Moving for Good:
Educational Gains from Leaving Violence Behind*

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Abstract

This paper estimates the effects of moving away from violent environments into safer areas on migrants' academic achievement in the context of the Mexican war on drugs. Using student location choices across space and over time, we recover individual-level migration paths for elementary and middle school students across all municipalities in Mexico. We find that students who were induced to leave violent areas due to increased violence experience academic gains after relocating to safer areas. These results seem to be explained by increases in school attendance and improvements in the learning environment after they move.

JEL classification: I24, I25, O15.
Keywords: Local violence; Migration; Educational trajectories.

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1 Introduction

Children's academic achievement and health outcomes are a function of their individual characteristics, school and parental inputs, and the local conditions they face in their communities. A central aspect that characterizes local environments that negatively affect students' outcomes is the exposure to local violence. Out-migration to safer areas is a way in which families can try to avoid the detrimental effects of violence. However, migration involves up-front costs related to relocation and costs associated with assimilation once people are established in a new place, and students switching schools could suffer learning losses due to adaptation. It is unclear if the welfare gains related to exposure to a safer context outweigh the migration costs.

In this paper, we provide causal evidence on the returns to migration, focusing on violence as a push factor, shedding light on the potential academic achievement gains of leaving violence behind. Using violence-induced migration as a quasi-exogenous shock, we study how moving out to safe areas affects students' academic performance. We analyze this in the context of the Mexican war on drugs, a period in which local violence reached unprecedented levels in Mexico.

Estimating the returns to migration has several empirical challenges. Movers and non-movers are likely to differ in unobservable characteristics, and naïve comparisons between movers and stayers can lead to biased estimates. Moreover, the same concern arises when comparing movers who migrate to different destinations, as the destination choice may be correlated with unobservables that affect the outcomes. To address these limitations, we estimate a model that compares test scores before and after migration for the same student and leverages the variation within the school of destination across students who relocate from municipalities with different levels of local violence. We compare students who migrate to the same destination schools located in areas that remained safe in the period of analysis.

Our setting and empirical approach have several advantages that allow us to overcome challenges typically present in the migration literature. Following Padilla-Romo and Peluffo

(2023b), we use students' location choices to build comprehensive migration flows over time. Our data targets the universe of students enrolled in elementary and middle school, which, given the large enrollment rates, account for the universe of movers in the case of elementary school-aged children and a large fraction of middle school-aged children before and after they move.[1] Moreover, we control for unobservable individual characteristics and characteristics common to the origin and destination. Importantly, migration happens in a context with a centralized educational system, which implies that, differently from refugees, international migrants, and national migrants in countries with decentralized school systems, movers do not need to adjust to a new language, to significant cultural changes, or a new education system. Our results indicate that for migrant students in elementary and middle schools in Mexico, relocation to safer local environments causes significant increases in test scores, which seem to be explained by improvements in student attendance and school environment.

The paper contributes to the literature that estimates the effects of migration from (broadly defined) disadvantaged areas on individual outcomes.[2] Among these students, experimental literature has studied the effects of moving out from poor neighborhoods in the U.S. in the context of the randomized program Moving to Opportunity (Sanbonmatsu et al., 2006; Chetty et al., 2016; Kling et al., 2007; Clampet-Lundquist and Massey, 2008; Ludwig et al., 2013; among others) and the effects of temporal migration in Bangladesh lean season (Bryan et al., 2014). Studies on the effects of relocation on migrants' outcomes using non-experimental settings include the effects of relocation due to natural disasters (Deryugina et al., 2018; Deryugina and Molitor, 2020), due to public housing demolitions (Chyn, 2018; Haltiwanger et al., 2020), and in the context of the great migration (Collins and Wanamaker, 2014; Countryman, 2017).[3]

We also contribute to understanding how drug-trafficking-related violence affects human

[1]For example, in 2010-2011, the national enrollment rate in middle school was 80.3% and 101.7% in elementary school.

[2]In our case, a disadvantaged area is defined in terms of levels of violence, which are not necessarily correlated with economic deprivation.

[3]Chyn and Katz (2021) provides an excellent review of the literature on neighborhood effects with a focus on evidence from high-income countries.

capital accumulation in the context of Mexico. It has been documented that increases in local violence lead to significant reductions in academic achievement in terms of test scores, years of education, school completion, and grade retention (Caudillo and Torche, 2014; Jarillo et al., 2016; Brown and Velásquez, 2017; Orraca-Romano, 2018; Chang and Padilla-Romo, 2022; Michaelsen and Salardi, 2020). Moreover, in previous studies, we have shown that the effects of violence are not restricted to the areas in which violence occurs. Specifically, violence-induced migration of previously violence-exposed students generates negative spillover effects in academic achievement among incumbent students in safe areas in the short run (Padilla-Romo and Peluffo, 2023b) that persist later in life (Padilla-Romo and Peluffo, 2023a). In this paper, we add to this literature by examining the returns to migration that students who move out of violence and relocate into safer areas obtain in terms of academic achievement.

2 Data

To identify migrants, we use data from ENLACE, a diagnostic test offered to all students in grades 3-6 of elementary school and 7-9 of middle school in Mexico. Our data includes students enrolled in schools that belong to the public and the private systems in Mexico who took the test once a year between 2009 and 2013.[4] ENLACE contains anatomized student identifiers that allow us to track students over time. We use the location of the school in which the student is enrolled when taking the test each year to identify migratory flows. Students will be classified as movers if they switch schools across years. A mover is someone who, between academic year t and academic year $t+1$, relocates to a different school in a municipality other than the municipality in which the school in which she was enrolled in year t. The origin and destination municipalities can belong to the same or

[4]In the case of elementary school ENLACE is available starting in 2006. Since the test was applied to all three grades of middle school beginning in 2009, we restrict our sample of elementary school students to the period 2009-2013 for consistency. The results are robust when we include the period 2006-2008 in the analysis for elementary school students.

different states. Because the transition between elementary and middle school typically involves school switching, we analyze movers separately for elementary and middle school (i.e., starting for the first time we observe a student in elementary or middle school, we consider someone as a mover if this individual switched municipalities in elementary or in middle school).

ENLACE contains questions on math, reading, and a third rotating subject. Our main outcome variable is the standardized composite test scores (math and reading). Our sample is restricted to movers, i.e., students whose municipality of school enrollment changes over time. In addition, we restrict our analysis to students observed four consecutive times for elementary school and three consecutive times for middle school.[5]

We use information from death certificates to measure exposure to local violence in each municipality and academic year. To do so, we build homicide rates as the number of deaths registered in a municipality as presumed homicides per 100,000 inhabitants in an academic year (August to July).

To shed light on the mechanisms driving the main results, we use ENLACE's context questionnaire, which has self-reported information regarding attendance behavior, incidence of bullying, and school environment for a sample of students taking the ENLACE exam. Specifically, students answer the following questions with possible answers never (0), hardly ever (1), sometimes (2), almost always (3), and always (4): How often do you skip school? How often do you skip class while in school? How often do you receive physical aggression by your classmates? How often are there physical aggression or fights in your school? How often are there threats in your school? How often students make fun of other students? How often students make fun of teachers? How often students damage school property? For each of these questions, we normalize the outcome for each academic year to have a mean of zero and a standard deviation of one.

[5]For students observed more than four (three) consecutive years in elementary (middle) school, we include the first four (three) consecutive observations in our analysis.

3 Identification Strategy

We restrict our sample to movers to estimate the relative gains of moving out of violence. A mover is a student who, either in elementary or middle school, was enrolled in school A in academic year t and in school B academic year $t+1$. We require schools A and B to be located in different municipalities and school B to be located in a municipality that remained safe during the analysis period. In particular, we consider destination municipalities that had homicide rates below the upper quartile of the cross-municipality distribution of homicide rates in each year during the period 2006-2013.[6]

Our main estimation equation is as follows:

$$TS_{isgt} = \alpha_i + \gamma_{gt} + \eta_{s_d t} + \sum_{j \neq -1} \beta_j 1(t = j) \Delta Homicide_{m_o m_d t} + \epsilon_{isgt} \tag{1}$$

where TS_{isgt} represent the standardized test score for student i, enrolled in school s, grade g in year relative to moving t, α_i, γ_{gt}, and $\eta_{s_d t}$, are student, grade-by-year relative to moving, and relative year by school of destination fixed-effects, and $\Delta Homicide_{m_o m_d t}$ measures the (standardized) pre-migration difference of the five-year average in homicide rates in the municipality of origin relative to the destination municipality. Standard errors are clustered at the student level.[7] In this model, β_j recovers the effects on test scores of a one standard deviation increase in safety ($\Delta Homicide_{m_o m_d t}$) j years after moving.

Suppose we observe that new students who relocate from violent to safe municipalities do, on average, better than those who migrated from other non-violent municipalities. In that case, we cannot conclude that safety generates gains in terms of academic achievement because these correlations may be due, at least in part, to selection into specific areas. To address this issue, we control for school of destination-by-relative time fixed-effects. Intuitively, we are comparing students who migrated from areas that experienced higher levels

[6] This group of municipalities follows the definition of "never-violent" municipalities in Padilla-Romo and Peluffo (2023b).

[7] Figure 1 shows the distribution of $\Delta Homicide_{m_o m_d t}$ for all students in our sample. Overall, 57% of all students in our sample are moving to safer, never-violent municipalities.

of violence relative to students who are enrolled in the same school and migrated from relatively safe areas the same number of years ago. Thus, the model allows for selection into destination schools and leverages the variation in the level of violence in the municipality of origin to recover the estimates of interest. Including student fixed effects allows us to control for time-invariant individual characteristics that can affect academic achievement.

The identification of the effects relies on the assumption that in the absence of migration (conditional on the controls included in the model), test scores would not exhibit differential trends for students living in areas with different levels of violence. By analyzing student outcomes trends prior to migration, we will provide supporting evidence in favor of this assumption. Specifically, we will show that students in high-violence areas (relative to the destination) were not experiencing improvements in test scores before migration.

4 Results

Considering all movers to never-violent municipalities, in Column 1 of tables 1 and 2, we estimate our baseline specification in Equation 1 for elementary and middle school students, respectively. In Column 2, we additionally control for the difference in the quality of education between the origin and destination municipalities, measured by the pre-migration differences in averages test scores between their municipality of destination and origin.[8] Regardless of the specification, the results indicate that moving away from violent municipalities improves elementary and middle school students' academic achievement. The estimates from our preferred specification in Table 1 Column 2 indicate that a one standard deviation increase in safety increases elementary school students' test scores by 1.5 percent of a standard deviation the year of the move, this effect increases to 4.1 percent two years after moving.[9]

[8] In Figure 2, we show the distribution of the relative change in education quality between the origin and destination municipalities. In Figure 3, we further show that these changes in education quality are not correlated with student's baseline (pre-migration) test scores.

[9] A one standard deviation increase in safety is measured by an increase in one standard deviation in the pre-migration difference of the five-year average in homicide rates in the municipality of origin relative to the destination municipality.

For middle school students, this same increase in safety increases test scores by 2.1 and 1.6 percent of a standard deviation the year of the move and one year after, respectively. Moreover, it is worth noting that after controlling for the relative gain in education quality, the point estimates remain similar in magnitude and statistical significance to the ones in our baseline specification.

Figure 4 presents the estimated results using our preferred specification in Column 2 of tables 1 and 2 when including the pre-treatment effects, considering elementary (Panel (a)) and middle school (Panel (b)) students. A potential concern is that the post-migration differential gains for students previously exposed to higher levels of violence could be explained by differential trends in academic achievement for students arriving from areas with heterogeneous homicide rates relative to the destination. However, the coefficients for the years before migration show that this is unlikely as these are close to zero and not statistically significant.

To put our estimates in context, in Figure 5, we examine how relative increases in safety translate into homicide rate reductions for students leaving violent areas behind. In particular, we find that a one standard deviation increase in the 5-year average pre-migration difference in homicide rates in the origin versus the destination municipality, on average, reduces homicides by 25 (per 100,00 inhabitants) for elementary school movers and by 30 homicides (per 100,000 inhabitants) for students who migrate during middle school.

For example, for an elementary school student who in 2010 migrated from Ciudad Juárez (where the average homicide rate between 2005 and 2009 was 50.4) to Guadalajara (where this average was 8.5), the average estimated increase in test scores two years after migration is 6.9 percent of a standard deviation.[10]

[10]This number is calculated using the 5-year average pre-moving homicide rates and the estimated effects in Panel (a) of figures 4 and 5. That is, $\frac{50.4-8.5}{25} \times 4.1 = 6.9$.

5 Mechanisms

In this section, we provide suggestive evidence on the mechanisms behind the improvements in the academic performance of students who moved to safer areas. As mentioned in Section 2, for the sample of movers in the context questionnaire, we observe self-reported measures of attendance behavior, bullying, and school environment. We use this information in a regression setting where we estimate a modified version of our preferred specification. We focus our analysis on all movers who migrated to a safer never violent municipality (i.e., m_d is never violent and $\Delta Homicide_{m_o m_d t} > 0$) and estimate a model that includes the municipality of destination-by-grade-by-academic-year fixed effects ($\alpha_{m_d gy}$).[11] Specifically, we estimate the following model:

$$Y_{im_dgy} = After_y\beta + \alpha_{m_dgy} + \epsilon_{im_dgy} \tag{2}$$

where Y_{im_dgy} are our different normalized measures of attendance behavior, bullying, and school environment, and $After_y$ is an indicator for the years after the move.

The results of this specification are shown in Figure 6. The estimates suggest that when students move to safer, never-violent municipalities, they report improvements in school attendance, less incidence of bullying, and a better school environment. That is, they report skipping school and being physically abused by their classmates less often. They also report lower incidences of physical aggression or fights in their schools, students making fun of students, and students damaging school property. These results suggest that increased attendance and an educational environment more prone to learning are potential mechanisms behind the improvements in academic performance we document in Section 4.

[11] Given that for most students in this sample, we observe them at most once, we are unable to include student fixed effects or school of destination-by-time fixed effects.

6 Conclusion

This paper studies the causal effects of moving out from violent areas into safer ones on students' academic performance. We rely on an administrative longitudinal dataset with information on students' location choices and a standardized test given to the same student in subsequent years. Our research design and the richness of our data allow us to compare students with themselves before and after they moved. Using students' location choice and the variation in the level of violence across origin and destination municipalities in the context of the Mexican war on drugs, we identify the returns to migration for students who are pushed to out-migrate from municipalities that experience increases in violence. We find that improving safety after moving increases test scores. These increases in test scores are potentially driven by improvements in attendance behavior, bullying, and school environment after moving. Altogether, our results highlight the importance of neighborhood safety on children's human capital accumulation.

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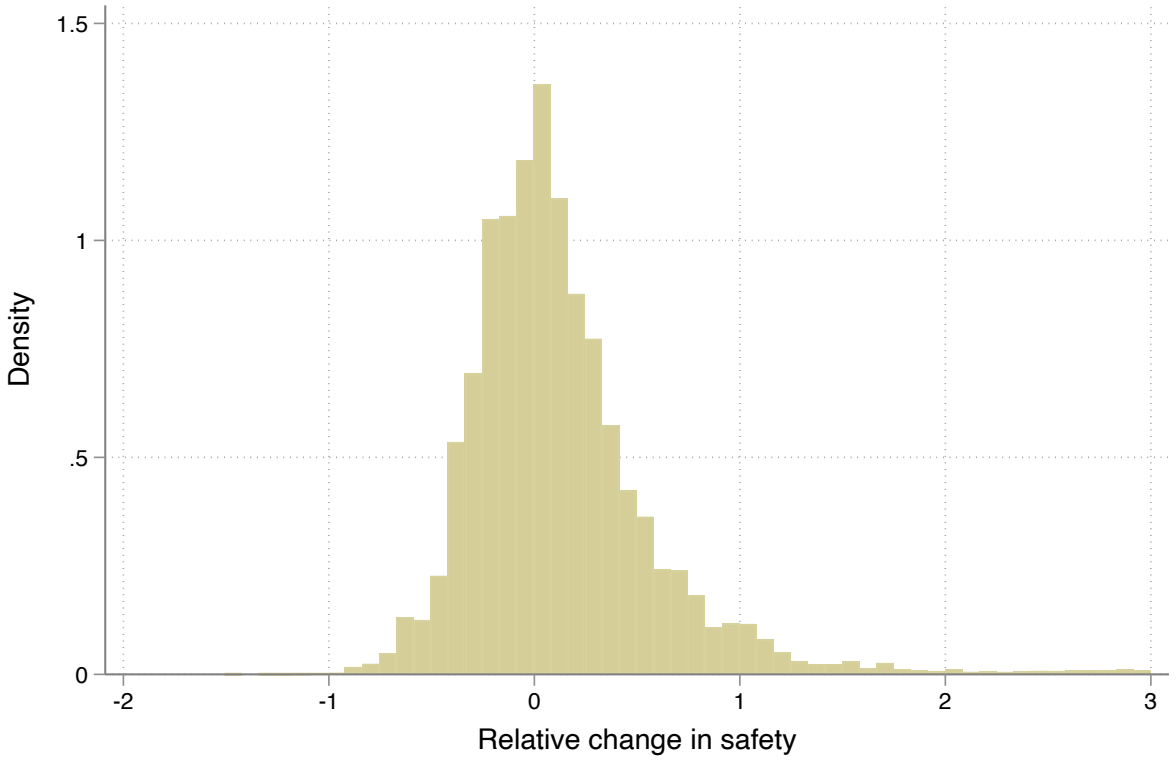
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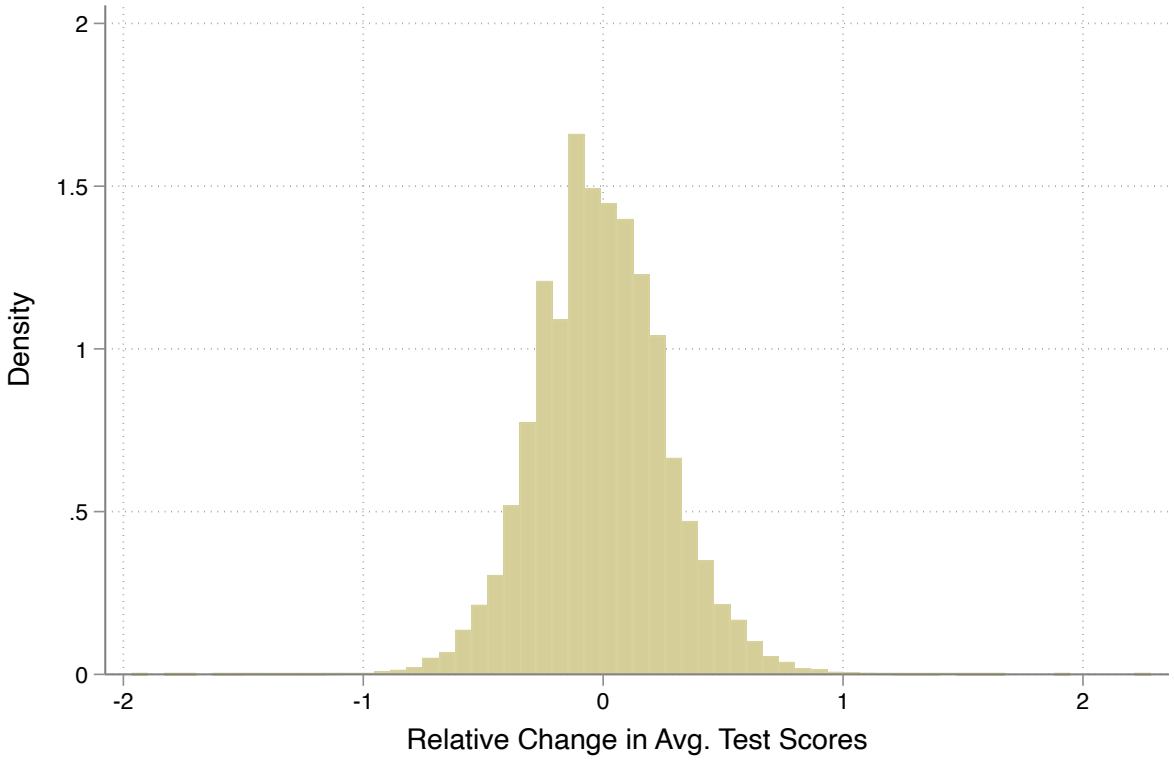
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Figure 1: Distribution of the Relative Change in Safety in Never-Violent Destinations ($\Delta Homicide_{m_o m_d t}$)



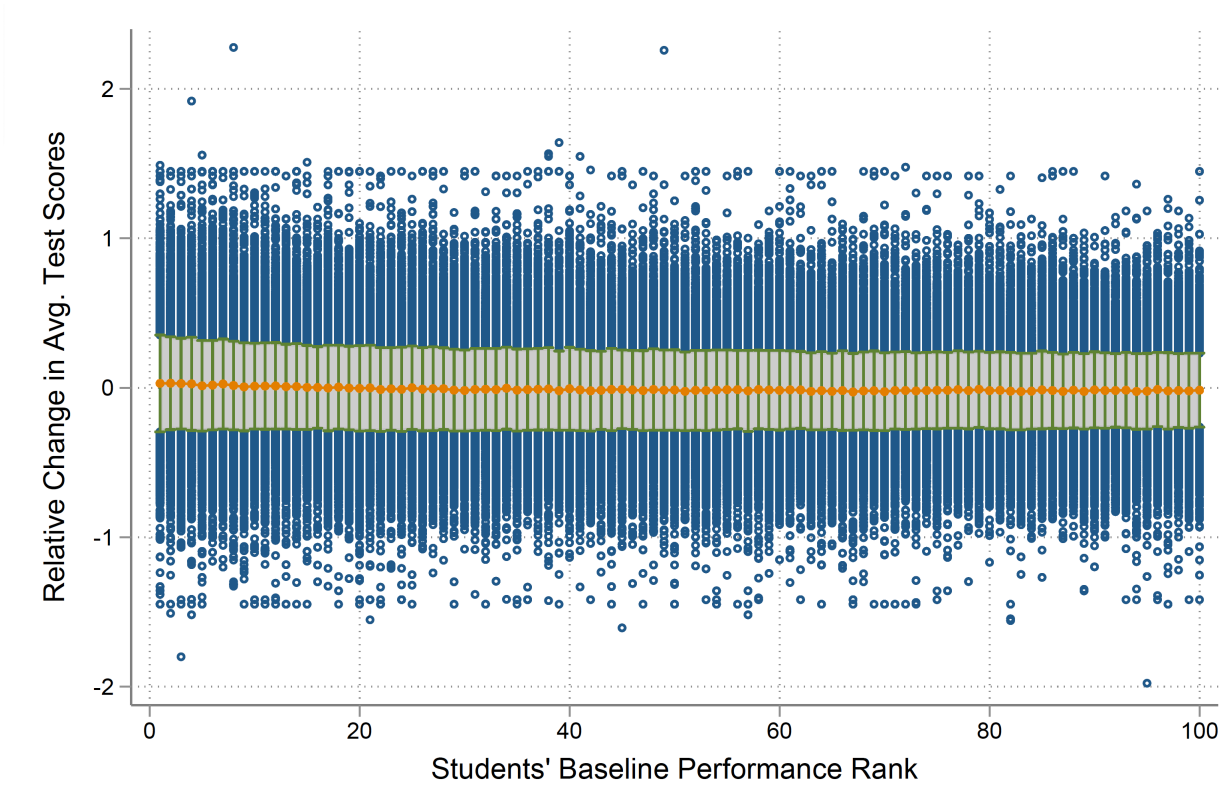
Notes: This figure shows the distribution of students' pre-migration difference of the standardized five-year average in homicide rates in the municipality of origin relative to the destination municipality. Positive values indicate improvements in safety in the municipality of the destination relative to the origin.

Figure 2: Distribution of the Relative Change in Avg. Test Scores ($\delta_{im_om_d}$)



Notes: This figure shows the distribution of students' average change in test scores between their municipality of origin and destination. Positive values indicate improvements in the average test scores of students in the municipality of destination relative to the origin.

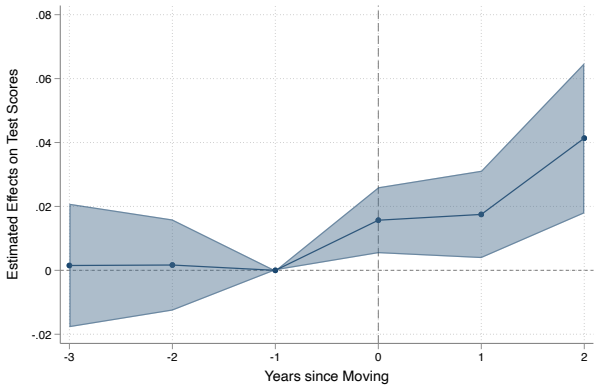
Figure 3: Baseline Performance Rank in the Percentile Distribution and Relative Change in Avg. Test Scores



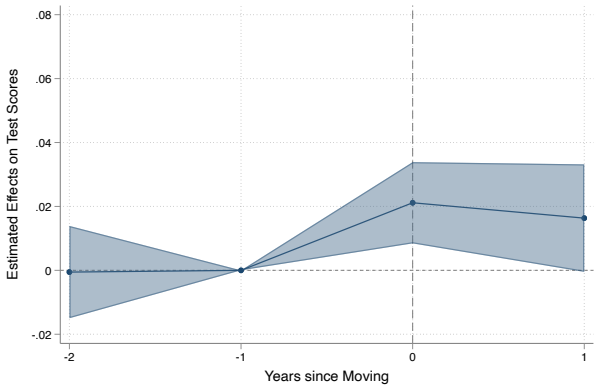
Notes: The figure shows a scatter plot together with mean and confidence intervals. The vertical axis shows the relative change in test scores between the municipality of origin and destination. The horizontal axis displays the students' baseline (prior to moving) performance rank in the percentile distribution of movers' test scores.

Figure 4: Estimated Effects on Test Scores by Educational Level

(a) Elementary School



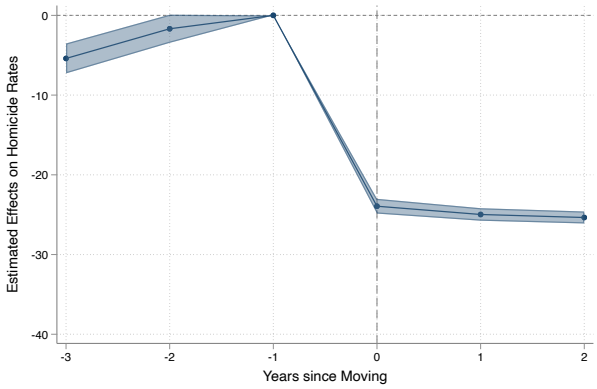
(b) Middle School



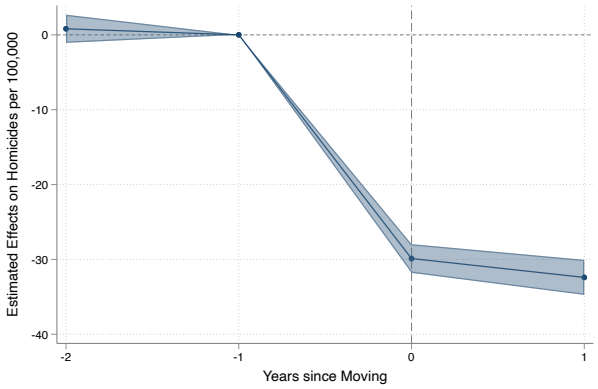
Notes: Estimates and confidence intervals in each panel come from the same regression the includes student fixed effects, grade-by-relative time fixed effects, and school of destination-by-relative time fixed effects. Standard errors for confidence intervals are clustered at the individual level.

Figure 5: Notes: Estimated Effects on Homicide Rates by Educational Level

(a) Elementary School

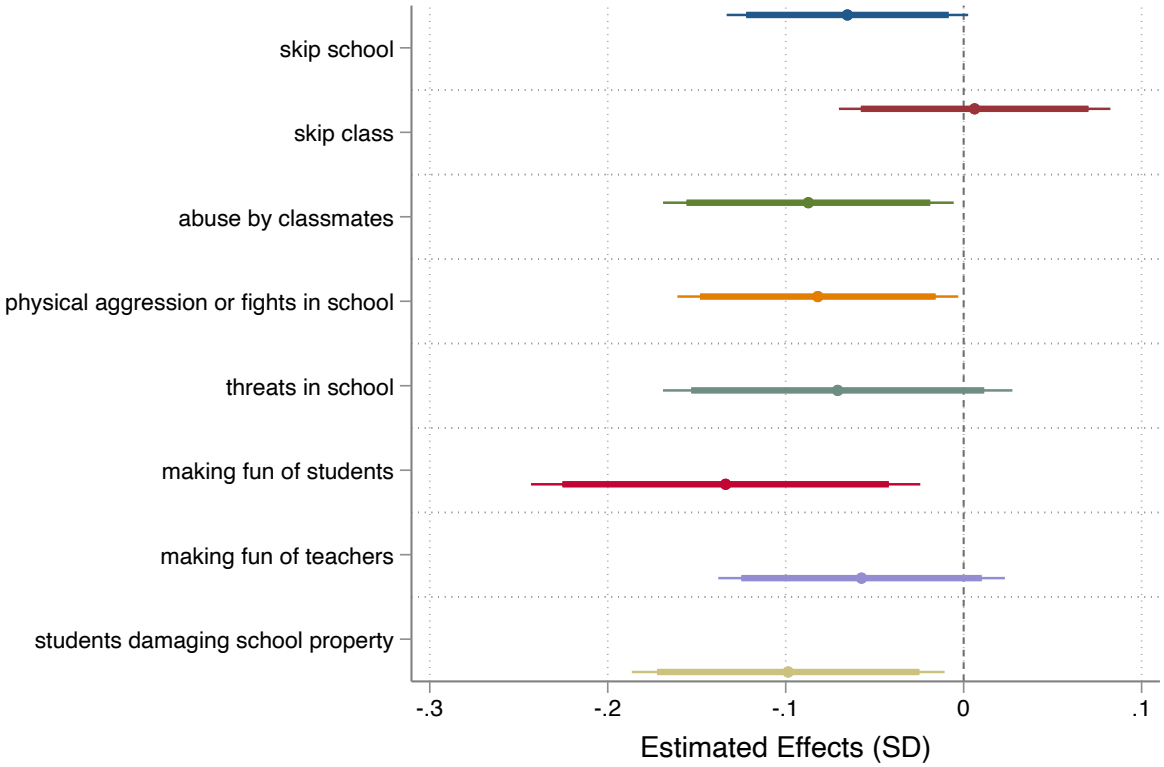


(b) Middle School



Notes: Estimates and confidence intervals in each panel come from the same regression the includes student fixed effects, grade-by-relative time fixed effects, and school of destination-by-relative time fixed effects. Standard errors for confidence intervals are clustered at the individual level.

Figure 6: Estimated Effects on Attendance Behavior, Bullying, and School Environment



Note: Each coefficient comes from a different regression that includes municipality of destination-by-grade-by-academic year fixed effects. Dependent variables on the vertical axis are normalized for each academic year and described in Section 2. Standard errors for confidence intervals are clustered at the destination municipality level. For each estimated coefficient, we show 90% (thicker) and 95% (thinner) confidence intervals.

Table 1: Estimated Effects of Moving on Test Scores: Elementary School

	(1)	(2)
Year of move $\times \Delta Homicide_{m_o m_d t}$	0.013***	0.015***
	(0.005)	(0.005)
1 year after $\times \Delta Homicide_{m_o m_d t}$	0.014**	0.017**
	(0.007)	(0.007)
2 years after $\times \Delta Homicide_{m_o m_d t}$	0.037***	0.041***
	(0.012)	(0.012)
Year of move $\times \Delta Score_{m_d m_o}$		0.103***
		(0.019)
1 year after $\times \Delta Score_{m_d m_o}$		0.125***
		(0.023)
2 years after $\times \Delta Score_{m_d m_o}$		0.147***
		(0.031)
N	239635	239635
Student FE	yes	yes
Grade-by-relative time FE	yes	yes
School of destination-by-relative time FE	yes	yes

Notes: Each column represents a different regression. Standard errors in parentheses are clustered at the student level. *, **, and *** significant at the 10%, 5% and 1% level, respectively.

Table 2: Estimated Effects of Moving on Test Scores: Middle School

	(1)	(2)
Year of move $\times \Delta Homicide_{m_o m_d t}$	0.025***	0.021***
	(0.006)	(0.006)
1 year after $\times \Delta Homicide_{m_o m_d t}$	0.020**	0.016*
	(0.008)	(0.008)
Year of move $\times \Delta Score_{m_d m_o}$		0.202***
		(0.027)
1 year after $\times \Delta Score_{m_d m_o}$		0.195***
		(0.037)
N	139057	139057
Student FE	yes	yes
Grade-by-relative time FE	yes	yes
School of destination-by-relative time FE	yes	yes

Notes: Each column represents a different regression. Standard errors in parentheses are clustered at the student level. *, **, and *** significant at the 10%, 5% and 1% level, respectively.