The Educational Consequences of Language Proficiency for Young Children *

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

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Abstract

This paper studies the educational consequences of language proficiency by investigating 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 test scores with larger effects on boys. In addition, we study whether there are spillover effects of dialect-speaking on classmates' academic performance. We find no evidence of any 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

The economic consequences of language proficiency have received increasing attention in recent years. Language skills are viewed as part of human capital and play an important role in labor market performance, schooling, health care, consumption and investment (see an overview in Chiswick and Miller (2014)). The existing literature predominantly studies the topic in the context of immigration. These studies focus on how the proficiency in local languages contributes to adult immigrants' labor market performance and social integration in host countries (Chiswick and Miller, 1995; Dustmann and van Soest, 2001; Dustmann and Fabbri, 2003; Bleakley and Chin, 2004, 2010; Yao and van Ours, 2015), as well as the wage premium of being bilingual or proficient in a second official language (Di Paolo and Raymond, 2012; Christofides and Swidinsky, 2010). Other papers investigate the educational performance of immigrant children (Dustmann et al., 2010; Geay et al., 2013) and the impact of bilingual education reform (Chin et al., 2013).

This paper contributes to the literature on the educational consequences of language skills but instead of studying immigrant students, it investigates the effects of speaking dialects at home on standard test scores. Since immigrants speak different languages from natives, they are the obvious choice of group for studying the effects of language. However, these immigrant students do not only differ from native students in terms of the spoken language 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 influences of cultural as well as linguistic differences. In contrast, dialect-speaking students share a relatively homogeneous background to those who speak the official language of the country. In this sense, our estimates are likely to capture purer language effects.

To our knowledge, our paper is the first to study the effects of speaking dialects on educational performance. Aside from the advantage of investigating the impacts of language proficiency exploiting dialect-speaking behavior, studying the economic consequences of dialect is important on its own. Diverse dialects are used in many countries and they are an integral part of daily communication. Nonetheless, the existing literature on dialect is scarce. Grogger (2014) reports that southern whites' speech pattern is associated with lower wages in US labor market. Gao and Smyth (2011), on the other hand, find a significant wage premium associated with fluency in standard Mandarin for dialect-speaking migrating workers in China. These papers present evidence on labor market performance; a natural extension to the literature is to study how dialect-speaking affects students' educational outcomes.

Besides the consequences on labor market performance at adulthood, the returns to language skills can be traced back to the accumulation of human capital at early stages of life. A few recent studies investigate how skills in local languages are related to academic performance of immigrant students although the evidence is still limited. Using the UK National Pupil Database and the Millennium Cohort Study, Dustmann et al. (2010) find that immigrant students in the UK lag behind native students at the beginning of primary school. This gap is smaller for students whose mother tongue is English. Moreover, the gap diminishes throughout 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 and therefore they cannot rule out 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 self-selection into schools, they report that there is no negative spillover effect from immigrants to native students.

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 study effectively the impact of language. Secondly, compared with other countries, native residents in the Netherlands are relatively more homogeneous in terms of ethnicity, culture, and even economic wealth. As a result, we are more likely to be able to pick out the effect of language without the influences of other socio-economic and demographic characteristics. Thirdly, despite the existence of various dialects in the Netherlands, Standard Dutch is predominantly used in school teaching, even in regions where the position of the local dialect is strong (see Cheshire et al. (1989) for an overview). In such a learning environment, dialect-speaking may pose negative effects on academic performance, especially on children's linguistic development. Furthermore, it may be more costly for these dialect-speaking children to interact with Standard Dutch speakers and teachers.

Our data from the PRIMA survey for Dutch primary schools provide 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. In particular, the data include crucial information identifying those students who speak dialect at home. In addition, we also observe their test scores and the 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 dialect effects on language and math test scores. This is because linguistic disadvantages faced by dialect-speaking students may affect language outcomes more and we may, as a result, find heterogeneous effects across subjects. Indeed we find that dialect-speaking students perform worse in language tests compared to Standard Dutch-speaking students. In particular, the dialect-speaking boys suffer from learning in a language that is different from their daily language at home. We argue that our point estimate is a lower bound of the dialect-speaking effect as there may be unobserved differences between dialect-speaking and non dialect-speaking children. However, unobserved heterogeneity may not be important as it is hard to imagine that this affects language scores but not math scores of boys. Similarly, it is hard to see why unobserved heterogeneity would affect language scores of boys but not language scores of girls. xxxx

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 patterns affect academic performance? Therefore, we also investigate the spillover effects between the two groups within the same classroom. Although spillover effects in the classroom have gained much attention among social scientists in the last decade, we are the first to explicitly focus on speaking patterns. Spillover effects in this setting can occur through several channels. First, there could be a negative spillover from dialect speakers to other students. Students may learn inaccurate grammar and pronunciation from classmates who use dialects at home. The negative effects may be more evident in language skills than in 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 may harm the academic performance of all students across 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 dialect speakers themselves. That is, with more peers speaking the same dialect, dialect speakers can have interactions with peers and conduct discussions at a lower cost. To sum up, we conjecture that more dialect-speaking classmates will impede learning for Dutch speakers, but the effects will be ambiguous for dialect speakers. Therefore, spillover effects must be investigated separately for each group.

It is well known that the identification of spillover effects suffers from a number of econometric difficulties. There may be parental selection as to where their children attend schools, so that peers' mother tongue is endogenously determined by school choice. Studies using non-experimental data attempt to mitigate the bias from self-selection by exploiting variation in the composition of peers across classes or schools (Ammermueller and Pischke, 2009; Hanushek et al., 2003; Lavy et al., 2012). The study on spillover 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 the same 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 the two tests to confirm that dialect-speaking students are randomly allocated in schools. 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 from peers' dialect-speaking on test scores. We conduct a range of sensitivity analyses, 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 skills. We focus on the effects of speaking Dutch dialects on individual test scores as well as the spillover effects of speaking dialects on classmates' test scores. Secondly, our paper is the first to investigate the socio-economic consequences of dialect-speaking in the context of education. Last, but not the least, we present a purer estimate of the impact of language proficiency. Since immigrant students not only speak different languages from native students but also come from heterogeneous cultural backgrounds, previous findings are likely to reflect the effects of cultural background of these immigrants also. Dutch dialect speakers, in contrast, share a relatively homogeneous 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 young children.

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

2 Languages and Dialects in the Netherlands

The predominantly spoken language of the Netherlands is Standard Dutch, originating in the urban areas of Noord-Holland, Zuid-Holland and Utrecht. Besides Standard Dutch, the regional 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 and promoted by the local government. In Friesland both Standard Dutch and Frisian are considered official languages and more than 80% of the adult inhabitants understand verbal Frisian. Frisian is also an integral part of the primary school curriculum except for some exempted schools in Friesland since the 1980s. Other regional languages include Limburgish and Low Saxon, which enjoy the status as "official regional languages" in related regions although there is no clear regulation regarding government support. Limburgish is spoken in the province of Limburg by about 75% of the inhabitants and Low Saxon is spoken in the provinces of Groningen, Drenthe, Overijssel and Gelderland by approximately 60% of the inhabitants. However, neither Limburgish nor Low Saxon are taught as a school subject. Other provinces also have dialects such as Brabantish, spoken in Noord-Brabant or Zeelandic in Zeeland (see an overview in Driessen (2005) and Cheshire et al. (1989)).

Table 1 summarizes the linguistic distances between Standard Dutch and various dialects and regional languages (Van Bezooijen and Heeringa, 2006).[1] We use the Lev-

[1] From here on, for simplicity, we refer to all dialects and regional languages used in the Netherlands

enshtein distance which is based on a comparison of the pronunciation of a word from one dialect and the corresponding word in Standard Dutch.[2] The distance is determined by how many alterations it requires 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 languages are considered to be. A larger Levenshtein distance indicates that the dialect is more different from Standard Dutch. As shown in Table 1, Frisian stands out from the other dialects by having the largest Levenshtein distance, i.e. 37, followed by Limburgish. As a point of comparison, the Levenshtein distance between Standard Dutch and English is reported to be 63 (Isphording and Otten, 2013). Therefore, the distances between some of the Dutch dialects and Standard Dutch are likely to be non-negligible.

3 Data and Background

3.1 PRIMA data

Our analysis employs data from PRIMA, a large-scale biannual longitudinal survey for primary schools in the Netherlands. The project was 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 select a cross-sectional sample of native students in the second grade. We drop immigrants from our sample and treat all non dialect-speaking students as Dutch-speaking.[3] Language information is only collected from parents of second graders. We are not able to follow later grades because of attrition in survey sampling at individual level. Moreover, we exclude the first two cohorts from the sample, because math scores and teacher characteristics are made comparable across cohorts only after the 1998/1999 survey.

as dialects. Frisian, Limburgish and Low Saxon are recognized as official regional languages by the European Charter for Regional or Minority Languages. Frisian has the highest level of recognition, which means that the Frisian provincial government may be more active in promoting the use of Frisian. Low Saxon and Limburgish have a lower level of recognition. See Driessen (2005) for more details.

[2]The Levenshtein distance is introduced by Kessler (1995). For an overview of linguistic distances and their use in economics see Ginsburgh and Weber (2015).

[3]We define students as immigrants if at least one parent was born outside of the Netherlands.

In the questionnaires, parents indicate in what language their child speaks to his/her mother, father, siblings and friends. Our data also reports the language spoken between the two parents. Each parent was asked to report one of three categories: Standard Dutch, dialects or Frisian, and other foreign languages. We consider a student to be dialect-speaking if he or she speaks dialect or Frisian to either his mother or father. The main independent variable is whether a student speaks a Dutch dialect or Standard Dutch at home to parents.[4] Our main variables of interest are the measures for educational outcomes. The PRIMA survey provides standard tests on language and math for second grade children.[5] The language test for children in second grade measures understanding of words and concepts such as first, last, many, few. The math test focuses on the sorting of objects, comparing numbers, counting, etcetera.

After exploring the effect of speaking dialect on individual test score, we investigate its spillover effects in classrooms. We calculate the share of dialect-speaking peers at class level excluding oneself, based on the unrestricted sample including immigrant students and missing observations. This indicator measures how intensely students interact with dialect-speaking peers. We will impose further restrictions on the sample for the spillover effects analysis. For example, we drop classes with less than five students to obtain more accurate shares and remove schools without any dialect speaker in the relevant grade as outliers. The resulting sample consists of 411 schools from four cohorts.

3.2 Summary statistics

Standard Dutch is predominantly used in Dutch primary schools. According to our sample from PRIMA survey, 10.1% of students in the second grade are reported to speak dialects to parents at home nationally. The survey provides location information of schools by 12 Dutch provinces. Table 1 summarizes the share of dialect-speaking students by province. The distribution of dialect-speaking students is very heterogeneous across provinces. Limburg is the province with the largest share of dialect-speaking students, 53%. It is followed by Friesland where as many as 39% of the students speak the

[4] We do not take into account the language spoken between siblings or friends because it may be affected by school education. The group of students speaking dialects with fathers highly overlaps with those who speak dialects with their mothers or siblings.

[5] To enable a comparison between language scores and math scores, we also normalize test scores for each subject. We divide the differences between each of the PRIMA test scores and the average test score by its standard deviation. The normalized score, therefore, has a mean of zero and standard deviation of one.

regional language with parents. In Drenthe and Zeeland, there are around 18% of dialect-speaking students. On the other hand, less than 2% of students speak dialects at home in the provinces of Noord-Holland, Utrecht and Zuid-Holland where modern Standard Dutch originated (see also the percentage of dialect-speaking students by province in the Appendix, Figure A1). [6]

Table 2 presents the means of our variables separately by language group and gender. To begin with, dialect speakers have lower test scores on both language and math compared to Dutch speakers, although the gap between the 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 age, family composition, whether one has always stayed in the Netherlands, and number of children at home. However, dialect speakers are much more likely to have dialect-speaking parents than Dutch speakers. Parents of around 89% of the dialect-speakers and only around 10% of the Dutch speakers use dialects at home, indicating that the language spoken by students in the second grade is predominantly determined by their parents' language usage. Also, dialect speakers are more likely to have parents with lower educational attainment than Dutch speakers. The proportion of parents with university or higher degrees is around 10 percentage points higher for Dutch speakers than for dialect speakers. And boys have significant higher probability to speak dialects at home with parents than girls, 10.5% versus 9.4%. Thirdly, we find no significant difference in teacher and school characteristics between the 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. Summarizing Table 1 and Table 2, we find that dialect associates with lower test scores of children and lower education level of parents; dialect speakers are mainly from less urbanized areas and certain provinces.[7]

[6] The share of dialect-speaking children in PRIMA survey is lower than that of dialect-speaking population. There is a considerable decrease in the use of dialects between generations and across years (Driessen, 2005).

[7] Note that immigrant children have a lower education level of their parents. For example, while about one-third of Standard-Dutch speaking children has a father with a lower secondary or lower educational attainment this is about 50% for dialect-speaking children and 75% for immigrant children.

Before we move on to our main analysis, Figure 1 compares Kernel density distribution of the test scores of Dutch-speaking students and dialect-speaking students. The top and bottom graphs present language scores and math scores, respectively. Graph (a) presents the distribution of language scores by gender and language group. For both boys and girls, there is not much difference between two language groups in the shape of distribution. But obviously dialect speakers have lower language scores than Standard Dutch speakers, especially for boys. From Graph (b), we find that the distributions of math scores for two language groups are more overlapping than those of the language scores. There is hardly any difference regardless of language usage, and this is true for both genders. Figure 1 only suggests a weak association between dialect-speaking and language scores at the individual level.

We present further similar Kernel density distribution graphs of test scores in Figure 2. In these figures, we compare the test score distribution of classes with a high versus a low share of dialect-speaking students. The "high share" classes are defined to be those with the average share, i.e. 22%, or more. Similarly, "low share" classes are those with less than 22%. It is clear from the upper graph that differences in Dutch speakers' language scores are limited regardless of the share of dialect speakers. The lower graph presents the same pattern for math scores. Figure 2 suggests that the share of dialect speakers at the class level does not seem to explain the differences in test scores for Dutch speakers. The figure also presents the distribution of test scores for dialect speakers. For both language and math scores, the distribution are similar between classes with a high share of dialect speakers and those with a low share. However, dialect speakers from high-share classes seem to have slightly higher math scores.[8]

[8]In the Appendix, we also plot average test scores against the share of dialect speakers at class level. Considering students' self-selection into schools, we demean the average scores and the shares at class level relative to those at school level. In Figure A2, the scatter plots and fitted lines indicate how test scores are correlated to the share of dialect speakers. For both Dutch speakers and dialect speakers, we find the fitted lines are flat. There is no correlation between the share of dialect speakers and average language or math scores.

4 Dialect-speaking and Test Scores

In this section we examine the relationship between dialect-speaking and academic performance. As a baseline, we estimate the following model using OLS:

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

where $Y_{ics,t}$ denotes the normalized test scores for student i in class c and school s at year t. $D_{ics,t}$ equals one if the student speaks a dialect to parents. $X_{ics,t}$ is a vector of all individual characteristics and class characteristics. α_s denotes the school fixed effects and γ_t indicates the 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 months, age squared, gender, a dummy for presence of both parents, a dummy for always having stayed in the Netherlands, dummies for number of children at home, dummies for father's and mother's level of education) and a set of class characteristics reported by teachers (teacher's gender, teacher's year of experience, number of students in class, a dummy for whether the class supports teaching combined with other grades, a dummy for whether the class supports remedial teachers, and dummies for different shares of immigrant students in class). Students may choose schools based on their socio-economic status as well as their spoken language. Therefore, we control for school fixed effects in order to correct for the potential bias that arises from such self-sorting into schools. As indicated in Table 2, 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. Therefore, we control for mother's as well as father's educational attainment.

Table 3 presents the OLS estimates for the effects of speaking dialect on language and math test scores. The parameter estimates are reported separately for boys and girls to account for gender-specific effects. In the first column, only year fixed effects are included. In subsequent columns, we gradually include individual characteristics, teacher characteristics, and school fixed effects in order to investigate how these variables affect our estimates.

In the first column of Panel (a), we find a significantly negative effect of speaking dialect on language scores for both boys and girls. When we add more control variables, the relevant parameter estimates decrease because dialect-speaking is correlated to background variables. Moreover, when we introduce school fixed effects to remove the endogeneity of school choice, we find that speaking dialect with parents significantly decreases boys' language scores by 0.079 of a standard deviation but has no effect on girls' language scores. We interpret the gender-specific effects in the way that boys and girls have different trajectories of language development. At the age of 5, girls may be better at adapting to the new language environment than boys.[9] Panel (b) presents 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, we can compare the magnitude of the estimated effects between subjects. Clearly, the effect of speaking dialect on math score is smaller and less significant than the effect on language score. Moreover, the negative effects of speaking dialects are present only for boys. To conclude, we find a penalty of speaking dialect on academic performance, but this only applies to boys' language scores, which is consistent with our preliminary findings in Figure 1.

It is possible that our results so far suffer from an omitted variable problem, since we may have failed to control for individual unobserved abilities. A student's own ability is likely to affect not only the rate of learning Standard Dutch, but also his academic performance. However, if there are unobserved differences between dialect-speaking and Standard-Dutch speaking children it is hard to see why these would affect language scores but not math scores of boys. Similarly, if unobserved heterogeneity is important it is difficult to understand why this would affect language scores of boys but not of girls. Nevertheless, to investigate this, we present additional results by including students' math test scores as an explanatory variable for the language score. The assumption is that there is no direct effect of dialect-speaking on math scores. The math test is targeted at basic mathematical concepts and reasoning and reflects the innate ability of the children in second grade. Panel (c) of Table 3 shows that there is a significantly negative effect of dialect-speaking on boys' language performance even after taking account of individual

[9] In fact, linguists have long pointed out the superiority of girls in language performance over boys. Murray et al. (1990) present evidence that girls begin talking earlier whilst Roulstone et al. (2002) show that girls accumulate vocabulary faster than boys. The differences in language performance are observed as early as 2-3 years old and into school years (e.g. Lynn (1992); Bornstein et al. (2000); Dionne et al. (2003)). Based on these findings, it may not be so far-fetched to argue that girls adapt better to a new language at the age of 5 or 6 and outperform boys in language tests.

characteristics, teacher characteristics, school fixed effects and their math scores. The parameter estimate of -0.066 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 increases the precision of the estimate. Also similarly to Panel (a), the effect on girls is insignificantly different from zero. All in all, this robustness check supports the idea of a possible causal effect of dialect-speaking on the language skills of children.

Table 4 presents parameter estimates of a sensitivity analysis. As a point of reference, panel (a1) repeats the baseline estimates of Table 3. Panel (a2) shows the effect of dialect-speaking if we include a dummy variable for dialect-speaking of parents. The negative language score effects of dialect-speaking for boys increases in size while the other parameter estimates are not affected. Apparently, if both parents are dialect-speaking the negative effects of dialect-speaking for the language scores of boys are stronger. As discussed in Section 2, the linguistic distance to Standard Dutch differs across Dutch dialects. If it is the case that speaking dialects indeed affects students' language performance, we should observe that the negative effect of dialect-speaking is more prevalent among students whose dialect is farther away from Standard Dutch. Panel (a3) shows the parameter estimates if we exclude the observations from Friesland, the province with a regional language that is the farthest from Standard Dutch. Compared to panel (a2) both the magnitude and the significance of the main parameter estimate for boys is reduced. In Panel (b), we use the interaction term between dialect dummy and the linguistic distance score as the explanatory variable. We interpret the parameter estimates in panel (b1) in the way that an increase of 10 units in the linguistic distance will cause a decrease in the dialect-speaking boys' language score by 0.025 of a standard deviation. Our results indicate that the penalty of speaking dialect on boys' language score increases with linguistic distance. Linguistic distance, however, does not affect girls' language scores or math scores in general. Introducing dialect-speaking of parents as an additional explanatory variable increase the magnitude of the negative effect of dialect-speaking on the language scores for boys. If we then exclude the observations from Friesland the negative effect of dialect-speaking interacted with linguistic distance on language scores is no longer significant for boys. All in all, the parameter estimates of Table 4 suggest that the negative effect of dialect-speaking on the language test for boys is largely but not completely driven by the province Friesland.

5 Spillover Effects of Dialect-speaking

5.1 Set-up of the analysis

In this section we investigate the spillover effects of speaking dialect on peers' performance. As a proxy for the intensity of students' communication in dialects within a classroom, we calculate the share of dialect-speaking peers relative to the total number of peers in each class.[10] We use the shares between 0 and 1 for 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 fewer than 5 students in order 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 discussed in Section 1, we want to investigate whether peers' speaking behavior affects test scores of Dutch-speaking students differently from dialect-speaking students. Motivated by the literature on peer effects, we apply the linear-in-mean model. Our main explanatory variable is the share of dialect-speaking peers at class level, calculated over all students in class and excluding the student of interest. We estimate using the following 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 $Y_{ics,t}$ denotes test scores for student i in class c and school s at year t. $\overline{D_{(-i)cs,t}}$ denotes the share of dialect-speaking peers at class level, excluding individual i. $X_{ics,t}$ is a vector of all individual and teacher characteristics. We control for school fixed effects, α_s to remove the variation explained by school choice. Furthermore, γ_t are year fixed effects, indicating that we control for 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 rely on two assumptions. The first assumption is that the dialect-speaking students are randomly allocated across cohorts within a school. The second assumption requires that dialect

[10] Around 30% of the observations did not report whether they speak dialects. This is because parents of these students did not answer the language questions. In Section 5 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. For further checks, we alternatively defined the share by treating all missing observations either as dialect speakers or as Dutch speakers. However, our results are robust regardless of the definitions used. Results are available upon request.

speakers are randomly allocated into classes if there are two or more classes within a grade in a school. For example, if school directors intentionally allocate more dialect speakers to classes with students of disadvantaged background, the negative spillover effect of dialect speakers will be overestimated. The validity of as well as the tests for these assumptions are discussed in Section 5.2.

A remaining concern regarding 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 is endogenous. For example, dialect-speaking students of higher ability may start using Standard Dutch at home because of exposure to Dutch-speaking classmates and teachers. We assume that the language spoken between children and parents is persistent for young children. We believe that our assumption is valid, since it is unlikely that parents switch from speaking dialects to Standard Dutch when their children have attended primary schools for only one year.

5.2 Random allocation of dialect speakers across classes

We argue that the share of dialect-speaking peers in class is exogenously determined if dialect speakers are randomly assigned into different classes in a grade as well as across cohorts within a school. This implies that the OLS estimate of λ in Equation (2) represents a causal spillover effect of dialect-speaking after we control for school fixed effects.

For 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 the particular school to identify the causal spillover effects. For schools where there are more than one class in the second grade, we rely on the random allocation of students between classes as well as across cohorts.[11] We assume that students are randomly allocated to each cohort within the same school. In addition, we assume that the allocation of students to classes within the same cohort in a school is also randomly determined. There are two reasons why we believe that the former assumption is likely to hold. Firstly, educational disadvantages experienced by dialect-speaking students have not drawn attention in the Netherlands. As a result, it is highly unlikely that Dutch parents would explicitly avoid schools with

[11] In our sample, we have 640 observations from 411 schools and 4 cohorts. Out of these schools, 378 school observations have a single class, 155 have two classes, 54 have three classes, 38 have four classes and 15 have five or more classes.

high shares of dialect-speaking students in previous cohorts. Secondly, school administrators usually have no information about the language spoken between children and parents at home prior to enrolment. Therefore, admission of students should not depend on the languages these students speak. Since each school director can identify whether a particular student in her school is speaking dialect once the student is admitted, allocation of students into second-grade classes may depend on students' spoken language. Therefore, we conduct the following two tests to examine the latter assumption, that students are randomly allocated into classes within the same cohort/school.

First, we perform the Pearson χ^2 test suggested by Ammermueller and Pischke (2009). If the allocation of students is random, the characteristics of each student should be independent of the characteristics of other students in class. For each school, we define n_{cj} as the actual number of students in classroom $c = 1, 2, ..., C_s$ with the subscript $j = 0, 1$, denoting Dutch-speaking and dialect-speaking respectively. We 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 $(C_s - 1)(J - 1)$ degrees of freedom. When further assuming that the allocation of students to each school is independent of any other, we can aggregate the Pearson test statistics. This aggregate follows a χ^2 distribution with $[\sum_s (C_s - 1)](J - 1)$ degrees of freedom. Based on our sample of schools with multiple classes, the aggregate Pearson test statistic is 406 with 453 degrees of freedom. Given the p-value of 0.95, we cannot reject the null hypothesis of random allocation.

Second, as 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 per cohort. The steps of the test are as follows. First, assuming that students are randomly assigned to classes, we calculate the number of schools with n difference in the number of dialect speakers between two classes within the same cohort/school where $n = 0, 1, 2, ..., 13$. We plot this simulated distribution of schools and compare it with the actual distribution which is based on our sample (See more details in Ohinata and van Ours (2013)). If students are indeed randomly allocated, we should observe that the two distributions are similar to each other. This is shown in Figure 3. The p-value for the F-test on the difference between the two distributions is 0.83, indicating that we cannot reject the null hypothesis.

In addition to the random allocation of dialect speakers into classes, we also need to ensure that the 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 5, we regress the share of dialect speakers on teacher characteristics and average background characteristics at class level. We also add school fixed effects and year fixed effects. The first column presents estimates based on the entire sample. The second column includes estimates based on schools with multiple classrooms per cohort. Irrespective of the samples, we find that all control variables except for the share of girls are uncorrelated with the share of dialect speakers. The F-statistics for the joint significance of either average characteristics or teaching resources confirm that these control variables cannot explain the share of dialect speakers at the class level.

5.3 Baseline results

Table 6 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. We include the individual characteristics, teacher characteristics, school fixed effects and year fixed effects as we did in the previous section. The dependent variable in each regression is the test scores after normalization with zero mean and standard deviation of 1. The independent variable of interest is the share of dialect-speaking peers with a range of 0 to 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, all parameter estimates are very small and insignificant. This suggests that the share of dialect-speaking peers in class does not have significant spillover 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 show 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.

It is also of interest to investigate whether having more dialect-speaking peers in the same class/cohort benefit or harm dialect speakers themselves. In Table 6, we also report the estimated spillover effects for dialect speakers. In Column 1 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 0.019 of a standard deviation. However, when we control for individual characteristics, teacher characteristics, school fixed effects and year fixed effects, 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 when more control variables are added. Interaction with more classmates speaking the same dialect neither benefit nor harm dialect speakers.

As 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 background and they may have difficulty in studying the standard language. According to the peer effects literature, disadvantaged students 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 potentially 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 for both groups and both subjects. The negative spillover from dialect speakers can be more or less offset by curriculum in Dutch and sufficient exposure with Dutch speakers.

5.4 Sensitivity checks

Table 7 presents a series of sensitivity checks for the causal spillover effects of peers' dialect-speaking. Panel (a) of Table 7 reports regression results separately for schools with multiple classes and schools with one single class in the second grade. For multiple-class schools, we are using variation both across classes and across cohorts. For these schools, we find that the relevant parameter estimates are larger in size than the baseline estimates but still insignificant. The parameters presented in the second row in Panel (a) are estimated using a sample of schools with a single-classroom and therefore based on across cohort variation. We find that the parameter estimates change substantially due to sample selection, but the estimates are still small and only marginally significant.

In Panel (b), we control for the peers' average individual background characteristics. In the language of Manski (1993), this allows us to account for the contextual effects. This is also to control for the correlation between peers' speaking pattern and their characteristics. According to the estimates, peers' speaking pattern has no effect on academic performance.

Panel (c) reports the spillover effects separately between classes with less or more than 22% dialect-speaking students. Our hypothesis is that negative spillover effects may dominate in classes where more peers use dialects due to more linguistic segregation and less exposure to Standard Dutch. However, in both high-share and low-share dialect-speaking classes, dialect-speaking peers have little influence on individual academic performance, except for a negative spillover effect on dialect speakers' language score at the 10% level.

We also investigate whether spillover effects differ between boys and girls. We regress the test scores of two groups separately on the share of dialect-speaking peers in the whole class. As shown in Panel (d), the spillover effects are small and insignificant for both boys and girls, although the point estimates are generally larger for boys.

In Panel (e), we check heterogeneous spillover effects across provinces. We use the interaction of the share of dialect-speaking peers and the linguistic distance of dialect (divided by 10) as the main explanatory variable, and find no spillover effect no matter how far a dialect is from Standard Dutch.

Finally, 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 in Panel (f) also suggest that there are no significant spillover effects.

6 Conclusion

This paper investigates the importance of language skills on academic performance among young children in the Netherlands. In contrast to the existing literature, which studies this issue by focusing exclusively on immigrant children, we explore the impacts of dialect-speaking on educational achievement. To our knowledge, this is the first paper that addresses this issue by focusing on non-immigrant children. In addition, we are the first to study how dialect-speaking patterns affect educational performance.

Our analysis is based on four cohorts of second grade native students. Using the unique Dutch dataset, PRIMA, we study the effect of dialect-speaking on individual test scores. In addition, we examine the potentially negative spillover effects of peers' dialect-speaking on the academic performance of classmates.

We find that dialect-speaking at home is strongly correlated with parental usage of dialects. It also correlates with province of residence, family background and urbanization level of the location of schools. We find that speaking dialect has a modest penalty on language skills for boys and this penalty increases as the linguistic distance between the students' dialect and Standard Dutch increases. We find no significant effect on language skills for girls. Dialect-speaking does not seem to affect math skills either for boys or for girls. Assuming that dialect-speaking does not affect math skills and including math scores to control for individual ability, we still find a negative effect of dialect-speaking on language scores for boys. For girls, we find no such effect.

We also study the spillover effects of peers' dialect-speaking on academic performance of Standard Dutch and dialect-speaking 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. In the linear-in-mean model, we estimate individual test scores on the share of dialect-speaking peers at class level. Neither of the groups experienced spillover effects and this finding is robust to several sensitivity checks.

Our findings lend support to parents and schools in guiding children's dialect-speaking behavior. The fact that boys are negatively affected by speaking dialect can be related to different trajectories of language development between young boys and girls. We conjecture that the dialect penalty on boys would disappear at later stages of life. In fact, the existing literature on bilingual systems suggests that there exists a wage premium for being proficient in a second language. Unfortunately, we cannot investigate whether or when boys catch up to girls in language performance, since our dataset only records the dialect-speaking information in the second grade and it also suffers from a high rate of attrition across grades. However, this is an interesting and an important question that deserves further attention in the future. Our results also suggest that it is unlikely that speaking dialects would be detrimental to classmates. Imposing interventions such as discouraging children to learn dialects or track students by mother tongue is likely to be unnecessary.

In order to put our findings into the broader context of the educational consequences of language skills, 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 boys lag behind their counterparts in language by 0.08 point of a standard deviation, first-generation immigrant students in the Netherlands perform worse in reading tests 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 partially a result of the lack of cultural differences experienced by dialect-speaking students. It is also possible that the linguistic barriers that dialect-speaking students face are much less severe than those experienced by 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 effect from dialect-speaking students to 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 effect from immigrants to natives. Of course, our study cannot rule out the possibility that the educational consequences of language would be non-negligible in countries where the linguistic barriers experienced by dialect speakers or non-native speakers in general are larger. We leave this question for future research.

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.

Bornstein, M. H., O. Haynes, K. M. Painter, and J. L. Genevro (2000). Child language with mother and with stranger at home and in the laboratory: A methodological study. *Journal of Child Language 27* (02), 407–420.

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

Chin, A., N. M. Dysal, and S. A. Imberman (2013). Impact of bilingual education programs on limited English proficient students and their peers: Regression discontinuity evidence from Texas. *Journal of Public Economics 107*, 63–78.

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.

Christofides, L. N. and R. Swidinsky (2010). The economic returns to the knowledge and use of a second official language: English in Quebec and French in the rest-of-Canada. *Canadian Public Policy 36*, 137–158.

Di Paolo, A. and J. L. Raymond (2012). Language knowledge and earnings in Catalonia. *Journal of Applied Economics 15* (1), 89–118.

Dionne, G., P. S. Dale, M. Boivin, and R. Plomin (2003). Genetic evidence for bidirectional effects of early lexical and grammatical development. *Child Development 74*(2), pp. 394–412.

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.

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.

Ginsburgh, V. and S. Weber (2015). Linguistic distances and their use in economics. CEPR Discussion Paper 10640.

Grogger, J. (2014). *Speech and Wages.* University of Chicago.

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.

Isphording, I. E. and S. Otten (2013). The costs of babylon?linguistic distance in applied economics. *Review of International Economics 21*(2), 354–369.

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.

Lynn, R. (1992). Sex differences on the differential aptitude test in british and american adolescents. *Educational Psychology 12*(2), 101–102.

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

Murray, A. D., J. Johnson, and J. Peters (1990). Fine-tuning of utterance length to preverbal infants: Effects on later language development. *Journal of Child Language 17*(03), 511–525.

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.

Roulstone, S., S. Loader, K. Northstone, and M. Beveridge (2002). The speech and language of children aged 25 months: Descriptive data from the avon longitudinal study of parents and children. *Early Child Development and Care 172*(3), 259–268.

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 and the share of dialect-speaking students in PRIMA

Province	Linguistic Distance	Dialect Speakers (%)	Number of Students
Drenthe	19	18.8	756
Flevoland	12	3.3	332
Friesland	37	39.0	1,346
Gelderland	28	2.8	2,801
Groningen	28	10.0	807
Limburg	32	53.0	1,816
Noord-Brabant	28	3.0	3,811
Noord-Holland	12	1.4	4,104
Overijssel	29	7.2	1,276
Utrecht	18	1.4	767
Zeeland	29	18.6	825
Zuid-Holland	12	0.4	3,573
Total	22.5	10.1	22,214

Source: Van Bezooijen and Heeringa (2006) and PRIMA Survey.
Note: In Column 1, the linguistic distances between various dialects spoken in each province and Standard Dutch are shown. The larger the value of the index, the more distant a dialect is from Standard Dutch. The weighted average linguistic distance is 22.5. In Column 2 and 3, we present the share of dialect-speaking students based on our sample for analysis. The shares are very similar based on the combined sample of native students and immigrants in the 2nd grade.

Table 2: Means of variables by language group and gender

	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
Dialect-speaking 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	16.4
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 sample of native students from 4 cohorts 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 3: Effect of dialect-speaking on test scores

	(1)	(2)	(3)	(4)
a. Language scores				
Boys	-0.123***	-0.053	-0.064**	-0.079**
	(0.034)	(0.032)	(0.032)	(0.036)
Girls	-0.102***	-0.024	-0.037	-0.008
	(0.036)	(0.034)	(0.034)	(0.042)
b. Math scores				
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				
Boys	-0.054**	-0.026	-0.035	-0.066**
	(0.027)	(0.027)	(0.027)	(0.031)
Girls	-0.081***	-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 in each regression is a dummy which equals 1 if the student speaks a dialect to his/her father or mother at home. In Panel (a) and (b), we control for individual characteristics, teacher and class characteristics, school fixed effects and year fixed effects. In Panel (c), all regressions include the math score as an independent variable. The number of boys in our sample is 11,832 and the number of girls is 10,987. Absolute t-statistics, which are based on the clustered standard errors at the class level, are shown in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Parameter Estimates Speaks Dialect at Home; Sensitivity Analysis

	(1)	(2)	(3)	(4)
Variables	Language scores		Math scores	
	Boys	Girls	Boys	Girls
a. Speaks dialect at home				
1. Baseline estimates	-0.079**	-0.008	-0.026	0.034
	(0.036)	(0.042)	(0.040)	(0.043)
2. Including dialect-speaking parents	-0.124***	-0.035	-0.070	0.011
as explanatory variable	(0.040)	(0.047)	(0.046)	(0.048)
3. Excluding Friesland	-0.085*	-0.022	-0.043	0.036
	(0.044)	(0.053)	(0.049)	(0.053)
b. Interacting with linguistic distance (/10)				
1. Speak dialects at home	-0.025**	-0.005	-0.009	0.005
	(0.012)	(0.014)	(0.013)	(0.014)
2. Including dialect-speaking parents	-0.040***	-0.013	-0.025	-0.005
as explanatory variable	(0.014)	(0.016)	(0.015)	(0.016)
3. Excluding Friesland	-0.023	-0.000	-0.015	0.007
	(0.016)	(0.019)	(0.018)	(0.018)

Note: The dependent variables are normalized scores. Panel (a1) repeats the parameter estimates of Table 3 column (4) panels (a) and (b). In Panel (b), the independent variable of interest is the interaction of the dummy for speaking a dialect at home and linguistic distance of the dialect divided by 10. In all panels, we include individual characteristics, teacher and class characteristics, school fixed effects and year fixed effects. Absolute t-statistics are based on the clustered standard errors at the class level and are shown in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Random assignment of teaching resources and Dutch-speaking students; share of dialect-speaking students in the classroom

	(1)	(2)
	All	Multiple classes
Share of girls in class	0.054**	0.040
	(0.026)	(0.027)
Average age in month	-0.180	-0.176
	(0.241)	(0.243)
Share of students from complete families	-0.040	-0.235
	(0.042)	(0.042)
Share of students who always stay in the Netherlands	0.015	0.008
	(0.053)	(0.056)
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. 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 classes in the second grade. Absolute t-statistics are based on the clustered standard errors at the class level and are shown in parenthesis. All the estimates include year fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Spillover effects of dialect-speaking on test scores

	(1)	(2)	(3)	(4)
a. Language score				
Dutch speakers	0.020	0.031	-0.018	-0.047
	(0.082)	(0.078)	(0.077)	(0.166)
Dialect speakers	0.191**	0.038	-0.000	-0.192
	(0.090)	(0.083)	(0.086)	(0.213)
b. Math score				
Dutch speakers	0.000	0.014	-0.003	-0.192
	(0.091)	(0.087)	(0.088)	(0.189)
Dialect speakers	0.195*	0.057	0.017	-0.049
	(0.101)	(0.097)	(0.098)	(0.202)
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 the share of dialect-speaking peers in class. In all panels, we include individual characteristics, teacher and class characteristics, school fixed effects and year fixed effects. The number of Dutch speakers is 7,149 and the number of dialect speakers is 2,262. Absolute t-statistics are based on the clustered standard errors at the class level and are shown in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Sensitivity Checks: Estimates of spillover effects

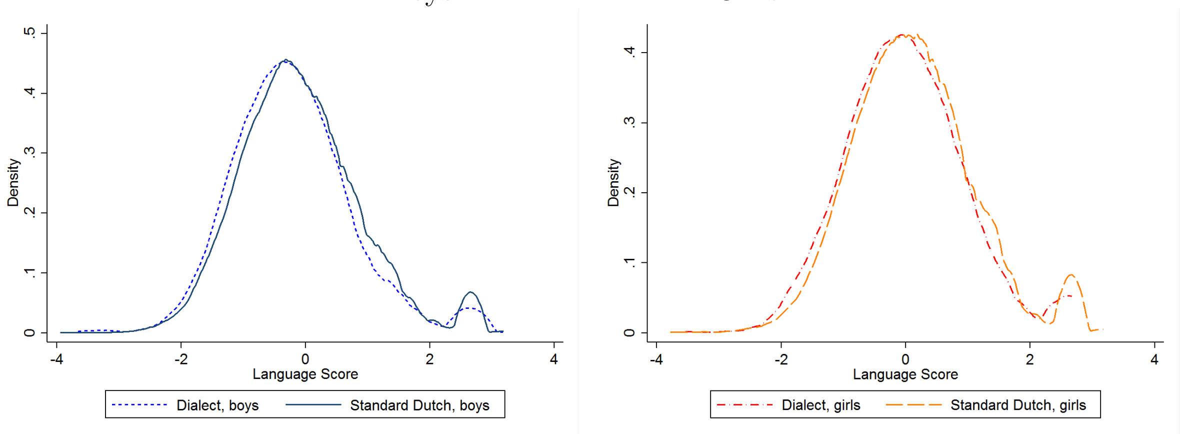
	Language score		Math score	
	Dutch speakers	Dialect speakers	Dutch speakers	Dialect speakers
	(1)	(2)	(3)	(4)
a. Multiple-class and single-class samples				
Multiple-class	-0.118	-0.359	-0.266	-0.275
	(0.187)	(0.248)	(0.200)	(0.198)
Single-class	0.225	0.139	0.270	0.771*
	(0.338)	(0.474)	(0.353)	(0.394)
b. Controlling peers' background characteristics				
Whole sample	-0.034	-0.123	-0.197	-0.037
	(0.164)	(0.215)	(0.188)	(0.203)
c. High share and low share samples				
High share class	-0.056	0.037	-0.711*	0.142
	(0.354)	(0.188)	(0.370)	(0.216)
Low share class	0.012	0.439	0.231	-0.781
	(0.285)	(2.080)	(0.273)	(2.270)
d. Gender heterogeneous effects				
Boys	-0.088	-0.417	-0.347	-0.216
	(0.238)	(0.306)	(0.231)	(0.242)
Girls	-0.130	-0.018	-0.070	0.150
	(0.232)	(0.288)	(0.250)	(0.314)
e. Independent variable: Share of dialect-speaking peers interacts with linguistic distance				
Whole sample	-0.030	-0.066	-0.088	-0.016
	(0.057)	(0.065)	(0.066)	(0.065)
f. Independent variable: Number of dialect-speaking peers				
Whole sample	-0.005	0.002	-0.021	-0.024
	(0.017)	(0.019)	(0.025)	(0.024)

Note: The dependent variable is normalized scores, except for Panel (f). The independent variable of interest is the share of dialect-speaking peers in class, except for Panel (e) and Panel (g). In all panels, we include individual characteristics, teacher and class characteristics, school fixed effects and year fixed effects. Absolute t-statistics are based on the clustered standard errors at the class level and are shown in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: Distribution of test scores by language spoken at home

a. Language score

Boys Girls



b. Math score

Boys Girls

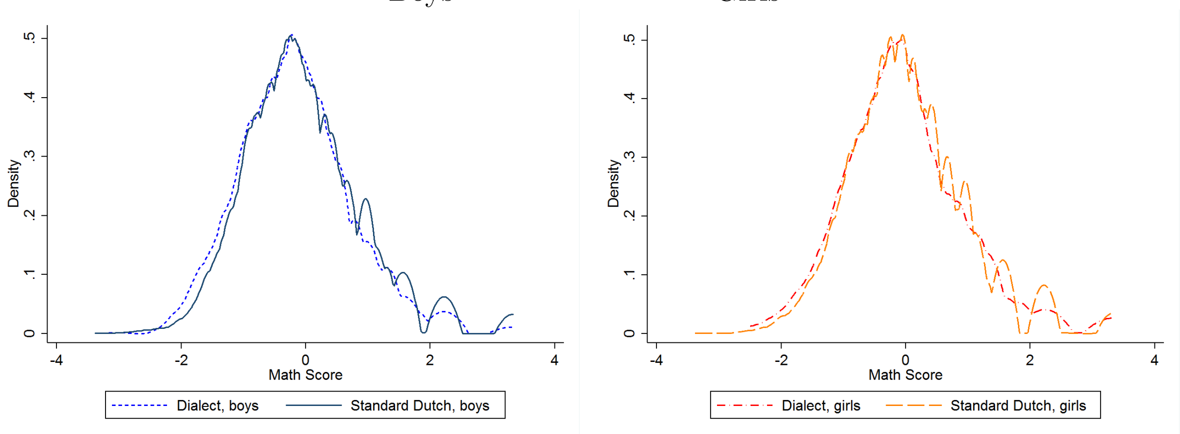
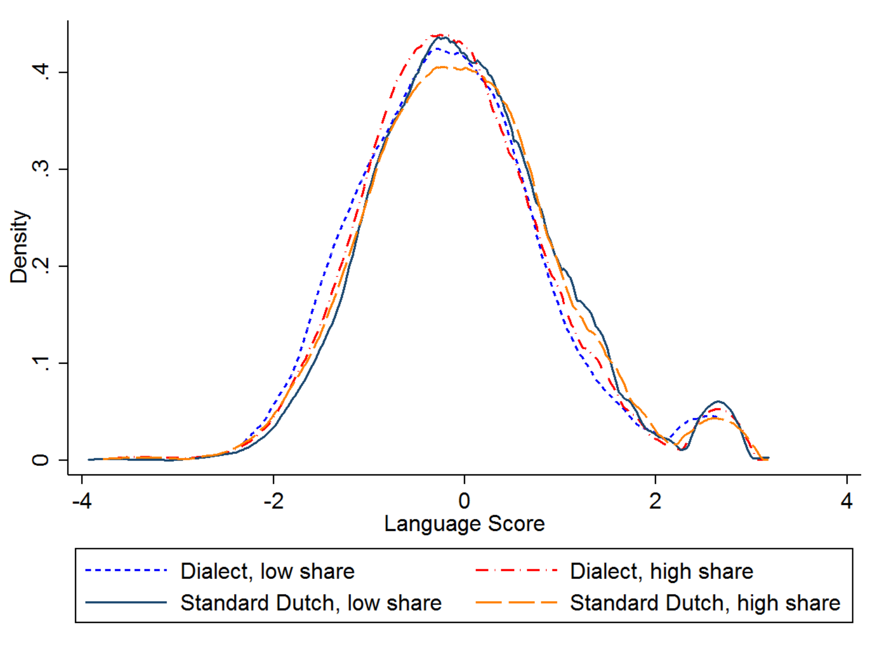


Figure 2: Distribution of test scores by share of dialect speakers (low–high) and language spoken at home

a. Language score



b. Math score

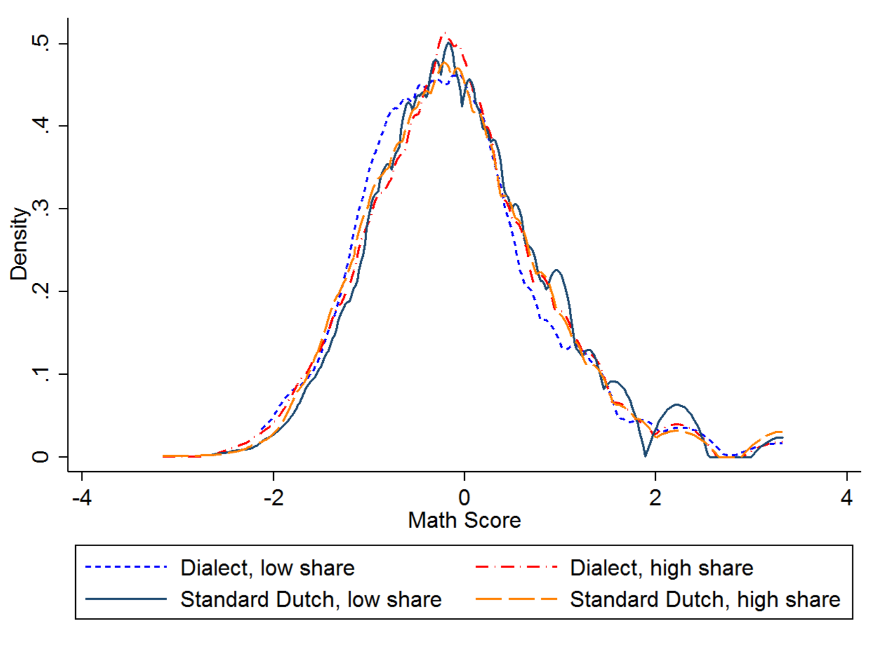
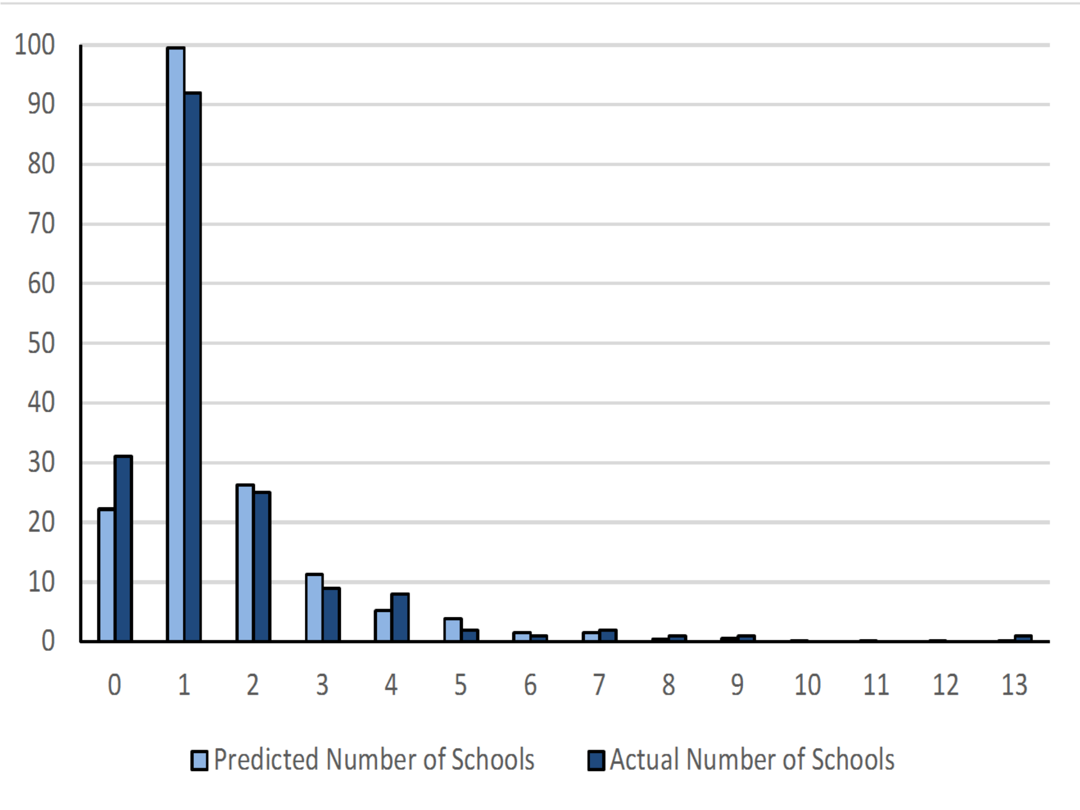


Figure 3: Random allocation of dialect-speaking students between 2 classes in one grade; difference in number of dialect speakers between two classes in one grade



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 $n = 0, 1, ..., 13$.

Appendix

Figure A1: Map of the Netherlands by province

a. Dialect-speaking students (%) b. Levenshtein linguistic distance

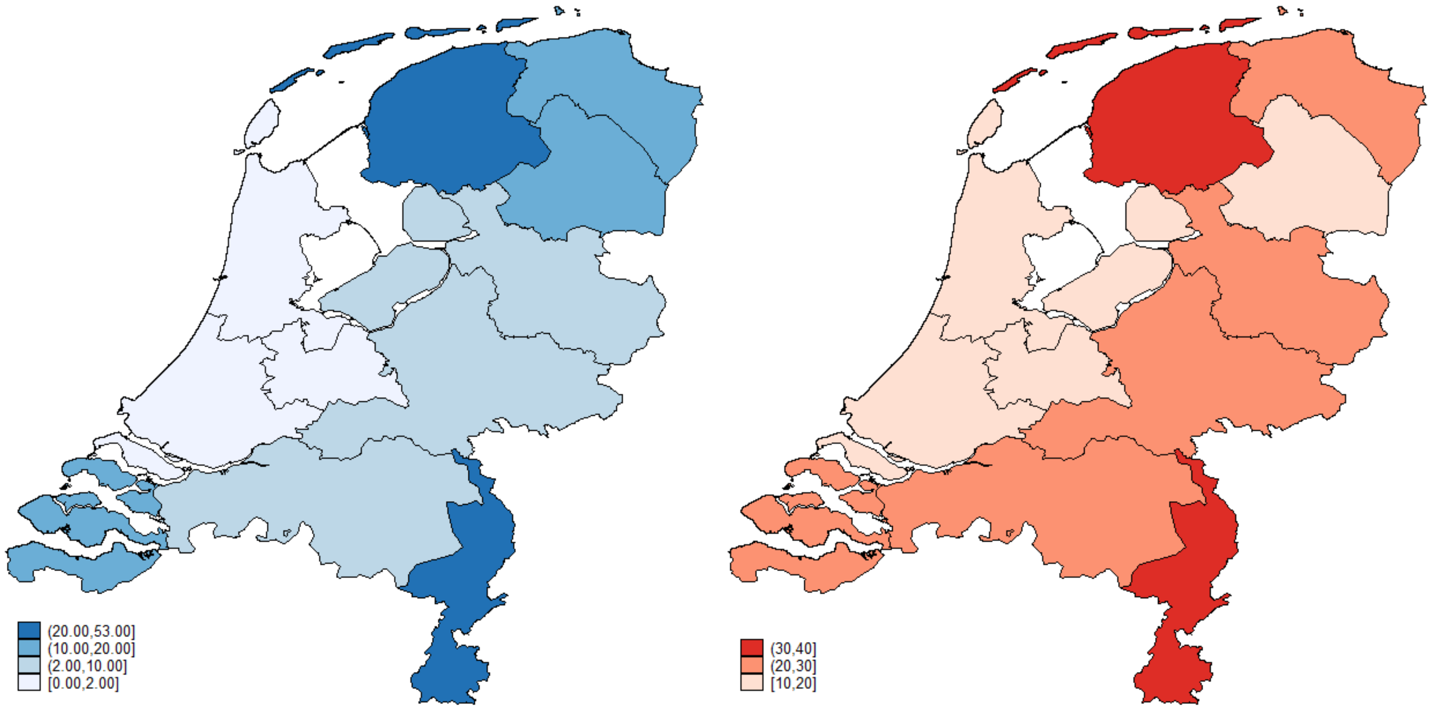
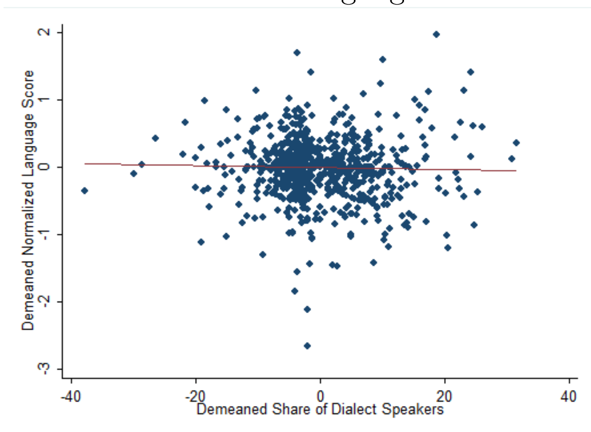


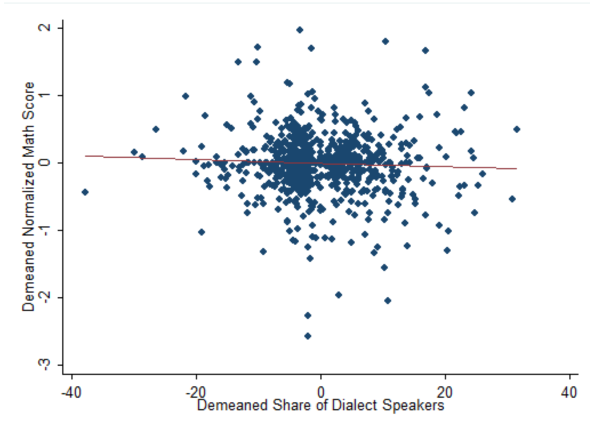
Figure A2: Class-level average score after within transformation and share of dialect-speaking students in class

a. Dutch-speaking students

Language score

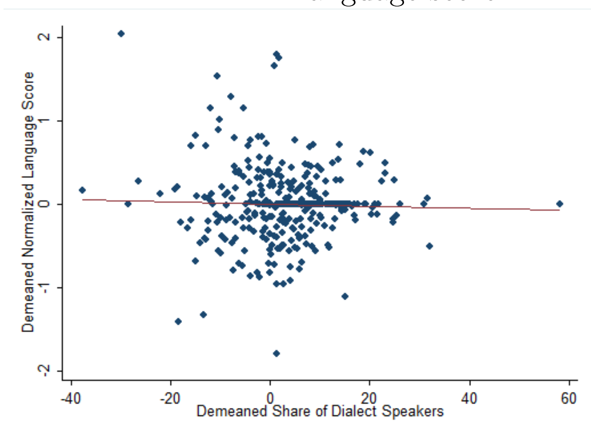


Math score



b. Dialect-speaking students

Language score



Math score