Who Else is New? Immigrants, New Students, and Academic Performance in Peru

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This article examines the impact of a large and rapid immigration flow on the academic performance of native high school students. I use quasi-random variation in classroom assignment to identify the effect of an additional Venezuelan classmate on Peruvians' eighth-grade standardized scores. I find that an additional immigrant student reduces the academic performance of locals by 1.8% and 1.2% of a standard deviation in math and reading, respectively. These effects are not explained by resource dilution, are robust to the possibility of classroom assignment of immigrants being related to past academic performance of natives, and are also stable across subnational regions and between the public and private school systems. I observe that the magnitude and pattern of heterogeneity of these effects is comparable to that of introducing a new native student to a classroom, which suggests the relevant characteristic of immigrant students in this context is their newness to the school. Turning to mechanisms, I find no changes in the effects by teacher experience, and some evidence of a decrease in native student effort after introducing a new student–regardless of nationality

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JEL Classification: I21 I24 J15

1 Introduction

In 2020, movement between developing countries accounted for a higher share of international migrants than migration from developing countries into developed ones (Schewel and Debray, 2023). Yet, most economics and public policy research on international migration focuses disproportionately on the latter migration avenue. Addressing this knowledge gap is important. There are reasons to believe that resource constraints and the limited state capacity of developing countries magnify the challenges of receiving large inflows of immigrants. This paper contributes to that end by looking at the impact of one of the largest immigration shocks within Latin America on the performance of native students.

Immigration from Venezuela to other countries in South America rose sharply starting in 2015 in response to rapidly deteriorating economic conditions, food and medicine shortages, and increased political repression. By 2018, around 3 million Venezuelans (10% of the population) had left the country (Acosta et al., 2019). Venezuelan presence in Peru - the main destination in South America after Colombia - reached 800,000 immigrants by the end of 2019 (2.5% of the Peruvian population), increasing from around 7,000 people just four years earlier. Between 10% and 15% of the newly arrived immigrants were children of schooling age.

As these immigrant children incorporated into the Peruvian school system, I exploit the fact that students in Peruvian schools were assigned a classroom in a manner close to random to identify the causal effect of having an additional Venezuelan classmate on the standardized scores of Peruvian eighth-graders. In Peru, classroom assignment within a school-grade-year happens at the start of the academic year and there is no established practice of sorting students based on academic performance. Also, students take all their classes in the same room, with teachers moving between classrooms.[1] Finally, students or parents typically have no influence on classroom assignment. This allows me to compare the standardized test scores of Peruvian students in classrooms with different numbers of Venezuelan students, controlling for school-by-year fixed-effects, individual demographics, and lagged academic performance. This identifies the causal effect of increased immigrant student presence on native academic

[1] This means all eighth graders within one school will have the same math teacher and Spanish teacher.

performance assuming Venezuelan students are - conditional on controls - randomly assigned to classrooms within school-year units.[2] No assumptions are made about how Venezuelan students select into schools or geographical regions, or how the set of natives in one school changes over time.[3]

I find that sharing a classroom with an additional Venezuelan student decreases native math performance by 1.8% of a standard deviation and reading performance by 1.2% of a standard deviation. For context, the difference in math performance between male and female Peruvian eighth graders is around 12% of a standard deviation, and the difference between those categorized as low socioeconomic status and those categorized as medium socioeconomic status is 20% of a standard deviation. These effects are of similar magnitude across different subnational divisions and in public versus private schools. The size of these impacts is comparable to those found by Figlio, Giuliano, Marchingiglio, et al. (2023) and Contreras and Gallardo (2022). These results give rise to two related but separate questions.

First, how are immigrant students different from native students? A specific group of students can be different from their peers in dimensions such as their academic ability, their exposure to violence, the time they have spent in their current schooling environment, or cultural differences that involve beliefs about effort and achievement.[4] Immigrant students could be different from natives in some or all of these dimensions. Unfortunately, there is no data on immigrant students' characteristics before they moved into Peru. However, one distinct trait of newly arrived immigrants is that they are by nature new to their high school. Therefore, I compare the effect of an additional immigrant student in a classroom with that of an additional new native student. I find suggestive evidence that these two subsets of students impact incumbent native students in a similar way: I do not detect any statistically significant differences in effect sizes or

[2]Since I focus on the eighth grade, school-by-grade-by-year fixed-effects are equivalent to school-by-year fixed-effects. Controls include sex, age, socioeconomic index of the student, whether the student is new to their high school, past performance, and classroom size

[3]See Martinez Heredia and Martinez (2023) for an analysis of school choice in Peru after the Venezuelan immigration shock

[4]See Lavy et al. (2012) and Cooley (2009) on academic ability, Padilla-Romo and Peluffo (2023); Gutierrez and Molina (2021) and Carrell and Hoekstra (2010) on exposure to violence, Assaad et al. (2023); Figlio and Özek (2019); Imberman et al. (2012) on time spent in the current school system, and Figlio, Giuliano, Özek, et al. (2019) and Hsin and Xie (2014) cultural differences.

their pattern of heterogeneity. This suggests that a shared characteristic between immigrant students and newly enrolled natives drives the results - possibly the newness of both groups to their high school.

The second question that arises from my results is: How are the relevant characteristics of immigrant students translating into poorer academic performance of natives? Conceptually, these results are compatible with a few channels. First, a change in the size of the student body may result in resource constraints that affect student performance. For example, classroom teachers may not have sufficient time to pay adequate attention to each student when classroom sizes get too large.[5] Second, changes in the student composition in a particular classroom, school, or school system can have an additional effect on native student performance. For example, natives may reconsider how much effort they exert in school in reaction to the presence, characteristics, or behavior of their new peers in the classroom, or they might switch schools.[6]. Alternatively, teachers may adjust their teaching or grading behavior in response to a change in the number of immigrant students. The evidence I find is consistent with a story of natives reacting to the influx of new students to their school - both native and immigrant - by reducing their effort in learning. This is consistent with natives spending more time either befriending or antagonizing recently arrived students instead of studying. I find no evidence of teacher experience generating heterogeneity in the main effect, which implies no changes in teacher behavior driven by experience. Finally, I rule out changes in classroom size as the full explanation by constraining the comparison to school-grade-year units with similar-sized classrooms and controlling for classroom size in all specifications.

This paper is the first to highlight the similarities between immigrant students and natives who are new to their high school. This connects two strands of literature: research on the impact of immigrants on native students and research on domestic student mobility. The former body of literature constains mixed results. For example, Figlio, Giuliano, Marchingiglio, et al. (2023) find positive effects for the U.S., while Geay et al. (2013), Ohinata and Van Ours

[5]See Cho et al. (2012), Hoxby (2000), and Krueger (1999) on the effect of classroom size on academic performance. I explore classroom size changes within my sample on Appendix E.

[6]See Cascio and Lewis (2012) and Betts and Fairlie (2003) for evidence of *native flight* in the U.S. I explore native flight within my sample on Appendix E.

(2013), and Schneeweis (2015) find non-significant effects after accounting for selection of immigrants into schools. In the particular case of the Venezuelan immigration shock, Rozo and Vargas (2020) observe non-significant effects on native performance on standardized tests in Colombia, while Contreras and Gallardo (2022) find negative effects on math and reading performance of natives in Chile. The latter body of literature looks at student movements within the same country and also contains mixed results. For example, Imberman et al. (2012) studies the effect of American refugees after the Katrina Hurricane on the performance of peers in adjacent regions in the U.S. and observe little to no impact on local students performance. A few studies look at the impact of students changing schools on the incumbent students in the receiving school and find negative effects (Gibbons and Telhaj, 2011, Hanushek et al., 2004). This paper connects these two strands of the literature by highlighting the nature of recently arrived immigrants as students new to their specific high school.

Another contribution of this paper is to take advantage of the Peruvian context and data available for all eighth-graders in the country to use an underutilized identification strategy in the education literature: classroom assignment. And because my identification strategy relies on the allocation of students across classrooms within school-year units, I am able to treat the number of native students who are new to their high school as a separate shock. That is, I can also compare the performance of natives in classrooms with different numbers of new Peruvian students. Focusing on the incumbent native students - those natives who are not new to their high school - I then have two separate effects on academic performance: the effect of an additional immigrant classmate and the effect of an additional new Peruvian student.

This paper also contributes to the literature on immigrant students by providing evidence from a different context than the one most often studied in the literature. First, most of the literature on immigrant peers is focused on developed countries receiving immigrants from developing countries.[7] The impacts of immigration on native student performance in a developing country are likely to differ from those in developed countries because of the former's relatively weaker state

[7]See, for example, Figlio, Giuliano, Marchingiglio, et al. (2023) on the U.S., Schneeweis (2015) on Austria, and Geay et al. (2013) on England.

capacity and higher infrastructure constraints. The immigration shock studied here involves immigrants from a country with a similar development level to the host country - and from a similar education system. Second, research on this topic commonly involves students who do not natively speak the host country's language[8]. This characteristic of immigrants can be one mechanism to explain impacts on natives' performance. The immigration shock analyzed here involves immigrants who speak the same native language as native students, thus ruling out differences in language proficiency as a mechanism. Finally, even within Latin America, the Peruvian context is markedly different from other countries that received large inflows of Venezuelans. The main destination country, Colombia, already had a well-established Venezuelan population before the shock while Chile - another popular destination - received a selected sample of highly-educated Venezuelan immigrants.

This article relates to a broad debate about the impact of immigrants on the country receiving them.[9] I offer here a novel and subtle interpretation of what is behind the effect of immigrant shocks on academic performance. This can help inform migration policy in a broader sense. Policymakers should think carefully before attributing observed effects to characteristics inherent to immigrants instead of characteristics shared with a subset of native students. For example, public resources may be better spent on teacher training programs to help incorporate new students into high schools instead of enforcing policies specifically directed to immigrants.

This paper has three parts. The first one sets up the stage, the second presents an answer to my research question, and the last part discusses how to interpret that answer. The first part starts in Section 2, where I describe the Peruvian education system and the immigration shock. It continues in Section 3, where I introduce my data sources and explain how I construct my sample. Part I ends in Section 4, with the empirical strategy. Part II takes place in Section 5, where I show my main results and robustness exercises. Finally, part III bring the paper to a close, with Section 6 discussing how to interpret my results; and Section 7 connecting my findings to larger immigration questions and education policy.

[8] See, for example, Gould et al. (2009), Jensen and Rasmussen (2011), and Ohinata and Van Ours (2013).

[9] See, for example, Borjas (2014), Peri (2012), Card (2005)

2 Background

2.1 High School Education in Peru

The Peruvian Education System consists of eleven grades of education, divided into six-year primary school and five-year secondary school. It is common for schools to offer both primary and secondary education. There are no restrictions on school enrolment by students' place of residence, and private schools are commonplace and available at a wide range of tuition costs.

Within schools, classroom assignment for each grade occurs at the start of the academic year, and there is no established practice of tracking. Additionally, students take all their classes in the same room - with subject teachers coming in and out of the room and students keeping their same classmates throughout the school day. This means all students in one school-grade will have the same math teacher and the same Spanish teacher. Finally, students or parents typically have no influence on classroom assignment.

2.2 Immigration Shock

The Venezuelan population in Peru reached 800,000 migrants in December 2019, increasing from 7,000 people in January 2016. Unlike many immigration waves to developed countries that involve single male migrants, Venezuelans who entered Peru by 2018 were evenly split among men and women (Figure 1). They were mostly between 20-39 years old, and often constituted a couple and brought along their children. Between 10 and 15% of immigrants were of schooling age (between 6 and 16 years old).[10]

[10]Not all of these children were enrolled in a Peruvian school at the time of the 2018 survey. Around 54% of those aged 6 to 11 and 60% of those aged 12 to 16 did not regularly attend school. Immigrant families cited economic problems, lack of knowledge of the Peruvian schooling system, and lack of documents as the main reasons for not enrolling their children in school (INEI, 2019).

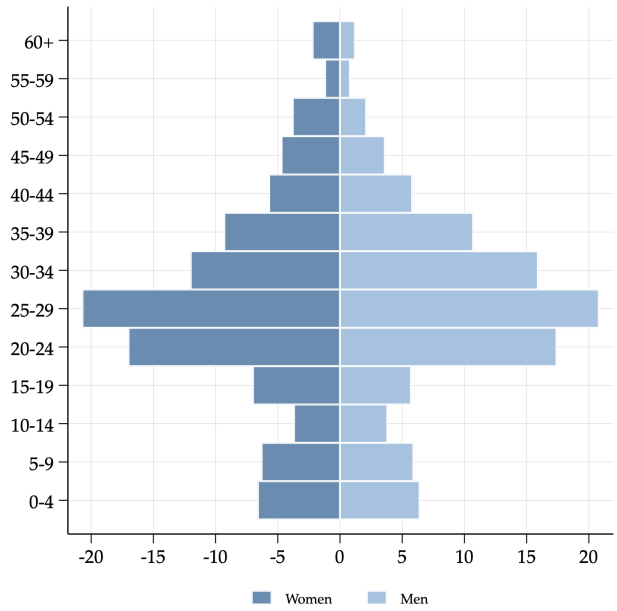

Figure 1: Age Distribution of Venezuelan Immigrants in Peru (2018)
Source: Peruvian National Migration Superintendency

A distinct characteristic of this immigration shock is the similarity of education levels between Peruvians and Venezuelans before the shock.[11] In addition, language and - to a great extent - culture, are similar between Venezuelans and Peruvians.[12]

[11] In 2015, the average years of education by age 25 was 9.09 and 9.64 for Peruvians and Venezuelans, respectively (United Nations Human Development Reports' Composite Indices and Components Time Series, recovered from https://hdr.undp.org/data-center/documentation-and-downloads on November 30, 2022.)

[12] That is not to say immigrants did not face discrimination. Discriminatory practices remained strong during this period (Freier and Pérez (2021)), despite only local negative labor market effects and some positive macroeconomic effects of the immigration event (Asencios and Castellares (2020), Groeger et al. (2024)).

3 Data

3.1 Data Sources

The main data source for this project is the annual *Evaluación Censal de Estudiantes* (Censual Student Evaluation or ECE, for its Spanish acronym). The ECE is conducted annually by the Peruvian Ministry of Education for all private and public schools in Peru and is currently available up to 2019. This dataset contains standardized testing records for math and reading at the individual level, but only for certain grades (second, fourth, or eighth grade) each year. I use scores on math and reading performance for students who were in the eighth grade in 2015, 2016, 2018, or 2019 as my main outcomes.[13] No test was administered in 2017 because of a nationwide teacher strike. The ECE design is based on Item Response Theory so that test scores are comparable within grades across years but not across grades (MINEDU, 2019). This dataset also contains student sex, age, and a socioeconomic status index. Administrative data allows me to observe student nationality, current report card grades, past report card grades, and school identifiers for each year in my sample; so that I can identify students who are new to their high school.

3.2 Definition of immigrant students

I consider immigrants all students in the Peruvian school system who were born in Venezuela. From 2014 to 2019, the total student population in Peru increased by 5.4%, while the Venezuelan student population in Peru in 2019 was more than 40 times as large as it was in 2014. The proportion of other foreign-born students in Peruvian eighth-grade classrooms remained stable and low during this period (Figure 2). Therefore, my sample is all Peruvian and Venezuelan students in the eighth grade during 2015, 2016, 2018, or 2019.

[13] I chose the eighth grade because it was tested the most often (4 times) during this period. Appendix A shows the evolution of Venezuelan presence in Peruvian schools is similar across grades.

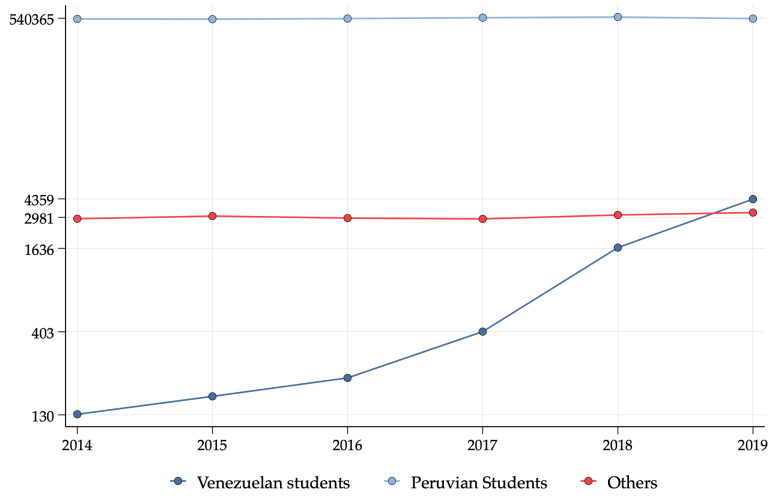

Figure 2: Number of Eighth-grade Venezuelan Students in Peru (logs)
Source: Peruvian Ministry of Education

3.3 Definition of sample of interest

I start with all Peruvian students who were enrolled in the eighth grade in either 2015, 2016, 2018, or 2019. To avoid school entry or exit into the market due to the immigration shock, I keep only schools that appear in all four years of the sample (82% of the original sample). Then I calculate the immigrant share at the school-year-classroom level, and I keep only Peruvian and Venezuelan students. Finally, I keep school-year units with variation in immigrant exposure across classrooms.[14] The final sample is 188,721 students across 8,278 classrooms.

[14]This excludes schools and school-year units with zero immigrant presence during the totality of the period of analysis.

3.4 Immigrant exposure

Immigrant exposure is measured as the number of Venezuelan students in a school-year-classroom unit (Figure 3). This is a sensible measure of exposure considering eighth-grade students in Peru are assigned one classroom at the start of the academic year and spend the totality of the school day in the same room, with the same group of classmates. The average classroom size is 29 students[15].

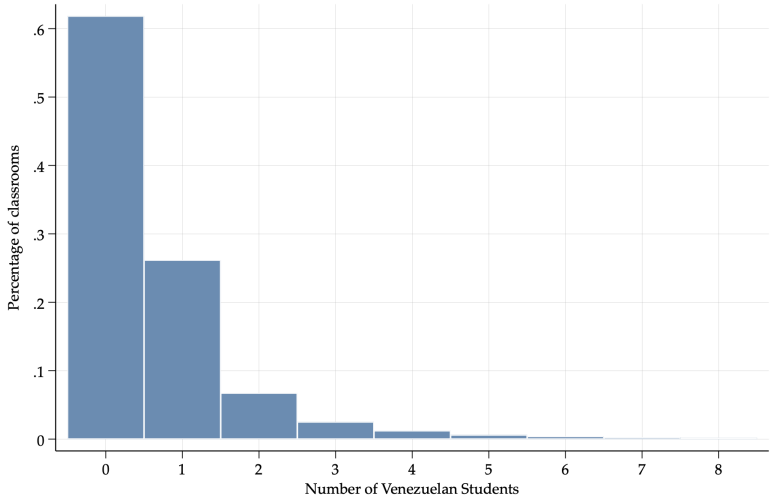

Figure 3: Distribution of Venezuelan Students across Peruvian classrooms
Source: Peruvian Ministry of Education

3.5 Characteristics of students

Table 1 shows summary statistics of student-level and classroom-level variables for native students. Peruvian students in classrooms with zero immigrant classmates scored on average slightly better in math and reading. When they have Venezuelan classmates, there are often one to four immigrant students, or between 3.5% and 14% of the students in the classroom, for a 28-student classroom. There are 1,292 schools in the sample in 239 different geographic districts. Around a fourth of schools are private, and almost all of them are located in urban areas.

[15] I define a classroom as a set of students that share a room in the school within a school-year unit. That is, every year there is a different set of classrooms in each school. Since the sample is restricted to eighth-grade students, school-year units are equivalent to school-grade-year units.

Table 1: Descriptive Statistics

	NumImm = 0		NumImm > 0	
	(1)	(2)	(3)	(4)
	Mean	SD	Mean	SD
Panel A: Individual-level Characteristics				
Math Test Score	0.203	0.953	0.150	0.946
Reading Test Score	0.279	0.934	0.246	0.925
Age	12.886	0.691	12.974	0.730
Socioeconomic Index	0.442	0.726	0.467	0.721
Share Female	0.508	0.500	0.502	0.500
Share changed school from last year	0.099	0.298	0.143	0.350
Number of Students	122,319		66,402	
Panel C: Classroom-level Characteristics				
Number of Immigrants	-	-	1.607	1.213
Classroom size	29.085	5.597	28.214	5.479
Number of Classrooms	5,119		3,159	

Table 1 shows descriptive statistics for the sample of eighth-grade Peruvian students in the analysis. Columns 1 and 2 refer to Peruvian students with zero immigrant classmates, while columns 3 and 4 refer to Peruvian students with at least one immigrant classmate.

4 Empirical Strategy

There is a negative correlation between the number of Venezuelan immigrants and Peruvian standardized test scores in any given classroom. However, several factors could be confounding this relationship. First, at the school system level, Venezuelan students select into Peruvian high schools. Particularly in the first years of the immigration shock, access to high school for Venezuelan immigrants might have been limited to lower-quality schools. Second, the composition of the student body in each school is changing over time. As more Venezuelans arrive, there could be movement of Peruvian students away or toward schools with a higher proportion of immigrants. If those Peruvians who change schools prompted by the entry of Venezuelans to their initial school are those performing relatively better than those who do not, there will be more underperforming Peruvians in schools with more Venezuelans, even if there is no direct causal link.[16] Finally, the assignment of immigrant newcomers to classrooms within school-year units might be related to past native academic performance. If all Venezuelan students were assigned to a classroom where Peruvians are already underperforming, it would look as if the immigrants negatively affect natives, even if there was no causal effect.

Using variation in immigrant exposure within schools accounts for the first problem, but not for the others. Looking at variation across classrooms within school-year units responds to the first and second potential issues, but not to the third. To address the three concerns mentioned here, I use variation in immigrant exposure across classrooms within school-year units while controlling for past native performance. In Peru, classroom assignment within a school-year unit occurs at the start of the academic year, students take all their classes in the same room, and there is no established practice of tracking. However, some schools might decide to assign students to classrooms based on past performance. Therefore, I regress the standardized test scores of Peruvians on Number of Immigrants, controlling for classroom size, past academic performance, demographic controls, and school-by-year fixed-effects.

[16] See Appendix E for an exploration of classroom size and native flight within my sample.

Formally, let i index Peruvian students, c denote classroom, s indicate school - only eighth grade - and use $t \in \{2015, 2016, 2018, 2019\}$ to index time. My main specification is:

$$y_{icst} = \alpha + NumImm_{cst}\beta + ClassroomSize_{cst}\theta + \mathbf{X}'_{icst}\gamma + \phi_{st} + \epsilon_{icst} \quad (1)$$

where X_{icst} includes past native performance, sex, age, age squared, student socioeconomic status, and recent school change, and ϕ_{st} are school-by-year fixed effects.

The identifying assumption for β is that, conditional on past native performance, Venezuelan assignment to classrooms within school-year units is as good as random.

5 Results

Table 2 shows the effect of variation in the number of immigrants in a classroom on Peruvians' performance in math and reading. Column 1 presents estimates with only covariates. Column 2 introduces school fixed-effects that produce a meaningful change in the estimates. This corroborates the argument that most of the selection of Venezulan students comes from school selection. Column 4 reports the results of estimating Equation 1. An additional immigrant student in the classroom leads to a 1.8% standard deviation decrease in math performance of natives and to a 1.2% standard deviation decrease in reading performance. The effects hold when partitioning the sample by capital region, natural region, or by private versus public school (Appendix B).

Table 2: Number of Immigrants and Native Academic Performance

	(1)	(2)	(3)	(4)
Results on math				
Number of Immigrants	-0.036***	-0.021***	-0.023***	-0.018***
	(0.004)	(0.003)	(0.004)	(0.004)
R-squared	0.078	0.191	0.196	0.421
N	188721	188721	188721	188234
Results on Reading				
Number of Immigrants	-0.025***	-0.017***	-0.016***	-0.012***
	(0.004)	(0.003)	(0.003)	(0.003)
R-squared	0.088	0.193	0.196	0.350
N	188721	188721	188721	188234
School FE	No	Yes	-	-
School x Year FE	No	No	Yes	Yes
Past Native Performance	No	No	No	Yes

All regressions are restricted to Peruvian students. All regressions include controls for sex, age, age squared, student socioeconomic status, recent school change, and classroom size. Robust standard errors shown in parenthesis are clustered at the school-year level.

I then test for nonlinearities on the impact of the number of Venezuelans. Estimates for different levels of immigrant exposure remain negative and statistically different from zero, but the confidence intervals are wide enough that there is no strong evidence to conclude that the effects are concave or convex as opposed to linear. These results look almost identical when allowing classroom size to also enter the specification nonlinearly (Appendix C).

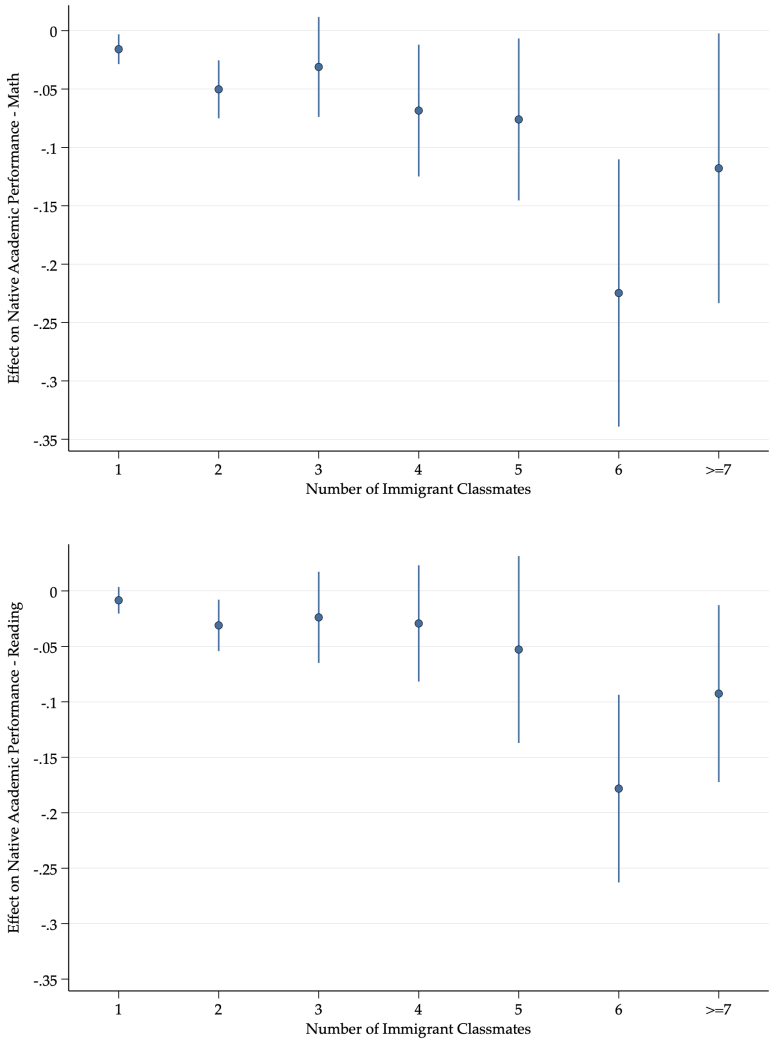

Figure 4: Nonlinear Effects

5.1 Robustness

A key issue in the identification process is the possibility that the within-school-assignment of Venezuelan immigrants to classrooms may be related to the past performance of Peruvians. If Peruvians were already underperforming before exposure to Venezuelans, any impact of more Venezuelan classmates might not be causal. Furthermore, if Peruvians were being assigned a classroom based on their own performance, low-performing natives would be surrounded by other low-performing natives that could further lower their academic performance. One strategy to account for this is directly controlling for individual past performance of natives, which is what the main specification does. Table 3 Panel A shows that results hold when using different measures of past native performance as controls, and when including peers' past performance in addition to own past performance as a control.

A different strategy is to analyze how likely is each school-year unit to be assigning students at random and then restrict the sample to only units where the random-assignment assumption is more plausible.[17] My sample consists of 1,879 school-year units, each of which has two or more classrooms. Let s index school-year units, denote the number of classrooms in each school-year unit by c_s, and let k index classrooms within units. I take the average of individual past performance in each classroom and compare it to the average of individual past performance in the whole school-year unit. That is, I calculate the mean squared error for each school-year (MSE) as follows:

$$MSE_s = \frac{\sum_{k=1}^{c_s} (\overline{score_s} - \overline{score_{sk}})^2}{c_s}$$

[17] This is a similar idea to that of de Gendre and Salamanca, 2020, who test for non-compliance of a national mandate to randomly assign students to classrooms within school-grades.

Then, for each school-year unit, I randomly reallocate each student to a classroom, keeping classroom sizes constant. I do this 1,000 times and record the simulated MSE each time. This gives me an empirical distribution of MSE under random assignment. For each school-year unit, I then compare the observed MSE to the produced distribution. Specifically, I calculate for each MSE_s the corresponding percentile of its associated distribution under random assignment. This gives each school-year unit a measure of how likely it is classroom assignment was random, as opposed to being driven by past performance (Appendix D, Figure D1).

Table 3 Panel B shows that the main result about the impact of exposure to immigrants remains close in magnitude and statistically significant when restricting the sample to those school-year units that placed between the 1st and 99th percentile and also when restricting the sample to school-year units assigned a percentile between the 5th and 95th. Point estimates in columns (2) and (3), as well as those in columns (4) and (5), are very close. This reflects the fact that restricting the sample in this way is already controlling for past performance as a factor in classroom assignment, and so including or excluding past performance as a covariate changes little in the estimation.

Table 3: Robustness Checks

	(1)	(2)	(3)	(4)	(5)
Panel A: Past Academic Performance					
			Math		
Number of Immigrants	-0.018***	-0.018***	-0.013***	-0.016***	-0.019***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
R-squared	0.421	0.332	0.402	0.346	0.422
N	188234	188234	134372	134396	188231
			Reading		
Number of Immigrants	-0.012***	-0.010***	-0.011***	-0.011***	-0.012***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)
R-squared	0.350	0.339	0.340	0.405	0.350
N	188234	188234	134372	134396	188231
7th-grade Math	✓				✓
7th-grade Spanish		✓			
2nd-grade ECE Math			✓		
2nd-grade ECE Reading				✓	
Peers 7th-grade Math					✓

	(1)	(2)	(3)	(4)	(5)
Panel B: Restricted Sample					
			Math		
Number of Immigrants	-0.018***	-0.016***	-0.015***	-0.014***	-0.014***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
R-squared	0.421	0.201	0.430	0.204	0.435
N	188234	132729	132367	108880	108578
			Reading		
Number of Immigrants	-0.012***	-0.009***	-0.008**	-0.008**	-0.008*
	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)
R-squared	0.350	0.206	0.360	0.211	0.365
N	188234	132729	132367	108880	108578
Full Sample	✓				
1st-99th Percentiles		✓	✓		
5th-95th Percentiles				✓	✓
7th-grade Math	✓		✓		✓

All regressions are restricted to Peruvian students. All regressions include controls for sex, age, age squared, student socioeconomic status, recent school change, and classroom size and school-year fixed effects. Robust standard errors shown in parenthesis are clustered at the school-year level.

6 Discussion

There are two related but separate questions to ask when interpreting the negative impact of immigrants on natives' academic performance. First, what is it about immigrants that is causing this effect? For example, immigrants could be lower-performing students or disruptive students. Second, how is that particular characteristic affecting native students? Are teachers reallocating time and effort to focus on immigrant students, thus giving less attention to natives? Are native students getting distracted by the incoming students?

It is difficult to answer the first question without data on immigrants before they entered the host country. However, I can compare them to another group of students with which they share at least one important characteristic: their newness to their particular high school.

6.1 Immigrants as new students

Venezuelan immigrants are - by nature of the shock - new students in Peruvian high schools. Could their status as new students help to explain their negative impact on natives? If it is the novelty of immigrant students and not something specific to immigrant status, we should expect to see an impact similar to the main result when using the number of new Peruvian students as treatment. With the original assumption of random assignment of students conditional on past performance, the number of new Peruvian natives entering classrooms within school-year units can be thought of as another treatment variable. Moreover, if both variables were affecting Peruvian incumbent students in the same way, we should expect any heterogeneity of the effects to also exhibit a similar pattern.

Table 4 shows that the effect of additional Venezuelan immigrants and the effect of additional new Peruvian students on incumbent natives' performance is not statistically different for math or reading, and the coefficients are of similar magnitude for reading (Column 1). I then interact each variable with covariates (sex, socioeconomic status, past performance) and then test for equality of two sets of coefficients: those associated with *Number of Immigrants* and with *Number of New Natives*, and those associated with the interactions of each of these treatments with covariates. I fail to reject the null hypothesis in almost all cases for both math and reading (Table 4, Columns 2-4).

These results suggest that one or more characteristics shared between new Peruvian students and immigrant students explain at least some of the impact on the academic performance of incumbent natives. In other words, immigrant students could be negatively impacting natives specifically because they are new to their high school, and not necessarily in a different way than new native students.

How are new students or immigrant students affecting natives? I now turn to this question by exploring the differential effects by teacher experience, and changes in student behavior.

Table 4: New Peruvian Students and Immigrants in the Classroom

	(1)	(2)	(3)	(4)
Panel A: Math				
Number of Immigrants	-0.017***	-0.012**	-0.016***	-0.017***
	(0.004)	(0.005)	(0.004)	(0.004)
Number of New Natives	-0.010***	-0.010***	-0.011***	-0.010***
	(0.001)	(0.002)	(0.002)	(0.001)
NumImm Interaction		-0.009**	-0.001	-0.008***
		(0.004)	(0.003)	(0.003)
NewNativ Interaction		-0.002	0.001	-0.004***
		(0.002)	(0.001)	(0.001)
R-squared	0.431	0.431	0.431	0.431
N	162309	162309	162309	162309
Interaction with Female		✓		
Interaction with Soc Status			✓	
Interaction with Past Perf				✓
Row1 = Row2 and Row3 = Row4				
p-value	0.169	0.107	0.297	0.228
	(1)	(2)	(3)	(4)
Panel B: Reading				
Number of Immigrants	-0.010***	-0.006	-0.008*	-0.011***
	(0.004)	(0.004)	(0.004)	(0.004)
Number of New Natives	-0.010***	-0.009***	-0.011***	-0.010***
	(0.001)	(0.002)	(0.001)	(0.001)
NumImm Interaction		-0.010**	-0.006	-0.006**
		(0.004)	(0.003)	(0.003)
NewNativ Interaction		-0.002	0.001	-0.003***
		(0.002)	(0.001)	(0.001)
R-squared	0.354	0.354	0.354	0.354
N	162309	162309	162309	162309
Interaction with Female		✓		
Interaction with Soc Status			✓	
Interaction with Past Perf				✓
Row1 = Row2 and Row3 = Row4				
p-value	0.993	0.275	0.247	0.740

All regressions are restricted to Peruvian students who were already in their eighth-grade school during the previous year. All regressions include controls for sex, age, age squared, student socioeconomic status, recent school change, classroom size, past academic performance, and school-year fixed effects. Robust standard errors shown in parenthesis are clustered at the school-year level.

6.2 Changes in Teacher Behavior

An increase in immigrant classmates might reduce native students' performance requiring teachers to spend additional instructional time with immigrants, thereby reducing teacher attention to natives. While I cannot directly observe teacher use of time, I can observe whether the effect of introducing immigrants is different if the distribution of teacher experience in the school changes.[18] I calculate the proportion of teachers in each school-year who have between 6 and 10 years of experience, between 11 and 15 years of experience, between 16 and 20, and 21 or more years of experience. I then interact each of these variables with the number of immigrants in a classroom and run a regression similar to my main specification.

Table 5, Panel A shows no discernable pattern of heterogeneity by teacher experience. In particular, one would expect to see a relatively large impact of experience between 6 and 10 years - compared to between 1 and 5 years - and then subsequent impacts getting smaller monotonically. Table 5, Panel B shows a similar result when looking at the entry of new native students as the shock.

These results suggest that teacher experience does not reduce the impact of new students on the performance of incumbents. This result in itself suggests that teacher training could benefit from increased attention to how to incorporate new students into the school. To the extent that teacher behavior is related to teacher experience, changes in the former would also not impact the effect of new student entry.

[18] This information is available for 2018 and 2019.

Table 5: Differential effects by teacher experience

	(1)	(2)	(3)	(4)
Panel A: Immigrants				
	Math		*Reading*	
Immigrant Count	-0.022***	-0.022***	-0.015***	-0.015***
	(0.004)	(0.004)	(0.004)	(0.004)
NumImm x 6-10 years of exp		0.006		0.008*
		(0.004)		(0.004)
NumImm x 11-15 years of exp		-0.006		-0.008*
		(0.005)		(0.004)
NumImm x 16-20 years of exp		-0.005		0.001
		(0.004)		(0.003)
NumImm x 21+ years of exp		0.002		0.002
		(0.005)		(0.004)
R-squared	0.416	0.416	0.343	0.343
N	143440	143440	143440	143440

	(1)	(2)	(3)	(4)
Panel B: New Peruvian Students				
	Math		*Reading*	
Number of New Natives	-0.012***	-0.012***	-0.011***	-0.011***
	(0.001)	(0.002)	(0.001)	(0.001)
NumNewNatives x 6-10 years of exp		0.002*		0.001
		(0.001)		(0.001)
NumNewNatives x 11-15 years of exp		-0.001		0.000
		(0.001)		(0.001)
NumNewNatives x 16-20 years of exp		-0.001		-0.001
		(0.002)		(0.001)
NumNewNatives x 21+ years of exp		0.000		0.000
		(0.002)		(0.001)
R-squared	0.416	0.416	0.343	0.343
N	143440	143440	143440	143440

All regressions are restricted to Peruvian students who were already in their eighth-grade school during the previous year and were in the eighth grade in 2018 or 2019. All regressions include controls for sex, age, age squared, student socioeconomic status, recent school change, classroom size, classroom size interacted with each of the categories of teacher experience, past academic performance, and school-year fixed effects. Robust standard errors shown in parenthesis are clustered at the school-year level.

6.3 Changes in Student Behavior

A different channel for the impact of immigrants on native performance is a change in student behavior after the immigration shock. For example, this could mean natives modify their level of effort or the frequency with which they interrupt class. Peruvian schools report a grade related to behavior only for 2019. The subject *"Independent Learning"* is graded based on how well the student defines their own learning goals, organizes learning strategies, and adjusts their performance during the learning process. As such, it is a measure of effort exerted by students.

Table 6 shows results for the sample of students in 2019 only. First, I compare the results in this sample with those in the main sample. Panels A and B show that the effect of having more immigrant classmates is negative and statistically significant, similar to my main results. Panels A and B further show that in this sample, the impact of the immigrant shock and that of the new natives shock is also comparable. Second, I use Independent Learning as an outcome and find negative effects of both shocks - 1% of a standard deviation - though the estimate is imprecisely estimated for the immigration shock.

Incumbent native students may react to additional immigrant and new native classmates by changing their patterns of social interaction, either by befriending or antagonizing the newly arrived students, and this changes the incumbent natives' level of effort and, finally, their academic performance.

Table 6: Effects on Student Behavior

	(1)	(2)	(3)
Panel A: Math			
Number of Immigrants	-0.021***		-0.018***
	(0.005)		(0.005)
Number of New Natives		-0.013***	-0.012***
		(0.002)	(0.002)
R-squared	0.414	0.414	0.415
N	87602	87602	87602
Row 1 = Row 3 p-value			0.259
	(1)	(2)	(3)
Panel B: Reading			
Number of Immigrants	-0.016***		-0.014***
	(0.004)		(0.004)
Number of New Natives		-0.013***	-0.012***
		(0.002)	(0.002)
R-squared	0.351	0.351	0.351
N	87602	87602	87602
Row 1 = Row 3 p-value			0.699
	(1)	(2)	(3)
Panel C: Independent Learning			
Number of Immigrants	-0.013*		-0.010
	(0.007)		(0.008)
Number of New Natives		-0.010***	-0.010***
		(0.004)	(0.004)
R-squared	0.492	0.493	0.493
N	87602	87602	87602
Row 1 = Row 3 p-value			0.960

All regressions are restricted to Peruvian students who were already in their eighth-grade school during the previous year and were in the eighth grade in 2019. The outcome "Independent Learning" is standardized. All regressions include controls for sex, age, age squared, student socioeconomic status, recent school change, classroom size, past academic performance, and school-year fixed effects. Robust standard errors shown in parenthesis are clustered at the school-year level.

7 Conclusions

This paper bridges the literature on immigrant effects on natives' academic performance and the research on the impact of new students on incumbents. I find robust evidence of negative impacts of immigrants on natives' performance, but also find these effects and their pattern of heterogeneity to be remarkably close to those that arise when introducing new native students to high schools. This allows me to offer a novel and subtle interpretation of an immigrant shock: that the newness of students is one relevant factor affecting incumbent students - regardless of the nationality of the new student. This can then help us think about how we handle migration in a broader sense. Policymakers should think carefully before attributing observed effects to characteristics inherent to immigrants instead of characteristics shared with a subset of native students. For example, public resources may be better spent on teacher training programs to help incorporate new students into high schools instead of enforcing policies specifically directed to immigrants.

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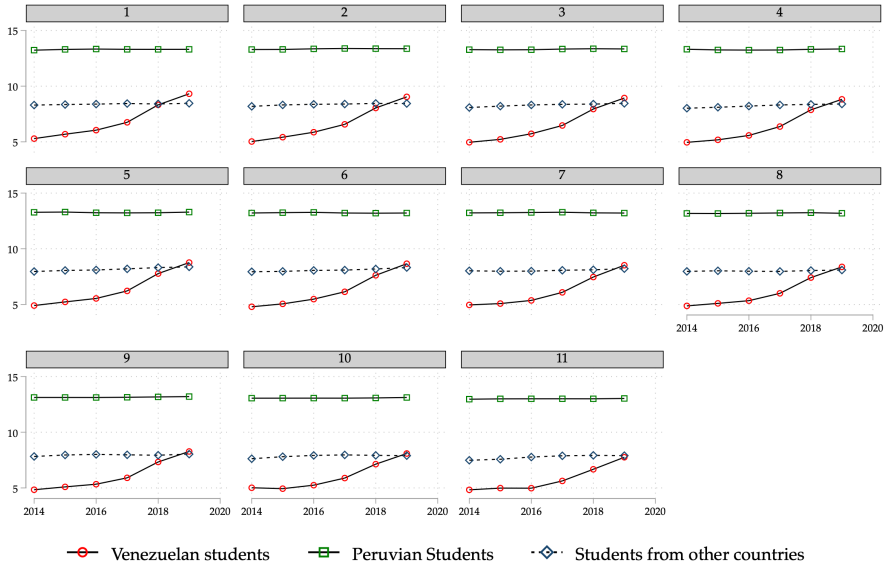
Appendix A: Evolution of Immigrant Students Number by Grade

Figure A1 shows that the immigration shock affected all grades in the Peruvian school system similarly.

Figure A1: Students in Peru by Country of Origin and Grade (logs)



Appendix B: Heterogeneous Effects

Figure B1 shows results from the main specification for completely exhaustive subsamples. First, since most of the schools in my sample are urban, I divide the sample into schools in the Peruvian capital (60%) and schools elsewhere. Then, I look at differences in the estimated effects between schools in the Peruvian coast (83%) and schools located in the highlands or jungle. Finally, I separate the sample into public (85%) and private schools.

Figure B1: Differential Effects by region and type of school

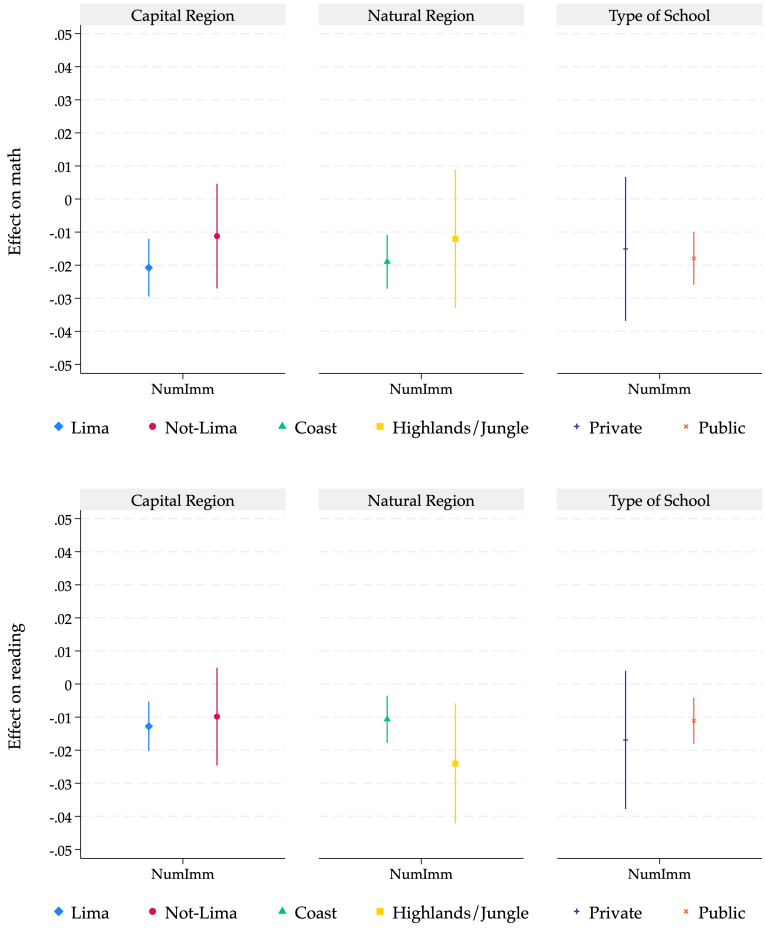


Table B1: Differential Effects by Sex of Immigrants and Natives

Panel A: Math

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of Immigrants	-0.018***	-0.014***						
	(0.004)	(0.004)						
NumImm x Female		-0.008**						
		(0.004)						
Number of Female Immigrants			-0.021***	-0.013**			-0.020***	-0.011*
			(0.005)	(0.006)			(0.005)	(0.006)
NumFemImm x Female				-0.015**				-0.015**
				(0.007)				(0.007)
Number of Male Immigrants					-0.019***	-0.017***	-0.017***	-0.017**
					(0.006)	(0.007)	(0.006)	(0.007)
NumMaleImm x Female						-0.004		-0.000
						(0.006)		(0.007)
R-squared	0.421	0.421	0.421	0.421	0.421	0.421	0.421	0.421
N	188234	188234	188234	188234	188234	188234	188234	188234

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Reading								
Number of Immigrants	-0.012***	-0.008**						
	(0.003)	(0.004)						
NumImm x Female		-0.008**						
		(0.004)						
Number of Female Immigrants			-0.011**	-0.005			-0.009**	-0.003
			(0.005)	(0.005)			(0.005)	(0.005)
NumFemImm x Female				-0.011*				-0.010*
				(0.006)				(0.006)
Number of Male Immigrants					-0.016***	-0.013**	-0.015***	-0.013**
					(0.005)	(0.006)	(0.005)	(0.006)
NumMaleImm x Female						-0.008		-0.005
						(0.006)		(0.007)
R-squared	0.350	0.350	0.350	0.350	0.350	0.350	0.350	0.350
N	188234	188234	188234	188234	188234	188234	188234	188234

Appendix C: Nonlinear Effects

Table C1 shows results from a nonlinear model on the effect of additional immigrant classmates on math or reading. Odd columns include classroom size as one variable, while even columns include classroom size as a set of binary variables.

Table C1: Nonlinear Effects

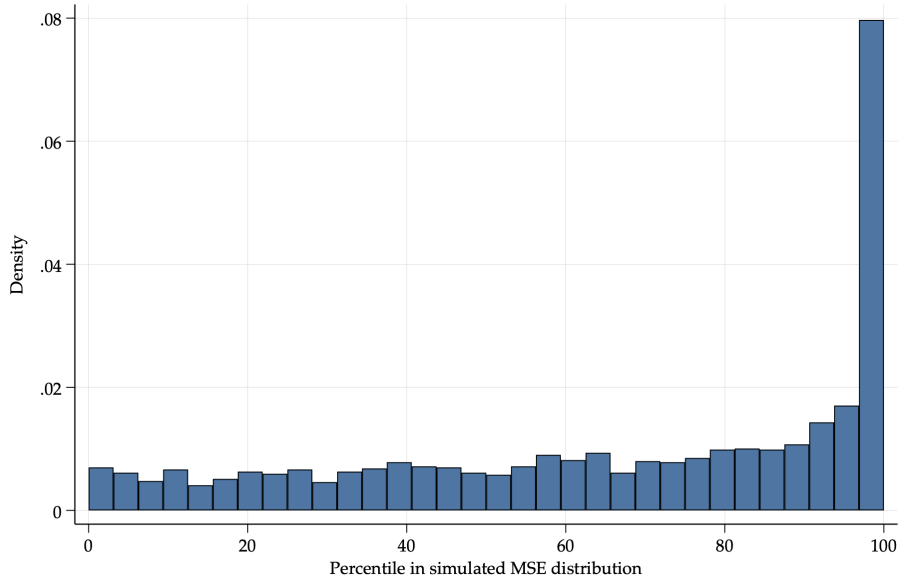
	Math		*Reading*	
	(1)	(2)	(3)	(4)
NumImm=1	-0.016**	-0.016**	-0.008	-0.008
	(0.006)	(0.006)	(0.006)	(0.006)
NumImm=2	-0.050***	-0.050***	-0.031***	-0.032***
	(0.013)	(0.013)	(0.012)	(0.012)
NumImm=3	-0.031	-0.030	-0.024	-0.024
	(0.022)	(0.022)	(0.021)	(0.021)
NumImm=4	-0.068**	-0.068**	-0.029	-0.030
	(0.029)	(0.029)	(0.027)	(0.027)
NumImm=5	-0.076**	-0.073**	-0.053	-0.054
	(0.035)	(0.035)	(0.043)	(0.043)
NumImm=6	-0.225***	-0.222***	-0.178***	-0.176***
	(0.058)	(0.059)	(0.043)	(0.044)
NumImm>=7	-0.118**	-0.120**	-0.093**	-0.095**
	(0.059)	(0.059)	(0.041)	(0.041)
R-squared	0.421	0.422	0.350	0.351
N	188234	188234	188234	188234
Classroom size Fixed Effects	No	Yes	No	Yes

All regressions are restricted to Peruvian students. All regressions include school-by-year fixed effects, past native performance, and controls for sex, age, age squared, student socioeconomic status, and recent school change. Odd columns include classroom size linearly, while even columns include classroom size as a set of binary variables. Robust standard errors shown in parenthesis are clustered at the school-year level.

Appendix D: Classroom Assignment within school-year units

Figure D1 shows the distribution of assigned percentiles for each of the school-year units in my sample. For each unit, I constructed a distribution of the mean squared error of student past performance under random assignment by simulating student assignment to classrooms - keeping classroom sizes constant. Then, I calculated to which percentile of this simulated distribution the observed mean squared error of student past performance correspondent. Some school-year units were assigned a 0 or 100 percentile, meaning student assignment to classrooms was either orthogonal or completely determined by past academic performance. However, the majority of school-year units fall somewhere in between. The robustness exercise presented in Table 3 uses restricted samples based on this distribution of assigned percentiles.

Figure D1: Distribution of Classroom Assignment Percentiles across school-year units



Simulated MSE distribution for each school-year unit comes from 1,000 simulations of random student assignment to classrooms. MSE is calculated using the difference between the average past academic performance in the whole school-year unit and the average past academic performance in each classroom in the school-year.

Appendix E: Classroom Size Effects and Native Flight

Aside from composition changes in school classrooms, two other phenomena are linked to an immigration shock. First, more immigrants in the school system mean bigger classroom sizes - at least in the short run. Second, native parents may move their children from schools with a relatively higher proportion of immigrants to other schools. My main results in the paper are robust to the occurrence and intensity of either of these changes, but I explore them here to better understand the immigration event in Peru.

Table E1: Correlations with Classroom Size and Native Flight within sample

	Classroom Size	*1 = Changed School*	
	(1)	(2)	(3)
Number of Immigrants	0.118***	0.005**	0.005**
	(0.040)	(0.002)	(0.002)
NumImm x Past Performance			-0.001
			(0.002)
R-squared	0.780	0.048	0.048
N	8278	60926	60926

For classroom size, I collapse my sample at the classroom level and then run a regression similar to my main specification. Table E1, Column 1 shows that for each additional immigrant student, classroom size only increased by 0.12 students. This means some native students were being reallocated to other classrooms at the same time immigrant students arrived, or new classrooms were opened.

For native flight, I focus on the last two years of my sample, when the migration event was more intense. For every native student, I construct a binary variable that shows whether the student changed schools between 2018 and 2019. I then run my main specification for the year 2018 only with that binary variable as the outcome. Table E1, Column 2 shows that for each additional immigrant classmate a native had in 2018, their probability of moving to a different school was 0.5 percentage points higher. However, this increase in probability is not different by past academic performance - measured as seventh-grade report-card math (Table E1, Column 3). That is, the likelihood of changing schools is higher when exposed to immigrant classmates, but it is not the highest or lowest-performing natives who are leaving.