Educational Consequences of Language for Young Children *

Yuxin Yao[†], Asako Ohinata[‡] and Jan C. van Ours[§]

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Abstract

This paper studies educational consequences of language by looking at the relationship between dialect speaking and academic performance of 5-6 year old children in the Netherlands. We find that dialect speaking has a modestly negative effect on language skill with larger effects among boys. In addition, we employ the linear-in-mean model to establish spillover effects of dialect speaking on classmates' academic performance, relying on random allocation of dialect speakers between classrooms in one grade. We find no evidence of spillover effect of peers' dialect speaking. The academic performance of neither Dutch speaking children nor dialect speaking children is affected by the share of dialect speaking peers in the classroom.

Keywords: Language, Academic Performance, Spillover Effects

JEL code: J24, I2

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[†]Department of Economics, CentER, Tilburg University, The Netherlands; y.yao@uvt.nl

[‡]Department of Economics, University of Leicester, UK; CentER, Tilburg University, The Netherlands; asakoohinata@gmail.com

[§]Department of Economics, CentER, Tilburg University, The Netherlands; Department of Economics, University of Melbourne, Parkville, Australia; CEPR(London), CESifo(Munich), CREAM (London), IZA(Bonn); vanours@uvt.nl.

1 Introduction

Increasing attention is paid to the economic consequences of language proficiency in recent years. Language skills are viewed as part of human capital playing an important role in schooling, labor market performance, health care, consumption and investment (see an overview in Chiswick and Miller (2014)).

The existing literature on the consequences of language proficiency exclusively studies the topic in the context of immigration. Most of these studies focus on how the proficiency in local languages contributes to adult immigrants' labor market performance or social assimilation (Chiswick and Miller, 1995; Dustmann and van Soest, 2001; Dustmann and Fabbri, 2003; Bleakley and Chin, 2004, 2010; Yao and van Ours, 2015).

A few recent studies investigate how the skills in local languages are related to academic performance of immigrant students although evidence is still limited (Dustmann et al., 2010; Geay et al., 2013). Using the UK National Pupil Data Base and the Millennium Cohort Study, Dustmann et al. (2010) find that immigrant students in UK lag behind native students at the beginning of the primary school. This gap is smaller for students whose mother tongue is English. Moreover, the gap diminishes throughout the primary and secondary schooling process and this is particularly prominent again among immigrants whose mother tongue is English. Their data, however, do not have information on parental education amongst others and therefore do not allow them to investigate the possibility that those who already speak English fluently come from highly educated families. Geay et al. (2013), on the other hand, study whether non-English speaking students affect native students' academic performance. They also use the National Pupil Database and present findings that non-English speaking immigrants often sort themselves into schools with more academically disadvantaged native students. Once they control for this self-selection into schools, they report that there is no negative spillover effect from immigrants to native students.

This paper contributes to literature on the educational consequences of language but instead of studying immigrant students, it investigates the effects of dialect speaking on the academic performance. Since immigrants speak different languages from natives, they are the obvious choice of group for studying the effects of language. However, immigrant students do not only differ from native students in terms of the language that they speak but they also have different socio-economic and cultural backgrounds. As a result, the estimated effects in previous papers are likely to reflect the combined effects from the cultural as well as linguistic differences. In contrast, dialect-speaking students share a relatively homogenous background to those who speak the standard language of the country. As a result, our estimates are likely to present purer impacts of language on education.

As a case study, we choose the Netherlands to investigate the effects of dialect speaking on education. There are three main reasons for our choice of country. Firstly, there exist multiple regional dialects in the Netherlands with varying degrees of linguistic distances to Standard Dutch. This variation allows us to effectively study the impact of language. Secondly, despite the existence of various dialects in the Netherlands, Standard Dutch is dominantly used in school teaching, even in regions where the position of the local dialect is strong (see Cheshire et al. (1989) for an overview). As a result, dialect speaking may pose negative effects on academic performance, especially on children's linguistic developments. This is because children who speak dialect at home may encounter difficulty in understanding study materials, which are taught in Standard Dutch. Furthermore, it is likely that interacting with Standard Dutch speaking classmates and teachers is more costly for these dialect-speaking children. Thirdly, our data, PRIMA survey for Dutch primary schools, provides us with a unique set of information collected from 5 to 6 year-old primary school children, their parents, as well as the school directors including whether they speak dialects at home, their various test scores and their classroom and school level characteristics.

In order to identify the effects of dialect speaking on test scores, we estimate a linear function with individual and classroom variables. In addition, we control for school fixed effects to take account of potentially endogenous selection of students into schools. We separately estimate the effects on language and maths tests. This is because linguistic disadvantage faced by dialect-speaking students may affect language test outcomes more and we may, as a result, find heterogeneous effects across subjects. We find that dialect-speaking students indeed perform worse in language test compared to Standard Dutch speaking students. In particular, it is the dialect-speaking male students, who suffer from learning in a language that is different from their daily language.

The fact that dialect-speaking students, who suffer academically, share the learning environment with those who speak Standard Dutch raises a further question: would classmates' speaking pattern affect academic performance? We, therefore, also investigate the spillover effects between the two groups within the same classroom. Although spillover effects in the classroom have gained tremendous popularity among social scientists in the last decade, we are the first to explicitly explore the spillover effects of speaking pattern alone on academic performance. Spillover effects in this setting can occur through several channels. First, there could be negative spillovers from dialect speakers to other students.

Students may learn inaccurate grammar and spelling from classmates who use dialects at home. The negative effects may be more evident in language skills than other subjects if this were the case. Second, although the use of Standard Dutch is encouraged by teachers and used by the majority of students in Dutch primary schools, informal verbal interaction in dialects can occur between dialect speakers, thus segregating students into a dialect speaking group and a Dutch speaking group. Insufficient in-class interaction can be harmful to academic performance of all students and on all subjects. Therefore, these channels suggest negative consequences of studying with dialect speaking peers for all students. However, having more dialect speaking peers in the same class may be beneficial for themselves. That is, with more peers speaking the same dialect, dialect speakers can integrate into peers and conduct discussion at a lower cost. To sum up, we conjecture that more dialect speaking classmates will impede learning for Dutch speakers, but the effects are ambiguous for dialect speakers. Therefore, spillover effects have to be investigated separately for each group.

It is well known that the identification of spillover effects suffers from a number of econometric difficulties. There exists parental selection in attending schools, so that peers' mother tongue is endogenously determined by school choice. Literature using non-experimental data attempt to mitigate the bias from self-selection by exploiting variation in the compositions across classes or schools (Ammermueller and Pischke, 2009; Hanushek et al., 2003; Lavy et al., 2012). The study on peer effects in European primary schools by Ammermueller and Pischke (2009) is close to our paper in terms of identification strategy. They use school fixed effects and exploit exogenous variation in class composition in one grade. In order to test whether classrooms are formed randomly with respect to a particular student characteristic, they perform a Pearson χ^2 test. In addition, Ohinata and van Ours (2013) introduce a check for random allocation for schools with two classes in one grade. Based on the difference in the number of immigrants between two classes, they can compare the observed distribution of schools with the simulated distribution obtained through random allocation. We adopt this test to confirm that dialect-speaking students are randomly allocated at least in schools with two classes. Relying on the variation in the share of dialect speaking peers between classrooms in one grade and across cohorts in the same school, we find no evidence of spillover effects of peers' dialect speaking on test scores. We conduct a range of sensitivity analysis, which all suggest that our findings are robust.

To summarize, the contribution of this paper to the literature is threefold. Firstly, it adds to the scarce literature on the educational consequences of language proficiency.

We focus on the effects of speaking Dutch dialects on childrens academic performance as well as the spillover effects of speaking dialects on classmates' academic performance. Secondly, it presents a purer impact of language proficiency. Since immigrant students not only speak different languages from native students but also come from different cultural backgrounds, the previously estimated impacts of language are likely to also reflect the effects of cultural background of these immigrants. Dutch dialect speakers, in contrast, share a relatively homogenous background to those who speak Standard Dutch. This suggests that our estimates are more likely to reflect the true impact of language on the educational attainment of students. Thirdly and lastly, our paper is the first to study the effects of dialect on educational performance.[1]

The rest of the paper is organized as follows: Section 2 introduces language usage in the Netherlands, Section 3 describes PRIMA data and presents stylized facts, Section 4 examines the effect of dialect speaking on test scores, Section 5 examines the baseline results for spillover effects of peers' dialect speaking, Section 5.4 presents some sensitivity checks for spillover effects and Section 6 concludes.

2 Languages and Dialects in the Netherlands

The dominantly spoken language in the Netherlands is Standard Dutch, originated in the urban areas of Holland. Besides Standard Dutch, the languages and dialects spoken in the Netherlands are remarkably diverse, including Frisian, Limburgish, and Low Saxon. Frisian, mostly spoken in the province of Friesland is recognized as a separate language. In Friesland both Standard Dutch and Frisian are considered as official languages and more than 94% of the adult inhabitants understand verbal Frisian. Frisian is also an integral part of the primary school curriculum. Another category of regional language includes Limburgish and Low Saxon, which enjoy the official status in related regions according to European Charter for Regional or Minority Language. Limburgish is spoken in the province of Limburg by more than 75% inhabitants and Low Saxon is spoken in the provinces of Groningen, Drenthe, Overijssel and Gelderland by approximately 60% inhabitants. But in these provinces Limburgish and Low Saxon cannot be chosen as the official first language. Moreover, there are a few regional dialects, such as Brabantish spoken in Noord-Brabant and Zeelandic in Zeeland (see an overview in Driessen (2005)

[1]The economic consequences of dialects or regional languages are rarely studied. Falck et al. (2012) study how cultural borders impede economic exchange between regions by measuring cultural differences by dialects. Gao and Smyth (2011) study the labor market return of the fluency in standard Mandarin for internal migrants who speak Chinese dialects.

and Cheshire et al. (1989)).

Table 1 summarizes the linguistic distances between various dialects and Standard Dutch (Van Bezooijen and Heeringa, 2006). These distances are calculated by using the Levenshtein distance, which was introduced by Kessler (1995). The Levenshtein method compares the pronunciation of a word from one dialect and compares it to the corresponding word in Standard Dutch. The distance between these words is determined by how many alterations one needs to make in order to make the dialect word sound similar to the word in Standard Dutch. The more adjustments the word requires, the farther away these two words are considered to be. In Table 1, these distances are denoted in numbers and larger values indicate that the dialect is more different from Standard Dutch. As shown in the table, Frisian stands out from the other dialects by having the largest Levenshtein distance, followed by the dialect in Limburg.

3 Data Description

3.1 PRIMA Data

In our analysis we use data from PRIMA, a large-scale biannual longitudinal survey for primary schools in the Netherlands. The project is conducted by the Institute for Applied Social Sciences in Nijmegen and the SCO-Kohnstamm Institute in Amsterdam from 1994 to 2005. The survey enrolls students in the second, fourth, sixth and eighth grade from 6 cohorts and over 600 schools, covering 10% of the relevant age population. It provides rich information on Dutch primary education, documenting test scores, school and class characteristics, and demographic information.

We employ a cross-sectional sample of native students in the second grade. We restrict our sample to native students and drop immigrant students.[2] We only focus on native students, so that we can ignore students who speak other languages and treat all non-dialect speaking students as Dutch speaking. In addition, we use the sample of the second graders because information on whether students speak dialects or not is only collected in the second grade. Moreover, we exclude the first 2 cohorts from the sample. This is because math score and teacher characteristics are made comparable across cohorts only after the 1998/1999 survey.

In the questionnaires parents indicate what language the student speaks to mother, fa-

[2]We define immigrant students as any students whose at least on parent was born outside of the Netherlands.

ther, siblings and friends receptively, as well as the language spoken between two parents. Three choices are provided: Standard Dutch, dialects or Frisian, and other languages. We consider a student to be dialect-speaking if he or she speaks dialects or Frisian to either mother or father. The main independent variable is whether a student speaks Dutch dialects or Standard Dutch to parents at home[3]. The dependent variables are the measures for educational outcome. PRIMA survey provides standard tests on language and math for each grade. PRIMA tests for the second grade are about basic concepts on Dutch language and math, unlike tests on academics skills for later grades. The test scores are converted based on the same scale of PRIMA tests for the fourth, sixth and eighth grade. To enable the comparison between language score and math score, we also normalize test scores for each subject[4].

Besides the effect of dialect speaking at individual level, we investigate its spillover effects in classrooms in Section 5. So we calculate the share of dialect speaking peers at class level excluding oneself, based on the whole sample of both native and immigrant students. This indicator measures how intensely students interact with dialect-speaking peers. We will impose further restrictions on the sample for spillover effects analysis. We drop the observations in classes with less than 5 students to obtain more accurate shares. We also remove schools without any dialect speaker in the grade as outliers. After we delete missing observations, the resulting sample consists of 411 schools from four cohorts.

3.2 Summary Statistics

In the Netherlands, Standard Dutch is dominantly used in primary schools. According to the PRIMA survey, 7.6% of all students in the second grade speak dialects to parents. The distribution of dialect speaking students in primary schools is strongly associated with the place of residence. The survey provides location information of schools by 12 Dutch provinces. Table 2 summarizes the share of students who speak dialects at home with parents by province. The statistics are based on all the second grade students, before any data selection procedure is performed. We find that dialect plays a fundamental role in daily interaction in Limburg and Friesland. As Limburgish has the status of official regional language, Limburg is the province with the largest share of dialect speaking students, 42%. As Frisian functions as a separate language, as much as 35% students

[3]We do not take into account the language spoken between siblings or friends. However, the group of students speaking dialects with father highly overlaps with those who speak dialects with their mothers or siblings.

[4]We first demean the PRIMA test scores and then divide the demeaned score by its standard deviation. So the normalized score has the mean of zero and standard deviation of one.

speak dialects with parents in Friesland. It is followed by Drenthe and Zeeland with less than 20% dialect speaking students. All other provinces have less than 10% dialect speaking students population. Less than 2% students speak dialects at home in the provinces of Noord-Holland, Utrecht and Zuid-Holland where the modern Standard Dutch is originated (Please see a map of the percentage of dialect speaking students by province in Appendix Figure A1).

Table 3 presents the average statistics by language groups and by gender based on native students in the second grade from four cohorts. To begin with, dialect speaking students have lower test scores on both language and math than Dutch speaking students, though the gap between two groups is modest. Girls have higher test scores than boys regardless of whether they speak dialects or not. Dutch speaking girls, therefore, are the most advantaged group, while dialect speaking boys have the worst average scores. Secondly, there is not much difference between dialect speakers and Dutch speakers in individual characteristics, such as gender, age, family composition, and whether one always stays in the Netherlands. However, dialect speakers are much more likely to have dialect speaking parents than Dutch speakers. Parents of around 88% dialect speakers and only more than 9% Dutch speakers use dialects at home, indicating that the language spoken by students in the second grade is predominantly determined by parents' language usage. Also, dialect speakers are more likely to have parents with lower education than Dutch speakers. The proportion of parents with university or higher degree is around 10 percentage points larger for the Dutch group than the dialect group. Thirdly, we find no significant difference in teacher and school characteristics between two groups, except that dialect speaking students are much more likely to attend schools in less urbanized areas. Intuitively, dialects play a more important role in daily interaction in less urbanized areas where population mobility is low. Finally, girls and boys have very similar characteristics in both language groups. To summarize Table 2 and Table 3, dialect could associate with lower test scores of children and lower level of education of parents, and dialect speaking students are mainly from less urbanized areas and certain provinces.[5]

Before we investigate the relationship between language and test scores at individual level in Section 4, Figure 1 compares Kernel density plot of test scores between Dutch speaking students and dialect speaking students. The top and bottom graphs present language score and math score on normalized scale respectively[6]. Graph a suggests that

[5]According to unreported regression results of the determinants of dialect speaking, we find that the probability that children speak dialects at home is 33 percentage points higher if their parents speak dialects to each other. Parents' education level is also negatively associated with speaking dialects. But other individual and teacher characteristics have very small association with language usage.

[6]The shape of distribution graphs on PRIMA scores before normalization is similar to Figure 1.

the distribution of language score is similar in shape for two language groups. The average score of dialect speakers is slightly lower than Dutch speakers. From Graph b we find that the distributions of math score for two groups are more overlapping than those of language score. There is hardly any difference in math score between dialect speakers and Dutch speakers. Figure 1 suggests that the association between dialect speaking and academic performance may be weak at individual level.

We further present similar Kernel density distribution graphs of test scores in Figure 2 and Figure 3. In these figures, we compare the test score distribution of classes with high versus low share of dialect-speaking students. The "high share" and "low share" are defined to be classes with 22% or more or less dialect-speaking students, respectively. On one hand, in Figure 2 for Dutch speakers, it is clear in the upper graph that difference in the mean and distribution of language score is limited regardless of how many dialect speakers are in class. The lower graph presents the same pattern for math score. It suggests that the share of dialect speakers at class level does not seem to explain the difference in test scores for Dutch speakers. On the other hand, Figure 3 presents the distribution of test scores for dialect speakers. For both language and math scores, the mean score and the distribution are similar between classes with a high share of dialect speakers and those with a low share. But test scores are more spread out for "high share" classes than "low share" classes.[7]

4 Dialect Speaking and Test Scores

In this section we examine the relationship between dialect speaking and academic performance. Assuming that dialect speaking is exogenous to test scores, we estimate the following model using OLS:

$$Y_{ics,t} = X_{ics,t}^{T}\beta + \delta D_{ics,t} + \alpha_s + \gamma_t + \varepsilon_{ics,t} \tag{1}$$

where $Y_{ics,t}$ stands for standardized test scores for student i in class c and school s at year t. $D_{ics,t}$ denotes as one if the student speaks dialect to parents. $X_{ics,t}$ is a vector of

[7] In Appendix, we also plot average test scores against the share of dialect speakers at class level. Considering self-selection of schools, we demean the average scores and the shares for each class in one grade, obtaining the difference of average score or shares between at class level and at grade level. In Figure A2 and Figure A3, the scatter plots and fitted lines suggest how test scores are correlated to the share of dialect speakers for Dutch speakers and dialect speakers respectively. For both groups of students, we find the fitted lines flat and there is no correlation between the share of dialect speakers and average scores on language or math.

all individual characteristics and teacher characteristics. α_s is for school fixed effects and γ_t is for year fixed effects. Finally, $\varepsilon_{ics,t}$ is the error term.

The key variable of interest is the dummy variable for speaking dialects at home, $D_{ics,t}$. A negative coefficient implies that dialect speaking students perform worse in the respective test. We control for a set of individual characteristics (age in month, squared age, gender, the dummy for presence of both parents, the dummy for always staying in the Netherlands, the dummies for number of children at home, dummies for father's education and for mother's education), a set of class characteristics indicated by teachers (teacher's gender, teacher's year of experience, number of students in class, the dummy for whether the class supports teaching combined with other grades, the dummy for whether the class supports remedial teachers, and the dummies for different levels of share of immigrant students in class). Since students may choose schools based on their socio-economic status as well as the language that they speak, we control for school fixed effects in Equation 1 in order to correct for the potential bias that arises due to such self-selection. From Table 3, we know that speaking dialect is correlated with parents' education. In particular, dialect speaking students typically have less educated parents, which in turn may affect students test scores. As a result, we control for mother's as well as father's educational attainment.

Table 4 presents the OLS estimates for the effects of dialect on language and math test scores. The parameter estimates are reported separately for boys and girls to account for gender heterogeneous effects. In the first column, only the year fixed effects are controlled. In subsequent columns, we gradually include individual characteristics, teacher characteristics, and school fixed effects in order to see how these variables affect our estimates.

In the first column of panel a, we find a significantly negative effect of dialect speaking on language score. When we add more control variables, the relevant parameter estimates decrease because dialect speaking is correlated to background variables (Column 2). Moreover, when we also introduce school fixed effects to remove the endogeneity of school choice, we find that the effect becomes significant at the 10% level (Column 4). This indicates that dialect speaking student has a lower normalized language score by 0.051 point of a standard deviation. When we analyze boys and girls separately, it becomes clear that the dialect effects on language scores are mainly driven by boys. After all background characteristics and fixed effects are included, speaking dialect with parents decreases boys' language scores by 0.078 point of a standard deviation but has no effect on girls' language scores. We interpret this gender heterogeneous effects as boys and girls have different paths of language development. At the same age of 5 years old, girls are better at adjusting to the new language environment than boys. As a result, speaking dialects only harm boys' language skills in Standard Dutch. Panel b present the dialect speaking effects on math score. Irrespective of whether we add school fixed effects or not, we do not find any significant effect once we control for individual characteristics. Since we use the normalized score, it is possible to compare the magnitude of the estimated effects between subjects. Clearly, the association between dialect speaking and math score is smaller and less significant than that of dialect and language score. Moreover, the negative effects of speaking dialects are only present for boys. To conclude, we find a negative effect of dialect speaking on academic performance, and this finding only applies to boys' language scores. This is consistent with our preliminary findings in Figure 1.

It is possible that our results so far suffer from an omitted variable problem if a student's own ability affect not only the rate of learning Standard Dutch, but also his academic performance. To take account of this, we present additional results by including students' maths test scores as an independent variable. The assumption is that there is no direct effect of dialect speaking on math scores, whilst the math scores reflect the academic ability of the children. Panel c of Table 4 presents that there is a negative and (at the 10% level) significant effect of dialect speaking on language performance even after taking account of individual characteristics, teacher characteristics and school fixed effects. The parameter estimate of -0.040 is not substantially different from the parameter estimate in the first row of panel a. Introducing the math score as an explanatory variable does not influence the magnitude of the effect of dialect speaking on language performance but it increases the precision of the estimate. When we look into boys alone, the effect is also significant at the 10% level, although the corresponding results for girls indicate that the effect is insignificantly different from zero. All in all, this robustness check gives an indication of a possible causal effect of dialect speaking on language skills of children.

As discussed in Section 2, the degree of linguistic distance differs across Dutch dialects, where some dialects are closer to Standard Dutch compared to others and vice versa. If it is the case that dialects indeed affect students' academic performance, we should observe that negative effect of dialect speaking is more prevalent among students whose dialect is farther away from Standard Dutch. Table 5 reports additional estimates to test this hypothesis. We present coefficient estimates on the interaction term between the dialect dummy and a variable that measures the linguistic distance between various dialects and Standard Dutch. The linguistic distance values are based on Table 1. Our results indicate the farther the dialect is from Standard Dutch, the more negative its effect is on boys' language test scores. Just as before, linguistic distance does not affect girls or maths test scores in general.

5 Spillover Effects of Dialect Speaking

5.1 Set-up of analysis

As the next step, we investigate the spillover effects of dialect speaking on peers' academic performance. As a proxy for the intensiveness of students' communication in dialects within a classroom, we calculate the share of dialect speaking peers in class based on all students in the second grade of four cohorts.[8] We use the shares in percentage points for the convenience of interpretation. As discussed in Section 3, we refine the sample to schools with at least one dialect speaker in one grade. We also drop observations from classes with less than 5 students to obtain a more precise measure of the shares. These procedures result in the native sample of 9,411 individuals from 411 schools and 1,091 classes.

As we discussed in Section 1, it is of our interest to investigate how peers' speaking behavior affects test scores of Dutch speaking students and dialect speaking students differently. Motivated by the literature on peer effects, we can apply the linear-in-mean model. Our main independent variable is the share of dialect speaking peers at class level, not including the dummy for speaking dialect oneself. This is because we discuss heterogeneous spillover effects in two subsamples and dialect speaking is endogenous to academic performance. When we assume that the share of dialect speaking peers is uncorrelated with individual test score, we can have the OLS equation:

$$Y_{ics,t} = X_{ics,t}^{T}\beta + \lambda\overline{D_{(-i)cs,t}} + \alpha_s + \gamma_t + \varepsilon_{ics,t} \tag{2}$$

where $Y_{ics,t}$ stands for test scores for student i in class c and school s at year t. $\overline{D_{(-i)cs,t}}$ denotes as the share of dialect speaking peers at class level, excluding $D_{ics,t}$. $X_{ics,t}$ is a vector of all individual characteristics and teacher characteristics. We control school fixed effects, α_s to remove the variation explained by school choice as Section 4. This is

[8] In the PRIMA survey, around 30% observations are missing in the dialect dummy, because parents of these students do not indicate language information. In the baseline we use the non-missing sample to calculate the share of dialect speaking peers, assuming that the share of dialect speakers is identical between the missing sample and the non-missing sample. Alternatively, we can define the share by treating all the missing observations as dialect speakers or Dutch speakers respectively. However, using the alternative definitions will yield robust spillover effect estimates.

also essential to identify peer effects in linear-in-mean model. γ_t is the year fixed effects, indicating that we control the cohort-specific shocks in test scores. $\varepsilon_{ics,t}$ is the error term.

In order to obtain unbiased and consistent OLS estimates in Equation 2, we need to rely on two assumptions. The first assumption is that the variation in the share of dialect speaking peers at class level is idiosyncratic across cohorts within one school. The assumption is likely to hold unless parents deliberately avoid schools with many dialect speaking students. There is no stigma associated with dialect speaking in the Netherlands. In fact, the educational disadvantage experienced by dialect speaking students has not been a major issue in primary schools. As a result, it is unlikely that parents choose schools based on the share of dialect speaking students. The second assumption is that dialect speakers are randomly allocated into classes if there are two or more classes in the same cohort. For example, if school administrators intentionally allocate more dialect speakers to classes with students of disadvantaged background, the negative effect of dialect speakers will be overestimated. However, the assumption is likely to hold because school administrators usually have no information on the language spoken between children and parents at home prior to assigning students to classes, thus speaking dialect or Standard Dutch is unlikely to be an allocating rule. Nonetheless, we propose two tests for the random allocation of dialect speakers across classes within the same school in Section 5.2.

Another concern about the consistency of OLS estimates is that students may change their language usage at home after attending primary schools, so that the share of dialect speaking peers can be endogenous. For example, dialect speaking students of higher ability may turn to use standard Dutch at home because of exposure to Dutch speaking classmates and teachers. However, we believe that the language spoken between children and parents is persistent over growth. Moreover, it is unlikely that parents switch from speaking dialects to standard Dutch when their children have attended primary schools for only one grade.

Up to now we argued that the share of dialect speaking peers in class serves as an exogenous determinant in individual academic performance if dialect speakers are randomly assigned into different classes in one grade and across cohorts in one school. So after we control school fixed effects, the OLS estimate by Equation 2 represents a causal spillover effect of dialect speaking, unlike the correlation in Section 4.

5.2 Random allocation of dialect speakers across classes

At school level we have 640 observations from 411 schools and 4 cohorts. The main variation generates from observations in schools with multiple classes at a certain year. Among the sample 378 school observations have a single class, 155 have two classes, 54 have three classes, 38 have four classes and 15 have more classes. For the sample from schools with one single class in the second grade, we rely on the idiosyncratic variation in the share of dialect speaking peers across cohorts in one school to identify the causal spillover effects. But for the sample where there are more than one classes in the second grade, we also rely on the random allocation of students between classes. Though there is no institutional evidence that schools will allocate students on the ground of dialect, we can provide formal statistical evidence that random allocation is close the reality.

First, we perform a Pearson χ^2 test suggested by Ammermueller and Pischke (2009). If the allocation of students are random, the characteristic of each student should be independent of other students and class characteristics. For each school we define n_{cj} as the actual number of students in classroom $c = 1, 2, ..., C_s$ with the characteristic $j = 1, 2$ for Dutch speaking and dialect speaking respectively. We can compute the predicted number $\hat{n_{cj}}$ of dialect speakers and Dutch speakers in any classroom. Then the Pearson test statistic for any school should follow a χ_2 distribution with $(Cs - 1)(J - 1)$ degrees of freedom. When further assuming that the allocation of students in each school is independent of another, we can aggregate the Pearson test statistics which follows a χ_2 distribution with $[\sum(Cs - 1)](J - 1)$ degrees of freedom. Based on our sample from schools with multiple classes, the aggregate Pearson test statistic is 405.99 and the degree freedom is 453. Therefore, the p-value is 0.95 where we cannot reject the null hypothesis of random allocation.

Second, suggested by Ohinata and van Ours (2013), we can formally test whether dialect speakers are randomly assigned to different classes in schools with 2 classes or not for schools with two second-grader classes per cohort. The steps of the test are as follows. We first simulate a distribution of the expected numbers of schools for each difference in the number of dialect speakers between classes had students been randomly allocated to each class (See more details in Ohinata and van Ours (2013)). We then compare the predicted distribution of these differences with the actual distribution from our data. If students are indeed randomly allocated, we should observe the two distributions to be similar to each other. This is shown by Figure 4. The F-statistic for the difference between the two arrays of distribution indicates that we cannot significantly reject the hypothesis that two distributions are the same.

In addition to the random allocation of dialect speakers into classes, we also need to ensure that allocation of teaching resources are uncorrelated with the share of dialect speakers in class. That is, the share of dialect speakers should not be correlated with other class-level variables, which may determine academic performance. In Table 6, we regress the share of dialect speakers on teacher characteristics and average background characteristics at class level. We also add both school fixed effects and year fixed effects. We first present estimates based on the entire sample. Column (2), on the other hand, include estimates calculated by only using schools with multiple classrooms per cohort. Irrespective of the samples, we find that all control variables except for share of girls have no relation with the share of dialect speakers. The F-statistics for joint significance of either average characteristics or teaching resources are smaller than critical values, suggesting that these control variables cannot explain the share of dialect speakers at class level.

5.3 Baseline Results

Table 7 presents the estimated effects of peers' dialect speaking on the academic performance of Dutch speakers and dialect speakers separately. This is to investigate the potentially heterogeneous spillover effects, which may depend on the language spoken by the affected students. In each column, we report estimates on the share of dialect speaking peers in class in percentage point. We include the individual characteristics, teacher characteristics, school fixed effects and year fixed effects as we did in Table 4. The dependent variable in each regression is test scores after normalization with zero mean and the standard deviation of 1. From Column 1 to 4 in Panel a, we find that the share of dialect speaking peers has no significant effect on Dutch speakers' language score. Irrespective of including control variables and school fixed effects, these coefficients are close to 0 and insignificant. These estimates suggest that the variation in the share of dialect speaking students across classes and cohorts do not lead to significant peer effects among Standard Dutch speaking students. Similarly in Panel b, we find that there is no significant spillover effect on Dutch speakers' math score. In conclusion, our results reassure us that providing a common learning environment for dialect as well as Standard Dutch speakers does not negatively affect the academic performance of students who speak Standard Dutch.

On the other hand, it is also of interest to investigate whether having more dialect speaking peers in the same class/cohort benefit or harm other dialect speakers. In the same table, we also report the estimated spillover coefficients for dialect speakers. In

Column 1 and 4 of Panel a, we regress language scores only on the share of dialect speaking peers and find modestly positive effects. When the share of dialect speaking peers increases by 10 percentage points, the language score of dialect speakers will increase by 0.02 of a standard deviation. When we control individual characteristics, teacher characteristics, school fixed effects and year fixed effects, however, the significant spillover effects disappear. This is most likely because the positive correlation between the share and the test score of dialect speaking students is explained by individual background and school choice. Similarly, Panel b indicates that there is no spillover effect on dialect speakers' math score. Dialect speakers do not benefit from interaction with more classmates speaking the same language.

As we discussed before, the spillover effects of dialect speakers on the majority Dutch speakers are expected to be negative for at least two reasons. First, dialect speakers are usually from more disadvantaged family and they may have difficulty in studying the standard language. According to the peer effects literature, the students at lower percentile may have negative effects on classmates' performance in general. Second, with many dialect speakers there would be linguistic segregation between groups of students in class. This would make in-class interaction costly. However, the spillover effects on the minority dialect speakers are ambiguous. Besides the potential negative effects discussed above, more peers speaking the same language can help dialect speakers to integrate in class, leading to positive effects on performance. Our findings, however, support none of these arguments. We find no spillover effects on both groups and on both subjects.

5.4 Sensitivity Checks

Table 8 presents a series of sensitivity checks for the causal spillover effects of peers' dialect speaking. Panel a of Table 8 report regression results separately for schools with multiple classes and school with one single class in the second grade. For multiple-class schools, we are using both between-class variation and across-cohort variation as we argued before. For those estimates using a sample of schools with multiple-classes, we find that the coefficients are similar in size and significance to the baseline estimates shown in Table 7. In contrast, estimates presented in the second row in panel a are estimated by a sample of schools each with a single-classroom and therefore only use across cohort variation. As a result, the share at class level is equivalent to the share at school level. We find that the size of coefficients changes slightly most likely because of using alternative variations to identify the spillover effects, although these estimates are still small and insignificant. To summarize, the findings here do not change from Table 7.

In Panel b, we also estimate regressions by controlling for the peers' average individual background characteristics. In the language of Manski (1993), these control variables allow us to take into account the contextual effects. According to the estimated results, peers' speaking pattern has no effect on academic performance regardless of controlling peers' average background characteristics.

Panel c reports the spillover effects separately between classes with more than 22% dialect speaking students and those with less than 22%. We conjecture that negative spillover effects may dominate in classes where more peers use dialects. However, in both high-share and low-share classes dialect speaking peers have little influence on individual academic performance, except for slightly negative spillover on dialect speakers' language score.

We also investigate whether spillover effects differ between boys and girls in Panel d. We regress the test scores of two groups separately on the share of dialect speaking peers in the whole class. The spillover effects are small and insignificant for both boys and girls, although the sizes of coefficients for boys are generally larger. So there is hardly any difference in the way that performance are influenced by peers' speaking behaviors across gender.

In Panel e, as we discussed in Table 5 we can check heterogeneous spillover effects across dialects. We use the interaction term of share of dialect speaking peers and linguistic distance of the dialect as the independent variable, and find no spillover effect no matter how far a dialect is from the Standard Dutch.

In the next two panels, we use other test score measures for the dependent variable and the independent variable. In Panel f, PRIMA test score before normalization is used instead of normalized score. Similar to the baseline, we find no spillover effect for all subjects and all groups. In Panel g, the number of dialect speaking peers in class, instead of the share, is used as a measure for exposure to dialect speakers. The estimated parameters also suggest no significant spillover effect.

6 Conclusion

In this paper, we investigate the relationship between dialect speaking and academic performance of young children in the Netherlands. In addition to the effect of dialect speaking on individual test scores, we study the spillover effects of peers' dialect speaking on academic performance. Unlike the previous studies, which investigated the language effects on immigrants' test score outcomes, we study the dialect speaking effects on native children. In order to deal with the endogeneity problem of spillover effects, we rely on random allocation of dialect speakers across classes in one grade and idiosyncratic variation of the share of dialect speakers across cohorts in one school.

Our analysis is based on four cohorts of the second grade native students. We find that dialect speaking at home is strongly correlated with parental usage of dialects with each other. Besides province of living, dialect speaking is mainly determined by parents' education level and urbanization level of living place. According to our dataset, dialect speakers usually have less advantaged background. We find that dialect speaking has a modestly negative effect on language skills for boys and no significant effect on language skills for girls. Dialect speaking does not seem to affect math skills. Assuming that dialect speaking does not affect math skills and including math skills as an indicator of ability we still find a negative effect of dialect speaking on language scores for boys. This is suggestive of a possible negative causal effect of dialect speaking on language performance for boys. For girls, we find no such effect.

We also study the spillover effects of peers' dialect speaking on academic performance, and how the effects are different for Standard Dutch speaking majority and dialect speaking minority. Relying on random assignment of dialect speakers across classrooms in one grade, we estimate individual test scores on the share of dialect speaking peers at class level. For both Dutch speakers and dialect speakers, we find no significant spillover effects and the coefficients are usually very small. The findings are robust against several sensitivity checks.

These findings can lend support to parents and schools in guiding children's dialect speaking behavior. It is of little concern that speaking dialects would be detrimental to students themselves and their classmates. Imposing interventions such as discouraging children to learn dialects or track students by mother tongue is likely to be unnecessary. The paper also contributes to policy making by suggesting that the efforts to advocate "bilingual" education and conserve regional culture would not harm students' academic performance.

In order to put our findings into a broader context of educational consequences of language, we draw findings from a comparable study on immigrant students in the Netherlands (Ohinata and van Ours, 2012). Whilst we find that the dialect speaking students lag behind other Dutch students by 0.051 point of a standard deviation, first-generation immigrant students in the Netherlands perform worse in reading test in comparison to native students by 0.28 point of a standard deviation, nearly 4 times more than that of dialect speaking students. The difference in the magnitude is likely to partially result from the lack of cultural differences experienced by dialect speaking students. It is also very possible that the linguistic barriers that dialect speaking students face is much less severe compared to first-generation immigrant students.

Given this, it is probably safe to say that it is not at all surprising that we do not find any spillover effects from dialect speaking students to Standard Dutch speaking students. Even though immigrant students are in a much more disadvantaged position compared to dialect-speaking students, Ohinata and van Ours (2013) find no spillover effects from immigrants to natives. Of course, this study cannot rule out the possibility that the educational consequences of language would be non-negligible in countries where the linguistic barrier experienced by dialect speakers is larger. We leave this question to be investigated in future studies.

References

Ammermueller, A. and J. S. Pischke (2009). Peer effects in european primary schools: Evidence from the progress in international reading literacy study. *Journal of Labor Economics 27*, 315–348.

Bleakley, H. and A. Chin (2004). Language skills and earnings: Evidence from childhood immigrants. *Review of Economics and Statistics 86*(2), 481–496.

Bleakley, H. and A. Chin (2010). Age at arrival, english proficiency, and social assimilation among U.S. immigrants. *American Economic Review: Applied Economics 2*(1), 165–192.

Cheshire, J., V. Edwards, H. Munstermann, and B. Weltens (1989). *Dialect and Education: Some European Perspectives*. Multilingual Matters Ltd.

Chiswick, B. R. and P. W. Miller (1995). The endogeneity between language and earnings: International analyses. *Journal of Labor Economics 13*(2), 246–288.

Chiswick, B. R. and P. W. Miller (2014). International migration and the economics of language. In B. R. Chiswick and P. W. Miller (Eds.), *Handbook of the Economics of Immigration*, pp. 211–269. Elsevier.

Driessen, G. (2005). In Dutch? Usage of Dutch regional langauges and dialects. *Language, Culture and Curriculum 18*, 271–285.

Dustmann, C. and F. Fabbri (2003). Language proficiency and labour market performance of immigrants in the UK. *Economic Journal 113*(489), 695–717.

Dustmann, C., S. Machin, and U. Schonberg (2010). Ethnicity and educational achievement in compulsory schooling. *Economic Journal 120*, 272–297.

Dustmann, C. and A. van Soest (2001). Language fluency and earnings: Estimations with misspecified indicators. *Review of Economics and Statistics 83*(4), 663–674.

Falck, O., S. Heblich, A. Lameli, and J. Sudekum (2012). Dialects, cultural identity and economic exchange. *Journal of Urban Economics 72*, 225–239.

Gao, W. and R. Smyth (2011). Economic returns to speaking 'standard Mandarin' among migrants in China's urban labour market. *Economic of Education Review 30*, 342–352.

Geay, C., S. McNally, and S. Telhaj (2013). Non-native speakers of english in the classroom: What are the effects on pupil performance? *Economic Journal 123*, 281–307.

Hanushek, E. A., J. F. Kain, J. M. Markman, and S. G. Rivkin (2003). Does peer ability affect student achievement? *Journal of Applied Econometrics 18*, 527–544.

Kessler, B. (1995). Computational dialectology in irish gaelic. In *Proceedings of the seventh conference on European chapter of the Association for Computational Linguistics*, pp. 60–66. Morgan Kaufmann Publishers Inc.

Lavy, V., M. D. Paserman, and A. Schlosser (2012). Inside the black box of ability peer effects: Evidence from variation in the proportion of low achievers in the classroom. *Economic Journal 122*, 208–237.

Manski, C. F. (1993). Identification of social endogenous effects: the reflection problem. *Review of Economic Studies 60*, 531–542.

Ohinata, A. and J. C. van Ours (2012). Young immigrant children and their educational attainment. *Economics Letters 116*(3), 288–290.

Ohinata, A. and J. C. van Ours (2013). How immigrant children affect the academic achievement of native Dutch children? *Economic Journal 123*, 308–326.

Van Bezooijen, R. and W. Heeringa (2006). Intuitions on linguistic distance: geographically or linguistically based? In T. Koole, J. Nortier, and B. Tahitu (Eds.), *Vijfde sociolinguïstische conferentie*, pp. 77–87. Eburon Uitgeverij BV.

Yao, Y. and J. C. van Ours (2015). Language skills and labor market performance of immigrants in the Netherlands. *Labour Economics 34*, 76–85.

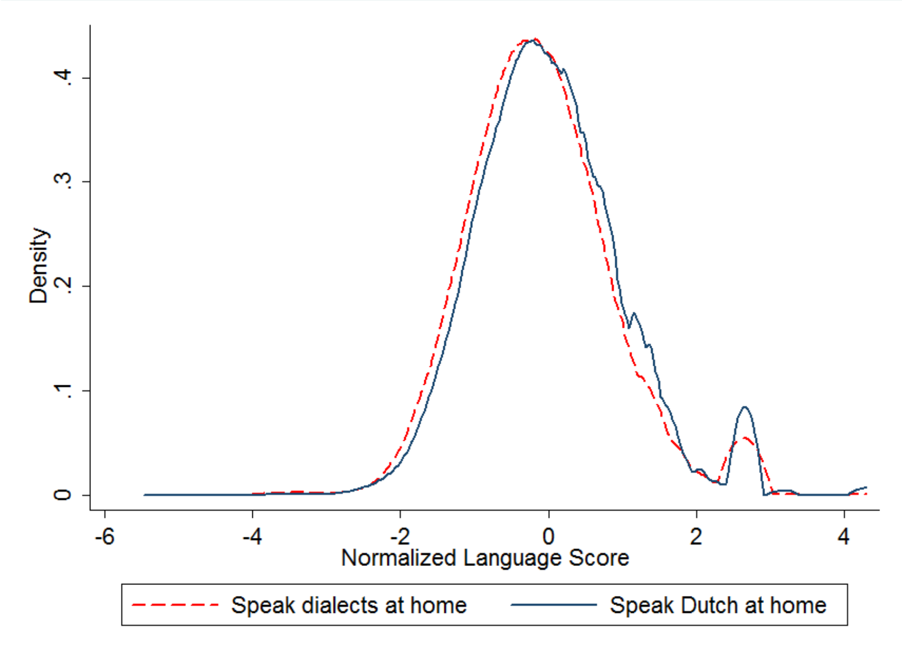
Table 1: Linguistic distances between dialects spoken in each province and Standard Dutch

Province	Linguistic distances
Drenthe	19
Flevoland	12
Friesland	37
Gelderland	28
Groningen	28
Limburg	32
Noord-Brabant	28
Noord-Holland	12
Overijssel	29
Utrecht	18
Zeeland	29
Zuid-Holland	12

Source: Van Bezooijen and Heeringa (2006).
Note: This table presents the linguistic distances bewteen various dialects spoken in each province and Standard Dutch. The larger the value of the index, the more different the particular dialect is from Standard Dutch.

Figure 1: Distribution of test scores by language group

a. Normalized language score



b. Normalized math score

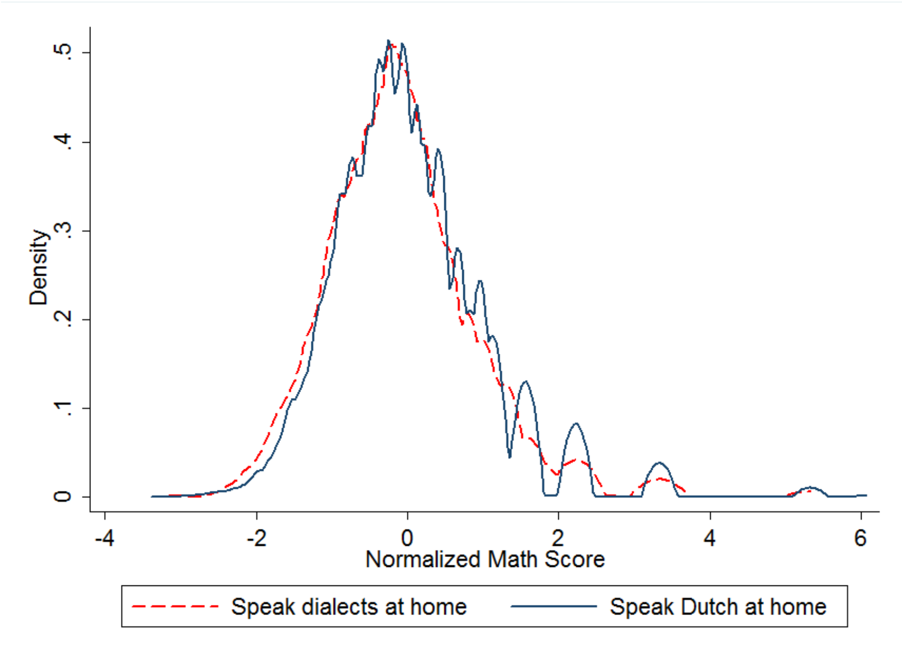
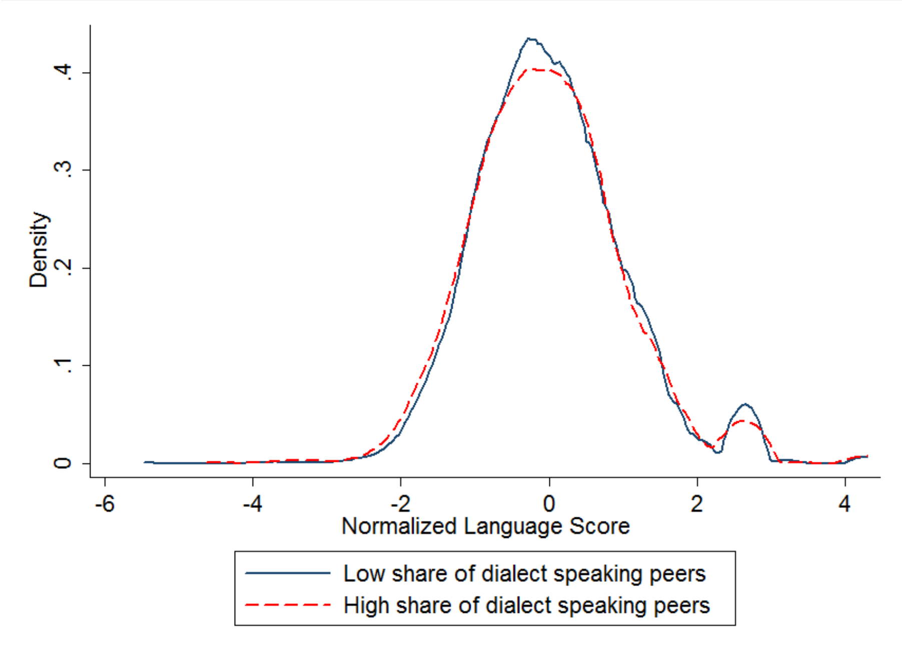


Figure 2: Distribution of test scores by share of dialect speakers: Dutch speaking students

a. Normalized language score



b. Normalized math score

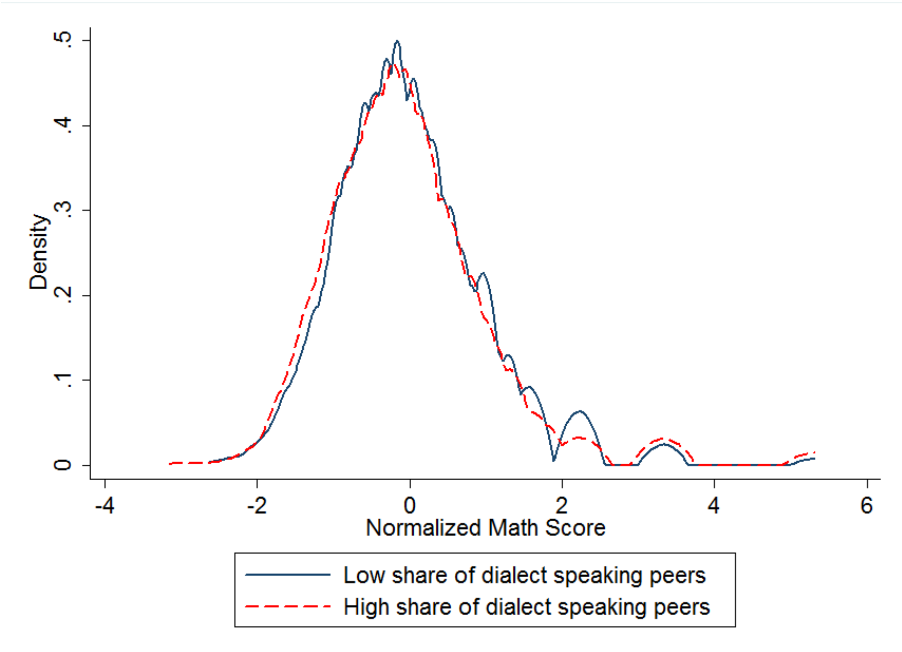
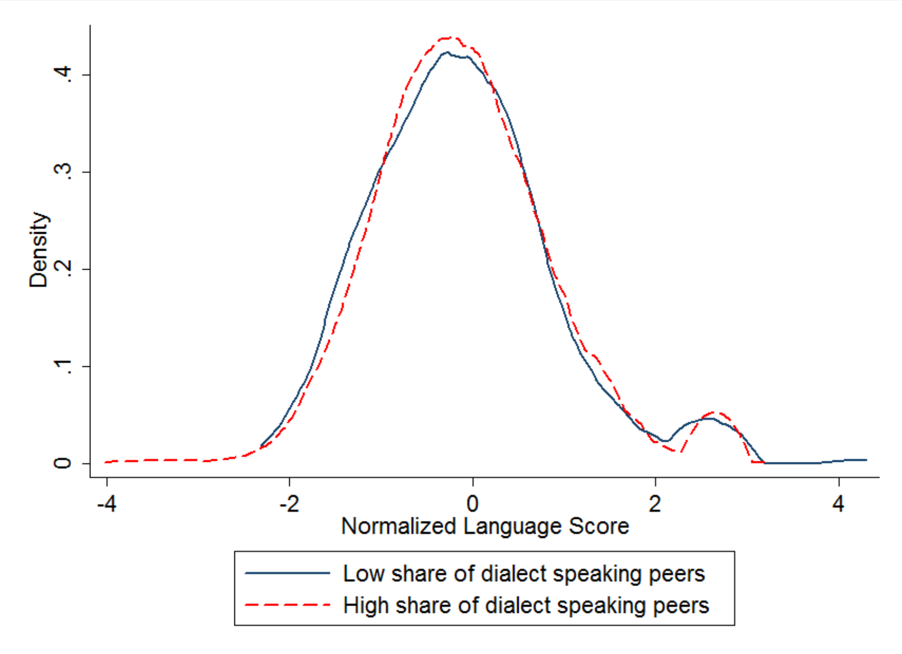


Figure 3: Distribution of test scores by share of dialect speakers: Dialect speaking students

a. Normalized language score



b. Normalized math score

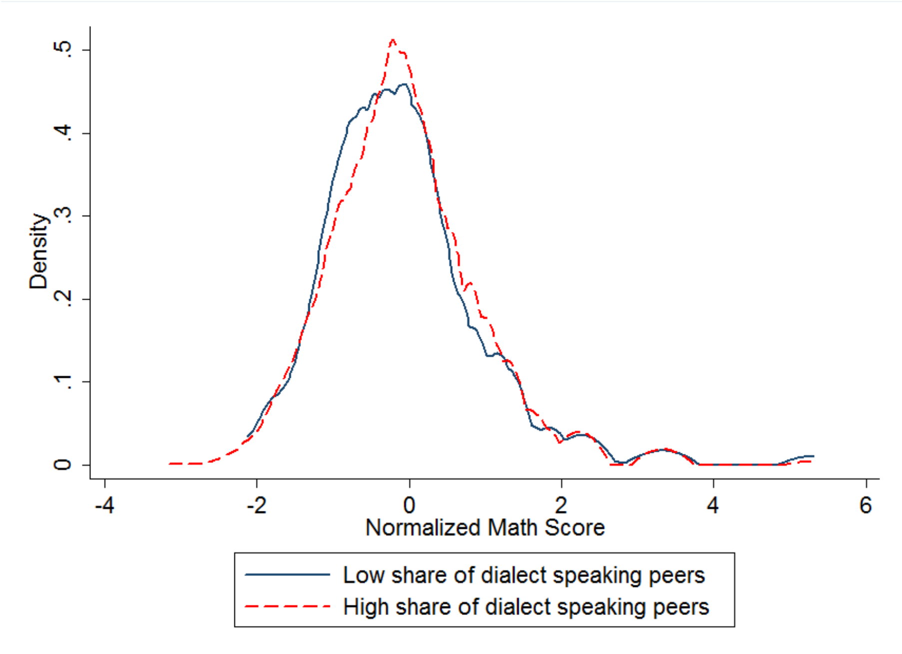
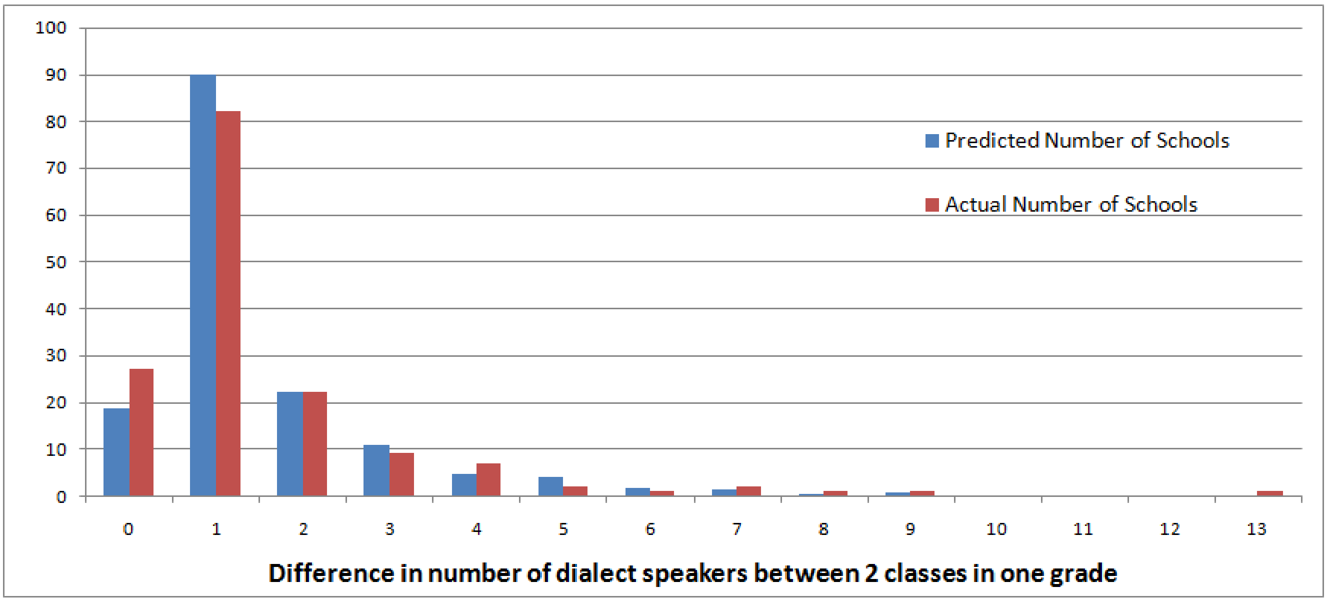


Table 2: Share of dialect speaking students in 1998-2005 PRIMA data

Province	Dialect speakers (%)	Number of students
Drenthe	17.3	1,182
Flevoland	2.4	677
Friesland	35.0	1,835
Gelderland	2.7	4,283
Groiningen	8.6	1,156
Limburg	41.6	3,119
Noord-Brabant	2.7	7,809
Noord-Holland	1.3	8,004
Overijssel	5.9	2,285
Utrecht	1.0	1,294
Zeeland	15.1	1,193
Zuid-Holland	1.0	8,047
Total	7.6	40,884

Note: The table presents the share of dialect speaking students based on the whole sample with nonmissing language information. Both native students and immigrants in the 2nd grade are taken into account in the statistics.

Figure 4: Random assignment of dialect speaking students between 2 classes in one grade



Note: This table uses the sample of schools with 2 classes in the second grade. It compares the predicted number of school and actual number of school with the difference n in the number of dialect speaking students between 2 classes, where $n = 0, 1, ..., 13$.

Table 3: Average characteristics by language groups

	Dutch speakers		Dialect speakers	
	Boys	Girls	Boys	Girls
Test scores				
Language score	-0.086	0.124	-0.219	0.015
(standard deviation)	(0.99)	(0.99)	(0.95)	(0.99)
Math score	-0.022	0.051	-0.152	0.013
(standard deviation)	(1.01)	(0.99)	(0.93)	(1.05)
Individual Characteristics				
Complete family (%)	97.2	98.1	99.1	99.5
Age in months	69.2	68.6	69.3	69.0
Always stay in the Netherlands (%)	98.1	98.1	99.1	99.5
Number of children at home	2.4	2.4	2.5	2.4
Speaking dialects between parents (%)	9.9	11.0	89.3	90.6
Father's education (%)				
Lower secondary school or lower	33.2	32.4	47.8	48.5
Upper secondary school	35.8	36.3	33.8	34.7
University or higher	25.8	25.4	15.7	13.9
Not available	6.2	5.9	2.8	2.9
Mother's education (%)				
Lower secondary school or lower	28.5	28.8	41.6	44.1
Upper secondary school	43.4	43.4	44.7	42.6
University or higher	21.9	21.8	11.2	10.5
Not available	6.2	6.0	2.6	2.8
Teacher and school characteristics				
Female teacher (%)	97.9	98.1	96.5	96.5
Year of teaching	16.3	16.3	17.8	18.4
Combining class (%)	75.0	75.2	66.0	65.4
Remedial class (%)	76.9	75.8	72.5	74.0
Number of students	15.9	15.8	17.5	17.3
Share of immigrants in class	18.0	17.7	15.7	46.9
Urbanization of location of school (%)				
Not urban	21.9	21.8	34.2	32.3
Little urban	24.8	25.9	36.0	37.4
Moderately urban	23.2	21.7	16.5	16.7
Very urban	23.3	24.3	13.2	13.5
Extremely urban	6.8	6.3	0.0	0.0
Number of Obs.	10,607	9,942	1,225	1,045

Note: The table presents the average statistics based on the native students sample in the 2nd grade. The test scores are normalized such that for the full sample the mean is 0.0 and the standard deviation is 1.0.

Table 4: Effect of dialect speaking on test scores

	(1)	(2)	(3)	(4)
a. Language scores				
All	-0.118***	-0.038	-0.050**	-0.051*
	(0.027)	(0.027)	(0.026)	(0.027)
Boys	-0.124***	-0.053	-0.064**	-0.078**
	(0.034)	(0.032)	(0.032)	(0.036)
Girls	-0.102***	-0.024	-0.037	-0.007
	(0.036)	(0.034)	(0.034)	(0.042)
b. Math scores				
All	-0.089***	-0.006	-0.019	-0.013
	(0.029)	(0.028)	(0.028)	(0.029)
Boys	-0.128***	-0.053	-0.059*	-0.026
	(0.035)	(0.033)	(0.033)	(0.040)
Girls	-0.038	0.048	0.029	0.034
	(0.039)	(0.038)	(0.038)	(0.043)
c. Language scores				
All	-0.070***	-0.035*	-0.041**	-0.045*
	(0.021)	(0.021)	(0.021)	(0.023)
Boys	-0.054**	-0.026	-0.035	-0.066**
	(0.027)	(0.027)	(0.027)	(0.031)
Girls	-0.084***	-0.048*	-0.052*	-0.024
	(0.028)	(0.028)	(0.028)	(0.038)
Individual characteristics	N	Y	Y	Y
Teacher characteristics	N	N	Y	Y
School fixed effects	N	N	N	Y
Year fixed effects	Y	Y	Y	Y

Note: The dependent variables are normalized scores. The independent variable of interest is a dummy which equals 1 if the student speaks a dialect to his/her father or mother at home. The individual characteristics are age in month, squared age in month, gender, a dummy for the presence of both parents, a dummy for staying in the Netherlands all the time, and dummies for number of children at home and parents' education. The teacher and class characteristics include teacher's gender, teacher's year of experience, number of students in class, a dummy for combining class, a dummy for remedial class and dummies for levels of share of immigrant students. Absolute t-statistics based on robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Sensitivity Analysis: Linguistic distance and dialect speaking

Variables	Language scores			Math scores		
	All	Boys	Girls	All	Boys	Girls
	(1)	(2)	(3)	(4)	(5)	(6)
Whole Sample						
Speak dialects at home×	-0.002*	-0.003**	-0.000	-0.001	-0.001	0.001
Linguistic distance	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Note: The dependent variables are normalized scores. The independent variable of interest is the interaction of the dummy for speaking a dialect at home and linguistic distance of the dialect. The individual characteristics are age in month, squared age in month, gender, a dummy for the presence of both parents, a dummy for staying in the Netherlands all the time, and dummies for number of children at home and parents' education. The teacher and class characteristics include teacher's gender, teacher's year of experience, number of students in class, a dummy for combining class, a dummy for remedial class and dummies for levels of share of immigrant students. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 6: Random assignment of teaching resources and Dutch speaking students; share of dialect speaking students in the classroom

	All	Multiple classes
	(1)	(2)
Share of girls in class	5.425**	3.984
	(2.594)	(2.746)
Average age in month	-0.180	-0.176
	(0.241)	(0.243)
Share of students from	-3.984	-2.355
complete families	(4.173)	(4.186)
Share of students who	1.452	0.787
always stay in the Netherlands	(5.332)	(5.593)
Average number of children	0.140	0.034
	(0.138)	(1.378)
Average father's education level	-0.882	-0.585
	(1.700)	(1.801)
Average mother's education level	0.745	-0.009
	(1.700)	(1.903)
Teacher is female	-0.185	0.124
	(3.260)	(3.308)
Teacher's year of experience	0.009	0.001
	(0.053)	(0.053)
Combining class	1.791	0.737
	(2.189)	(3.270)
Remedial class	-1.013	0.151
	(1.298)	(1.460)
Number of students	-0.001	-0.143
	(0.155)	(0.192)
Share of immigrant students: 10-30%	0.326	0.562
	(1.341)	(1.460)
Share of immigrant students: 30-50%	-3.164	-3.910
	(1.954)	(2.060)
Share of immigrant students: 50-70%	-2.733	-1.852
	(3.349)	(4.033)
Share of immigrant students: 70-100%	-1.358	-0.481
	(3.164)	(3.382)
F-statistics for average characteristics	0.86	0.50
F-statistics for teaching resources	0.74	1.05
Number of classrooms	1,093	717
Number of schools	411	182

Note: The dependent variable is the share of dialect speaking students in class at percent level. All regressions are at class level with year fixed effects and school fixed effects. In Column (2), we only use the sample from schools with multiple (more than one) classes in the second grade. Absolute t-statistics based on robust standard errors in parentheses. All the estimates include year fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Spillover effects of dialect speaking on test scores

	(1)	(2)	(3)	(4)
a. Language score				
Dutch speakers	0.000	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.002)
Dialect speakers	0.002**	0.001	0.000	-0.002
	(0.001)	(0.001)	(0.001)	(0.002)
b. Math score				
Dutch speakers	0.000	0.000	-0.000	-0.002
	(0.001)	(0.001)	(0.001)	(0.002)
Dialect speakers	0.002**	0.001	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.002)
Individual characteristics	N	Y	Y	Y
Teacher characteristics	N	N	Y	Y
School fixed effects	N	N	N	Y
Year fixed effects	Y	Y	Y	Y

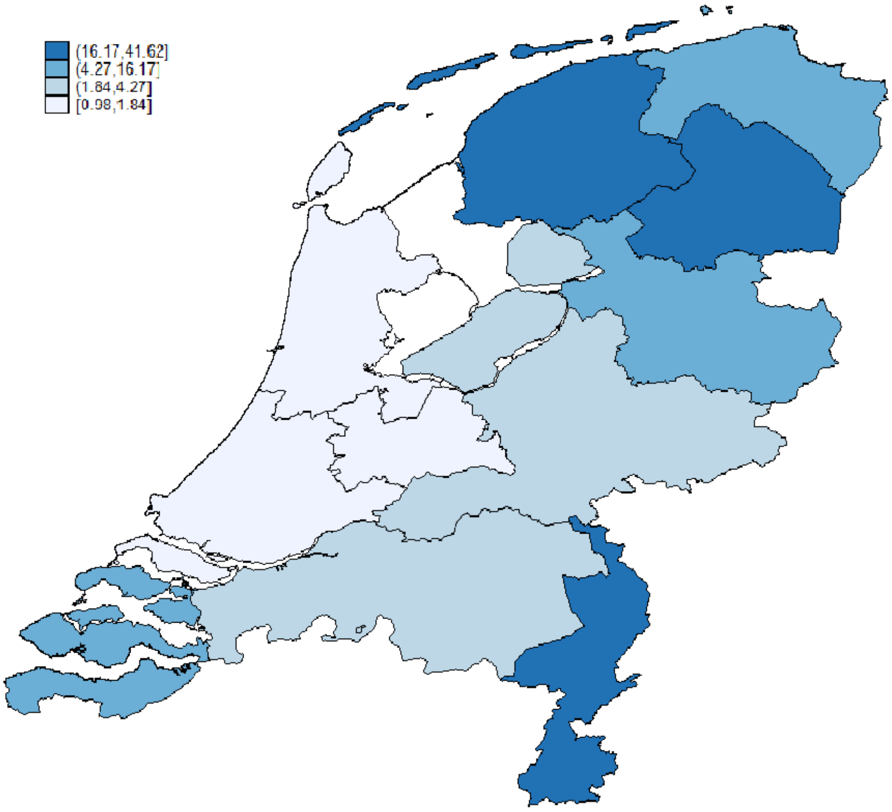
Note: The dependent variable is normalized scores. The independent variable of interest is share of dialect speaking peers in class at percent level. The individual characteristics are age in month, squared age in month, gender, a dummy for the presence of both parents, a dummy for staying in the Netherlands all the time, and dummies for number of children at home and parents' education. The teacher and class characteristics include teacher's gender, teacher's year of experience, number of students in class, a dummy for combining class, a dummy for remedial class and dummies for levels of share of immigrant students. Absolute t-statistics based on robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 8: Sensitivity Checks: Estimates of spillover effects

	Language score		Math score	
	Dutch speakers	Dialect speakers	Dutch speakers	Dialect speakers
	(1)	(2)	(3)	(4)
a. Multiple-class and single-class samples				
Multiple-class	-0.001	-0.003	-0.004	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)
Single-class	-0.001	-0.003	-0.002	-0.001
	(0.004)	(0.002)	(0.003)	(0.002)
b. Controlling peers' background characteristics				
Whole sample	-0.000	-0.002	-0.001	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)
c. High share and low share samples				
High share class	-0.001	-0.007*	0.000	0.001
	(0.004)	(0.004)	(0.002)	(0.002)
Low share class	0.000	0.002	0.004	-0.008
	(0.003)	(0.003)	(0.021)	(0.023)
d. Gender heterogeneous effects				
Boys	-0.001	-0.001	-0.004	-0.000
	(0.002)	(0.002)	(0.003)	(0.003)
Girls	-0.003	-0.001	-0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.003)
e. Independent variable: Share of dialect speaking peers interacts with linguistic distance				
Whole sample	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
f. Dependent variable: PRIMA score				
Whole sample	-0.015	-0.026	-0.063	-0.007
	(0.055)	(0.026)	(0.071)	(0.027)
g. Independent variable: Number of dialect speaking peers				
Whole sample	-0.010	-0.012	-0.010	-0.003
	(0.011)	(0.013)	(0.014)	(0.014)

Note: The dependent variable is normalized scores, except for Panel f. The independent variable of interest is share of dialect speaking peers in class at percent level, except for Panel e and Panel g. The individual characteristics are age in month, squared age in month, gender, a dummy for the presence of both parents, a dummy for staying in the Netherlands all the time, and dummies for number of children at home and parents' education. The teacher and class characteristics include teacher's gender, teacher's year of experience, number of students in class, a dummy for combining class, a dummy for remedial class and dummies for levels of share of immigrant students. Absolute t-statistics based on robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

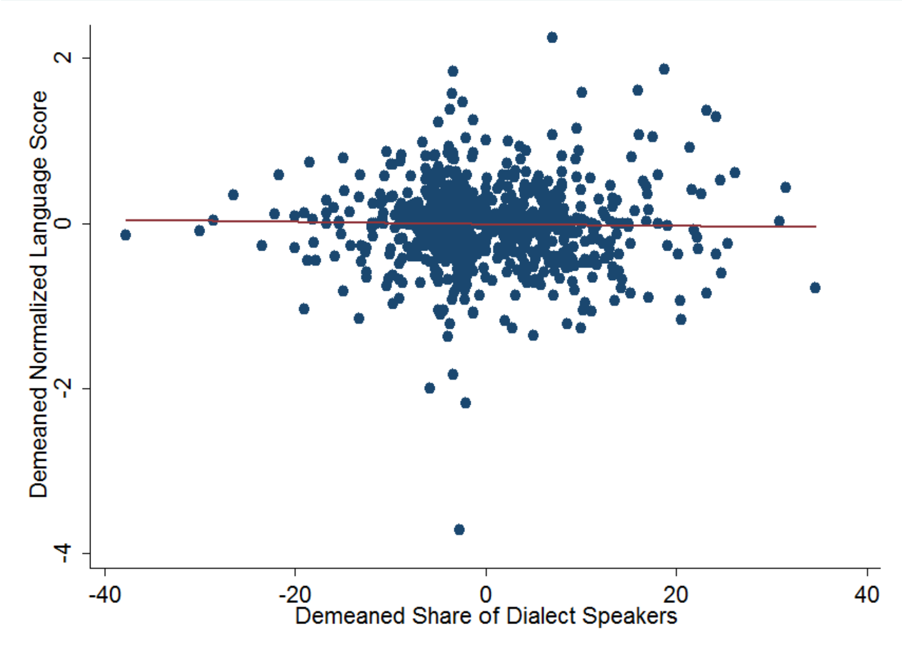
Figure A1: A map of the share of dialect speaking students (%)



Appendix

Figure A2: Demeaned average score and share of dialect speaking students in class: Dutch speaking students

a. Normalized language score



b. Normalized math score

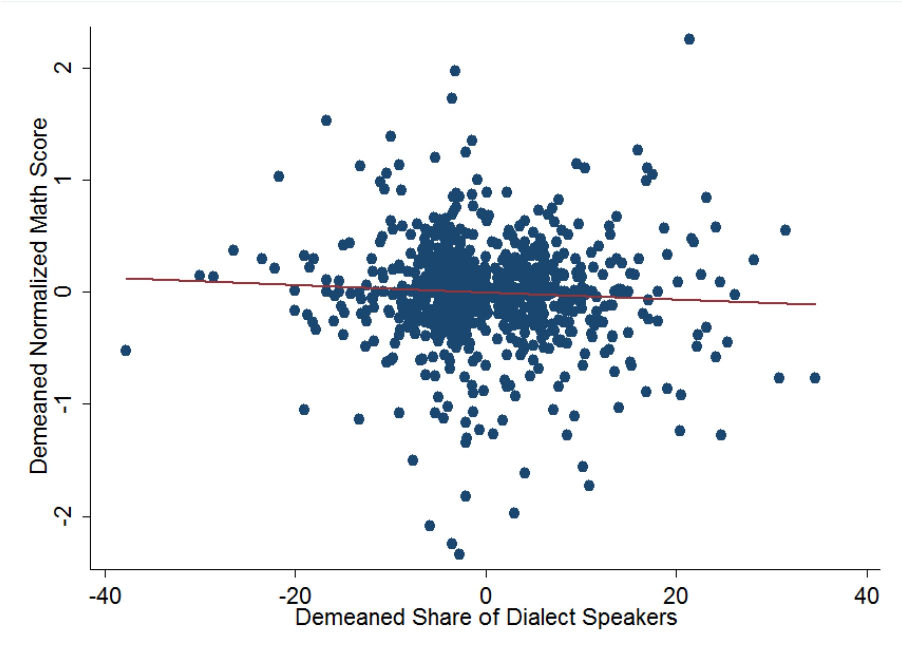
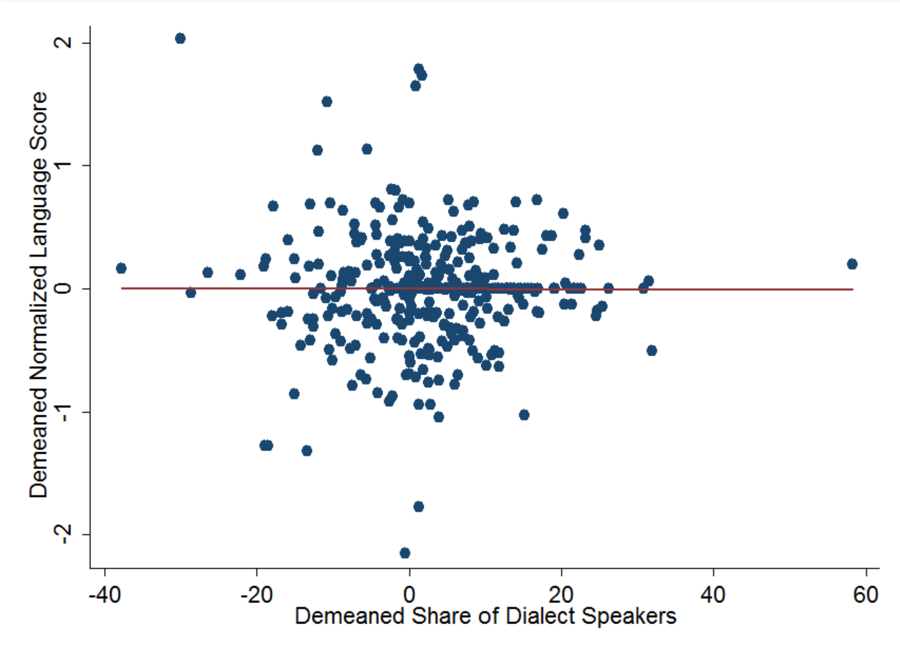


Figure A3: Demeaned average score and share of dialect speaking students in class: Dialect speaking students

a. Normalized language score



b. Normalized math score