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ABSTRACT

Immigrant Peers and Foreign Language Acquisition*

Immigrants change the school environment. A focus has been on negative spillovers on native students' educational attainment. Yet, exposure to immigrant peers has the potential for a wider range of effects. This paper examines effects on foreign language acquisition focusing on Norway. In Norway all students are taught, and are assessed, in English from an early age. We demonstrate that exposure to native English-speaking peers increase Norwegian students' English language skills. We provide evidence that these spillover effects likely occur outside of the classroom. They are solely present for English language skills and provide evidence of positive spillovers from immigrant diversity in schools that is missing from the existing literature. Our results have implications for the wider social effects of immigration and how foreign languages are taught in schools.

JEL Classification: J15, I21

Keywords: immigration, English language attainment, educational attainment

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I. INTRODUCTION

Immigration changes society including school environments. This has led to a now large literature on how immigrant children peers, who themselves face educational difficulties, affect the core skills of native children (see for instance Figlio and Özek, 2019; Bossavie, 2020; Figlio et al, 2021; Green and Iversen, 2022, and Morales 2022, amongst many others). Yet, the changes in the composition of school classes that follow increased immigration has potentially wider effects on child outcomes across domains that may be difficult to measure. As an example, a core argument for public schooling relates to increased tolerance, social capital and social cohesion (Dee 2004, Milligan et al. 2004) which may be influenced by the degree of diversity in the classroom. Along these lines, exposure to children from immigrant backgrounds who differ in culture and life experiences may have implications for the development of civic behaviour and social capital of school children (Bandiera et al, 2019).

One way immigrant children differ is the set of language skills they possess. In some cases these may languages not widely spoken within the host country and where exposure to these languages may only have a very limited, diffuse, role in native students' wider educational development. In many cases, however, these languages may form part of a set of additional languages learnt actively by native children within schooling and/or prioritised by educational authorities. There exist many such examples including Spanish in the US or French in the UK. Notably, English is prioritised across a wide variety of countries where it is not the first language, but where it is actively taught throughout school due to its perceived value as an international language. These include, but are not limited to, Nordic countries.

Exposure to mother tongue speakers of foreign languages is known to accelerate language learning. Beyond the direct benefits of learning other languages, there is a growing emphasis in education policy on the benefits of bilingualism to cognitive development

(Bleakley and Chin 2008; Cappellari and Di Paolo, 2018), and it has been shown that bilingualism leads to higher wages (Ginsburgh and Prieto-Rodriguez, 2011), while, for instance, foreign (English) language use increases labour market earnings in Germany (Stöhr, 2015).[1] It is difficult, however, in most settings to estimate any spillover effects on foreign language acquisition from exposure to mother tongue speakers. This reflects a range of factors including the fact that studying these languages may be voluntary, students are able to choose which language to study, and that these language skills do not form part of core educational assessment and hence are not uniformly tested.

This paper exploits the institutional setting of Norway to explore how exposure to native speakers influences English language acquisition. Norway provides an informative setting for a range of reasons. In Norway, all children study English as a second language from early primary school on and there is universal testing of these language skills. This, when coupled with the recent changes in immigration patterns in Norway and highly disaggregated register data, provides an opportunity to examine language acquisition spillovers from native English speaking background (ESB) immigrant children to native Norwegian children.

Our main approach is to estimate the effect of school-grade variation in English speaking background immigrant children on the English attainment of Norwegian children. This approach identifies effects on-the-basis of demographic variation in immigrant children. This leaves a range of potential biases that may undermine the interpretation of our key estimates. We control for shares of immigrant children (both children of economic immigrants and children from refugee backgrounds), such that our identifying assumption is that holding immigrant shares constant, whether a given immigrant student is from an ESB

[1] There is also a long standing (but not large) literature that seeks to examine the effect of bilingual instruction programs in schools on educational attainment. These find mixed results, ranging from positive effects (Pope, 2008) through to substantial negative effects on core skills attainment, see for instance Jepsen (2010) and Anghel et al (2016).

background (or not) is as good as random from the perspective of their native school colleagues. We explore potential violations of this assumption. One particular concern is that ESB children could be positively selected relative to other immigrant children. Hence, any effect on English language attainment may be a more general positive peer spillover. Here, we use test score information on two additional subjects tested at the same time as English, namely Norwegian and Mathematics. If ESB peers are, on average, high quality peers one would also expect spillovers in other test score domains.

Our main result is that Norwegian primary school children exposed to English speaking peers exhibit higher educational attainment in English. These effects are robust to a range of different approaches aimed at identifying the language background of immigrants. Moreover, we demonstrate that this is not a broader peer-ability effect reflecting, for instance, the positive selection of English-speaking background immigrant children in general. Exposure to immigrant children who have English as their mother language generates positive effects on Norwegian school peers, but a zero effect on their Norwegian language and math attainment. This fits with descriptive evidence we present that shows that while English speaking background immigrant children themselves perform markedly better on English tests, they exhibit average performance in math and a distribution of math performance that is similar to Norwegian students. A question is how these spillovers occurr? We provide further evidence demonstrating that these peer effects occur solely within same gender peers, and only for Norwegian children above average competence in English. One interpretation of this is that these spillovers occur through children's interactions outside of English language classes through, for instance, playground interactions.

Our results suggest important positive spillovers from immigration largely absent from the previous literature. While our results co3me from a particular setting, we argue that they

have implications for immigration policy and the effects of diversity in schools in a wider range of countries. In addition, there are implications for how non-native languages are taught within schools and, in general, learned by children. For instance, our results suggest that immigrant peers could operate as valuable educational inputs in certain learning domains but that this likely is reliant on interaction outside of classrooms. More generally, we take our results as being indicative of a range of potential effects of greater diversity on educational outcomes that, while difficult to measure, may be societally important and should more clearly form a focus of the debate on the effects of immigration.

II. BACKGROUND, INSTITUTIONAL DETAILS and DATA

English is compulsorily taught in Norway from an early age throughout compulsory schooling (to age 16), reflecting a view that it is an essential skill for all children. At the same time for many children English is never or rarely spoken outside of school (or even outside of English class), children's tv and movies are typically dubbed into Norwegian, and in practice there is large variation in the English language ability of adult Norwegians. This reflects the fact that Norwegian remains the main language of everyday family, leisure and work life.

At the same time, Norway has recently experienced a dramatic increase in immigration from a low base. This has included a shift away from previous immigration patterns which were heavily drawn from neighbouring countries with similar languages to Norwegian to a broader range of immigrants including from English speaking countries. Prior to the 1990s, Norway had a very small immigrant population (approx. 3.8 % of the total population in 1989), and a large share were European economic immigrants. Economic immigration has increased markedly over the past 3 decades, for example increasing from 2,400 entrants in 1993 to 26,700 in 2011, but down to 16,000 in 2019, and with changes in the countries of origin. Naturally, economic immigrants are free to choose where they live within Norway

(refugees are not – see Green and Iversen 2022). While there is a greater concentration in major cities, there remains a substantial spread across Norway, and ultimately we are able to demonstrate that our estimates hold outside of the major cities where sorting may be the most acute.

There exist several institutional features that are additionally advantageous for our papers. In our period of analysis, and since 1997, school is compulsory for children aged 6-16 in Norway. There is no ability school tracking system in compulsory schooling. While a small number of municipalities have some free school choice, in practice Norwegian students go to their local school with other children resident in the same area. The number of private primary schools is very low and in our period of analysis less than two percent of Norwegian children attend private schools. Public schools are obliged to take all students from a predefined catchment area that is rarely changed.

Our data on test scores comes from the Norwegian Directorate for Education (UDIR). Norwegian students are tested in reading in Norwegian, reading in English and mathematics in 5th grade, 8th grade and 9th grade. We focus on 8th grade scores (corresponding roughly to age 14) for a number of reasons. First, these tests occur approximately one month upon entry into middle school (ungdomsskole). This leads us to use class composition in primary school as the main measure of peer exposure. This combined with earlier test scores allows us to explore alternative approaches to categorising ESB immigrant school children (more below). At the same time, focusing on year 8 allows us to examine longer term effects of peer exposure on later education outcomes. One complicating factor with the year 5 test scores is that, for technical reasons, the English language test was not conducted in 2011.

English is taught in Norwegian schools from the start of primary school (barneskole) which commences at the year children turn 6. While it is in principle possible to delay school entry, in practice this is very uncommon: 98.6% of school children start in the ‘correct’ year. There

is also a strong emphasis on social progression such that grade retention is also extremely rare. English language forms a compulsory part of instruction across all years of compulsory schooling, and through to the academic track of high school (age 16+).

We standardise test scores to mean 0 and standard deviation of 1 for each year. Our population of analysis is all Norwegian eighth graders for 2010 to 2015 inclusive[2], except for a very small number of students who are exempted from tests for other reasons such as special educational needs. This provides nine cohorts of between 50 000 and 60 000 students every year. We observe in which grade students are in within a given school and year, but not their class. Hence all measures of composition are at the school-year level.

This test score data is merged with individual information and family information from Statistics Norway. The family information includes parental education, income and a range of other standard family background variables. Information on schools such as enrolment, school type and other characteristics of the schools, are drawn from an administrative system (Grunnskolens informasjonssystem, GSI). This information is collected annually. In addition, we observe a range of information regarding students from an immigrant background. Of importance is the information on reasons for immigration and source country. We observe if an immigrant came to Norway as a refugee, asylum seeker, for family reunion or for work. Our approach is to assign refugee status to a child if they or either of their parents entered Norway originally as a refugee or asylum seeker. This aims to capture, for instance, the relatively common case in Norway where the first entrant was a refugee but where the other parent and/or the child themselves entered for the purposes of family re-union. Other immigrant children are those who have at least one parent born overseas who originally came to Norway for work or education. Our focal group is Norwegian born children who have two parents who were also born in Norway.

[2] National testing was first introduced in 2007.

Importantly, we observe country of origin and we use this as our first way of determining language background of children. Our initial approach assigns a student to being from an English Speaking Background if they or at least one of their parents (who they live with in Norway) is from one of the English speaking countries specified in Appendix A1. These children are, in practice, drawn from the group of non-refugee immigrant children. Naturally, our approach is likely to generate measurement error. In our results, we explore a range of alternative classification approaches where the main message is that our results are robust to these. Appendix Table A2 provides descriptive statistics on the key variables in our analyses split according to the immigrant status of children.

Immigrants, in general, gain lower test scores than Native students, but this is particularly marked for children from a refugee background. Refugee children perform markedly worse across all test scores than other immigrants and native students. On average non-immigrant Norwegian 5th grade students are in school grades where 3.8% of students are refugees and 4.2% are other immigrants.

Figure 1 provides information on differences in English, Norwegian and Mathematics test score performance according to whether students are Norwegian, English-Speaking Background (ESB) Immigrants, Non-English Speaking Background (NESB) immigrants, or children from a refugee background. The first panel clearly demonstrates that the average ESB immigrant outperforms all other students in English tests and are, in general, substantially over-represented amongst the highest performers. There is little difference between Native and NESB students. A key question is whether these differences area likely to reflect overall ability or socio-economic differences across these student groups recalling the differences in, for instance, parental background observed in table A2. Here the plots for both Mathematics and Norwegian are informative. The mathematics plot demonstrates little, if any, difference between ESB immigrant children and native children, while NESB

children perform worse. A similar picture is revealed from the plot of Norwegian scores. These suggest little difference in average performance between ESB and Native performance in areas other than English. This suggests that ESB students are uniquely better in English language skills. Nevertheless, we later explore the potential for spillovers in other subjects.

INSERT FIGURE 1

III. EMPIRICAL STRATEGY

Our main estimating equations are variants of the following:

$$A_{ist} = \alpha_0 + \alpha_1 ESB_{st} + \alpha_2 Imm_{st} + \alpha_3 Refugee_{st} + \beta' \boldsymbol{X}_{ist} + \delta_s + \gamma_t + u_{ist} \quad (1)$$

Where A_{ist} is student achievement for individual i at the beginning of grade 8. We regress this on exposure to immigrant peers in the primary school they attended, where practically this means that all relevant immigrant characteristics and individual controls are measured at grade 5 (the previous observation in the registers). Hence, ESB_{st} is the number of ESB students in grade 5, at school s and time t. We additionally control for IMM_{st} and Ref_{st}, the share of immigrants and refugees, respectively. This means our main estimates are the effect of primary school exposure (year 5) to immigrant peers on educational attainment upon entry into middle school (start of year 8). When combined with the inclusion of year 5 school fixed effects (δ_s) our estimates of interest come from within school-cohort variations in the number of ESB students holding constant the share / number of both immigrant and refugee students. Hence the identifying assumption is that, for a given share of immigrants and refugees in a class, it is as good as random if a given immigrant is from an English-Speaking Background. X_{cst} is a vector of time varying school cohort characteristics. γ_t is the year fixed effect, while u_{ist} is an error term. We cluster standard errors at the school-year

level. We estimate (1) and all models only for native students: students born in Norway with two Norwegian born parents.

There are two broad categories of threats to identification. The first group is any failure of our key assumption that ESB student exposure is as good as random holding constant immigrant shares. This would include any form of selective ESB enrolment patterns with respect to native students or any differential mobility patterns of native students by ESB type. We seek to examine the potential for this to be a salient issue in our robustness section below.

The second category reflects issues of interpretation of our key estimates even given that these assumptions hold. ESB students may differ from other immigrant students in ways that more broadly influence the educational performance of their classmates. For instance, even if their assignment to school cohorts is as good as random, we may estimate a broader ESB immigrant effect that does not (just) reflect their differential language skills. Again, this is difficult to rule out. Our main approach is to estimate analogues of (1) for our two other test scores, mathematics and Norwegian. If, for instance, ESB students are simply higher quality peers we should observe spillovers across other domains of educational attainment. Beyond this, we explore a range of measurement issues related to the classification of immigrant children, particularly with respect to ESB. Whilst, important in their own right these also serve to clarify that it is the English language skills of immigrants that are likely driving our results.

IV. RESULTS

Table 1 presents initial estimates of (1) for the English test score performance of Norwegian students. All estimates include school fixed effects such that they provide the effect of within school variation in ESB students on the English test scores of Norwegian students.

We initially provide estimates for the number of ESB students in the grade and these are reported in column (1). This has a positive, weakly significant, effect on Norwegian students' English test score performance. A one ESB student increase leads to an average 0.004 of a standard deviation increase in English test score performance. This is small but potentially non-trivial when one remembers that we are estimating average effects over whole school grades.

One might, however, expect there to be non-linear effects of ESB peers and an advantage of our data is to be able to provide estimates for finer cuts. Column (II) provides estimates where disaggregate ESB peer exposure to one ESB student, two ESB students, and more than two ESB students. These estimates highlight two points. One, we retrieve substantially larger effects of having at least two ESB students in the school grade on English language performance.[3] Two, it suggests that the small weakly significant effects of reported in the first two columns reflect the combination of a lack of any effect for having just one ESB, and larger effects for more substantial numbers of ESB peers. This, we argue, is a strength of our register data, the ability to retrieve precise estimates of this form. As a result, in much of our following estimates for English language performance we focus on specification (II).

INSERT TABLE 2

One issue is that these ESB effects may simply reflect that these students are in general high ability peers, even while Figure 1 suggests that they differ primarily in English language skills. At the same time, these effects on English could reflect other factors. For instance, these students could locate in schools where overall test score performance is generally improving (or avoid schools where they are worsening), or their parents locate in residential

[3] We stress that we do not directly observe peer interactions, hence one could consider these reduced form estimates and all that follow as lower bounds of the true effect of actual exposure to ESB peers on English language attainment.

areas which are changing in terms of their demographics in ways that change school test score outcomes. In all cases, this would lead us to expect that changes in the composition of ESB peers should lead to general increases in test score performance across subjects. To explore this, Table 2 reports analogous estimates to those reported in Table 1, but for mathematics and Norwegian test performance.

For mathematics (I and II) this reveals no effect of having ESB students as peers. This is true for both the number of ESB students (I) and when we split this according to different amounts of ESB students (II). Note that one alternative reason why we might detect effects is if improvements in English language skills spillover to improvements in mathematics performance. While we cannot explore this, we note again that mathematics is taught wholly in Norwegian making this less likely. We demonstrate similar zero effects for Norwegian language performance (III and IV).

The key point from Tables 1 and 2 is that ESB student peers lead to higher English language performance amongst Norwegian students, and that this effect on learning is domain specific. We detect no effects on mathematics or Norwegian language performance.

INSERT TABLE 3

One natural question is whether these average effects hide substantial hetereogeneity according to student type. Table 3 provides estimates where we split the samples according to demographic differences that are often viewed as conditioning learning outcomes. The improvements to English language skills are quite similar across girls and boys, but there is an indication that exposure to English language speakers is more beneficial for Norwegian children with lower educated parents. This would fit with these children being less likely to be exposed to English in the home.

ROBUSTNESS

We next seek to explore a range of concerns and issues regarding the interpretation of our main results.

First, is the role of mobility. Are there any mobility patterns such that Norwegian students who are more motivated or able are more likely to attend school with ESB students? Note again that the pattern of our results means that this would have to solely reflect English ability and/or interest, rather than for instance wider academic ability, and our main estimation approach would require this to occur within schools over time.

INSERT TABLE 4

As a first step, we explore this in Table 4 which reports a variant of our main estimates where we additionally include a control for the Norwegian students' year 5 English test score performance. Hence, we seek to control for Norwegian students' prior level of English skills which naturally is a strong predictor of their year 8 test score performance. Yet, our main ESB estimates of interest are essentially unchanged by this, and in fact they become slightly larger for more than 2 ESB students.

We next investigate whether exposure to ESB students in year 5 is predictive of non-random mobility afterwards. One way we are able to do this using our data is explore whether exposure to ESB peers in year 5 is predictive of attending a school other than the 'standard' middle school a child from a given primary school would attend. We can observe this as given middle schools draw on a range of feeder primary schools. We report estimates in the second column of Table 4. While there is one weakly statistically significant estimate, we stress the small size of this effect. Being exposed to 2 ESB students, increases the probability of going to a different school by approximately 3 quarters of one percentage point, while there is no statistically significant effect for more than 2 ESB students.

A more general, but related, concern reflects the concentration of ESB students in specific schools or locations, and that these schools may vary in important unobserved ways that are time-varying. We examine two key issues. One, while we have already excluded the small number of international schools that have very high concentrations of English-speaking students, we further examine whether our results reflect remaining schools with high shares of ESB students. In Table A3 we report estimates where we sequentially remove school-year observations with more than 10 ESB students (I) and more than 5 ESB students (II). Our main results are essentially unaffected by this. Related to this, ESB students are concentrated in the major cities. In Table A4 we investigate excluding the 4 biggest cities in Norway where this concentration is most acute, Oslo, Bergen, Trondheim and Stavanger. Our main estimates are unchanged by this. In unreported estimates, we also simply excluded all major cities, while this hurts precision the estimated coefficients of interest were qualitatively unchanged.

Perhaps schools in areas with increasing amounts of economic immigrants are becoming in generally more international. While controlling for other immigrant shares is helpful, we can go further by re-estimating our main models of interest but instead including indicators for an alternative group of economic migrant children. Specifically, we replace our indicators of ESB peers with students from a romance language background.[4] These students are slightly less prevalent than their ESB counterpart. For instance, 1.47% of students are from these backgrounds compared to 2.26% for ESB immigrants, and there are on average 2.13 romance language students per school-year compared to 2.80 for ESB students. We report these estimates in appendix table A5. These suggest no effect of romance language students on native student English attainment. There are two implications of these results. First, our main results do not simply reflect growing internalization in a given area / school. Second, it

[4] Specifically, all children from France, Italy, Spain, Portugal, Central and South America.

may be that Norwegian and immigrant students who have weaker Norwegian skills may be more likely to communicate in English. If this does occur, this communication between non-native English speakers does not appear to change Norwegians' English language skills.

Another set of concerns relate to the definition of ESB students. While the patterns in, for instance, Figure 1 are strongly suggestive that we are identifying immigrant students from an ESB background we recognize that we are not able to directly observe language background of children and that alternative definitions are possible. As a first step, we simply re-estimate our preferred specification changing the distributional cut we use to define ESB. Table A5 presents estimates where instead of classifying ESB on the basis of 60% speaking English, we alternately use 50% and 70%. These demonstrate that the general patterns remain, but perhaps becomes somewhat weaker as we move to looser definitions (50%). This fits with a view that doing so introduces more measurement error as any given immigrant family may be less likely to be truly English speaking.

TABLE 5

A related issue is that while we observe ESB students from a variety of countries of origin, they are (not surprisingly) dominated by a handful of these. As a result, the effects we observe could reflect idiosyncratic factors with respect to particular groups of immigrant children. Our approach to examining this is to provide estimates of our main model of English achievement where we stepwise remove each of the ESB countries with the largest number of students. These estimates are reported in Table 5. These demonstrate essentially no effect of the removal of any of these countries. This suggests that our effects do not, for instance, reflect the effects of particular ESB immigrants, and instead provide the general effect of exposure to ESB peers.

An alternative approach to classifying ESB is to, rather than rely on country of origin, use 5th grade scores in English as an indicator of language background of immigrant children. Table 6 presents a range of estimates of the effect of ESB peers on native English performance at grade 8 where we use alternative measures derived from immigrant year 5 tests scores. These are the number of immigrant peers who scored more than average in year 5 English (column I), more than one standard deviation above the average (column 2) or move than 2 standard deviations above the average (column 3). The patterns fit with earlier estimates, in all cases exposure to more ESB peers leads to higher native English performance. Moreover, these are increasing in magnitude as the quality (test scores) of ESB peers increases.

EXTENSIONS AND MECHANISMS

Do these effects persist over time? We have the ability to track these students through to their performance in 10th grade tests. These represent important national tests which form a part of the entry requirements to academic and vocational tracks. This comes at the cost of a loss observations, both because of fewer cohorts that we observe from year 5 to year 10, but also because students are randomly assigned to taking only some of these exams (See for instance Bensnes 2020 and Landaud et al, 2022 for more thorough discussions of this institutional feature). We report the estimates in Table 7. While not statistically significant, the pattern of results for year 10 English exam performance essentially follow those reported earlier and are of a similar magnitude This provides some indication of longer lasting effects of exposure to ESB peers on English language skills.

Further key questions relate to the mechanisms generating these effects. These are important for a range of reasons including better understanding the source of these spillovers and generalizing these results to other settings. While we cannot be exhaustive, we explore two points.

First, what do these spillovers represent? Do they reflect advantages from having additional English language speakers in English classes, or from greater interactions with English language speakers in general? One way to explore to this is to look at same gender spillovers. The intuition is that for this group play outside of class is still predominantly gendered such that same-gender interaction is more common. If language spillover effects occur outside of the classroom, then one might expect them to be stronger within gender pairs (ESB boys and Native boys, ESB girls and Native girls). In contrast, one would expect any within classroom effects to be more general and have less of a gendered dimension. We explore this by re-estimating our main models but distinguishing between the gender of the ESB peers and estimating separately by the gender of the native students.

This is quite data demanding and leads us to estimate our models in a slightly more parsimonious manner. For example, for female students, we estimate exposure to 1, 2 or 3 or more ESB female students while additionally controlling for the number of male ESB students (and vice versa for male native students). We also report estimates for just the number of male and female ESB students (separately) which helps to illustrate the main results from this table. These are that the ESB language spillovers appear to operate solely through same gender groups. Across these specifications, we never find effects of cross-gender spillovers (ESB boys on native girls, ESB girls on native boys). Instead, spillovers occur specifically within gender, are especially strong for boys. There is an effect as high as a 0.044 of a standard deviation increase in average English scores. These results we believe are suggestive of spillovers occurring outside of the classroom, rather than for instance an extra teacher effect from having ESB immigrants in the classroom.

A further issue is who benefits from exposure to native language speakers. If improved language skills are occurring through social interactions outside of the classroom one might imagine this to be contingent on the language skills of the native student. For instance, it

seems unlikely that these types of interactions would improve skills that are at a very low level (where communication is simply difficult) or when skills are very high such that informal communication is productive. We explore this by estimating models split by quartile of the native Norwegian students English attainment in year 5. These results are reported in Table 9. These demonstrate that, even though the general pattern of positive spillovers are present across the ability distribution, the spillovers are concentrated amongst students in the 3rd quartile of English language attainment. When taken with the results reported in Table 9, this is further suggestive of benefits that come from the ability to communicate with English speakers.[5] An additional concern is that exposure to native language speakers may discourage those with poor initial English language skills. Table 9 suggests that this does not occur.

V. CONCLUSION

The effect of more diversity in schools continues to generate debate, particularly with respect to the effects of increased immigration. This paper takes a different approach to much of the existing literature by focusing on one aspect of exposure to immigrant peers that has the potential to generate positive educational spillovers on native students, the acquisition of skills in languages other than the host countries dominant language. Norway provides an interesting and useful case insofar as it has experienced increased immigration (from a low base), has a universal emphasis on English language acquisition in school, and attracts many immigrants (and their children) who have English as their mother tongue.

Using this setting, combined with register data, we seek to estimate the effect of exposure to English speaking background (ESB) peers on the English language attainment of native

[5] The lack of an effect for the highest performing Norwegian students could reflect ceiling effects in the tests or non-linearities in the peer effects. In unreported estimates, we estimated analogous models to Table 9 but with sextiles instead. Again, we found positive and statistically significant effects for native students who had above average English skills (sextile 4 and 5) but no effect for the top group (sextile 6). While not definitive, this suggests that it may be ceiling effects in the English language test.

Norwegian children. We demonstrate positive spillovers, our estimates suggest effects in the order of a 0.02 of a standard deviation increase in English language test scores at year 8 for a Native student exposed to 2 or more ESB students in their primary school grade. These are reduced form estimates which may understate the effects of exposure to native speakers. We then report a range of estimates that suggest this does not simply reflect the fact that ESB peers are, in general, better-quality peers. For instance, we detect no equivalent effect on math or Norwegian performance. Our results are robust to a range of concerns regarding mobility and measurement of ESB. Finally, we provide tentative evidence that these effects persist until at least the end of middle school.

We go further and demonstrate that these effects are concentrated amongst same-sex pairings, especially between boys. These effects are large and essentially only present for those native students who already have better than average English language skills. Together these results point towards spillovers that occur outside the classroom, and through social interaction between English speaking immigrant children and Norwegian children with above average English language skills.

In summary, we provide evidence of positive language acquisition spillovers from native language speaking peers. This, we feel, has likely broad applicability to a range of settings where students learn foreign languages and are exposed to peers who have this language as a mother tongue. Moreover, this may be indicative of the potential for a range of wider, but We demonstrate patter typically difficult to measure, benefits from diverse school peers. Finally, it suggests that native speakers, in the form of peers, are a potential input into educational production that could be utilised by education systems.

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TABLE 1: The Effect of English Speaking Background (ESB) Peers on English Test Score Performance at Year 8.

	I	II
Number of ESB students	0.0042*	
	(0.00235)	
One ESB student		-0.005
		(0.007)
Two ESB students		0.023**
		(0.009)
3+ ESB students		0.023**
		(0.011)
Constant	-0.211***	-0.210***
	(0.0176)	(0.0177)
Observations	206,032	206,032
r^2	0.120	0.120

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other control variables are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

TABLE 2: The Effect of English Speaking Background (ESB) Peers on Mathematics and Norwegian Test Score Performance at Year 8.

	Math		Norwegian	
	I	II	I	II
Number of ESB students	0.003		0.003	-0.003
	(0.002)		(0.002)	(0.007)
One ESB student		-0.001		-0.005
		(0.006)		(0.008)
Two ESB students		-0.007		-0.005
		(0.008)		(0.008)
3+ ESB students		0.008		0.011
		(0.009)		(0.009)
Constant	-0.182***	-0.180***	-0.282***	-0.280***
	(0.0166)	(0.0167)	(0.0158)	(0.0161)
Observations	250,975	250,975	243,031	243,031
R-squared	0.169	0.169	0.160	0.160

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

TABLE 3: Heterogeneous Effects of English Speaking Background (ESB) Peers on English Test Score Performance at Year 8.

	I Boys	II Girls	III Low educated parents	IV Highly educated parents
One ESB student	0.001	-0.012	0.004	-0.014
	(0.010)	(0.0092)	(0.010)	(0.008)
Two ESB students	0.025**	0.020*	0.027**	0.019*
	(0.013)	(0.012)	(0.014)	(0.011)
3+ ESB students	0.025*	0.020	0.034**	0.015
	(0.014)	(0.014)	(0.016)	(0.012)
Constant	-0.192***	-0.215***	-0.358***	-0.089***
	(0.024)	(0.023)	(0.025)	(0.022)
Observations	103,914	102,019	79,889	126,038
R-squared	0.135	0.131	0.067	0.099

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

TABLE 4: The Effect of ESB Peers on (I) English Test Score Performance Controlling for Year 5 English Test Scores and (II) School Mobility.

	I Controlling for Past Attainment	II Attend Neighbourhood Middle School?
One ESB student	-0.004	-0.003
	(0.007)	(0.004)
Two ESB students	0.023**	-0.007*
	(0.009)	(0.004)
3+ ESB students	0.031***	-0.003
	(0.010)	(0.004)
Fifth grade performance	0.478***	
	(0.002)	
Constant	-0.190***	0.828***
	(0.0171)	(0.009)
Observations	204,960	204,960
R-squared	0.317	0.127

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. (I) reports the effects of ESB students on English Performance controlling for 5th Grade Performance (II) reports the effects of ESB students on attending neighbourhood middle school.

TABLE 5: The Effect of English Speaking Background (ESB) Peers and English Test Score Performance at Year 8, Excluding Countries of Origin.

	(1)	(2)	(3)	(4)	(5)
Excluding…	Ireland	UK	US	Australia	New Zealand
One ESB student	-0.005	-0.006	-0.006	-0.005	-0.005
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Two ESB students	0.023**	0.021**	0.020**	0.022**	0.023**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
3+ ESB students	0.023**	0.020*	0.020**	0.023**	0.023**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Constant	-0.210***	-0.215***	-0.212***	-0.211***	-0.211***
	(0.017)	(0.017)	(0.018)	(0.0177)	(0.0177)
Observations	206,003	204,241	204,008	205,945	206,018
R-squared	0.120	0.119	0.119	0.120	0.120

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

TABLE 6: Alternative Measures of ESB peers and English Performance at Grade 8

	Immigrant Year 5 English Score		
	Greater than Average	One St.Dev Above Average	Two St.Dev above average
One ESB	0.008	-0.003	0.012
	(0.007)	(0.008)	(0.008)
Two ESB	-0.002	0.003	0.017
	(0.009)	(0.012)	(0.017)
3+ ESB students	0.032***	0.035**	0.040*
	(0.011)	(0.016)	(0.022)
Constant	-0.209***	-0.209***	-0.209***
	(0.018)	(0.018)	(0.018)
Observations	206,032	206,032	206,032
R-squared	0.119	0.119	0.120

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

TABLE 7: The Effect of English Speaking Background (ESB) Peers on Year 10 English Test Score Performance

	(1)
One ESB	-0.009
	(0.016)
Two ESB	0.028
	(0.020)
3+ ESB students	0.027
	(0.023)
Constant	-0.455***
	(0.041)
Observations	42,023
R-squared	0.200

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

TABLE 8: Same Gender Peers and English Performance at Grade 8

	(1) Girls	(2) Boys
Opposite Gender ESB (#)	0.004	-0.005
	(0.04)	(0.005)
One Same Gender ESB	-0.007	0.004
	(0.008)	(0.009)
2 Same Gender ESB	0.021*	0.029**
	(0.013)	(0.014)
3+ Same Gender ESB	0.016	0.044**
	(0.019)	(0.019)
Constant	-0.216***	-0.190***
	(0.023)	(0.024)
Observations	102,019	103,914
R-squared	0.131	0.135

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

TABLE 9: Effects of ESB Peers on Year 8 English Performance, by year 5 English Performance.

	Year 5 English Performance			
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
One ESB student	0.003	-0.016	0.018*	-0.011
	(0.012)	(0.011)	(0.0106)	(0.010)
Two ESB students	0.011	0.008	0.030**	-0.001
	(0.013)	(0.014)	(0.014)	(0.012)
3+ ESB students	0.004	0.014	0.058***	0.001
	(0.016)	(0.016)	(0.016)	(0.01)
Constant	-0.955***	-0.322***	0.122***	0.746***
	(0.026)	(0.028)	(0.027)	(0.024)
Observations	54,154	50,323	52,545	48,525
R-squared	0.117	0.120	0.121	0.134

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

Table A1 Country of Origin and English Speaking Background

Country	% inhabitants with English as first language	Number of students in 5th grade all years.
Gibraltar	96.97	7
Ireland	93.22	252
United Kingdom	92.3	8239
Man	99.93	1
Virgin island (U.S)	90.37	4
Barbados	93.91	10
Antigua og Barbuda	77.65	1
Belize	63.07	5
Bahamas	78.66	11
Bermuda	96.92	5
British virgin islands	86.96	1
Cayman islands	76.6	1
Grenada	90.91	12
Montsserat	67.8	1
Anguilla	92.31	1
Saint Kitts and Nevis	78	1
Saint vincents and grenadines	95	4
US	78.1	7412
French Guyana	86.55	1
Australia	72.74	579
New Zealand	85.9	174

Table A2: Selected Descriptive statistics

	ESB		Natives		Non ESB refugees		Non ESB other immigrants	
	Mean	St.dev	Mean	St.dev	Mean	St.dev	Mean	St.dev
Math Score 8th grade	0.161	0.991	0.038	0.992	-0.530	0.934	-0.194	1.005
English Score 8th grade	0.406	0.982	-0.006	0.992	-0.299	1.01	-0.084	1.015
Reading score 8th grade	0.181	0.979	0.043	0.987	-0.569	0.979	-0.327	1.010
Math score 5th grade	0.146	0.994	0.048	0.982	-0.579	0.986	-0.240	1.041
English Score 5th grade	0.497	1.061	-0.023	0.976	-0.272	1.069	0.015	1.079
Reading score 5th grade	0.158	0.984	0.054	0.976	-0.615	1.020	-0.408	1.052
Fathers with university degree	0.502	0.5	0.342	0.474	0.224	0.417	0.234	0.424
Mothers with university degree	0.607	0.488	0.487	0.5	0.163	0.369	0.277	0.447
Mothers's income	378 382	328 237	347 131	240 729	138 767	176 244	213 520	221 039
Father's income	695 399	802576	586 254	483 070	244 195	263 869	405 790	354 320
Gender	0.497	0.5	0.489	0.5	0.493	0.5	0.491	0.5
Parity	1.84	0.927	1.92	0.972	2.348	1.53	1.848	1.11

Table A3: Exposure to ESB Peers and English Performance in 8th Grade Excluding schools with high numbers of ESB students

	10 or less ESBs in grade	5 or less ESBs in grade
One ESB student	-0.005	-0.005
	(0.007)	(0.007)
Two ESB students	0.023**	0.023**
	(0.009)	(0.009)
3+ ESB students	0.023**	0.025**
	(0.010)	(0.010)
Constant	-0.220***	-0.217***
	(0.018)	(0.018)
Observations	205,795	198,616
R-squared	0.119	0.114

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

Table A4: Exposure to ESB Peers and English Performance in 8th Grade Excluding Specific Cities in Norway

	(1) Ex Oslo	(2) Ex Stavanger	(3) Ex Bergen	(4) Ex Trondheim
One ESB student	-0.002	-0.005	-0.004	-0.002
	(0.007)	(0.007)	(0.007)	(0.007)
Two ESB students	0.024**	0.021**	0.024**	0.026***
	(0.010)	(0.009)	(0.010)	(0.009)
3+ ESB students	0.021**	0.025**	0.021**	0.025**
	(0.011)	(0.011)	(0.011)	(0.010)
Constant	-0.229***	-0.217***	-0.209***	-0.204***
	(0.0184)	(0.018)	(0.018)	(0.018)
Observations	193,958	201,439	195,965	198,848
R-squared	0.106	0.119	0.120	0.121

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

Table A5: Exposure to Romance Language Peers and English Performance in 8th Grade

	(I)
One Romance Language Peer	0.004
	(0.007)
Two Romance Language Peers	0.0122
	(0.009)
3+ Romance Language Peers	-0.0138
	(0.013)
Constant	-0.212***
	(0.0176)
Observations	206,032
R-squared	0.120

NOTE: All explanatory variables are measured at 5th grade level. All models include controls for the share of other immigrants and the share of refugees. Other controls are gender, maternal education level, paternal education level, parental income, family structure and grade enrolment. All models have school fixed effects. Robust standard errors clustered at the school-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively

Table A6: Exposure to ESB Peers and English Performance – Sensitivity to Alternative Definitions of ESB

	>50%	>70%
One ESB student	-0.006	-0.005
	(0.007)	(0.007)
Two ESB students	0.013	0.023**
	(0.009)	(0.009)
More than two ESB students	0.021**	0.023**
	(0.010)	(0.010)
Share of refugees	-0.035	-0.035
	(0.087)	(0.087)
Share of other immigrants	0.052	0.054
	(0.072)	(0.072)
Constant	-0.209***	-0.210***
	(0.018)	(0.018)
Observations	206,032	206,032
R-squared	0.120	0.120

Note: In table 1 an ESB is defined as an immigrant from a country with more than 60 % of the inhabitants speaking English as first language. In this table we analyse the robustness of that cutoff. In column 1, 50 % is used as cutoff. In column 2, 70 % is used.

FIGURES

Figure 1: Kernel Density Plots of 8th Grade Test Scores