is not random, the estimates presented above may suffer of a bias. To rule this out, the second panel of table **??** shows estimates for the sub-sample including only postcodes which did not experience any school openings and closures, i.e. for which the distance to the first and the second nearest school did not vary during the period of the analysis.[41] Reassuringly, estimates are robust to the exclusion of postcodes experiencing openings/closures, suggesting that the regressions in table 4 and 5 are not capturing changes in the composition of the eligible and ineligible groups over time.

[40] Both estimates on the choice of school and the quality of the school attended are similar when further restricting the sample to students with the second nearest school between 1.5 and 2.5 miles.

[41] This decreases the number of observations by roughly 30%.

6.4 Falsification tests

As an additional way of checking the validity of the identification strategy, in the remainder of this section I present a number of falsification tests.

The top panel of table **??** reports regressions of the probability of attending the nearest, the second nearest or any other school and of the quality of the school attended for the city of London. As mentioned, London was not subject to the duties imposed by the Free Transport policy, as all students are provided with discounted fares on any public transport since 2005. Hence, if the identification strategy is valid, one should not observe any change in the choice of school following the implementation of the programme. Columns 1 to 3 show 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 among students living in London: estimates are virtually zero and not significant across all specifications. Columns 4 reports estimates on the quality of the school attended as defined in table 5. Again, all estimates are close to zero and not significant at the standard levels.

The second panel of table **??** reports estimates for non-FSME students. As non low income students are not entitled to free transport, there should be no effect of the programme on their choice of school. All estimates, with the exception of school quality, are close to zero and non significant at the standard levels.

Overall, these falsification tests lend reassuring support to the findings the previous sections.

6.5 Non-linear effects

As in figure 8, figure 9 reports the attendance of the nearest school before and after policy separately for students for whom the first school is close and far away. Once again, I focus on FSME pupils with the first school within 2 miles as in figure 8 . The left graph focuses on pupils whose nearest school is located between 1 and 2 miles from home, the right graph on students whose first nearest school is within 1 mile. According to the predictions of the theoretical model, the effect of the programme should be larger the higher the cost (measured in terms of distance) of travelling to the nearest school, holding constant the distance to the second nearest school. Consistent with this, the difference between the outcome of the eligible and ineligible groups before and after the policy is significant only for the sub-sample of students whose nearest school is above 1 mile from home. Moreover, results seem to be driven by pupils whose second nearest school is located closer to the 2 miles threshold.

Table 8 reports the corresponding estimates of equation 1 The top panel shows the

estimates on two separate regressions by distance to the nearest school (i.e below 1 mile or between 1 and 2 miles), reverting to the most saturated specification as in column 5 of table 4. Column 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 2.5 p.p. and significant for those living more than 1 mile from the nearest school. The second column reports the coefficients for the probability of attending the second nearest school: estimates are small and not significant for students living closer than 1 mile to the nearest school, while a positive and significant effect in the order of 1.5 p.p. is found for those whose nearest school is above 1 mile from home.

The second panel shows the estimates on three separate regressions by distance to the second nearest school. Specifically, I divide the eligible sample in 1) students whose distance to the second nearest school is above 2 but below 3 miles; 2) students whose distance to the second nearest school is above 3 but below 4 miles and 3) students whose distance to the second nearest school is above 4 miles. Results are significant only for students whose second nearest school is located closer to the 2 miles threshold, i.e. between 2 and 3 miles from home, though a similar effect emerges for students with the second nearest school between 4 and 6 miles.

6.6 Heterogeneous effects

Table 9 reports the estimates of the probability of attending each of the nearest schools for the same specifications of column 4 of table 4 by quality of the two available schools, by region of residence and Local Authorities Income Deprivation Affecting Children Index (IDACI).[42]

Columns 1 and 2 of table 9 show the estimates for (1) the sub-sample of students living in postcodes for which the second nearest school is of higher quality than the nearest and (2) the sub-sample of students living in postcodes for which the second nearest school is of lower quality than the nearest. According to theory predictions, both sub-samples of students may respond to the policy if the transport subsidy is generous 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 standard levels. Similarly, the probability of attending the second nearest school increases significantly only for those students whose second nearest school is of lower quality.[43]

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

[43]Figure 1.A2 in Appendix A provides visual evidence of the heterogeneity of results across different

Columns 3 and 4 investigate heterogeneities 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 lower coverage of public transport, meaning that, compared to urban areas, the time cost of travelling to school would be generally higher. Most Local Authorities conformed to the Free Transport policy introducing a school bus service 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. Unsurprisingly, the larger effect of the policy is found in less dense regions: pupils living in rural areas are 2.6 p.p. less likely to attend their nearest school and 1.6 p.p. more likely to enrol at the second nearest, while virtually no effect is found for students living in urban areas.

Finally, columns 5 and 6 report results for two separate regressions for Local Authorities with a IDACI score below (less deprived) or above the median (most deprived). Though coefficients are negative in both regressions, the effect is significant only for students living in most deprived areas and in the order of 2.2 p.p.. Estimates of the probability of attending the second nearest school are also larger and 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 have a deprived background. 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 at the best school regardless of free transport.

7 Summary and Conclusions

This paper investigates how the provision of free transport to attend schools further away affects the school choices of low income families. I explore a unique policy change that occurred in England in 2008, which expanded the right to free transport for low SES students 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

sub-groups of the population. All figures report the probability of attending the nearest school from home as a function of the distance to the second nearest school (i.e. the eligibility variable) separately for the before policy period and the post policy period. Sub-figures a) and b) show the before and after policy attendance of the nearest school by the relative quality of the two schools: sub-figure a) looks at students whose second nearest school is of higher quality compared to the nearest one (i.e. those who would gain from switching school), while sub-figure b) at those whose second nearest school is of lower quality compared to the nearest. In both sub-samples there is a clear decrease in the fraction of eligible students attending the nearest school. Sub-figures c) and d) show the same patterns for the sub-samples of urban and rural areas. Finally, sub-figures e) and f) divide the sample based on LA deprivation.

enrol their children in more distant schools, the effect on school quality is ambiguous, as constrained parents may be induced to select schools further away even without a true gain in terms of quality. Moreover, over-subscription of high quality schools may de facto limit parents' choice to less popular schools.

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

Results show that, consistent with the intuition provided above, students eligible for free transport enrol at 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 zero or slightly negative and robust to alternative specifications.

Though the direct objective of the Free Transport policy was to improve the quality of the school attended by low income families, it may still be possible that the programme succeeded under different dimensions. Specifically, though I do not address this here for lack of data, students may benefit from higher choice, even without attending better schools. For instance, it may be that families took advantage of the subsidy to escape the poor environment where they are living and that their children benefit from having peers with less disadvantaged backgrounds. However, results in table 5 seem to suggest that, if anything, as a result of the policy students enrolled in schools with a higher proportion of low income students. Nonetheless, this is only a proxy of students' background. Additionally, pupils may gain from other school characteristics that are not observable in the data. For instance, they may select schools which more directly target disadvantaged students or that provide a wider number of amenities, such as gardens and computers.

Policy Implications Home to school transport policies typically have the goal to improve the quality of education for low income students. However it is important to carefully determine a priori what are the incentives families will face, as well as what are the institutional barriers that may prevent the success of such policies. Specifically, in the case under analysis two concerns emerge. First, given the subsidy's conditionality on distance, the policy create incentives for some families to apply to further away schools even if there is no gains in terms of quality. Second, high quality schools are likely to be oversubscribed. As distance is the main criteria for admission, the choice of school for

students eligible for free transport may de facto be limited to poor quality schools. In light of this, the main suggestion to policy makers may be the following. First, in order to avoid disincentives, the subsidy should not be conditioned on distance (i.e. to further away school), but extended to any school. Alternatively, the free transport could be restricted to more distant schools which are of higher quality compared to the one nearby. Second, to overcome the over-subscription problem, one might think of introducing special quotas for low income students in most popular, high quality schools.

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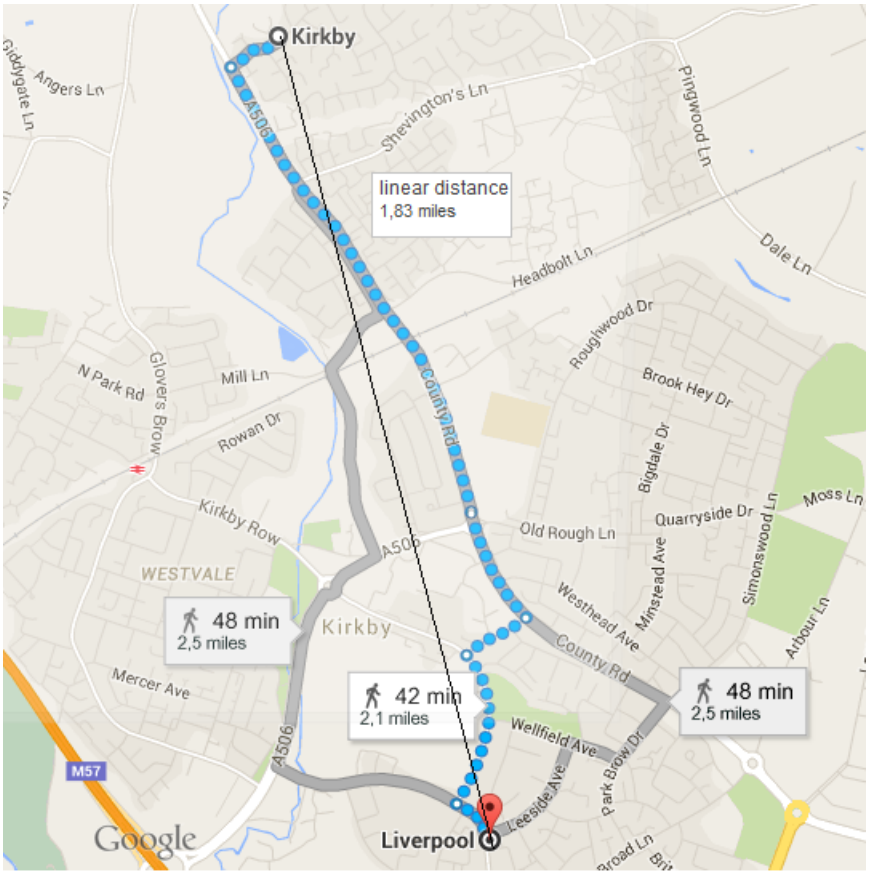
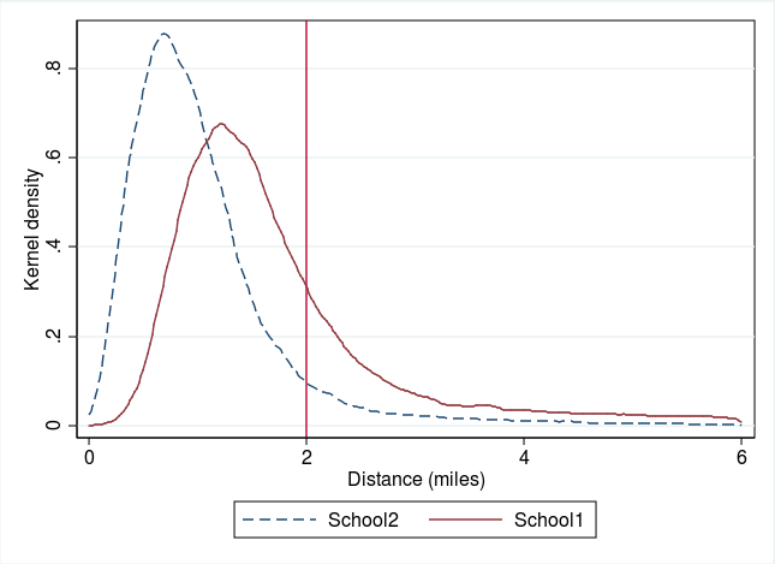
Tables and figures

Figure 1: Linear and walking distance to the second nearest school



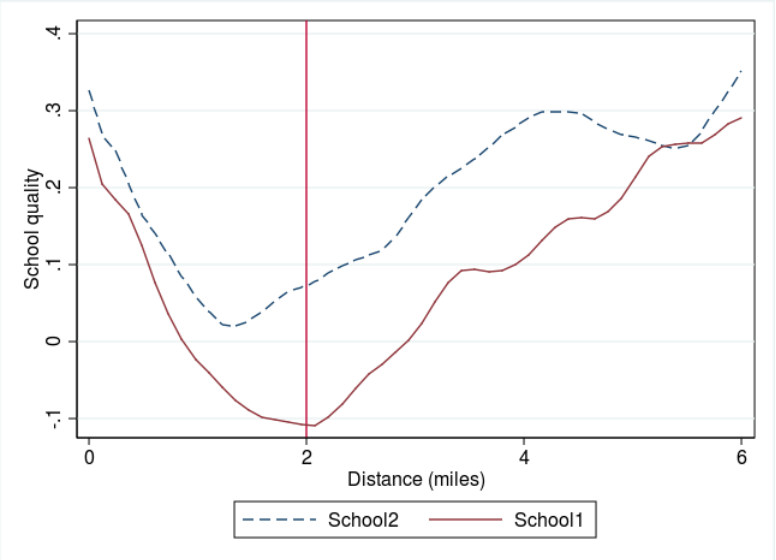
Notes: Author's calculations on PLASC data. The map reports the linear (black line) and walking distance (blue and grey lines) between the pupil house and the second nearest school from home.

Figure 2: FSME students' distribution by distance to the first and second nearest schools



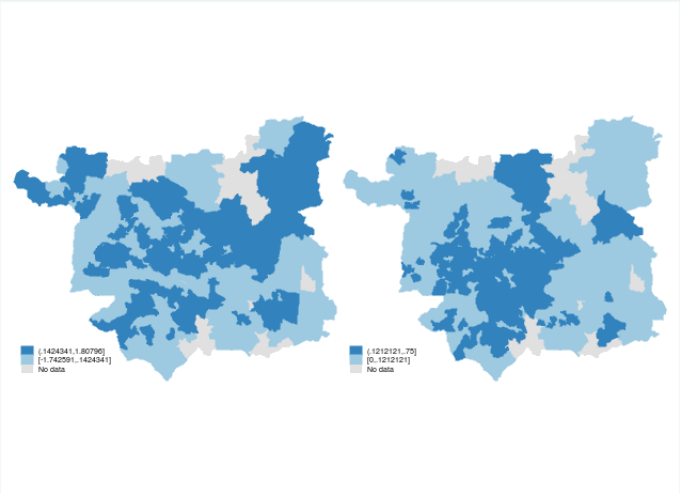
Notes: Author's calculations on PLASC data for the period 2005-2011.

Figure 3: School quality distribution by distance to the second nearest school- FSME students



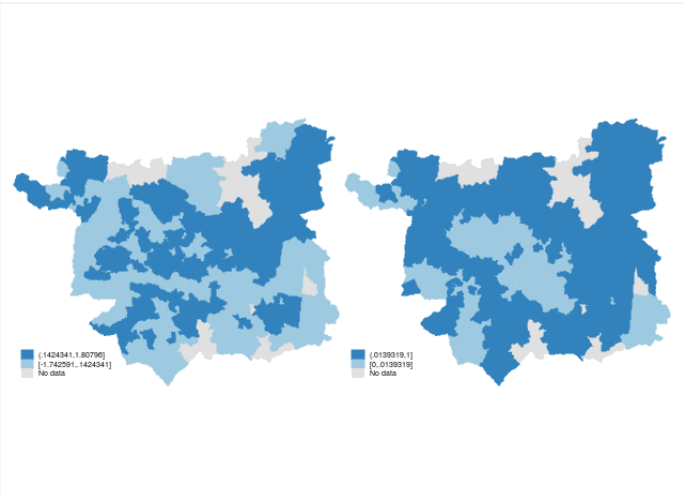
Notes: Author's calculations on PLASC data for the period 2005-2011. Local mean smoothing.

Figure 4: School quality and FSME students distribution by neighbourhood- city of Leeds



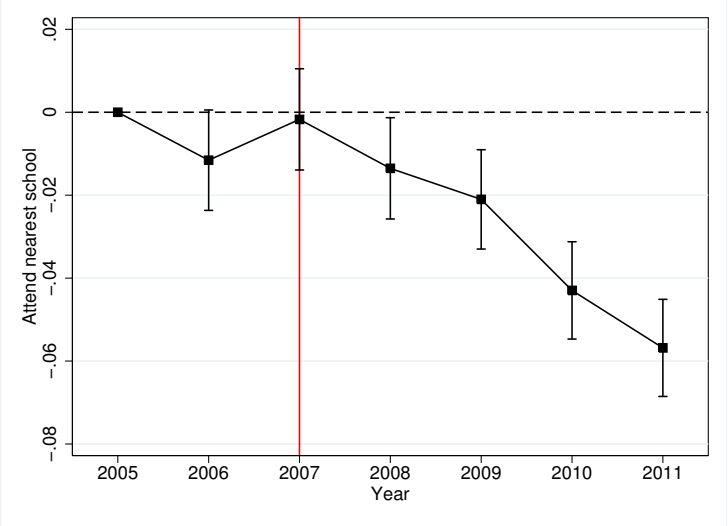
Notes: Author's calculations on PLASC data for the period 2005-2011. The maps on the left show the difference between the quality of the second nearest school and the quality of the nearest school for the whole population of students by LLSOA (Lower Layer Super Output Area) The maps on the right show the proportion of FSME students by LLSOA.

Figure 5: School quality and treatment group distribution by neighbourhood (FSME only)- city of Leeds



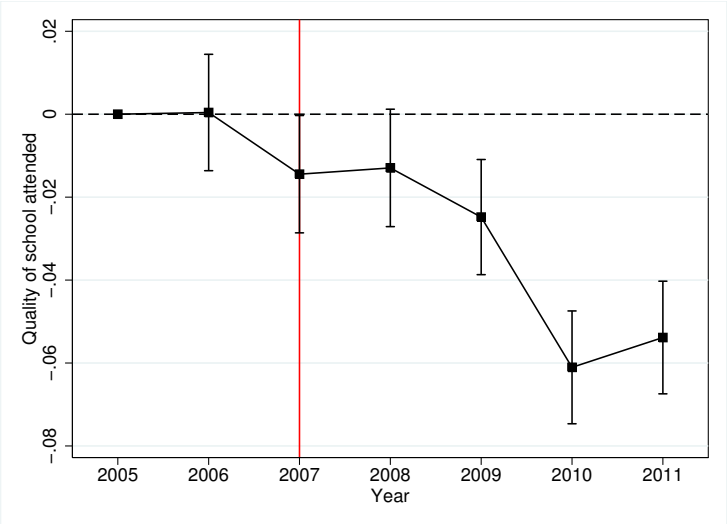
Notes: Author's calculations on PLASC data for the period 2005-2011. The maps on the left show the difference between the quality of the second nearest school and the quality of the nearest school for FSME students by LLSOA (Lowe Layer Super Output Area). The maps on the right show the proportion of students living between 2 and 6 miles from the second nearest school by LLSOA.

Figure 6: School attended



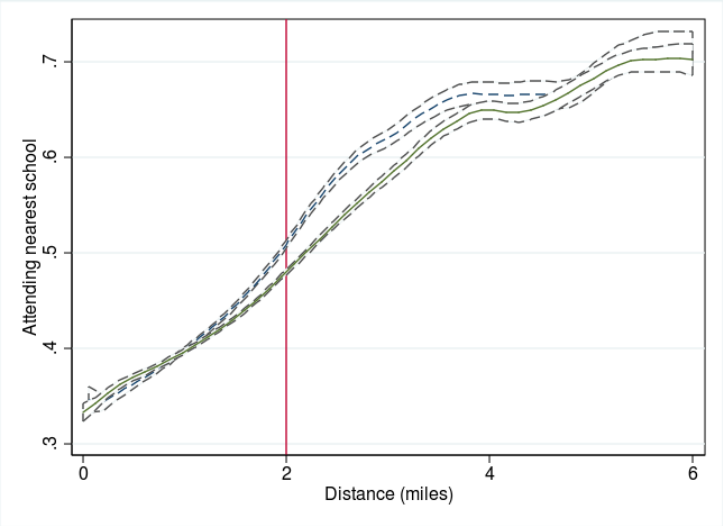
Notes: The solid line displays the coefficients of a regression of a dummy for attending the nearest school on the interaction between the year dummies and the eligibility dummy. 95% confidence intervals. Omitted category: year 2005.

Figure 7: School quality



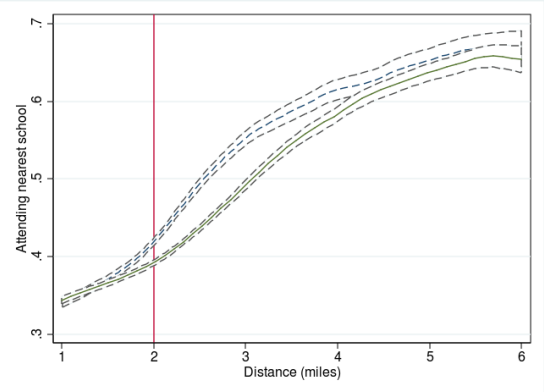
Notes: The solid line displays the coefficients of a regression of the quality of the secondary school attended on the interaction between the year dummies and the eligibility dummy. 95% confidence intervals. Omitted category: year 2005.

Figure 8: Before-after probability of attending the nearest school by distance to the second nearest school

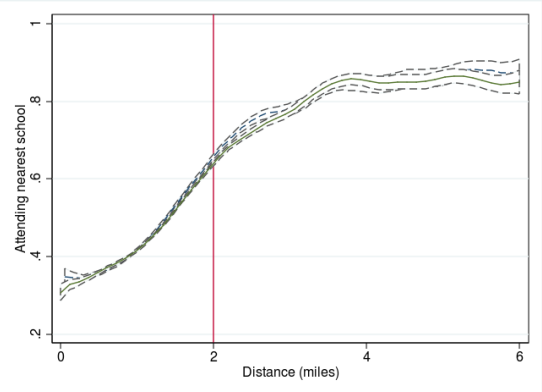


Notes: Author's calculations on PLASC data for the period 2005-2011. Local mean smoothing with 95% confidence interval. The dashed lines refer to the pre policy period, the solid lines to the post policy period.

Figure 9: Before-after probability of attending the nearest school by distance to the second nearest school: non linear effects



(a) Distance nearest school>1



(b) Distance nearest school<1

Notes: Author's calculations on PLASC data for the period 2005-2011. Local mean smoothing with 95% confidence interval. The dashed lines refer to the pre policy period, the solid lines to the post policy period.

Table 1: Free transport to school

	$dist_1$	$dist_2$	PRE 2008	POST 2008	SAMPLE %
INELIGIBLE	< 2	< 2	**NO**	**NO**	**73.31**
ELIGIBLE	< 2	> 2	**NO**	**YES** ($School_2$)	**17.60**

Table 2: Schools' characteristics

	All schools	Bottom decile	Top decile
Panel A: Schools			
Number of schools	3,323		
Community schools (%)	50.23		
Academies (%)	7.52		
Foundation schools (%)	23.14		
Voluntary schools (%)	2.29		
Other schools (%)	16.28		
Number of new enrolments	147.19	2.07	274.86
Average exit cohorts' test scores	0.21	-0.78	1.60
Panel B: Students' composition			
White British (%)	79.24	15.58	98.23
FSME (%)	19.29	1.33	56.63
Females (%)	48.72	10.59	90.45
English speakers (%)	88.49	36.00	99.86

Notes: Author's calculations on PLASC data. The table reports summary statistics for the period 2005-2011. Quality of school is defined as the average of the schools' test scores over the whole period. It has been standardized to have a mean of zero and a unit standard deviation.

Table 3: FSME students' characteristics

	All	Eligible	Ineligible
Panel A: Demographics			
White British (%)	76.34	87.42	73.68
Pakistani (%)	6.91	2.06	8.07
Indian (%)	1.4	0.44	1.63
Bangladeshi (%)	1.78	0.53	2.07
Black African (%)	2.16	0.94	2.45
Other ethnic group (%)	11.42	8.61	12.09
Females (%)	49.46	49.00	49.57
English speakers (%)	85.76	94.79	83.59
Panel B: Available schools			
Distance to nearest school (miles)	0.88	1.08	0.83
Distance to second nearest school (miles)	1.77	2.86	1.51
Attending nearest school (%)	47.83	65.84	43.50
Attending second nearest school (%)	17.60	8.16	19.87
Quality of school attended	-0.06	0.03	-0.08
Quality of nearest school	-0.04	-0.04	-0.04
Quality of second nearest school	0.08	0.14	0.07
N	416,366	80,589	335,777

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

Table 4: School choice

	[1]	[2]	[3]	[4]
ATTEND:				
1. School 1	-0.027***	-0.024***	-0.023***	-0.018*
	(0.007)	(0.007)	(0.006)	(0.007)
2. School 2	0.012**	0.009*	0.009*	0.010*
	(0.004)	(0.004)	(0.004)	(0.005)
3. Other schools	0.016*	0.015*	0.014*	0.009
	(0.007)	(0.007)	(0.007)	(0.006)
Time Fixed Effects	X	X	X	X
LA Fixed Effects	X	X	X	X
Additional controls	X	X	X	X
$dist_2$		X	X	X
$dist_1$			X	X
Postcode Fixed Effects				X
N	416,365	416,365	416,365	416,365

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. Controls include gender, a dummy for whether the pupil defined himself as "white British" and a dummy for being English native speaker and are interacted with time dummies. Controls for distance are polynomials of the 2^{nd} order.

Table 5: Additional outcomes

	[1]	[2]	[3]	[4]	N
SCHOOL QUALITY:					
1. Test scores (2005-2011)	-0.022**	-0.021*	-0.021**	-0.022**	413,691
	(0.008)	(0.008)	(0.008)	(0.007)	
2. % White British	-0.224	-0.182	-0.185	-0.130	413,744
	(0.308)	(0.298)	(0.296)	(0.270)	
3. % FSME	0.643***	0.698***	0.610***	0.369**	413,744
	(0.153)	(0.150)	(0.150)	(0.127)	
4. % English	-0.337	-0.299	-0.301	-0.118	413,744
	(0.242)	(0.233)	(0.231)	(0.210)	
Time Fixed Effects	X	X	X	X	
LA Fixed Effects	X	X	X	X	
Additional controls	X	X	X	X	
$dist_2$		X	X	X	
$dist_1$			X	X	
Postcode Fixed Effects				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. Controls include gender, a dummy for whether the pupil defined himself as "white British" and a dummy for being English native speaker and are interacted with time dummies. Controls for distance are polynomials of the 2^{nd} order.

Table 8: Non-linear effects

	ATTEND:			
	School$_1$	School$_2$	Other schools	
	[1]	[2]	[3]	N
BY DIST$_1$:				
$dist_1 < 1$	-0.007	0.006	0.002	266,428
	(0.009)	(0.005)	(0.010)	
$dist_1 > 1$	-0.025**	0.015*	0.010	149,937
	(0.009)	(0.007)	(0.009)	
BY DIST$_2$:				
$2 < dist_2 < 3$	-0.019*	0.011	0.008	393,379
	(0.008)	(0.006)	(0.008)	
$3 < dist_2 < 4$	-0.006	0.002	0.004	348,114
	(0.014)	(0.007)	(0.012)	
$4 < dist_2 < 6$	-0.019	0.007	0.012	346,426
	(0.015)	(0.007)	(0.014)	

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. All regressions include: gender, a dummy for whether the pupil defined himself as "white British" and a dummy for being English native speaker and are interacted with time dummies. Controls also include 2nd order polynomials of distances to the nearest and second nearest schools, time fixed effects and postcode fixed effects.

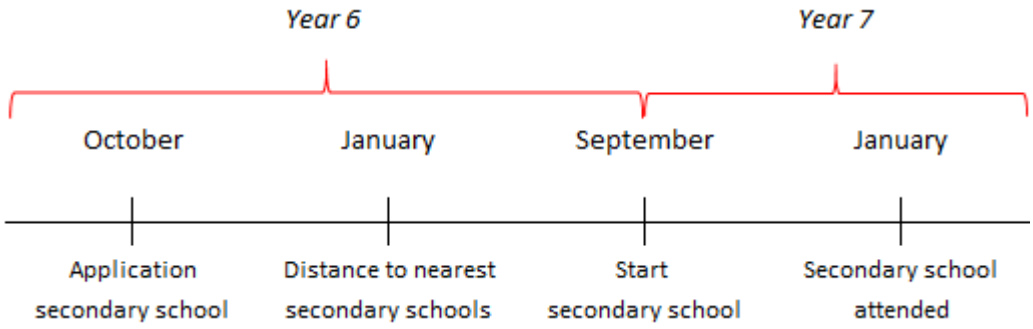
Table 9: Heterogeneous effects

	BY QUALITY:		**BY REGION:**		**BY IDACI:**	
	$Q_1 < Q_2$	$Q_1 > Q_2$	Urban	Rural	Least deprived	Most deprived
	[1]	[2]	[3]	[4]	[5]	[6]
1. School 1						
	-0.013	-0.022*	-0.009	-0.026**	-0.014	-0.021*
	(0.009)	(0.011)	(0.012)	(0.009)	(0.011)	(0.009)
2. School 2						
	0.004	0.019*	0.001	0.016**	0.008	0.011
	(0.006)	(0.008)	(0.008)	(0.006)	(0.008)	(0.006)
3. Other schools						
	0.009	0.003	0.008	0.010	0.006	0.011
	(0.009)	(0.008)	(0.010)	(0.010)	(0.010)	(0.008)
N	229,538	174,969	237,832	178,533	139,407	274,575

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. All regressions include: gender, a dummy for whether the pupil defined himself as "white British" and a dummy for being English native speaker and are interacted with time dummies. Controls also include 2^{nd} order polynomials of distances to the nearest and second nearest schools, time fixed effects and postcode fixed effects.

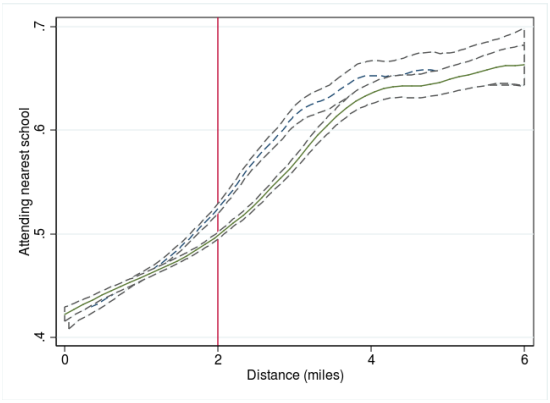
Appendix A: Supplementary tables and figures

FIGURE 1.A1: Time-line of data building

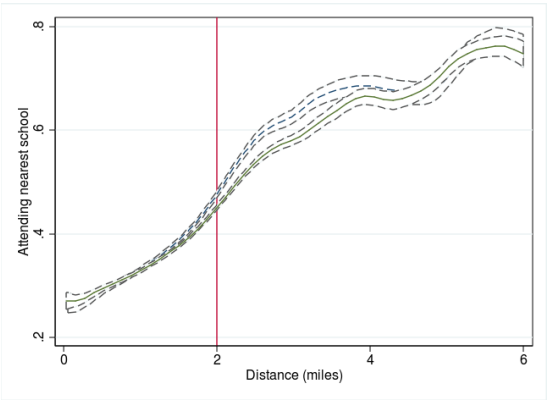


Notes: The figure shows the time-line of data building. In January of the last year of primary school (Year 6) the Pupil Census reports the address of students and each pupil is matched to his three nearest secondary schools (and corresponding distances). One year after, the Census reports the information relative to the secondary school attended and the variable "quality of school attended" is determined.

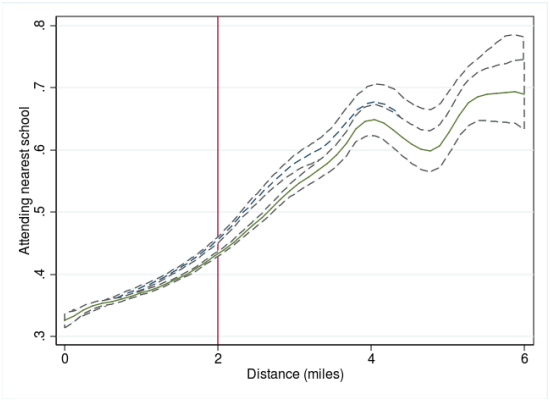
FIGURE A1: Heterogeneous effects: before-after probability of attending the nearest school by distance to the second nearest school



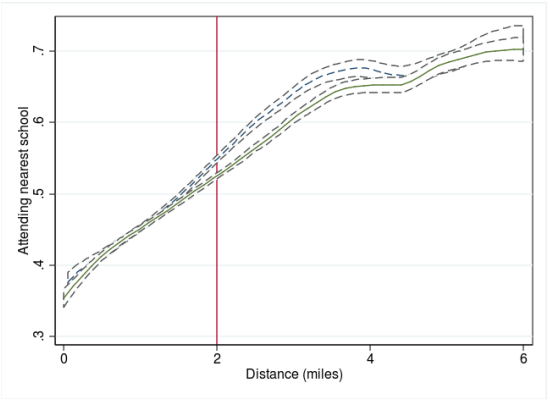
(a) $Qual_2 > Qual_1$



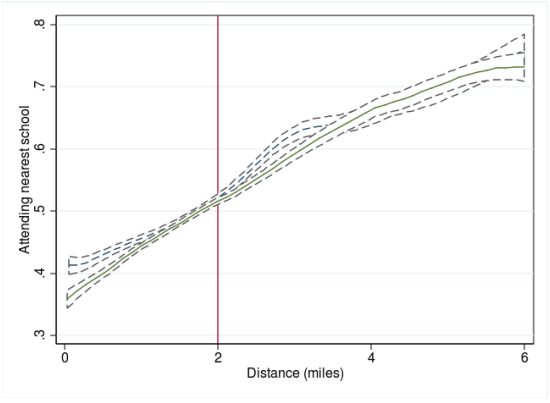
(b) $Qual_2 < Qual_1$



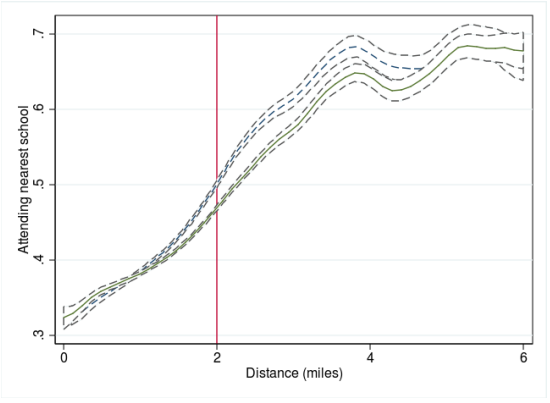
(c) Urban areas



(d) Rural areas



(e) Least deprived



(f) Most deprived

Notes: Author's calculations on PLASC data for the period 2005-2011. Local mean smoothing with 95% confidence interval. The dashed lines refer to the pre-policy period, the solid lines to the post-policy period.

TABLE 1.A1: Estimates for the sample including students with the nearest school above 2 miles from home

	ATTEND:			**SCHOOL QUALITY:**
	School$_1$	School$_2$	Other schools	Test scores (2005-2011)
	[1]	[2]	[3]	[4]
	-0.013	0.010*	0.003	-0.022**
	(0.007)	(0.005)	(0.008)	(0.007)
N	458,008	458,008	458,008	454,570

Notes: OLS estimates. Clustered (at the Local Authority level) standard errors in parenthesis. Eligible group is defined as pupils with the second closest school between 2 and 6 miles from home walking distance. All regressions include: gender, a dummy for whether the pupil defined himself as "white British" and a dummy for being English native speaker and are interacted with time dummies. Controls also include 2nd order polynomials of distances to the nearest and second nearest schools, time fixed effects and postcode fixed effects.

TABLE 1.A2: Estimates for the sample excluding students attending a voluntary aided school

	ATTEND:			**SCHOOL QUALITY:**
	School$_1$	School$_2$	Other schools	Test scores (2005-2011)
	[1]	[2]	[3]	[4]
	-0.016	0.009	0.009	-0.018*
	(0.008)	(0.005)	(0.007)	(0.008)
N	362,079	362,079	362,079	359,512

Notes: OLS estimates. Clustered (at the Local Authority level) standard errors in parenthesis. Eligible group is defined as pupils with the second closest school between 2 and 6 miles from home walking distance. All regressions include: gender, a dummy for whether the pupil defined himself as "white British" and a dummy for being English native speaker and are interacted with time dummies. Controls also include 2nd order polynomials of distances to the nearest and second nearest schools, time fixed effects and postcode fixed effects.

TABLE 1.A3: Test for parallel trends

	ATTEND:			**SCHOOL QUALITY:**
	School$_1$	School$_2$	Other schools	Test scores (2005-2011)
	[1]	[2]	[3]	[4]
$D_p * 2006$	-0.018	0.003	0.016	-0.002
	(0.012)	(0.007)	(0.013)	(0.007)
$D_p * 2007$	-0.019	0.008	0.011	-0.011
	(0.010)	(0.006)	(0.010)	(0.008)
$D_p * post2007$	-0.030**	0.014*	0.018*	-0.027**
	(0.010)	(0.007)	(0.008)	(0.009)
N	416,365	416,365	416,365	413,691

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. All regressions include: gender, a dummy for whether the pupil defined himself as "white British" and a dummy for being English native speaker and are interacted with time dummies. Controls also include 2nd order polynomials of distances to the nearest and second nearest schools, time fixed effects and postcode fixed effects.

Appendix B: theoretical framework

Consider a family whose utility of attending school j is given by

$$U_j = Q_j - \beta_1 dist_j + e_j$$

where 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 its children at the nearest school (S_1) or second nearest (S_2) whenever the overall utility gain is higher than for the other school. Thus, a family will choose to enrol its children at the nearest secondary school with probability

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

Where F is the cumulative distribution of $e_2 - e_1$. The constant α captures the decrease in the cost of distance induced by the subsidy: $\alpha = 0$ 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 $dist_2 \geq 2$, with t_0 and t_1 denoting the pre and post-policy periods respectively.

The main implications of the model are:

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

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

3. $\frac{\partial P(S_1=1)}{\partial \alpha \partial dist_2} \geq 0$ if $P(S_1 = 1)$>0.5 (and $\frac{\partial P(S_1=1)}{\partial \alpha \partial dist_2} \leq 0$ if $P(S_1 = 1)$<0.5): the negative effect on the probability of attending S_1 is lower the higher the distance to S_2 as long as the fraction of students attending the nearest school is more than one half (and higher otherwise).

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

$$E(Q) = Q_1 P(S_1 = 1) + Q_2 P(S_2 = 1)$$

Hence

$$\frac{\partial E(Q)}{\partial \alpha} = (Q_1 - Q_2)\frac{\partial P(S_1 = 1)}{\partial \alpha}$$

The effect is ambiguous and depends effectively on the distribution of school quality among those who took up the policy. Although ex-ante $Q_2 > Q_1$ (see table 1.3), meaning that FSME children could potentially gain from the policy, I show that the students responding to the policy were disproportionally those for whom $Q_2 < Q_1$, so that $\frac{\partial E(Q)}{\partial \alpha} \leq 0$.[44]

[44]The intuition behind that is explained in greater detail in section 4 of the paper.