# Effects of School Referral on Bilingual Children's Outcomes*

Anna Piil Damm†, Elena Mattana‡, Helena Skyt Nielsen§ and Benedicte Rouland**

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**Abstract:** This paper uses a regression discontinuity design to investigate the effects of a school referral policy on the academic achievement, well-being and social relations of a subgroup of bilingual pupils who do not speak the host-country language at home. Since 2006, all bilingual school starters living in the second largest city in Denmark are required to take a Danish language test shortly before school start. Children whose scores fall below a pre-determined threshold are referred to a school with at most 20% pupils with inadequate language proficiency per school. Moreover, if the school is located outside the school district, the local authorities provide the pupils with free bus services between home and school. Comparing pupils below and above the threshold, our very preliminary results show a significant but very small negative effect on the probability to attend the after-school program of the school.

*Keywords*: Regression Discontinuity; School Segregation; Immigration; Public Policy; Education.

*JEL codes*: I20; I28

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† Department of Economics and Business, Aarhus University, Fuglesangs Allé 4, DK-8210 Aarhus V. Email: apd@asb.dk.

‡ Department of Economics and Business, Aarhus University, Fuglesangs Allé 4, DK-8210 Aarhus V. Email: emattana@econ.au.dk.

§ Department of Economics and Business, Aarhus University, Fuglesangs Allé 4, DK-8210 Aarhus V. Email: hnielsen@econ.au.dk.

** Centre for Social Data Analytics, School of Economics, AUT, Private Bag 92006, Auckland 1142, New Zealand. Email: benedicte.rouland@aut.ac.nz.

## I. INTRODUCTION

Multiple initiatives have been implemented internationally to counteract residential segregation, e.g. the Moving to Opportunity (MTO) program in the US[1] and the Boston's Metco program. Also in Denmark, municipalities have implemented policies to counteract potential negative effects of high concentration of immigrants and descendants of immigrants, ranging from housing policies aiming at changing the socioeconomic composition in socially deprived neighborhoods to school reforms (e.g. school closures, school district changes, additional school resources, spatial dispersal of immigrant children across public schools and daycares). Whether and which school desegregation policies work, and what their mechanisms are, is still mostly an open question.

Empirical investigation of school composition is not a straightforward task because parents sort into neighborhoods in terms of unobserved characteristics.[2] Therefore, class composition and school characteristics typically reflect neighborhood characteristics, and, therefore, the family background of pupils is only partly observed. Ideally, estimation of impacts of school composition on pupil outcomes requires a randomized-controlled trial which randomly assigns pupils to schools with different socioeconomic composition of pupils. In view of the high value parents place on school quality (see e.g. Black, 1999), such a randomized-controlled trial would be extremely difficult to implement.

In this paper, we present new evidence on how school composition and school desegregation initiatives influence academic achievement, well-being and social relations of the subgroup of bilingual pupils who do not speak the host-country language at home, henceforth referred to as bilingual pupils. Specifically, we exploit exogenous variation in school composition stemming from a school desegregation policy in the second largest city in Denmark, Aarhus. According to the policy, bilingual school starters take a Danish language test shortly before school start. The local authorities then assign those bilingual school starters whose scores fall below a pre-determined threshold to a school with at most 20% bilingual school starters with poor Danish language skills. Moreover, if the school is

[1] See e.g. Chetty, Hendren and Katz (2016) for evidence on the impacts of MTO on children's long-term outcomes.

[2] See e.g. Damm (2014) for quasi-experimental evidence on neighborhood sorting of immigrants.

located outside the school district, the local authorities provide the pupils with free bus services between home and school.

Keeping a standard education production function in mind, a school move affects academic outcomes of bilingual pupils by changing peer composition and/or school characteristics like school resources, class size, and teacher experience. Both experimental studies[3] and studies using observational data[4] find evidence that pupils' academic performance is influenced by their peers. There is some disagreement about the effecs of school resources on achievement. According to Hanushek (2006), there is little indication of a consistent relationship between resources available to schools (reflected among other things in class size) and student achievement, whereas Fredriksson et al. (2013) and Chetty et al. (2014) document persistent long-run effects of reduced class size.[5]

The main aim of the school desegregation policy is to improve academic achievement of *all* bilingual pupils – irrespective of whether they are referred to a reception school or attend the local public school – by means of an improved socioeconomic mix in all public schools attended by bilingual pupils. Bilingual pupils with a significant need for host-country language support who are referred to a reception school will attend a public school characterized by a relatively low share of bilingual pupils and a higher share of pupils from higher socio-economic status families. However, the reception school also receives substantially lower per pupil spending. Therefore, theoretically, assignment to a reception school has ambiguous effects on academic achievement. As consequence of the school desegregation policy, the remaining pupils in public schools in or adjacent to immigrant dense neighborhoods will also experience an improved socioeconomic mix due to the cap of max 20 % bilingual school starters with a significant need for host-country language support and reduced flight of pupils from high socioeconomic status families.

[3] Sacerdote (2001) and Zimmerman (2003).
[4] Hoxby (2000), Hanushek, Kain, Markman and Rivkin (2003), Hoxby and Weingarth (2005), Gibbons and Telhaj (2006), Angrist and Lang (2004), Gould, Lavy and Paserman (2009), Arcidiacono and Nicolson (2005), Ammermueller and Pischke (2009), Lavy and Schlosser (2011), Billings, Deming and Rockoff (2014), Chin, Daysal and Imberman (2016). Danish studies of peer effects on pupils' academic performance include Rangvid (2007a), Rangvid (2007b), Jensen and Würtz (2011) and Kristoffersen et al. (2015).
[5] According to Reschovsky and Imazeki (1997) an increase in per pupil funding for low income pupils has been linked to narrowing the achievement gap between poor and more affluent pupils. For the relationship between school finances and achievement gaps, see also Reschovsky and Imazeki (2001; 2003). Empirical studies also document a link between school funding cuts and achievement (see e.g. Jackson, Wigger and Xiong 2018).

One way of testing whether the school desegregation policy is successful is to compare academic achievement of bilingual pupils with similar background across school settings: reception school versus district school. To this end, we will use a regression discontinuity design and compare academic outcomes of bilingual pupils across school settings using pupils register data from Aarhus Municipality linked with administrative registers from Statistics Denmark. Specifically, we compare outcomes of bilingual pupils whose language test scores fall just below the theoretical cutoff and who are "bused" to a school outside the residential neighbourhood, with the outcomes of pupils whose scores are above the theoretical threshold for school referral. We use the language test threshold to instrument the propensity of being referred to a school other than the district school. Thus, the probability of being referred to a school outside the school district when the pupil fails the test rises sharply to around 20% at the cutoff, and is close to zero below the cutoff.

If our RD results show that bilingual pupils in reception schools have better academic outcomes than similar peers with free school choice, it will suggest that the peer effect due to improved composition of pupils in the reception school more than outweighs the negative effect of lower per pupils spending. The policy recommendation will then be to re-distribute either funds from reception schools to immigrant-dense schools, or bilingual pupils from immigrant-dense schools to reception schools. If instead our RD results show the opposite – i.e. that bilingual pupils in reception school have worse academic outcomes than similar peers with free school choice – the policy recommendation will be to refer fewer bilingual pupils with a significant host-country language support need to reception schools, or to shift funding from immigrant-dense schools to reception schools.

Due to the low shares of immigrant and co-ethnic pupils in reception schools, referral to a reception school may impose a cost on the referred child in terms of well-being and lack of social integration in the school, at least in the short-run.[6] Therefore, we also investigate the effects of referral to a reception school on children well-being and social integration.

[We find… TBW]

[6] So far, there is no clear evidence of the general importance of ethnic background or minority status of children for the establishment of social relations. Previous studies suggest that common language skills, common knowledge and common everyday lives of children matter significantly in their choice of friends. Thus, minority and majority children often self-segregate (Gulløv, 2010).

The rest of the paper is structured as follows. Section II describes background and the relevant policy. Section III presents the administrative register data, whereas Section IV introduces the empirical strategy. Section V discusses results, and finally, Section VI concludes the study.

## II. Institutional Background and School Desegregation Policy

### *II.A. Institutional Background*

Already at age four, the vast majority (98% in 2004[7]) of Danish children are enrolled in some form of public day-care, which is heavily subsidized.[8] For the children in this study, education was compulsory from the calendar year in which the child turned six[9] until completing ninth grade. School starts with a one-year preschool class and ends with a compulsory school exit exam (around age 16). Compulsory education, as well as most post-compulsory education, are free of charge at public schools, whereas private schools charge tuition fees (but are 85% publicly subsidized).

Until a nation-wide school reform in 2014, only a small number of Danish public schools required the pupils to attend school for the entire day from 8 am to 4 pm. Henceforth, we refer to such schools as "full day schools" (in Danish 'heldagsskole'). Pupils in normal public school had a significantly shorter school day. Since 2006, two school districts in Aarhus Municipality have been full day schools: Tovshøjskolen and Søndervangsskolen. These school districts are also characterized by high shares of bilingual pupils.[10]

Another type of public schools is magnet schools (in Danish 'magnetskoler') of which there are four in Aarhus: Ellekær Skole, Hasle Skole, Sødalsskolen and Skjoldhøjskolen. Magnet schools are located in school districts with high shares of bilingual pupils and receive substantially higher funding per pupil in order to reduce public school flight by local families. The teaching in magnet schools is planned with special

[7] Source: statistikbanken.dk
[8] A minimum of 67% of the expenses is covered by the local authorities (c.f. the Children's Act).
[9] Pre-2009 cohorts could opt out of preschool class, though, which became compulsory for the cohort starting school in 2009. Before 2009, average enrolment in the optional pre-school class was 83% (2005 figures; UNI-C 2012).
[10] Brøndum and Fliess (2009).

focus on inter-culturalism, targeted teaching, social skills, school-parent collaboration and music and other creative subjects.[11]

In school, pupils are divided into classes when entering preschool and typically remain in the same class until grade nine if they do not change schools. The maximum class size, regulated by national law, is 28 students, whereas the average is 22 students, which is similar to other OECD countries (OECD 2016). In preschool, students are taught by a classroom teacher, whereas they are taught by subject-specific teachers from first to ninth grade.

Associated with public schools, there exist after-school care and youth clubs with activities guided by professionals and paraprofessionals. These services are available from pre-school to age 18 and most often located next to school facilities. Attendance in after-school care and youth clubs in Aarhus Municipality is high until ages 10-12, when children become more autonomous and opt out. The charges for these services are income-dependent but heavily subsidized.

An overlapping group of professionals and other adults typically follow the pupils through several grades, although there are no legal regulations as to the organization across grades. This institutional setting is organized with a focus on stable peers, social relations and well-being.

### *II.B. The Aarhus Municipality School Desegregation Policy*

Danish cities are characterized by a high residential concentration of non-western immigrants and descendants. Damm et al. (2006) calculate and an isolation index – the probability that a non-western immigrant meets another non-western immigrant in the neighborhood of residence – equal to 23. This is high, if one considers that non-western immigrants constituted only 6% of the population. As consequence of this residential concentration, there is school segregation of immigrant pupils in primary and lower secondary schools: while, overall, 11% of pupils in public schools are immigrant of descendants, in 9% of public school, their concentration is above 25%.

[11] Brøndum and Fliess (2009).

Pupils in Denmark have free school choice among public schools and most pupils choose to attend the public school located in their school district, henceforth referred to as the district school. However, since 2005, Danish municipalities have been allowed to refer bilingual pupils with a significant need for host-country language support to a school, possibly located in another school district, at school start.[12] This law gave Danish municipalities the right to subject all bilingual school starters to a Danish language test shortly before school start and – if the test score fell below a pre-determined threshold – assign the pupil to a school with less than 20% bilingual school starters with a significant need for host-country language support.

This type of school intervention has been carried out in the second largest city in Denmark, Aarhus, since August 2006 and is still in place. In Aarhus, all school-starters, school-movers and newcomers with Danish as their second language take a Danish language test before school start and before a school move within the municipality. Each year around 550 school starters (i.e. 18% of all school starters in the municipality) take the Danish language test. On the basis of the test score, bilingual school starters are assigned to one of three school type categories: M or reception class (in Danish 'Modtagerklasse'), S or school referral (possibly to a public school in another school district) and F or free school choice (i.e. typically attend the district school).[13]

Category F pupils (annually around 26%) are pupils whose test scores exceed the threshold for having a normal level of Danish language proficiency (for that age). Category S pupils (annually around 67%) are pupils whose test score falls below the threshold for preserving free school choice and thus have a significant need for language support. As a consequence, they are referred to a school by the municipality. If the school district has more than 20% bilingual school starters with a significant need for language support, some category S pupils are referred to a school outside the school district and provided with free bus services between home and school. As for selection of the 20% category S pupils who are referred to the district school, the municipality gives first priority to category S pupils

[12] Cf. article 5, Part 8 in the Danish Public School Law ('Lov om folkeskolen'), passed as Law no. 594 on the 24th of June 2005. A child who does not speak Danish at home is considered bilingual.

[13] Pupils with free school choice are entitled to a slot in the school district. However, parents can wish for a slot in a different school district and in case of available slots in the school wished for by the parents, the pupil will be assigned to it.

with special problems or problems in the family (e.g. traumas from war in the source country), and second priority to category S pupils with siblings in the district school. Finally, category M pupils (annually around 5%) have an even larger need for language support and are therefore referred to a reception class. For all these children, private school is also an option.

The language test is composed of three tasks, designed to get at different aspect of a child's language skills. The first task examines the child's active Danish vocabulary: the child is shown a number of pictures and is asked to name what the pictures show. The words represent objects and concepts that occur in the child's everyday life and the outside world. The second task tests the ability of the child to understand full sentences. The child is instructed to listen and repeat sentences that become longer and grammatically more complex. If the child gets 10 points, it means that she can repeat a sentence with a relevant content of three syllables, if she gets 13 points the sentence has 13 syllables and so on. Finally, the third task examines the ability of the child to understand complex sentence construction. The child is shown a photograph, then a number of statements are read for the child, and she is asked to point to their correct place on the photograph. The statements are of different length and grammatical complexity.

The thresholds between the three categories are a function of the score in the three materials and the child's exact age (Table 1). Children who score M in all three tasks are assigned to category M. Children who score F in all three tasks are assigned to category F and children who score F in two tasks but *miss one point* to score F in one of the three tasks are assigned to category F. All remaining children are assigned to category S. The cutoff in the first task depends on the age of the child on the day of the test: children who score below 31 get M, 5 year olds get F if they score above 35, 5 and half year olds need to score above 39, 6 year olds above 40, 6 and a half year olds above 42, and 7 year olds have to score above 43 to get F. In the second task, children who score between 0 and 9 get M, those who score between 10 and 12 get S, and those who score above 12 get F. Finally, in the third task, children who score 12 get S, those with a score below 12 get M, and those with a score of 13 get F.

[Table 1]

Category M consists of pupils who perform very poorly and there is no finer meaningful test score available. However, the test scores of pupils in category S and category F may be translated to a fine scale, and we are thus able to distinguish distance to the cut-off value. Hence, we focus on the threshold between school referral and free school choice.

Figure 1 shows the category assignment rule described above: conditional on scoring F in two tasks, the probability of getting free school choice jumps from approximately zero to one as the child's score in the remaining task jumps above the threshold. Figure 1 shows that in practice the rule is followed strictly, as the jump in probability is as sharp as expected.

[Figure 1]

## III. DATA

### *III.A. Data Sources*

Our data stem from two primary sources: Danish administrative registers from 1980 (or from the start date of the register) up to the latest update, and the following registers from Aarhus Municipality: (i) the pupils register from 2007 to 2014, (ii) the after-school care register from 2006-2014, (iii) responses to a parental satisfaction survey every other year since 2007, (iv) information on primary school resources in 2016, and (v) responses to an annual wellbeing survey since 2014.

The national administrative registers provide detailed information on daycare attendance, national test scores, as well as individual demographic characteristics for both parents and children, such as age, country of origin, immigrant status, date of immigration. For parents, we also have information on their education level and employment status.

The pupil register for Aarhus Municipality contains detailed information on language tests (including the test date[14], scores in each task, final overall score and the

[14] For this preliminary draft, we have not been able to use the exact test date. We are waiting to receive this information.

assignment to a school) and the school district. A total of 4979 school starters have been screened between 2007 and 2014. We drop 133 pupils with special problems who get a special treatment and cannot get referred to a school outside of the district school. 127 pupils are recorded as taking the school starter test in two different years.[15] We drop 3 further pupils who have missing information on the school district. Out of the remaining sample of 4843 school starters, 1450 pupils score above the cutoff and get free school choice, 162 are assigned to a reception class (four schools in Aarhus have reception classes), and 677 out of the 3231 kids who score S are referred to a school outside the school district (see Panel A of Table 2).

Figure 2 shows the share of pupils who are granted free school choice (category F pupils), referred to a school (category S pupils), and referred to a school outside the school district, since the implementation of the policy. Overall, we observe opposite trends between category F-pupils and category S-pupils over time, but parallel trends between the latter and pupils who get a referral outside of the school district. Up to one third of all kids with a school referral are referred to a school outside the school district. In 2009, we observe a change in the trends: school referrals tend to be less and less likely while the share of pupils who are granted free school choice increases. Possible explanations include compositional effects caused by more restrictive asylum and family-immigration laws in Denmark since 2002,[16] and increased resources for Danish language support to bilingual children in kindergartens in Aarhus during our observation period.

[Figure 2]

*III.B. Background Variables*

We report sample characteristics in Panel A of Table 2. The majority of tested children are children of immigrants (about 95%), mostly born in Denmark (85%); 87% originate from non-western countries, and almost half of them are of middle-eastern origin. These children come from large families: the average number of children in the household

[15] However, the scores are exactly identical in the two years, leading us to believe that these pupils delayed their enrolment of one year and were assigned to a school the year after with the same test.
[16] Law on foreigners (Udlændingelov) number 365 of 6 June 2002.

is 4, and 67% of families have both parents. Mothers tend to be 5 years younger than the fathers, are less likely to be employed (24.1% versus 43.6%), and more likely to be out of the labor force (65.5% versus 39.5%). The share of both parents being out of the labor force is very high overall. Parental education level is low; 59% of mothers and 48% of fathers are high school dropouts, while 11% of mothers and 21% of fathers have tertiary education.

We also report characteristics for the school districts and the attended school in Panel A of Table 2. Between 2006 and 2014 we record 52 distinct school districts in Aarhus Municipality that the children in the sample live in. The average fraction of non-Danes in the school districts where the children in our sample live is around 45%, and the average share of mothers with tertiary education is 27.8%. 65.5% of school districts are sending schools (due to the policy allowing at most 20% pupils with inadequate language proficiency per school), while 7.5% are receiving schools. The average school size in the school districts where the children in our sample live is about 411 pupils. Turning to the schools the children in our sample actually go to: the average size of the class attended by the children in our sample is 22 pupils, with about 3.6% of children referred to a school outside the district. Finally, note that private school is an option for all kids. In our sample, 9.3% of children go to private school, this compares with the 9.9% pupils attending starting school at a private institution while having free school choice. The number is much higher for children who are referred to a school outside the district school, of which 15.3% start school in a private institution.

[Table 2]

*III.C. Outcome Variables*

The outcomes that we use to understand the effects of school referral on the children are: i) the national test score in the subjects reading and math, ii) the fraction of the school year that the pupil is absent from school in each school year, iii) whether the pupil is enrolled in after-school care at his school, iv) parental school satisfaction.[17]

[17] Because we are still constructing the outcome variables, our ability to show the effects of the policy is quite limited at this time.

The first set of outcomes are based on national tests from the period 2010 to 2017. The tests are IT-based, self-scoring, adaptive tests.[18] Instead of giving all pupils the same questions and summing the number of correct answers, the software estimates an ability measure after each question and then finds a question with a difficulty level that matches the contemporary measure of the student's ability level. After each question, the software re-estimates a new ability level and the difficulty level of the next question is based on a RASCH algorithm that ensures that students are given questions that they have a 50% probability of answering correctly. Thus, the final ability estimates are not a function of the number of correct answers but rather a function of the difficulty level of the questions and the ability of the student. The final ability measures are distributed from –7 to 7 on a continuous logit scale.

Pupils are tested ten times from 2nd grade to 8th grade, and the compulsory test is administered in the spring. We use national test scores in reading and math as measures of pupil achievement. The compulsory national test in reading is taken by every student in the 2nd, 4th, 6th and 8th grade, while the national test in math is taken by every student in the 3rd and 6th grade (from 2018 also 8th grade). The national tests are thought to have a pedagogical purpose rather than an accountability purpose. Thus, the main purpose of the tests is to give feedback to teachers, students, and parents on the individual child's ability level. In principle, the teacher can assist academically weak students or provide them with aids or breaks during tests. Unfortunately, information on assistance, aid, or other provisions made for these students is unavailable to researchers. In principle, the tests are compulsory for all students enrolled in public schools, but principals may exempt some students from the tests.

The tests are designed to simultaneously estimate the student's ability in three cognitive areas of each subject, and the algorithm alternates question testing in each of these three cognitive areas. For reading, the cognitive areas are language comprehension, decoding, and reading comprehension. For mathematics, the cognitive areas are numbers and algebra, geometry, and applied mathematics. To calculate an average student ability score in reading and mathematics, we first standardize the ability measures in the population within year, grade, subject, and cognitive area (mean 0, st. dev. 1); then we sum

[18] For details on the national tests, see Beuchert and Nandrup (2018).

the standardized measures for the three cognitive areas in each subject and we standardize the final measures in the population (mean 0, st. dev. 1).

From Panel B in Table 2, we see that the average ability measures for our sample are [TBW].

The second outcome we look at is enrollment in the after-school program of the attended school (henceforth referred to as SFO). In Table 2, we report that 62.8% of children are enrolled in SFO in grade 0.

The third outcome we are interested in is school attendance, which we get information on from the pupils register. [TBW]

Finally, our fourth set of outcomes are based on the parental satisfaction surveys and on the share of pupils whose parents have decided to move in the year after the test, which measures parental overall satisfaction. In Table 2, we report that 6.5% of all tested school starters have changed school district in the year after the test. [TBW]

## IV. EMPIRICAL STRATEGY

### *IV.A. Discussion of the Cutoff Rule*

Because of the composite nature of the cutoff, we have to aggregate the scores on the three tasks to identify pupils who are around the cutoff. Starting from the theoretical rule described in Section II.B, we first rank the students according to how many points they are missing in order to get free school choice (based on the score in each task) and then we set the cutoff so that children with one missing point and above get free choice (F), and children with two missing points and below get school referral (S).[19] We call this the missing points cutoff rule. Figure 3 shows the free school choice assignment rule plotted against the missing points cutoff rule. As shown in Figure 1, the assignment rule is followed to the letter and the jump in probability is very sharp: children who score below the cutoff

[19] For instance, following Table 1, a 6-year old child has free school choice (F) only if he/she gets at least (40 points in task 1 + 13 points in task 2 + 13 points in task 3) or (41 points in task 1 + 12 points in task 2 + 13 points in task 3) or (41 points in task 1 + 13 points in task 2 + 12 points in task 3).

have approximately zero probability of getting free school choice, while for children who score above the cutoff this probability is approximately one.

[Figure 3]

Still, the missing points cutoff rule does not perfectly match up with the actual assignment[20]. There are 12 pupils scoring below the theoretical cutoff who get F as total actual score, while 93 pupils score above the theoretical cutoff and still get S as actual total score (and 12 are bused). There are also 5 or less pupils scoring an F who are bused.

An alternative way to define the cutoff is what we call the total points cutoff rule: we sum the number of points in the three tasks and we define an approximate cutoff per age group based on the total number of missing points. Reporting from Table 1, the cutoffs are (61, 65, 66, 68), for children age five, five and a half, six, and six and a half. This approach is more straightforward but not as precise in assigning students to the right group because a bad score in one task can be compensated by an excellent score in another task, so that the child gets passes the cutoff to have free school choice.[21] Figure 4 shows the free school choice assignment rule plotted against the total points cutoff rule. While the probability of getting free school choice rises sharply after the cutoff, the assignment rule is not perfect.

[Figure 4]

The two methods differ in the number of kids around the cutoff. Figures 5 and 6 show the distribution of kids around the missing points and the total points cutoff rules.

[20] Because we do not know the exact test date at the moment, we took a conservative approach by assuming the test happened on January 1st—while it is supposed to happen between January and March according to our contact person at Aarhus Municipality. However, considering the rule for scoring material 1, knowing the exact test date is very important because it determines the child's age at the time of screening. Therefore, by making such an assumption, we are generating mechanical errors.

[21] Getting back to the former example (in footnote 18), the child should get a minimum score of 66 points to have free school choice, independently of the score in each task. Therefore, a 6-year old child who has (42 points in task 1 + 11 points in task 2 + 13 points in task 3) will have free school choice according to the total points cutoff rule (because he/she scores 66 in total) while he/she would not it according to the missing points cutoff rule (because he/she misses more than one point in task 2).

From Figure 5 we can see that children are distributed around the missing points cutoff rule in a double peak. This is a direct consequence of the way the rule is defined: there are more and more combinations of 'missing points' between the three tasks as we move further away from the cutoff, defined as one missing point only. Figure 6 shows how, instead, the distribution around the total points cutoff rule is closer to normal. As a consequence of the possibility to compensate scores between tasks with this second rule, there is a higher number of children around the cutoff. In the analysis, we use the missing points cutoff rule as baseline and we use the total points cutoff rule as robustness check.

[Figure 5]

[Figure 6]

Tables 3 and 4 show difference in means in background characteristics of pupils below and above the cutoff, whether defined by the missing points rule (Table 3) or the total points rule (Table 4). We report differences for two different specifications, depending on the distance to the cutoff (+/- 5 and +/-8 points around the cutoff). While there are a few significant differences, they do not appear to be systematic across specifications, except for the share of fathers with college education and the share of unemployed fathers, which both tend to be significantly higher among the above-cutoff group.[22]

[Table 3]

[Table 4]

*IV.B. Fuzzy RD/IV*

Our empirical approach consists in using the theoretical cutoff rule as instrument for being referred to a school other than the school district one. As shown in Figure 7, the

[22] We tried eight different specifications in total, widening the distance around the cutoff from one missing/extra point to eight missing/extra points. Overall, significant differences in means in background characteristics are not systematic as they either disappear from a specification to another and/or change in sign.

probability of being referred to a school outside the school district when the student is assigned to category S rises sharply to around 20% at the cutoff, and is close to zero below the cutoff.

[Figure 7]

Let $D_{ist}$ be a binary variable which is equal to one if pupil *i,* living in school district *s,* is referred to a school outside his school district in year *t*, and let $F_{ist}$ be equal to 1 if the pupil has free school choice, i.e. is above the theoretical cutoff rule. Then the first-stage of our IV strategy looks as follows:

$$D_{ist} = \gamma_0 + \theta F_{ist} + \sum_m \gamma_m S_{istm} + \gamma_4 X_{ist} + \gamma_s + \gamma_t + \epsilon_{ist},$$

where $S_{istm}$ is the distance to the partial cutoff in task $m$ of pupil $i$, $X_{ist}$ is a set of individual and parental characteristics for pupil $i$ (including the distance to the partial cutoff in task $m$, $S_{istm}$), $\gamma_s$ is a set of school district dummies, and $\gamma_t$ is a set of calendar year dummies.

In the second-stage, let $Y_{istg}$ be the outcome of interest measured in grade $g$, where $g$=2,3. Therefore, we have:

$$Y_{istg} = \lambda_0 + \tau D_{\boldsymbol{ist}} + \lambda_1 X_{ist} + \lambda_s + \lambda_t + \eta_{istg}$$

where $\tau$ is the coefficient estimate of interest; it is the estimated effect on the outcome of interest in grade $g$ of being referred to a school outside his school district, $\lambda_s$ is a set of school district dummies, and $\lambda_t$ is a set of calendar year dummies.

### *IV.C. Discussion of IV assumptions*

[TBW]

## V. RESULTS

### *V.A. Enrolment in after-school programs*

[Table 5]

[Table 6]

[TBW]

## VI. Conclusion

[TBW]

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Table 1. Determination of total scores.

***Panel A - score in each task***

| | Task 1 | | Task 2 | | Task 3 | |
|---|---|---|---|---|---|---|
| Age | Points | Score | Points | Score | Points | Score |
| 5 | ≤30 | M | 0-9 | M | ≤11 | M |
| | 31-35 | S | 10 to 12 | S | 12 | S |
| | ≥36 | F | ≥13 | F | 13 | F |
| 5.5 | ≤30 | M | 0-9 | M | ≤11 | M |
| | 31-39 | S | 10 to 12 | S | 12 | S |
| | ≥40 | F | ≥13 | F | 13 | F |
| 6 | ≤30 | M | 0-9 | M | ≤11 | M |
| | 31-40 | S | 10 to 12 | S | 12 | S |
| | ≥41 | F | ≥13 | F | 13 | F |
| 6.5 | ≤30 | M | 0-9 | M | ≤11 | M |
| | 31-42 | S | 10 to 12 | S | 12 | S |
| | ≥43 | F | ≥13 | F | 13 | F |

***Panel B - total score***

| Task 1 | Task 2 | Task 3 | Total Score |
|---|---|---|---|
| M | M | M | M |
| F | F | F | F |
| F | F | S (1 missing point) | F |
| F | S (1 missing point) | F | F |
| S (1 missing point) | F | F | F |
| All other cases | | | S |

Table 2. Sample description

***Panel A - Background variables***

| | mean | std. dev. |
|---|---|---|
| *School starters* | | |
| boy | 0.505 | 0.500 |
| age Jan 1st | 5.123 | 0.364 |
| immigrant | 0.075 | |
| descendant | 0.853 | |
| non-western | 0.873 | |
| africa | 0.259 | |
| middle east | 0.452 | |
| east asia | 0.133 | |
| both parents | 0.670 | |
| children in family | 3.977 | 2.115 |
| daycare age 0-3 | 0.633 | |
| daycare age 3-6 | 0.855 | |
| | | |
| *Language test* | | |
| total points | 61.405 | 9.004 |
| points task 1 | 37.778 | 5.759 |
| points task 2 | 11.660 | 1.798 |
| points task 3 | 11.967 | 2.643 |
| F | 0.299 | |
| M | 0.034 | |
| S | 0.667 | |
| referred because of sibling | 0.172 | |
| referred to other school | 0.209 | |
| referred to district school | 0.595 | |
| | | |
| *School District characteristics* | | |
| overall number of distinct school districts (1) | 52 | |
| "magnetskole" | 0.258 | |
| "heldagskole" | 0.198 | |
| receiving school | 0.075 | |
| sending school | 0.655 | |
| size of school in school district | 411.955 | 238.950 |
| share of mothers with tertiary education | 0.278 | 0.135 |
| share of non danes in school district | 0.454 | 0.282 |
| | | |
| no. obs. | 4843 | |

Notes:

(1) the number, size, and composition of school districts varies over the years, there were 42 school districts in 2014

Table 2. Sample description (cont.)

***Panel A - Background variables***

| | mean | std. dev. |
|---|---|---|
| *Attended School characteristics* | | |
| private school | 0.093 | |
| class size | 22.397 | 8.132 |
| share bused kids per class | 0.036 | 0.069 |
| private school if free school choice | 0.099 | 0.155 |
| private school if referred to a school outside the district | 0.153 | 0.173 |
| | | |
| *mother (2)* | | |
| age | 32.015 | 5.922 |
| immigrant | 0.946 | |
| student | 0.041 | |
| employed | 0.241 | |
| unemployed | 0.073 | |
| out of the labor force | 0.655 | |
| high school dropout | 0.588 | |
| high school graduate | 0.299 | |
| college educated | 0.113 | |
| unmarried | 0.136 | |
| divorced | 0.105 | |
| | | |
| *father (3)* | | |
| age | 37.020 | 7.309 |
| immigrant | 0.955 | |
| student | 0.017 | |
| employed | 0.436 | |
| unemployed | 0.093 | |
| out of the labor force | 0.395 | |
| high school dropout | 0.478 | |
| high school graduate | 0.312 | |
| college educated | 0.210 | |
| unmarried | 0.112 | |
| divorced | 0.092 | |
| | | |
| ***Panel B - Outcome variables*** | | |
| SFO attendance (year after test) | 0.628 | |
| school satisfaction (4) | 73.303 | 15.680 |
| move year after test | 0.065 | |
| | | |
| no. obs. | 4843 | |

Notes:

(2) 4766 mothers

(3) 4595 fathers

(4) 1368 parents have completed enough questions in the satisfaction survey to calculate the index

Table 3. Balancing tests, missing points cutoff rule

| | +/-5 points around the cutoff | | | +/-8 points around the cutoff | | |
|---|---|---|---|---|---|---|
| | (0) | (1) | (0) - (1) | (0) | (1) | (0) - (1) |
| male | 0.476 | 0.487 | -0.010 | 0.474 | 0.512 | -0.038 |
| age Jan 1st | 5.713 | 5.640 | 0.073*** | 5.647 | 5.650 | -0.003 |
| dane | 0.073 | 0.066 | 0.007 | 0.075 | 0.062 | 0.013 |
| immigrant | 0.058 | 0.068 | -0.011 | 0.065 | 0.066 | 0.000 |
| descendant | 0.870 | 0.866 | 0.004 | 0.860 | 0.872 | -0.012 |
| children in family | 3.942 | 4.042 | -0.100 | 3.855 | 4.028 | -0.173* |
| | | | | | | |
| *mother:* | | | | | | |
| age < 25 | 0.088 | 0.116 | -0.028 | 0.089 | 0.115 | -0.027* |
| age 25-29 | 0.284 | 0.261 | 0.023 | 0.270 | 0.258 | 0.012 |
| age 30-34 | 0.318 | 0.302 | 0.017 | 0.320 | 0.299 | 0.021 |
| age 35-39 | 0.203 | 0.190 | 0.013 | 0.209 | 0.197 | 0.012 |
| age > 39 | 0.107 | 0.132 | -0.025 | 0.112 | 0.131 | -0.018 |
| student | 0.039 | 0.032 | 0.007 | 0.054 | 0.029 | 0.025*** |
| employed | 0.235 | 0.250 | -0.015 | 0.268 | 0.232 | 0.036* |
| unemployed | 0.088 | 0.078 | 0.009 | 0.075 | 0.070 | 0.005 |
| out of the labor force | 0.671 | 0.650 | 0.021 | 0.647 | 0.673 | -0.027 |
| high school dropout | 0.557 | 0.602 | -0.045 | 0.536 | 0.616 | -0.080*** |
| high school graduate | 0.342 | 0.291 | 0.051* | 0.332 | 0.280 | 0.052** |
| college education | 0.102 | 0.107 | -0.005 | 0.132 | 0.104 | 0.028* |
| | | | | | | |
| *father:* | | | | | | |
| age < 25 | 0.021 | 0.021 | 0.000 | 0.018 | 0.026 | -0.007 |
| age 25-29 | 0.139 | 0.147 | -0.008 | 0.135 | 0.137 | -0.001 |
| age 30-34 | 0.216 | 0.231 | -0.015 | 0.228 | 0.227 | 0.000 |
| age 35-39 | 0.244 | 0.241 | 0.003 | 0.227 | 0.245 | -0.018 |
| age > 39 | 0.380 | 0.360 | 0.020 | 0.392 | 0.365 | 0.027 |
| student | 0.018 | 0.011 | 0.008 | 0.028 | 0.009 | 0.019*** |
| employed | 0.436 | 0.456 | -0.020 | 0.471 | 0.452 | 0.019 |
| unemployed | 0.128 | 0.083 | 0.045*** | 0.117 | 0.086 | 0.031** |
| out of the labor force | 0.397 | 0.416 | -0.019 | 0.372 | 0.419 | -0.047** |
| high school dropout | 0.476 | 0.524 | -0.048 | 0.447 | 0.505 | -0.059** |
| high school graduate | 0.303 | 0.305 | -0.002 | 0.297 | 0.322 | -0.026 |
| college education | 0.221 | 0.171 | 0.050** | 0.256 | 0.172 | 0.084** |
| | | | | | | |
| no obs. | 468 | 805 | | 812 | 1249 | |

Notes #1: (1) = below the cutoff while (0) = cutoff and over

Note #2: cutoff= 1 missing point

*: significant at the 10% level

**: significant at the 5% level

***: significant at the 1% level

Table 4. Balancing tests, total points cutoff rule

| | +/-5 points around the cutoff | | | +/-8 points around the cutoff | | |
|---|---|---|---|---|---|---|
| | (0) | (1) | (0) - (1) | (0) | (1) | (0) - (1) |
| male | 0.484 | 0.501 | -0.017 | 0.482 | 0.519 | -0.038** |
| age Jan 1st | 5.593 | 5.628 | -0.035** | 5.572 | 5.639 | -0.066*** |
| dane | 0.070 | 0.065 | 0.005 | 0.074 | 0.062 | 0.013 |
| immigrant | 0.069 | 0.062 | 0.007 | 0.068 | 0.062 | 0.006 |
| descendant | 0.861 | 0.872 | -0.011* | 0.858 | 0.877 | -0.019* |
| children in family | 4.033 | 4.055 | -0.022 | 3.958 | 4.049 | -0.091 |
| | | | | | | |
| *mother:* | | | | | | |
| age < 25 | 0.085 | 0.114 | -0.029** | 0.086 | 0.114 | -0.029*** |
| age 25-29 | 0.276 | 0.248 | 0.028 | 0.270 | 0.249 | 0.021 |
| age 30-34 | 0.277 | 0.305 | -0.028 | 0.285 | 0.305 | -0.020 |
| age 35-39 | 0.224 | 0.205 | 0.019 | 0.225 | 0.204 | 0.021 |
| age > 39 | 0.138 | 0.128 | 0.009 | 0.135 | 0.128 | 0.007 |
| student | 0.041 | 0.033 | 0.009 | 0.047 | 0.031 | 0.017*** |
| employed | 0.255 | 0.247 | 0.008 | 0.280 | 0.235 | 0.045*** |
| unemployed | 0.078 | 0.079 | -0.001 | 0.070 | 0.075 | -0.005 |
| out of the labor force | 0.654 | 0.657 | -0.002 | 0.636 | 0.670 | -0.034** |
| high school dropout | 0.567 | 0.592 | -0.025 | 0.559 | 0.609 | -0.049*** |
| high school graduate | 0.328 | 0.303 | 0.026 | 0.319 | 0.289 | 0.030* |
| college education | 0.105 | 0.105 | -0.000 | 0.122 | 0.103 | 0.019* |
| | | | | | | |
| *father:* | | | | | | |
| age < 25 | 0.018 | 0.027 | -0.009 | 0.017 | 0.028 | -0.011** |
| age 25-29 | 0.136 | 0.138 | -0.001 | 0.133 | 0.133 | 0.000 |
| age 30-34 | 0.188 | 0.225 | -0.037** | 0.198 | 0.223 | -0.025** |
| age 35-39 | 0.258 | 0.242 | 0.016 | 0.249 | 0.244 | 0.005 |
| age > 39 | 0.399 | 0.368 | 0.031* | 0.403 | 0.371 | 0.031** |
| student | 0.019 | 0.013 | 0.006 | 0.023 | 0.010 | 0.013*** |
| employed | 0.457 | 0.469 | -0.012 | 0.473 | 0.465 | 0.008 |
| unemployed | 0.110 | 0.086 | 0.024** | 0.106 | 0.088 | 0.018* |
| out of the labor force | 0.392 | 0.407 | -0.015 | 0.378 | 0.409 | -0.031* |
| high school dropout | 0.476 | 0.514 | -0.038 | 0.459 | 0.502 | -0.042** |
| high school graduate | 0.304 | 0.315 | -0.010 | 0.302 | 0.325 | -0.023* |
| college education | 0.220 | 0.172 | 0.048*** | 0.239 | 0.173 | 0.066*** |
| | | | | | | |
| no obs. | 1423 | 1316 | | 1975 | 1831 | |

Notes #1: (1) = below the cutoff while (0) = cutoff and over

Note #2: cutoff= 1 missing point

*: significant at the 10% level

**: significant at the 5% level

***: significant at the 1% level

Table 5. IV estimations, sample +/-8

First stage (dep var: school referral)

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **F rule** | -.2167*** | -.2158*** | -.2349*** | -.2553*** | -.2392*** | -.2393*** |
| | (.0424) | (.0426) | (.0426) | (.0415) | (.0460) | (.0462) |
| distance to cutoff Material 1 | .007 | .0047 | .0078 | .0097* | .0095* | .0088 |
| | (.0049) | (.0051) | (.0051) | (.0415) | (.0055) | (.0055) |
| distance to cutoff Material 2 | -.0033 | -.0015 | -.0002 | -.0003 | -.0021 | -.0023 |
| | (.0095) | (.0096) | (.0095) | (.0093) | (.0103) | (.0103) |
| distance to cutoff Material 3 | -.0147 | -.0110 | -.0076 | -.0025 | -.0075 | -.0080 |
| | (.0104) | (.0105) | (.0104) | (.0102) | (.0119) | (.0120) |
| F-test | 26.08 | 25.65 | 30.34 | 37.85 | 26.98 | 26.83 |

Second stage (dep var: SFO attendance)

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **school referral** | -.02661 | -.0810 | -.3130 | -.2732 | -.4961** | -.4914* |
| | (.2293) | (.2302) | (.2172) | (.1949) | (.2530) | (.2519) |
| distance to cutoff Material 1 | .0018 | .00243 | -.0034 | -.0027 | -.0101* | -.0101 |
| | (.0049) | (.0054) | (.0053) | (.0051) | (.0061) | (.0062) |
| distance to cutoff Material 2 | .0085 | .0039 | .0047 | .0022 | -.0041 | -.0060 |
| | (.0116) | (.0114) | (.0114) | (.0112) | (0138) | (.0139) |
| distance to cutoff Material 3 | -.0217 | -.0233* | -.0253* | -.0219* | -.0272* | -.0241 |
| | (.0137) | (.0308) | (.0131) | (.0123) | (.0164) | (.0164) |
| age controls^ | | X | X | X | X | X |
| year dummies^ | | | X | X | X | X |
| school district dummies^ | | | | X | X | X |
| parental characteristics^^ | | | | | X | X |
| children in family | | | | | X | X |
| gender | | | | | | X |
| geographical origin | | | | | | X |
| immigrant status | | | | | | X |

Notes:

*: significant at the 10% level

**: significant at the 5% level

***: significant at the 1% level

^: some significant coefficient

^^: father unemployed and mother high school dropout sometimes significant at the 10% level

Table 6. IV estimations, sample +/-5

First stage (dep var: school referral)

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **F rule** | -.1919*** | -.1877*** | -.2206*** | -.2603*** | -.2606*** | -.2603*** |
| | (.0570) | (.0572) | (.0570) | (.0555) | (.0618) | (.0619) |
| distance to cutoff Material 1 | -.0021 | -.0442 | .0019 | .0071 | .0096 | .0086 |
| | (.0098) | (.0100) | (.0100) | (.0098) | (.0110) | (.0111) |
| distance to cutoff Material 2 | -.0078 | -.0083 | -.0069 | -.0041 | -.0015 | -.0025 |
| | (.0127) | (.0128) | (.0126) | (.0124) | (.0139) | (.0140) |
| distance to cutoff Material 3 | -.0005 | .0031 | .0089 | .0114 | .0052 | .0035 |
| | (.0156) | (.0157) | (.0156) | (.0151) | (0172) | (.0174) |
| F-test | 11.34 | 10.76 | 15.00 | 21.95 | 17.79 | 17.66 |

Second stage (dep var: SFO attendance)

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **school referral** | -.0466 | -.0643 | -.3321 | -.2380 | -.4381 | -.4493 |
| | (.0065) | (.3484) | (.3079) | (.2506) | (.3062) | (.3064) |
| distance to cutoff Material 1 | .0065 | .0055 | -.0054 | -.0026 | -.0082 | -.0089 |
| | (.0118) | (.0125) | (.0116) | (.0104) | (.0124) | (.0126) |
| distance to cutoff Material 2 | .0051 | .0042 | .0051 | .0016 | -.0005 | -.0044 |
| | (.0167) | (.0168) | (.0167) | (.0153) | (.0182) | (.0186) |
| distance to cutoff Material 3 | -.0245 | -.0210 | -.0197 | -.0181 | -.0254 | -.0211 |
| | (.0180) | (.0175) | (.0175) | (.0166) | (.0215) | (.0220) |
| age controls^ | | X | X | X | X | X |
| year dummies^ | | | X | X | X | X |
| school district dummies^ | | | | X | X | X |
| parental characteristics^^ | | | | | X | X |
| children in family | | | | | X | X |
| gender | | | | | | X |
| geographical origin | | | | | | X |
| immigrant status | | | | | | X |

Notes:

*: significant at the 10% level

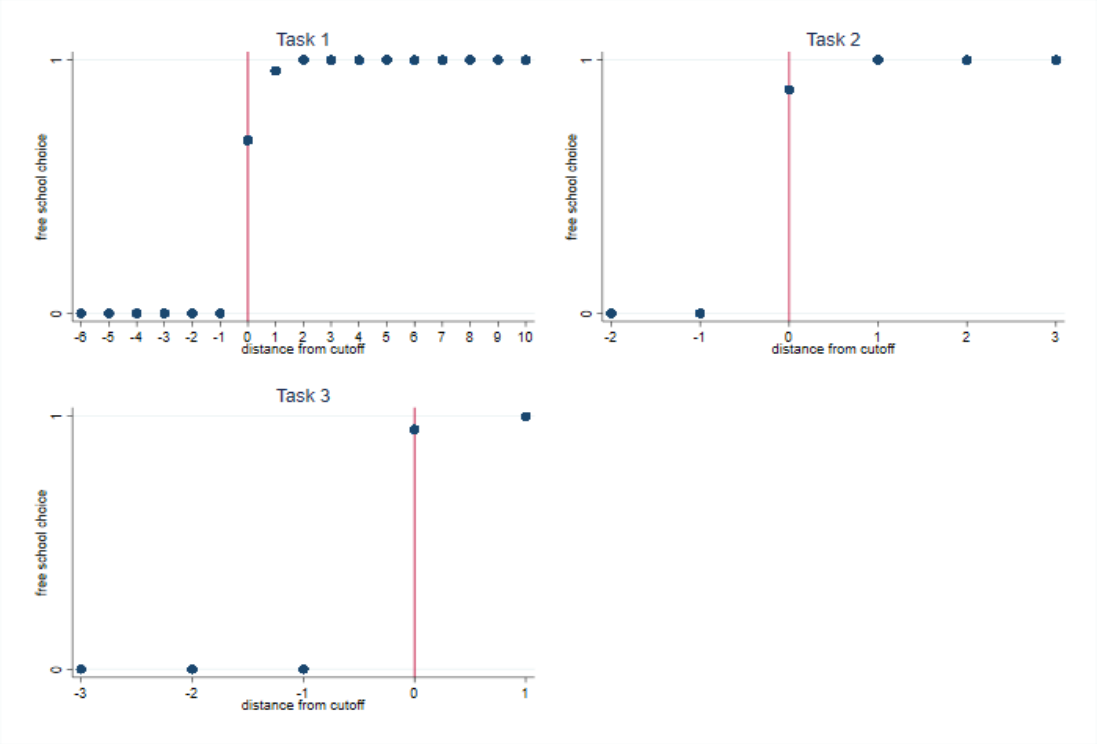
**: significant at the 5% level

***: significant at the 1% level

^: some significant coefficient

^^: father unemployed and mother high school dropout sometimes significant at the 10% level

Figure 1. Free school choice, conditional on the task.




Note: In order to respect Statistics Denmark rules on privacy, fractions with fewer than 5 individuals in the nominator have been rounded down (or approximated) to 0

Figure 2. Distribution of language test scores by year (shares)

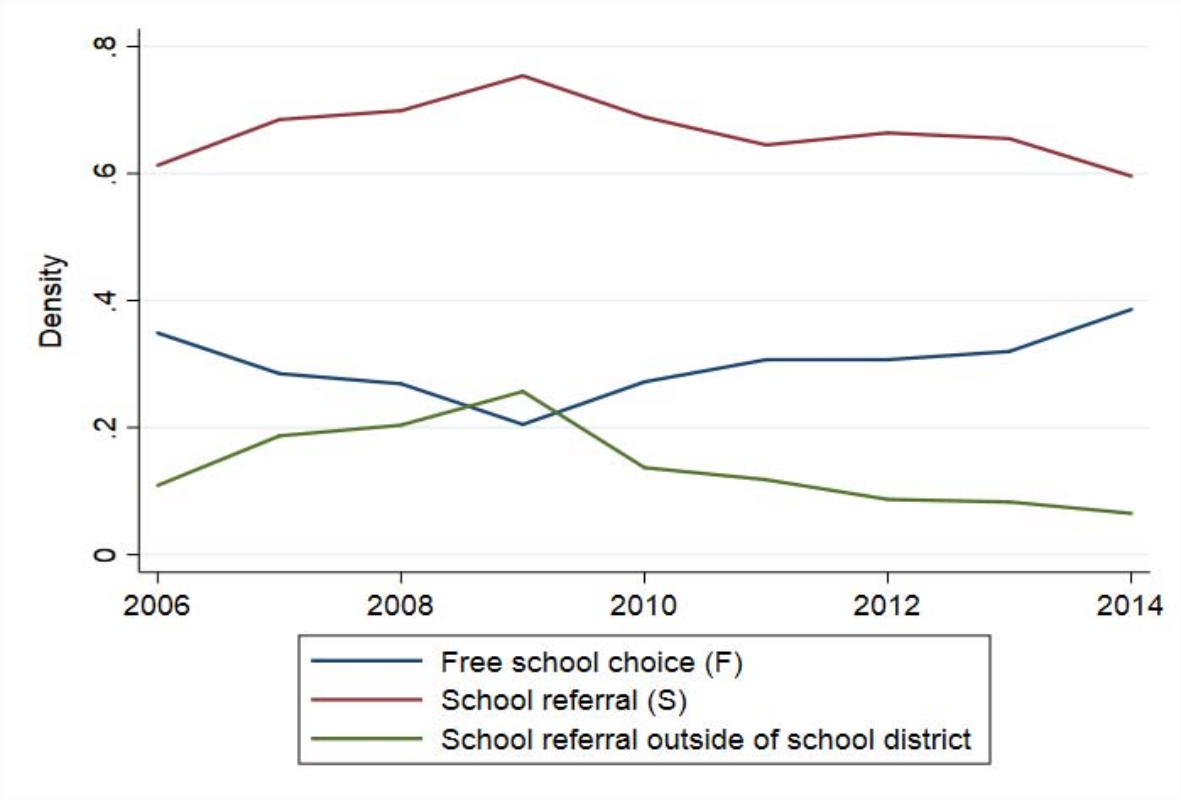
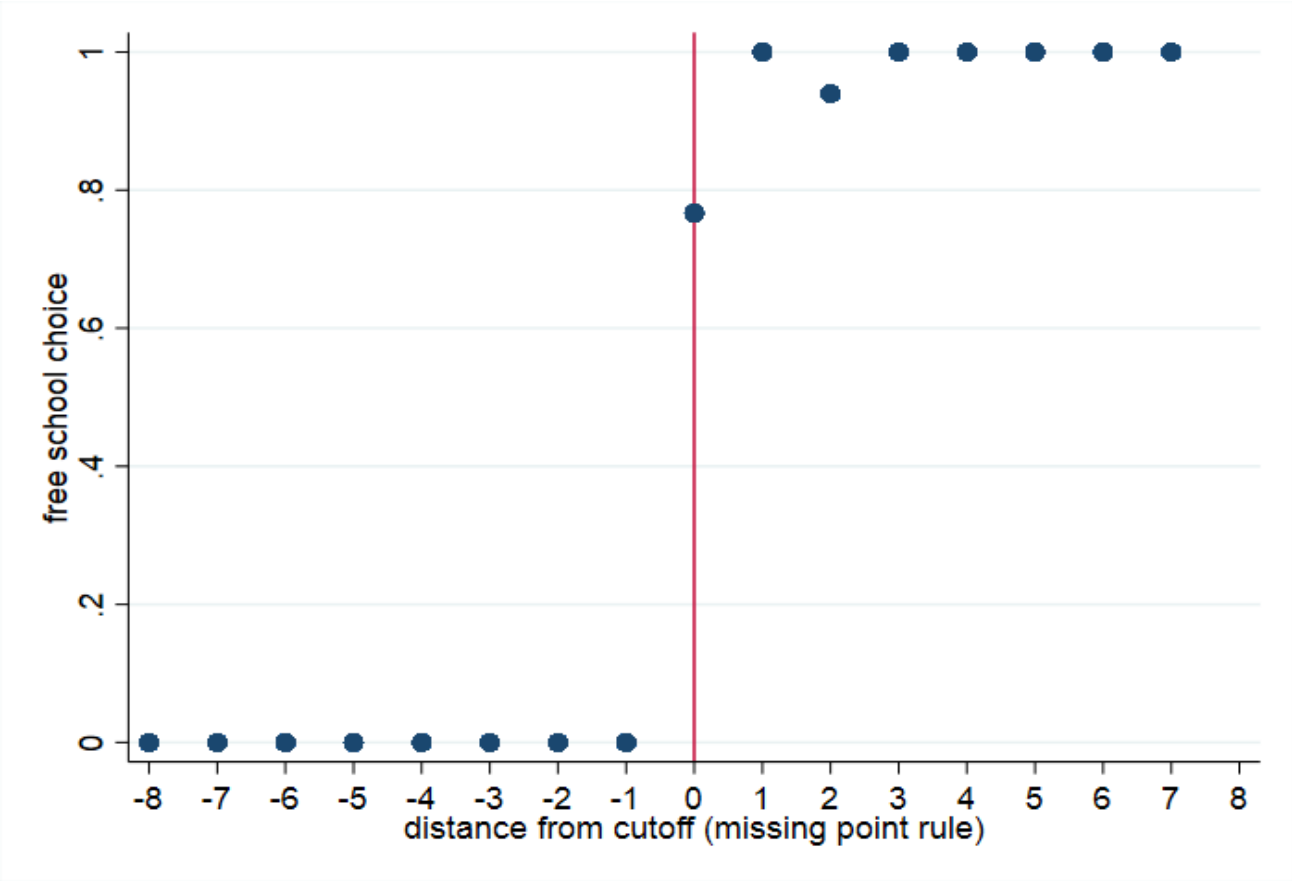
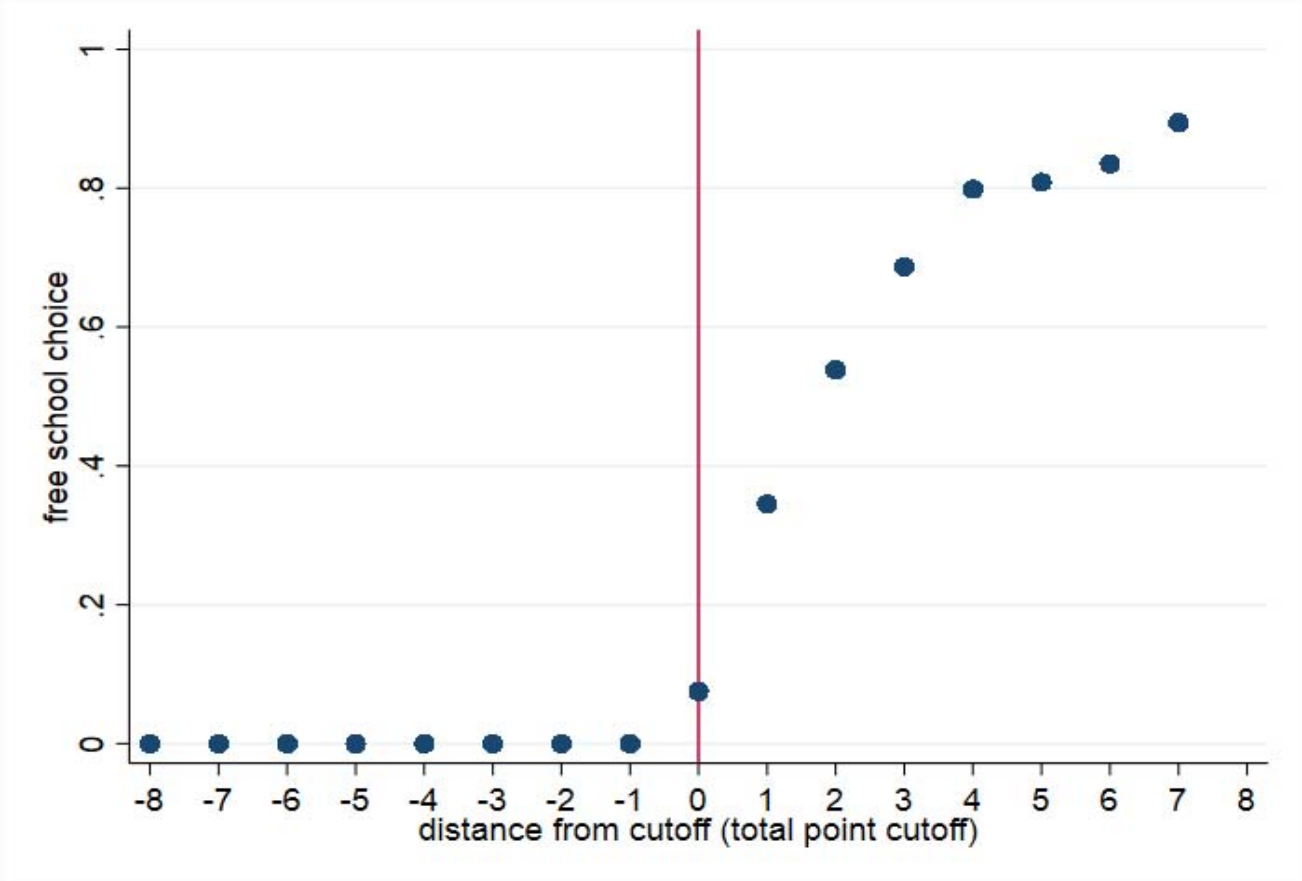


Figure 3. Free school choice, missing point rule




Note: In order to respect Statistics Denmark rules on privacy, fractions with fewer than 5 individuals in the nominator have been rounded down (or approximated) to 0

Figure 4. Free school choice, total point rule




Note: In order to respect Statistics Denmark rules on privacy, fractions with fewer than 5 individuals in the nominator have been rounded down (or approximated) to 0

Figure 5. Distribution of children around the cutoff, missing point rule.

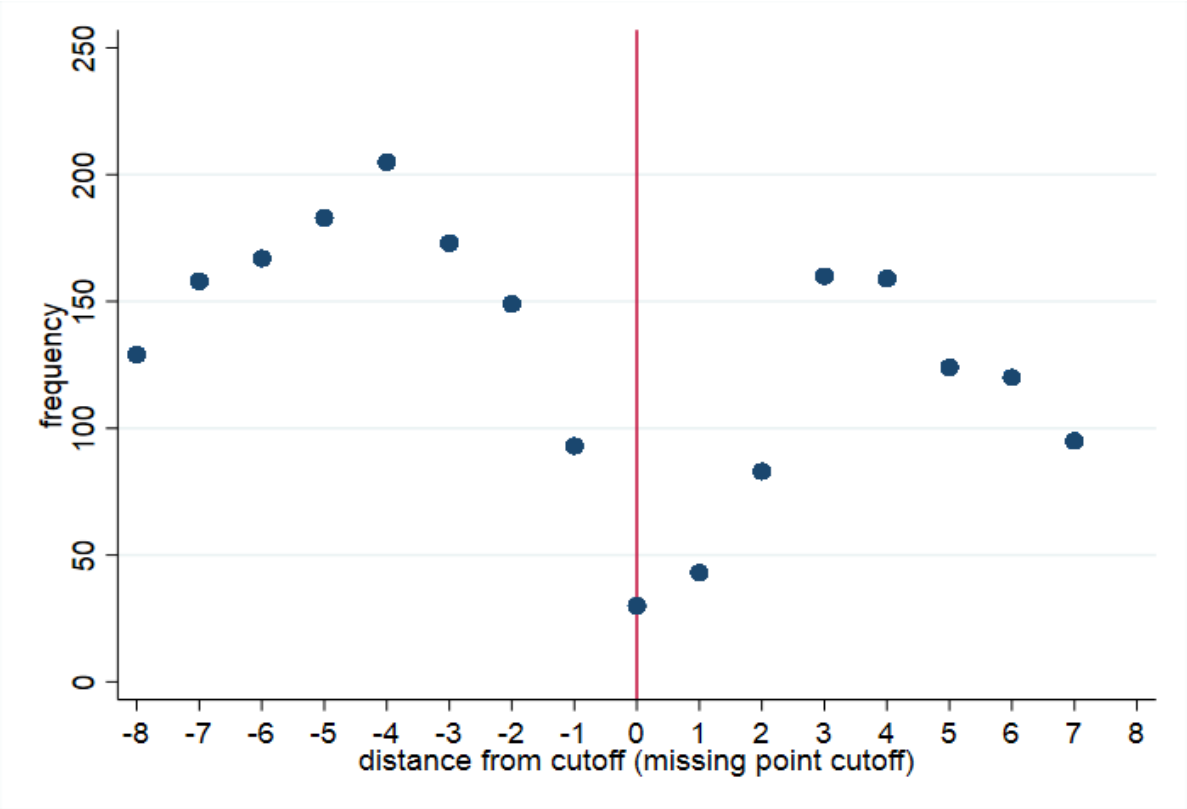


Figure 6. Distribution of children around the cutoff, total point rule.

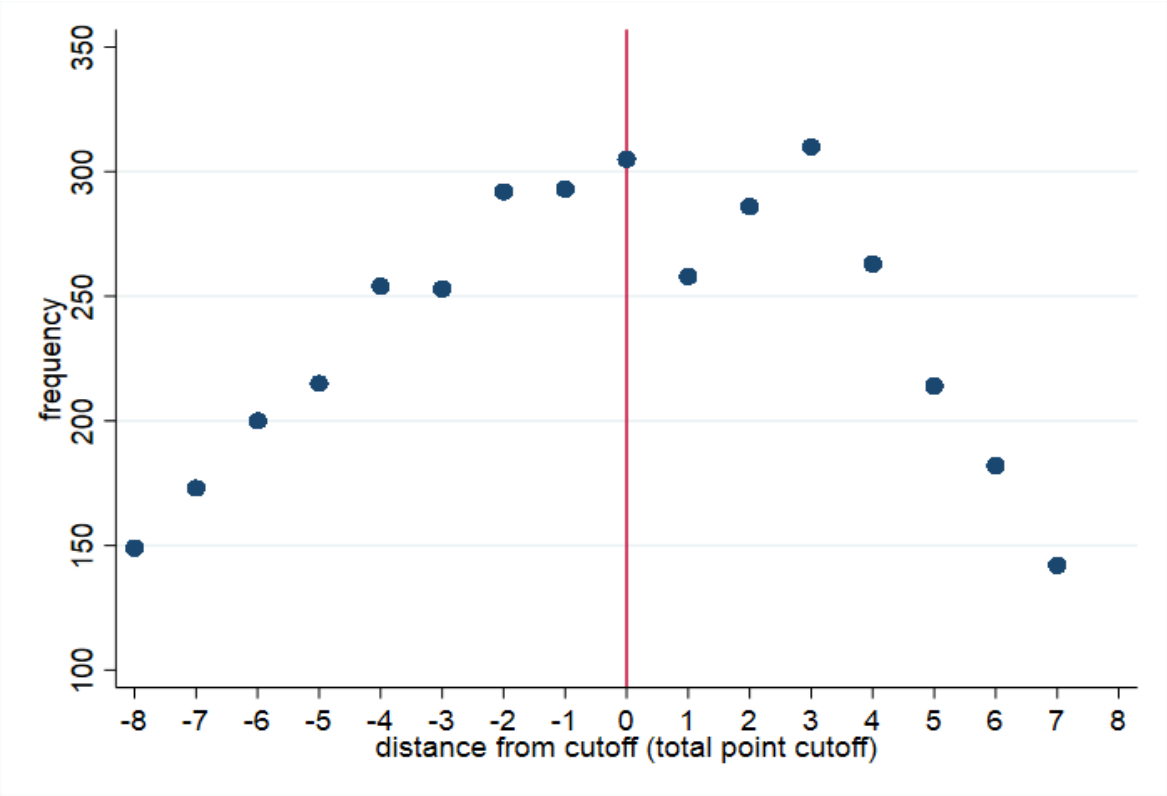
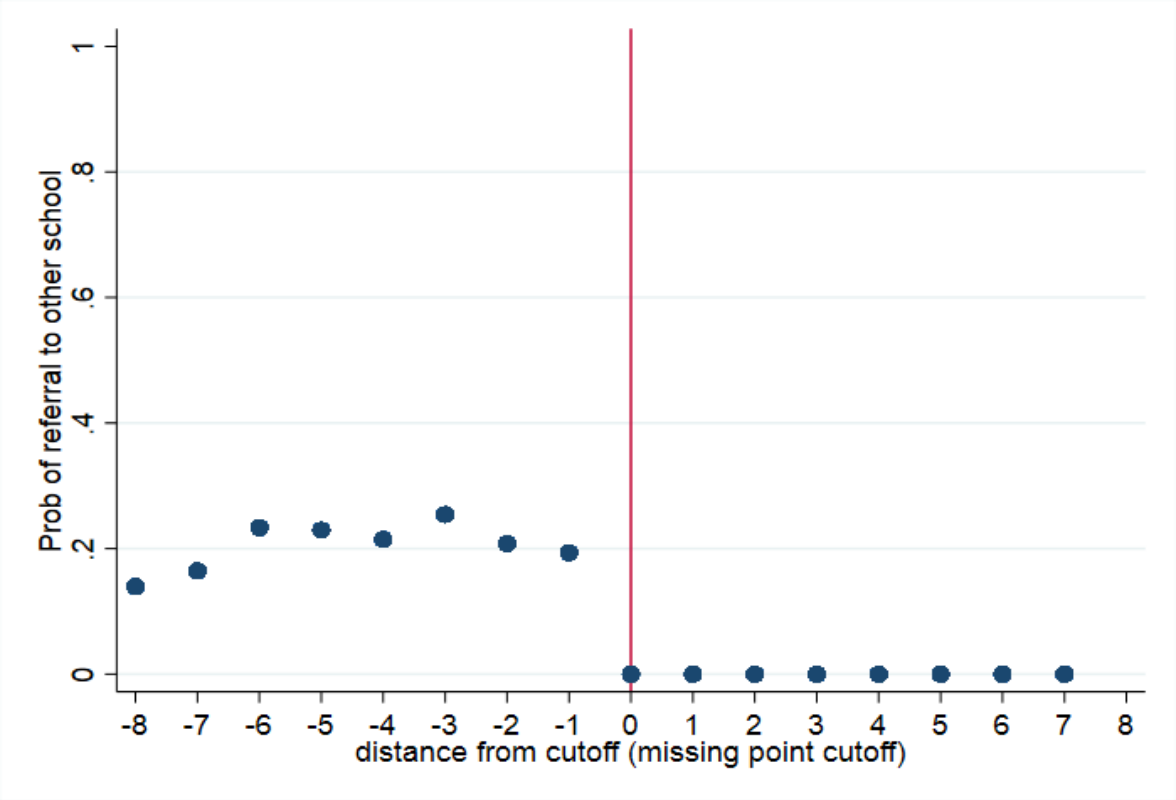


Figure 7. Probability of being referred to a school outside the school district.




Note: In order to respect Statistics Denmark rules on privacy, fractions with fewer than 5 individuals in the nominator have been rounded down (or approximated) to 0