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Refugees and the Educational Attainment of Natives

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ABSTRACT

Refugees and the Educational Attainment of Natives*

There has been a recent rapid increase in immigration into Europe, specifically in the form of refugees and asylum seekers. This raises a range of social challenges and a particular focus is education and school systems. A growing body of research investigates the impact of immigrants on native test score performance. In practice this reports very mixed results and a difficulty is that immigrant groups are often pooled together due to data restrictions. We return to this issue using Norwegian register data that allows us to distinguish refugees from other immigrants. Using narrow within-school, within-family comparisons combined with the Norwegian refugee settlement system we demonstrate marked negative effects of refugee children on the test score performance of their native school children classmates. These effects are simply not present for other immigrants, and stem primarily from refugee children who themselves are most at risk of low performance. These negative effects are concentrated on students at most risk of underperformance, boys and children from lower educated backgrounds, and may reflect a lack of compensatory inputs at schools.

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I. INTRODUCTION

There has been a recent rapid increase in immigration into Europe, specifically in the form of refugees and asylum seekers. At the height of the immigration wave in the mid-2010s approximately one million refugees and asylum seekers came to Europe. Norway has experienced a particularly dramatic increase in immigration coming from a historically low base. While only 3.5 percent of the total population of Norway in 1990 were immigrants (and 5.3% in 2000), they now account for 14% of the total population. A substantial share of this increase is refugees, representing roughly one in four recent immigrant arrivals to Norway.

Rapid increases in the immigrant population have the potential to generate a range of social challenges and one particular focal point is education and school systems. Reflecting this, there is a growing body of literature in the US and Europe examines the effect of immigrants in schools. This literature largely focuses specifically on the impact of immigrants, as a broad group in the classroom, on the educational attainment of native students. This research reports mixed evidence. For instance, Ballatore et al (2018) and Frattini and Meschi (2018) demonstrate marked negative effects of increases in exposure to immigrant classmates on native Italian students in schools and in vocational training, respectively. Both present evidence that these negative effects are concentrated amongst low income students. Tonello (2016), also for Italy, demonstrates zero to small negative effects in Italian Junior High Schools, with some evidence that these become larger (more negative) with higher immigrant shares. Large negative effects have been found for Denmark (Jensen and Rasmussen, 2011). While, earlier Norwegian evidence suggests that non-European immigrant peers lead to higher native dropout from secondary schooling (Hardoy and Schøne 2013), but later evidence suggests no effect (Hardoy et al 2018). Other earlier cross-European evidence suggests negative, but small, effects (Brunello and Rocco, 2013). Evidence from the Netherlands suggest a worsening of the learning environment associated with greater immigration shares but no effect on test scores except for recent arrivals (Ohinata and Van Ours, 2013, Bossavie, 2020). At the same time, existing US evidence has at times demonstrated broadly positive effects of immigration on native educational attainment (Hunt, 2017), or negative effects only when immigrant students have limited English aptitude (Diette and Uwaifo Oyelere, 2014). Corresponding UK evidence demonstrates no causal effect of non-English speakers on the school performance of native students (Geay et al 2016).

One issue with interpreting and generalising these findings is the sheer diversity of immigrant groups both within and across countries. Typically, these papers pool immigrants

on the basis of students being immigrants themselves, or the children of immigrants, rather than for instance the reason for immigration or country of origin. In particular, economic immigrants and refugees are likely to differ in a range of ways likely to influence own educational performance, their interactions with native students within the school and classroom, and ultimately any effect on native educational attainment. In the paper most closely related to ours, Figlio et al (2019) examines how a dramatic increase in the exposure of native students in Florida to a particular immigrant group, Haitian refugees following the earthquake in 2010, influenced native tests scores. They highlight the fact that the effect of refugees on incumbent students is likely to be substantially different to other immigrants. This reflects both the nature of refugee migration which might involve sudden, and highly disruptive, movements against the background of conflict, natural disasters or other shocks, and the fact that these immigrants often have characteristics that make them very dissimilar to the native population. They demonstrate no adverse effect of this inflow of refugees on native student educational performance.

Our paper returns to this issue using administrative data for Norway. Our data and setting are advantageous for several reasons. Our register data allows us to distinguish between immigrant groups, both by reason for immigration, and by country of origin. This, we argue, has advantages for both the precision of estimates, but also in terms of isolating likely sources of any immigrant effects. For instance, the ability to distinguish between reasons for migration are important as appropriate policy responses, such as targeted school interventions, are likely to differ across immigrant types. Likewise, educational impacts of changes in immigration policy, or changes in immigration flows, may also depend on this. Our main approach focuses on the effect of immigrant and refugee class composition on the mathematics test scores of Norwegian primary school students. Naturally, there are a range of challenges to causal identification most notably non-random location and schooling decisions of immigrants and potential native mobility responses to immigration. We adopt a range of approaches to these issues where we exploit the richness of our data and our institutional setting. For instance, we can adopt very narrow points of comparison such as exploiting within sibling, and within school, variation in exposure to immigrant classmates, while still retrieving precise estimates of the parameters of interest. In addition, and as described below, the settlement locations of refugees in Norway are allocated by the central government, limiting (at least initial) endogenous sorting. Together this allows us to retrieve estimates of the effect of refugee students on native educational outcomes that we argue can be interpreted causally.

In summary, our estimates show marked negative impacts of refugee shares on native mathematics performance in primary school. Native children, when exposed to higher refugee shares than their siblings in the who attended the same school, perform markedly worse on average in mathematics. We demonstrate that these results are robust to a range of additional potential confounders. In addition, we show that no such effect is evident in the case of non-refugee immigrant classmates. We demonstrate that these negative effects are concentrated among those must likely to underperform educationally, boys and students from less educated family backgrounds. Moreover, these effects stem from particular refugee groups who themselves are most likely to underperform. We provide tentative evidence that these negative effects may reflect a lack of compensatory inputs at the school level. More broadly, our results suggest potential negative impacts from refugee inflows that motivate targeted policy interventions. In addition, it highlights the range of heterogeneity in effects across immigrant groups, and even within refugee groups. This raises questions regarding the interpretation of evidence using aggregated immigrant groups.

II. BACKGROUND, INSTITUTIONAL DETAILS and DATA

Immigration to Norway has increased considerably over the last decades. This immigration has come from a range of geographic regions and there have been changes in the composition of region of origin. For instance, the share of immigrants from eastern Europe has increased substantially over the last 12-15 years, as has the share of immigrants from Asian countries, while at the same time the share of immigrants from western Europe and other Nordic countries has decreased. In 2018, around half of all immigrants to Norway came from European countries, while about one third came from Asia, and 14 percent came from African countries. A significant proportion of this recent immigrant inflow is in the form of refugees (for example 12.5 % in 2018). Along with much of the rest of Europe there were large spikes in refugee entry in the years 2015 through to 2017. The age structure of this immigration means that refugees are over-represented among school age children.

Norway, like other Scandinavian countries, exercises a range of controls over the settlement patterns of refugees within the country. The legal framework regulating the treatment of refugees, asylum seekers and family reunions is decided at the national level. The UDI (Norwegian Directorate of Immigration) processes applications for protection, family reunion and residence. When a refugee is granted permanent residence the Directorate of Integration and Diversity (IMDi) allocates the refugees a place to live. It does this by approaching

municipalities to see if they are willing to accept refugees.[1] To aid this process the government has devised a matching grant scheme as an incentive for municipalities to accept the resettlement of refugees. Municipalities can decide on the number of refugees to accept, but they do not have any power to decide *which* refugees to accept. There are no overarching rules on where municipalities provide housing for refugees, but they are given municipal housing where location is typical a function of current capacity. In practice there is a lot of dispersion of refugee settlement both across and within municipalities, and as we demonstrate later, this manifests itself in very few schools with marked concentrations of refugee students. After several years in the first municipality, it is possible for refugees to move elsewhere, and internal migration from rural communities to larger population centers, particularly into the greater Oslo area, is common. Importantly, we can demonstrate that our main results remain if we exclude Oslo, and other major cities of Norway, where one might think that this endogenous sorting is most concentrated and problematic.

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. While a small number of municipalities have free school choice, in practice Norwegian students go to their local school with other children from their 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. After compulsory school ends, students can take upper secondary school (3 years) either in an academic or a vocational track. This is also free and publicly provided. A very high share of Norwegian students begin post-compulsory upper secondary school, but the dropout rate is around 25 percent. This is heavily concentrated amongst those in the vocational track.

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 5th grade scores (corresponding roughly to age 11). This primarily reflects the fact that shortly prior to the 8th grade test students change from primary to lower secondary school. Hence, there is substantially reshuffling of classes, schools and peers.[2] We further choose to focus primarily on mathematics, rather than reading in Norwegian and English. We do this for a number of reasons. First, refugee and other students from non-Norwegian backgrounds are often taught Norwegian separately to the main

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[1] As at 2016, there were 431 municipalities in Norway.
[2] An additional issue is that we do not observe grade composition for grades 6 and 7.

class or, at the least, given different learning material. This fundamentally changes in-class interaction in this subject. In contrast, all students are taught mathematics together and there is no ability streaming. At the same time, a concern with English scores is that, in some cases, refugee and immigrant students may have superior English language skills to young Norwegian children. In addition, there are higher patterns of test exemption for refugee children in Norwegian. This is done primarily on the basis of limited knowledge of the Norwegian language. Overall patterns of exemption are reported in Table A1. In extensions we report estimates for these two additional test scores but urge a degree of caution in interpreting these results.

We standardise test scores to mean 0 and standard deviation of 1 for each year. Our population of analysis is all Norwegian fifth graders for 2007 to 2015 inclusive[3], except for a very small number of students who are exempted from the math 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-grade-year level. This has the potential for some deleterious effects on the precision of our estimates but avoids problems of endogenous sorting of children into class within grades. Later we re-estimate our main model on schools with smaller numbers of students at the grade level where there is likely only one class. In the analysis that uses family fixed effects, and compares siblings, we drop singleton observations leaving us with a total estimating sample of 203,039. The underlying results, without family fixed effects, are unaffected if estimated on this smaller sample.

This test score data is merged with individual information and family information from Statistics Norway. An important feature of this data is the availability of family identifiers that make it possible to identify siblings. In addition, 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. We observe if an immigrant came to Norway as a refugee, asylum seeker, for family reunion or

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[3] National testing of year 5 students was first introduced in 2007.

for work. We exploit this information on parental immigrant status to identify refugee children. 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.

Appendix Table A2 provides descriptive statistics on the key variables in our analyses. 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. To provide more information Figure 1 provides kernel density estimates of the distribution of the share of refugees across classes. To aid presentation this is only presented for classes with at least 1 refugee in the class. This excludes just under half of our school-grade observations where no refugees are present. This demonstrates that while most of these remaining grades have small numbers of refugees there do exist some higher shares. Our main estimates provide the linear effect of the share of refugees but in further estimates we investigate potential non-linearities and investigate robustness to excluding schools with high shares of refugees.

III. EMPIRICAL STRATEGY

Our main estimating equations are variants of the following:

$$A_{icst} = \alpha_0 + \alpha_1 Ref_{cst} + \alpha_2 IMM_{cst} + \beta' X_{icst} + \delta_s + \gamma_f + u_{icst} \ (1)$$

Where A_{icst} is student achievement for individual i, in cohort c, at school *s* and at time t. Ref_{cst} is the share for refugees for cohort c, at schools s and time t. IMM_{cst} represents the share of other immigrants in the same cohort, while X_{cst} is a vector of time varying school cohort characteristics. δ_s is the school fixed effect and γ_f is the family fixed effect, while u_{icst} is an error term. We cluster standard errors at the school-grade-year level. We estimate (1) only for native students, i.e. those not classified as a refugee or other immigrant. Hence α_1 and α_2 provide estimates of the effect of refugee, and other immigrant share, exposure respectively on native test score performance.

There are a range of empirical challenges to estimating and interpreting the coefficients of interest from (1). A major issue is the potential for non-random selection of immigrants and

refugees into schools and classes. There exist a range of approaches to dealing with these issues. The inclusion of school fixed effects in (1) removes time invariant differences in factors such as school quality that may influence both test score attainment and enrolment patterns of both immigrant and native children. The key parameters are then identified by variations in class composition within schools between cohorts (Hoxby 2000; Gould et al. 2009; Hanushek et al. 2009). A concern with this approach in our setting is that changes in immigrant shares at schools may lead to mobility responses from native families and students. This may lead to time variation in family background characteristics of native students that we are unable to control for. For instance, in the presence of increasing immigrant flows, so called native flight might occur where better resourced families respond to increases in immigrant concentrations in a school (and locality) via housing and school movement.

Our main approach is to include family fixed effects in (1) such that our parameters of interest come from within-family, over-time, variation in immigration concentration between siblings. This, arguably, provides estimates that hold family background and inputs constant. In our most complete specification, we do this in a setting that also includes school fixed effects such that our estimates rely on between sibling within school variation in exposure to different immigration shares. This approach removes many of the obvious sources of bias in our estimation. There remains the potential for other time varying sources of bias both at a school and family level. In the robustness section we explore issues related to possible remaining time-varying sources of bias.

INSERT FIGURE 1

IV. RESULTS

Table 1 reports estimates of the relationship between immigrant shares and math performance of native students where we build up towards the full specification of (1). We do this to highlight a number of features of these estimates. Column (1) is a naïve regression with only year dummies and no other controls. This reveals a small, and not statistically significant, negative correlation between the share of refugees in the school-grade and native math performance. There is, however, a very large positive relationship between the share of other immigrants and native math performance of approximately 0.6 of a standard deviation. The second column introduces a number of individual and family controls, where full estimates of these parameters are available on request. The effect of other immigrants on native test score

performance remains essentially unchanged, however the effect of the share of refugees becomes sizeable, negative and statistically significant.

INSERT TABLE 1

As discussed earlier, two main threats to the interpretation of these results are the non-random sorting of immigrants across schools, and any non-random sorting of natives across schools as a result of changes in immigrant shares. Column III reports estimates where we include both school and family fixed effects. Hence identification comes from within school and within family variation in exposure to immigrants. A side effect of this is that we drop all singleton observations (single children or children without siblings who also attended schooling and sat the 5th grade math exam within our data period). This essentially halves our sample size. In unreported estimates, we re-estimated models I and II on this smaller sample and the tenor of these results were unchanged. All models with sibling fixed effects include a set of parity dummies (2nd child, 3rd child etc) in order to control for any birth order effects on test scores such as have been demonstrated in previous results for Norway (Black et al, 2005).

The negative effect of refugee shares on native school performance increases in the order of 50%, and there is now no effect of other immigrant shares (negative but not statistically significant). The disappearance of the previous large positive effect of non-refugee immigrants on native school performance suggests that these immigrants are strongly positively selected into schools. In unreported experiments where we included either school or family fixed effects, both lead to a reduction in the estimated positive effect of non-refugee immigrant shares (when compared to column II). This fits with a view of an, on average, advantaged group who are free, at least via the housing market, to choose schools and are concentrated heavily in the larger cities where student performance is typically substantially higher in Norway. Once this is controlled for non-refugee immigrant shares have a non-statistically significant effect on native test scores, although these estimates are routinely negative from this point on.

Although less dramatic, the magnitude of the negative effect of refugee shares increases in size once school and family fixed effects are introduced. This suggests that a failure to control for this sorting biases the parameter of interest towards zero. This is our preferred specification and all further estimates are based on this within family within school approach unless otherwise indicated. How large are these effects, and how should we interpret

them? A one standard deviation increases in the share of refugees reduces a given native students' performance in math by around 1.4 % of a standard deviation.[4]

One natural question is whether these effects are concentrated amongst specific groups of students. A body of evidence suggests that negative peer effects are concentrated amongst boys and / or children from low-socioeconomic backgrounds (see for instance Figlio, 2007; Lavy and Schlosser, 2011 and for Norway, Bonesrønning and Iversen, 2013). Reflecting this, in Table 2 we report estimates that are split by gender of the child and according to educational level of their mother.[5] When combined with family and school fixed effects, they result from comparisons between, for instance, brothers/sisters or 2 or more children with the same highly educated mother. These estimates are striking. There is no effect of the refugee share on girls, and a smaller non-statistically significant negative effect for children with a mother with a university degree or higher. The negative effects of refugee shares are concentrated entirely among boys or those from lower educated parental backgrounds. These effects are substantially larger than the estimates for the full sample. It is also notable that there is a negative relationship for other immigrants for children whose mothers have less than a degree, an effect not present elsewhere. Together, these estimates fit with a view that refugee shares in the classroom are associated with poorer educational attainment primarily for children more at risk of low educational attainment in general.

INSERT TABLE 2

Robustness

While our empirical approach addresses several obvious threats to identification, there remains the potential for other sources of bias. In this section we adopt a number of approaches aimed at examining these issues.

One concern with our strategy is flight from schools. A response to increasing immigrant shares at given schools may be for natives to exit. Our narrow focus on siblings who attend the same school reduces some of the concerns that this biases our main estimates of interest. Yet, another effect of any mobility response by native students is that this alters the native peer group for those students that remain. If peer effects are important, then some part of the negative refugee effect may occur through this deterioration in wider peer quality within the

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[4] Table A2 reports analoguous estimates for Norwegian and English, respectively. These estimates are typically near zero and never statistically significant at standard levels. However, we once again urge caution in interpreting these estimates due to the differential patterns of test taking in these subjects reported earlier.
[5] Estimates that instead use father's level of education present similar results.

school that we do not control for. To investigate this, we estimated a range of models that attempt to control for wider peer composition. These include the average educational levels of non-immigrant classmates (mothers and fathers)[6] and the average income of non-immigrant classmates' parents. Table 3 reports estimates where we control for these separately, and an additional set of estimates where we control for these together. In no case does this substantially alter our main estimates of interest even as, for example, paternal education is positively related to the test score performance of native students. This suggests little role for wider changes in peer group composition as a main driver of our estimates.

<div align="center">INSERT TABLE 3</div>

While recent refugee arrivals to Norway are heavily constrained with little choice of residential location, as discussed earlier this constraint becomes weaker over time. This leads to a concern that our results may be affected by later patterns of non-random location choice. A particular concern is the sorting of refugees into major cities. We re-estimated our main models excluding the 5 largest cities in Norway (Oslo, Bergen, Trondheim, Stavanger and Tromsø). The resultant estimates are reported in Table 4. When compared to the baseline estimates, the effects of refugee share on native test score performance is again essentially unchanged. This makes us more confident that our main estimates are not being driven by larger cities, and specifically, the endogenous sorting of refugees to schools in major cities. Interestingly, the effect of other immigrants is more negative and statistically significant. We also provide estimates solely for schools in the 5 largest cities, these estimates are very imprecise so caution must be exercised when interpreting them. They do, however, also suggest that there are also negative effects of refugees in major cities.

<div align="center">INSERT TABLE 4</div>

School choice is very limited in Norwegian schools and the aim is to integrate refugee children quickly into neighbourhood publicly run schools.[7] Nonetheless, municipalities may in some cases organise special teaching for groups of students with special needs in schools other than their neighbourhood school. As an example, refugees can be placed in introductory classes the first year after they arrive in Norway in a school with more resources for specialised teaching. After this year the children are then placed back in their neighbourhood school.

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[6] We include these as average ISCED level, but an alternative approach using share of parents with university or higher qualifications yields similar results.

[7] There is also effectively no grade retention, and students are taught with other students of the same age.

There is no official data on school catchment areas in Norway, and we lack any additional information that explicitly informs us of whether students attend their closest neighbourhood school. However, based on detailed information on every students' neighbourhood ('grunnkrets')[8], we create proxy catchment areas using information on which schools other, non-immigrant, children in the same area attend. We utilise this to create an alternative version of share of refugees based on only those who we are highly certain go to their neighbourhood school.[9] We view this as a very conservative approach likely to often incorrectly characterise refugees as attending a school other than their closest. We then use this information in a number of exploratory ways that are summarised in Table 5. First, we re-estimate our main models where we include only as those refugees attending their neighbourhood school as part of our grade-share variable. In the second column, we additionally include a control for refugee shares where we are not sure if they are attending their neighbourhood school. In the final column we simply exclude from our estimation all school-grade-year observations where there is even one refugee attending who may not be in their neighbourhood school. These results reveal two main points. First, our main estimates do not reflect systematic patterns of non-attendance in neighbourhood schools. Second, attempts to focus on settings where we are more certain about attendance patterns strengthen our main findings. In all cases this leads to markedly larger, negative, effects on native performance. In the most extreme treatment of the problem, our estimated coefficient of interest is more than twice as large in absolute terms as our baseline estimate. An additional point relates to whether patterns of refugees attending schools other than their neighbourhood school reflects additional resources aimed at helping refugee education and integration. While ultimately, we cannot explore this further these results one interpretation of this results is that these targeted resources may reduce the negative impact on native educational performance.

<center>INSERT TABLE 5</center>

To this point, we have demonstrated robust negative effects of increased refugee shares on native test score performance. While on average, and shown in Figure 1, refugee children are

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[8] There are approximately 14,000 of these neighbourhoods in Norway

[9] Specifically, we observe the neighborhood that students reside in and which school they attend. We pool the 9 years of our data and categorise a school as being a neighbourhood school if at least 90% of students in the area attend it on average across these 9 years. We use this to then characterize whether refugee students attend their neighborhood school. Note this approach will likely lead to misclassifying students as not attending their neighborhood school in cases where, for instance, school catchment areas do not align very well with our residential areas, or a school was shut-down or a new school built during the period.

quite spread across Norwegian schools there is a long tail of classes with high shares of refugees. A concern may be that our results are generated by high refugee share settings that are likely to have unobservable differences that may influence test scores in a range of ways, and where the teacher and class environment may be atypical. More broadly, any effect of refugee shares on native student performance may be non-linear. Table 5 reports estimates that aim to investigate these issues.

<div align="center">INSERT TABLE 6</div>

The first column simply adds a quadratic term to the share of refugees. This term is positive but not statistically significant. Nonetheless this, when combined with the more negative estimate of share of refugees in the cohort, could suggest negative effects that are concentrated in low shares of refugees. Column 2 examines this further allowing the effect of refugee numbers to vary over 1 refugee child in class, 2 in the class, or 3 or more. While the effect of 1 refugee is not statistically significant, the pattern of coefficients broadly supports a linear effect of refugee numbers.

Table 6 reports estimates which take an alternative approach, and address a related but different issue, are schools with high refugee shares somehow different in a way that is consequential for test score performance? We estimated models where we successively exclude school-grade observations with greater than 50% refugee share progressively all the way through to greater than a 10% refugee share. These results are remarkably consistent and suggest that our estimates do not reflect the effect of settings where refugee shares are high. One might be tempted to also interpret these results as suggesting that increasing the concentrations of refugees have no additional effects on native test score performance, but one must remember the interpretation of these estimates in the presence of school and sibling fixed effects. They are unlikely to be informative about, and we lack the statistical power to (for instance) estimate, the effect of changes within school and family from, for instance, a 10% to 50% refugee share.

<div align="center">INSERT TABLE 6</div>

Mechanisms and Extensions

A natural question is what mechanisms are likely to generate these substantial negative effects we estimate? This is a difficult question and one which register based information is less suitable to explore. Nonetheless, we are able explore to some extent the potential role of school

inputs. In particular, do time-varying school inputs adjust as refugee shares change, specifically in a way that could be viewed as compensatory? We examine a number of measures of school inputs observable to us through the GSI data systematically vary with refugee shares. Given the markedly lower test score performance for refugee students apparent in Table A3, and their negative impact we demonstrate on native students, one might expect a well-functioning public school system to introduce compensatory inputs.

Again, we examine this in a within family and school framework that aims to hold many other factors constant. Hence, this asks the question what happens to the school inputs of a student who is taught in the same school as their sibling but experiences, for example, a higher refugee share in their grade? Is there any evidence that the school authorities act to introduce additional school inputs? At the same time, additional refugee children may impact on enrolment and the negative effect we are picking up could reflect, at least in part, negative effects of increases in class size.[10] We estimate variants of our school and sibling fixed effects model with, as dependent variables, grade enrolment size, the grade level student to teacher ratio, and the ordinary instruction hour per student (only available for grades 5 to 7 combined). Table 7 reports the effects of refugee shares, and other immigrant shares, for each of these outcomes. While we observe grade size, rather than class size, the magnitude of effect is very small, negative and far from statistically significant. A change in the class from no refugees to one comprising only of refugees would lead to a reduction in grade level enrolment at a school of 1 student. This makes it unlikely that there is variation in class size that is correlated with refugee shares. Related to this, we find no evidence that student-teacher ratios are influenced. While negative, again this is not statistically significant, and again very small in magnitude. The same is true for instruction hours per student. The lack of any effect, especially compensatory increases in inputs, may provide some hint at why refugee classmates have a negative effect on native student performance. These students face additional challenges in school and demand more attention from teachers, yet we cannot detect any evidence of responses in terms of the school inputs, at least those we can observe.

INSERT TABLE 7

Finally, and as highlighted in the introduction, the existing literature has with notable exceptions typically focused on quite broad immigrant categories. We have demonstrated here

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[10] Although we recognize that Norway is a country where precisely zero effects of class size on test scores and other outcomes have been consistently demonstrated (Leuven et al, 2008; Falch et al, 2017; Leuven and Løkken, 2020).

that the effects of immigrants on native outcomes, at least in our setting, differ markedly between those with a refugee and other immigration background. Naturally, refugees themselves represent a heterogeneous group across a range of dimensions. An important feature of our setting is that they should not differ in terms of their initial location placements across Norway, hence across schools, or more generally in their treatment by Norwegian authorities.

We are able to further disaggregate refugees according to country of origin. We have no priors regarding differential country of origin effects and this is necessarily exploratory, but we do this with a view towards the large variation in immigrant effects highlighted in the existing literature. We divide refugees into four regional categories (Middle East, former Yugoslavia, Asia, and Africa) based on numbers of observations. Together, these four regions of origin account for the vast majority (97%) of refugees in Norway and Table A4 provides related descriptive statistics for each of these groups. As can be seen, even amongst these quite aggregated groups, there are marked average differences in family background characteristics, and also test score performance.[11] We then re-estimated our family fixed effects models allowing for the refugee effects to vary by these regions of origin. The specific approach we take is to estimate four separate regressions where, in each case, we separate the focal group of refugees from the other 3 groups. This means that in each case we provide an estimate of the effect of the specific refugee group and an estimate for the other three groups pooled. This is done primarily for the sake of precision, but a regression where we estimate four parameters, one for each refugee group, results in point estimates that are in essence the same as the top row of Table 8.

INSERT TABLE 8

These estimates demonstrate dramatic differences in effects according to regions of origin. The average negative impact from the refugee share in class seems to be driven primarily by refugees from African countries and from the Middle east. The coefficient for share of refugees from former Yugoslavia is also negative and similar to our main result, but not statistically significant. While imprecise and not statistically significant there is some suggestion that refugees from Asian countries have a positive impact on the math performance of native students. We make no claims about why these differences exist, but note they broadly

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[11] Note that these patterns of test score differences remain in simple estimates that control for family background differences and school fixed effects.

fit with the differences in (for instance) average test score performance of these different refugee groups themselves reported in Table A4. Hence, one interpretation is that they fit generally with a view that students who themselves face academic difficulties are the most likely to be the source of negative peer effects. This in turn fits with evidence on the source of negative peer effects in schools (Lavy et al 2012). We feel this further reinforces out point a more disaggregated understanding of the source of peer effects from refugees, and immigrants in general, is a necessary condition for the development of appropriate policy responses.

V.   CONCLUSION

The effects of immigration on a range of outcomes in recipient countries remains highly debated and controversial. Events such as European Migrant Crisis of 2015 bring this into sharper focus. One particular focus of policy debate and research is the impact of immigration, and in particular, immigrant children on the educational outcomes and school experiences of native children. The current research in this area covers a range of countries and provides mixed evidence. The majority of this research does this by examining quite broad categories of immigrants who in practice vary markedly in terms of important characteristics likely to influence their own educational performance and in terms of their reasons for immigration. This paper returns to this issue in a setting, Norway, which has both experienced a dramatic increase in immigration and where we are able to distinguish two quite distinct groups of immigrants, refugees and economic immigrants.

We demonstrate robust negative effects of refugees on the math scores of native primary school children, and no effect of other immigrants. We do this by comparing within-sibling within-school variation in exposure to immigrant peers. These negative effects are concentrated on boys and / or children from lower educational backgrounds, and are associated with refugee groups how themselves are likely to face educational difficulties. Our results are important for at least two reasons. One, immigration policy regarding entry of refugee and economic immigrants is simply different, this combined with our results suggests more nuanced effects of changes in immigration policy than suggested by much of the previous literature. Second, it suggests a role for targeted interventions that are best aimed at schools who enrol refugee children, and particularly refugee children who themselves face educational difficulties. In extensions to our main results we provide evidence that these negative effects may reflect a lack of compensatory inputs at the school level. This is likely

consequential given the dramatic underperformance of children from refugee backgrounds on test scores and their likely related need for greater attention in the classroom.

While not a feature of our setting, our results suggest particularly deleterious effects in places where refugee children themselves at risk of low attainment sort into / or are sorted into school environments with native children who also face this risk. This is likely to exacerbate educational inequality. Naturally, one could question the generalisability of our results to other settings, but we highlight that many strong assertions on the effects of immigrants and immigration on student outcomes have been made in the current literature based on quite aggregated treatments of immigrant groups. Our research demonstrates how, in practice, these effects can vary substantially across immigrant groups, and even within children from a refugee background. Future research should seek to explore channels and mechanisms that generate such heterogeneous effects

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Table 1: The Share of Refugees, Other Immigrants, and the Mathematics Scores of Native Students, 5th Grade 2007-2015

	I	II	III
Share of refugee immigrants in the school grade	-0.0305 (0.0579)	-0.149*** (0.0547)	-0.192** (0.0937)
Share of other immigrants in the school grade	0.636*** (0.0492)	0.514*** (0.0447)	-0.0954 (0.0740)
Observations	393,461	380,294	203,039
R-squared	0.005	0.117	0.673
Time Fixed Effects	yes	yes	yes
Controls	no	yes	yes
School fixed effects	no	no	yes
Family fixed effects	no	no	yes

Controls are gender, maternal education level, paternal education level, and grade enrolment. Column III additional includes birth order number of the child as a series of dummies. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 2: Heterogeneous Effects of Refugee Shares on Mathematics Scores of Native Students, 5th Grade 2007-2015

	I Girls	II Boys	III Mothers with less than University Education	IV Mothers with University Education or higher
Share of refugee immigrants in the school grade	0.121 (0.163)	-0.279* (0.164)	-0.269** (0.134)	-0.155 (0.116)
Share of other immigrants in the school grade	0.012 (0.129)	-0.127 (0.130)	-0.249** (0.107)	0.0372 (0.0947)
Observations	54,441	58,764	85,907	115,634
R-squared	0.703	0.699	0.656	0.662

All controls as per column (III) table 1 including time dummies, school and family fixed effects. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 3: The Share of Refugees, Other Immigrants, and the Mathematics Scores of Native Students, 5th Grade 2007-2015. Changes in the Composition of Native Peers

	I	II	III	IV	V
Share of refugee immigrants in the school grade	-0.172* (0.0940)	-0.171* (0.0948)	-0.206** (0.0952)	-0.179* (0.0943)	-0.177* (0.0958)
Share of other immigrants in school grade	-0.0944 (0.0740)	-0.0916 (0.0740)	-0.103 (0.0745)	-0.0898 (0.0742)	-0.102 (0.0747)
Mean Fathers' Education	0.0231** (0.0101)				0.0202* (0.0111)
Mean Mothers' Education		0.0134 (0.0096)			0.0116 (0.0109)
Mean Fathers' Income			-0.000623 (0.000699)		-0.00124* (0.00075)
Mean Mothers' Income				0.000396 (0.000367)	0.00024 (0.000380)
Observations	203,039	203,039	203,035	203,036	203,032
R-squared	0.673	0.673	0.673	0.673	0.673

All controls as per column (III) table 1 including time dummies, school and family fixed effects. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE 4: The Share of Refugees, Other Immigrants, and the Mathematics Scores of Native Students, 5th Grade 2007-2015. Including and Excluding Large Cities

	Excluding the 5 Largest Cities	Only the 5 Largest Cities
Share of refugee immigrants in school grade	-0.184* (0.102)	-0.205 (0.243)
Share of other immigrants in school grade	-0.155* (0.0807)	0.138 (0.195)
Observations	166,364	35,137
R-squared	0.667	0.679

All controls as per column (III) table 1 including time dummies, school and family fixed effects. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE 5: The Share of Refugees, Other Immigrants, and the Mathematics Scores of Native Students, 5th Grade 2007-2015. The Role of Attending Neighbourhood Schools

	I	II	III
Share of refugee immigrants in school grade (and in the neighbourhood school)	-0.242* (0.132)	-0.254* (0.132)	-0.450** (0.224)
Share of refugee immigrants in school grade (uncertain if in the neighbourhood school)		-0.152 (0.121)	
Share of other immigrants in the school grade	-0.0933 (0.0738)	-0.0968 (0.0739	-0.168* (0.0987)
Observations	203,039	203,039	105,422
R-squared	0.673	0.673	0.679

All controls as per column (III) table 1 including time dummies, school and family fixed effects. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Column 1 reports our estimates where the share of refugees is only for those refugees where it is highly certain that they attend their closest neighborhood school. Column II introduces an additional control for shares of refugees where we are uncertain that they attend their neighborhood school. Column III excludes all schools where there is an uncertain if any refugees are attending it and it is not their neighborhood school.

TABLE 6: Non-Linear Effects of Refugees on the Mathematics Scores of Native Students, 5th Grade 2007-2015

	I	II
Share of refugee immigrants in school grade	-0.324** (0.158)	
Share of refugee immigrants in school grade ^{2}	0.692 (0.633)	
1 Refugee in class		-0.0119 (0.00922)
2 Refugees in class		-0.0258** (0.0118)
3+Refugees in class		-0.0359*** (0.0126)
Share of other immigrants in school grade	-0.0878 (0.0747)	-0.0936 (0.0739)
Observations	203,039	206,342
R-squared	0.673	0.671

All controls as per column (III) table 1 including time dummies, school and family fixed effects. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE 7: The Share of Refugees and the Mathematics Scores of Native Students, 5th Grade 2007-2015. Excluding School-Grades with High Refugee Shares

	I	II	III	IV	V
	Less than 50 %	Less than 40 %	Less than 30 %	Less than 20 %	Less than 10 %
Share of refugees in the school grade	-0.194** (0.0943)	-0.202** (0.0950)	-0.206** (0.0974)	-0.203* (0.111)	-0.330** (0.161)
Share of other immigrants in school grade	-0.0939 (0.0740)	-0.0937 (0.0741)	-0.101 (0.0743)	-0.106 (0.0762)	-0.0952 (0.0830)
Observations	203,005	202,880	202,138	196,950	172,102
R-squared	0.672	0.672	0.673	0.673	0.675

All controls as per column (III) table 1 including time dummies, school and family fixed effects. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE 8: The Effect of Refugee Shares on Measures of School Inputs

	Grade Enrolment	Student to Teacher Ratio	Ordinary instruction hours per student
Share of refugees in the cohort at school	-1.071 (1.874)	-0.00195 (0.00644)	-0.864 (2.724)
Share of other immigrants in the cohort at school	-3.374** (1.312)	0.00654 (0.0051)	-2.144 (3.230)
Observations	203,039	203,039	203,039
R-squared	0.952	0.808	0.809

All controls as per column (III) table 1 including time dummies, school and family fixed effects. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

TABLE 9: The Share of Refugees from Different Regions of Origin and the Mathematics Scores of Native Students, 5th Grade 2007-2015.

	I former Yugoslavia	II Africa	III Asia	IV Middle East
Share of refugees from…	-0.170 (0.224)	-0.387** (0.167)	0.197 (0.221)	-0.361** (0.177)
Share of other refugees	-0.196* (0.101)	-0.106 (0.112)	-0.265*** (0.102)	-0.125 (0.109)
Share of other immigrants in the school grade	-0.0954 (0.0740)	-0.0964 (0.0739)	-0.0959 (0.0739)	-0.0949 (0.0740)
Observations	203,039	203,039	203,039	203,039
R-squared	0.673	0.673	0.673	0.673

All controls as per column (III) table 1 including time dummies, school and family fixed effects. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

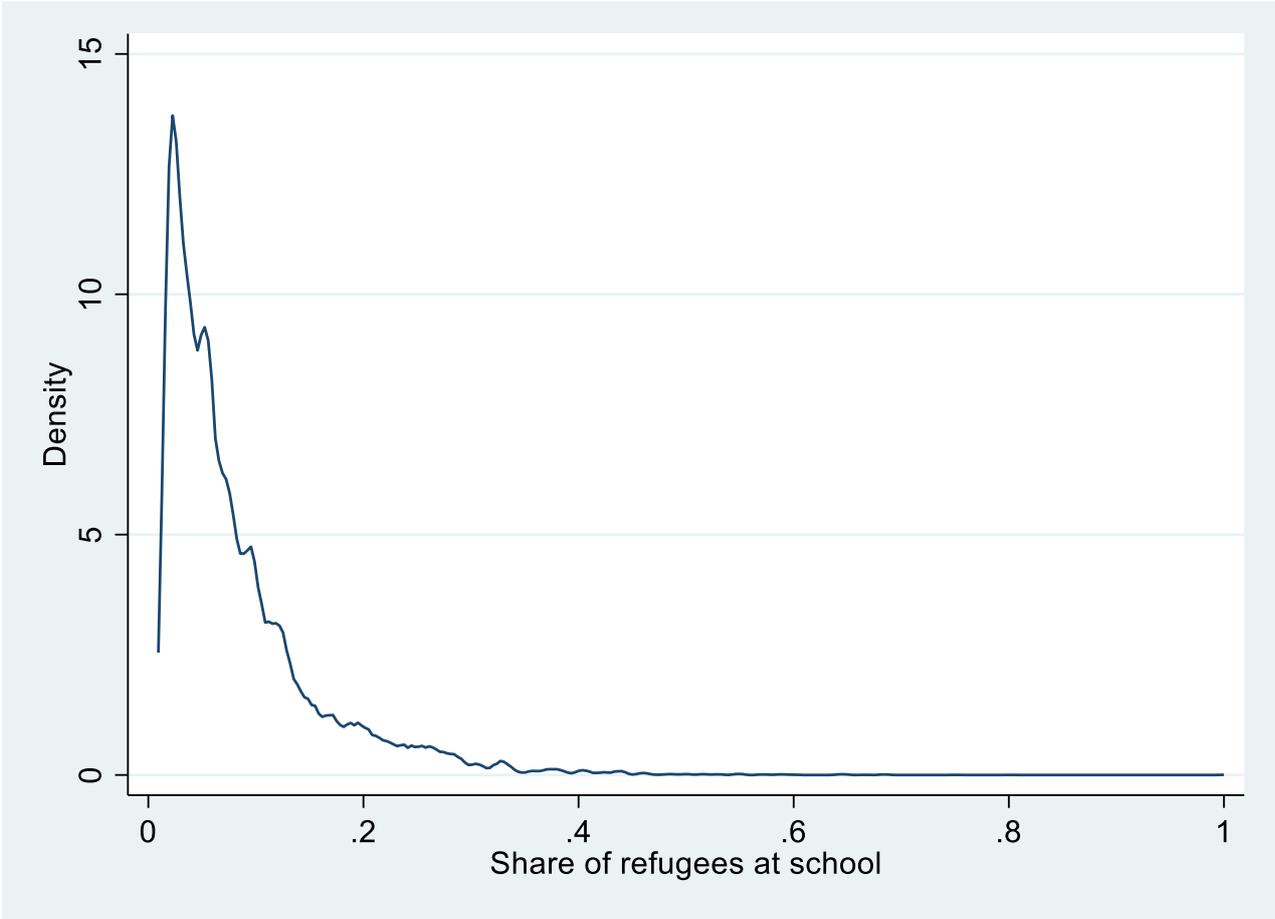**FIGURE 1: The Distribution of the Share of Refugees Across Grades, 2007-2015**

Table A1: Attendance, non-attendance and exemptions at Grade 5 national tests by subject and immigrant status, 2007-2015.

	Native Students	Refugees	Other immigrants
Math			
Did not meet	0,46	1,3	0,99
Exemption	1,96	9,23	6,77
English			
Did not meet	0,47	1,17	0,83
Exemption	2,26	10,18	7,45
Norwegian			
Did not meet	0,68	1,3	1,17
Exemption	2,65	12,56	10,43

Table A2: Descriptive statistics for key variables, Grade 5 Students 2007-2015

	Native students		Refugees		Other immigrants	
	Mean	**Std.dev**	**Mean**	**Std.dev**	**Mean**	**Std.dev**
Math Test Scores	0.048	0.983	-0.577	0.986	-0.229	1.04
Norwegian Test Scores	0.054	0.976	-0.614	1.020	-0.406	1.05
English Test Scores	-0.023	0.976	-0.269	1.070	0.034	1.09
Refugee Share	0.038	0.053	0.143	0.107	0.101	0.102
Other Immigrants Share	0.047	0.063	0.134	0.150	0.202	0.172
Grade Enrolment	41.2	22.20	48.4	20.10	47.7	22.00
Parity	1.92	0.97	2.34	1.53	1.84	1.100
Female	0.489		0.493		0.49	
Father's Income	586,254	483,070	264,304	23,001	413,247	369,741
Mother's Income	347,131	240,729	176,689	25,604	214,566	223,872
Father's education level:						
Unknown education	0.010		0.153		0.257	
Primary school	0.000		0.092		0.037	
Lower secondary school	0.154		0.279		0.202	
Incomplete secondary education	0.060		0.036		0.050	
Completed secondary education	0.435		0.202		0.198	
Degree or Higher	0.342		0.225		0.240	
Mother's education level:						
Unknown education	0.000		0.125		0.156	
Primary school	0.000		0.132		0.054	
Lower secondary school	0.134		0.349		0.255	
Incomplete secondary education	0.055		0.028		0.041	
Complete secondary education	0.323		0.202		0.214	
Degree or Higher	0.487		0.167		0.280	
Observations	393,461		22,128		25,085	

All test scores normalised to mean zero for each year-grade observation. Income in 2015 real values.

TABLE A3 Refugee Shares and Performance on Language Tests, 2007-2015

	Reading in Norwegian	Reading in English
Share of refugees in the cohort at school	0.0352 (0.0891)	0.0504 (0.105)
Share of other immigrants in the cohort at school	-0.107 (0.0723)	0.00840 (0.0867)
Constant	1.091*** (0.309)	0.692* (0.371)
Observations	194,430	152,781
R-squared	0.657	0.656

All controls as per column (III) table 1 including time dummies, school and family fixed effects. Robust standard errors clustered at the school-grade-year level in parentheses. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table A4 Selected Summary Statistics, Refugees and Region of Origin, 2007-2015

	Refugees from former Yugoslavia	Refugees from Middle East	Refugees from Africa	Refugees from Asia
Math Test Scores	-0.434	-0.593	-0.848	-0.318
Norwegian Test Scores	-0.470	-0.718	-0.763	-0.415
English Test Scores	-0.094	-0.410	-0.430	-0,021
Mother Income (NOK)	217 490	107 747	97 501	160 925
Father Income (NOK)	336 101	198 822	188 446	298 869
Father's education level:				
Unknown education	0.063	0.111	0.258	0.130
Primary school	0.020	0.142	0.085	0.115
Lower secondary school	0.209	0.254	0.287	0.353
Incomplete secondary education	0.055	0.028	0.025	0.053
Complete secondary education	0.450	0.184	0.165	0.157
Degree or Higher	0.207	0.281	0.180	0.192
Mother's education level:				
Unknown education	0.068	0.136	0.163	0.122
Primary school	0.032	0.141	0.186	0.152
Lower secondary school	0.294	0.344	0.372	0.383
Incomplete secondary education	0.037	0.024	0.017	0.044
Complete secondary education	0.375	0.153	0.163	0.169
Degree or Higher	0.193	0.209	0.098	0.129
Observations	4,220	7,351	7,789	4,736

All test scores normalised to mean zero for each year-grade observation. Income in 2015 real values.