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# Is neighbourhood destiny? Exploring the link between neighbourhood mobility and student outcomes

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**Abstract**

The notion that children from 'good' neighbourhoods are destined for success while those from 'bad' neighbourhoods are destined for failure has considerable popular appeal. Residential location is strongly linked to school quality, access to educated adults, exposure to violence, etc. There is, however, surprisingly little evidence on the link between the neighbourhood in which a child begins school and later schooling outcomes. Understanding early neighbourhood experiences is important for determining whether students are 'stuck' in neighbourhoods of disadvantage. It is also critical for determining the extent to which students who begin their schooling careers in disadvantaged neighbourhoods are destined for poor schooling outcomes, and conversely, whether changing neighbourhood context improves student performance. In this study, therefore, we document how students' early neighbourhood and schooling experiences are related to later success in school, and explore how changing neighbourhood and school contexts explain differences in academic outcomes. Using data from New York City (NYC), we construct a panel containing all students enrolled as first graders in NYC public schools in 1996–1997, following them through academic years 2007–2008, which would be their 12th grade year if they made standard academic progress (annual one-grade promotion). Far from supporting the simplistic story of 'dead-end' neighbourhoods, our analyses describe a situation where students from poor neighbourhoods actually move more often than their peers in less disadvantaged

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neighbourhoods and are more likely to experience changes in neighbourhood and school quality, with 45.7% of neighbourhood moves from the poorest neighbourhoods being made to significantly higher quality neighbourhoods.

**Keywords**
mobility, neighbourhood change, neighbourhood quality, school quality, student outcomes

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## Introduction

In 2011, New Jersey Governor Chris Christie voiced a commonly held belief about the role of neighbourhoods in the life course of children: 'How do we change this system so that destiny is not determined by zip code …?' (Christie, 2011). The notion that children born into 'good' neighbourhoods are destined for success while those born into 'bad' neighbourhoods are destined for failure has considerable intuitive appeal. Residential location is strongly linked to school quality, access to educated adult role models, exposure to violence and crime, etc. There is, however, surprisingly little evidence on the link between origin neighbourhoods – that is, the neighbourhood in which a child begins school – and later schooling outcomes. Does origin neighbourhood (or school) matter in the long run? Does the effect disappear with residential (or school) moves? That is, is it possible to move to opportunity and thereby improve later outcomes?

Considerable research examines the importance of neighbourhood and school, and, separately, the impact of early childhood experiences on academic performance. Little work, however, considers these together, parsing the contribution of early neighbourhood and schools, so there is little evidence on how origin neighbourhood matters in the long run. We begin to fill this gap, using rich longitudinal data on NYC public school students, which allows us to track their progress and mobility from first grade through high school. We explore the relationships between origin neighbourhood and schools, subsequent residential and school moves, and, ultimately, performance in school.

Understanding early neighbourhood experiences is important for determining whether students are 'stuck' in neighbourhoods of disadvantage. Such understanding is also critical for determining the extent to which students who begin their schooling careers in disadvantaged neighbourhoods are destined for poor schooling outcomes, and conversely, whether changing the neighbourhood context can have beneficial effects on student performance. In this study, therefore, we focus on documenting how students' *early* neighbourhood and schooling experiences are related to later success in school, as well as the extent to which changing neighbourhood and school contexts, particularly changing socio-economic contexts, explain differences in student academic outcomes.

## Context

A long-standing line of research explores how neighbourhoods shape academic performance, with consistent findings that students living in poor neighbourhoods experience worse outcomes than their peers (Brooks-Gunn et al., 1993; Duncan, 1994; Ellen and Turner, 1997; Halpern-Felsher et al., 1997). While this research is largely correlational

and does not necessarily provide causal estimates of neighbourhood effects, neighbourhoods may shape student outcomes for a variety of reasons. First, neighbourhood of residence determines access to public goods and institutions that may contribute to academic success. These might include public schools or libraries, cultural institutions such as museums, or community organisations such as the YMCA that provide extracurricular activities (Tiebout, 1956; Weinstein, 2008). Second, neighbourhoods influence the set of adults available to serve as role models/mentors to students and to provide access to networks. Third, neighbourhoods determine the students' peer group – both in and outside of school – which may have implications for performance (Sin, 2011; Crane, 1991; Hanushek et al., 2003; Jencks and Mayer, 1990; Leventhal and Brooks-Gunn, 2000; Weinstein, 2008). Fourth, the neighbourhood environment may influence student performance more directly. As an example, neighbourhood crime, violence or noise may hamper academic success (Lacoe, 2013; Sharkey et al., 2013). Finally, ecological perspectives posit that neighbourhoods may influence children more indirectly through parents' behaviour and family practices (Leventhal and Brooks-Gunn, 2000).

At the same time, there is considerable evidence that early childhood experiences matter to success in the long run. Several recent studies conclude that early *school* experiences, such as kindergarten class size (Chetty et al., 2010; Heckman, 2006) or the quality of third grade teachers (Chetty et al., 2011) affect later academic and non-academic outcomes, such as test scores, college attendance and wages.

Importantly, virtually all of the existing research on neighbourhoods focuses on the short-term impacts of neighbourhoods. There is little evidence on the long-term effect of neighbourhoods experienced in early childhood, and few studies disentangle the effects of origin neighbourhood from current neighbourhood and/or *personal* and *family* characteristics, such as race, income or nativity (Duncan et al., 1994; Holzer et al., 2008). One exception to this is the Moving to Opportunity study, which examines the effects of moving public housing residents into lower poverty neighbourhoods in an experimental context (Kling et al., 2007). This study does not, however, tell us anything about how moving to lower poverty neighbourhoods is related to later outcomes for children who do not live in public housing or those families who *choose* to move to a lower poverty neighbourhood absent a financial incentive. We address this gap by examining how mobility out of origin neighbourhoods is related to student performance both in the short and long term.

## Data

We draw on a rich longitudinal database containing individual-level data for a complete census of students attending NYC public schools in grades 1–12 from academic years (AY) 1996–1997 through 2007–2008 (roughly 1,000,000 observations per year). Every student record contains demographic, programme and academic information, including school attended, birthplace, race, gender, language ability, poverty status (i.e. eligibility for free or reduced price lunch), attendance, participation in special education and language programmes, standardised test scores and graduation outcomes. Importantly, these data also contain the zip code of the student's residence in each academic year, which identifies students' neighbourhoods. Thus, we observe students'‘origin' neighbourhoods at first grade and track neighbourhood moves over their schooling careers.

Using this data, we construct a panel containing all students enrolled as first graders in NYC public schools in 1996–1997,

**Table 1.** Descriptive characteristics, 1st grade class, 1996–1997.

| | All | Included | Excluded |
|---|---|---|---|
| Female | 49.2 | 50.7 | 32.7 |
| Asian/other | 10.3 | 11.0 | 2.9 |
| Black | 34.2 | 33.3 | 44.1 |
| Hispanic | 39.9 | 39.3 | 45.7 |
| White | 15.4 | 16.1 | 7.1 |
| Non-English at home[1] | 44.3 | 55.1 | 62.0 |
| ESL[2] | 21.4 | 20.8 | 27.1 |
| LEP[2] | 17.0 | 16.3 | 25.0 |
| SPED[3] | 6.5 | 5.0 | 21.9 |
| Native born | 89.5 | 89.1 | 94.5 |
| Free lunch | 77.1 | 76.0 | 89.8 |
| Reduced lunch | 6.2 | 6.5 | 2.8 |
| Full price lunch | 12.5 | 13.3 | 3.7 |
| Missing lunch info | 4.2 | 4.3 | 3.7 |
| SAP student[4] | 26.1 | 24.9 | 0.2 |
| Retained[5] | 15.8 | 17.3 | 0.1 |
| Ungraded SPED student[6] | 8.3 | 0.0 | 99.2 |
| Exiter[7] | 49.7 | 54.2 | 0.5 |
| *N* | 88,991 | 81,502 | 7489 |

*Notes*: [1]The percentage of students who speak a language other than English at home.
[2]English as a Second Language (ESL) and limited English proficient (LEP) students are classified based on results from the Language Assessment Battery and receive additional support services including placement in bilingual education or a free-standing ESL programme.
[3]Those students who are ever classified as eligible for special education services. These students are placed in graded classrooms but receive additional supports.
[4]Those students who are continuously enrolled for all 12 years of the sample and who are in 12th grade in 2007–2008.
[5]Those students who are ever held back in a grade.
[6]Students whose disabilities are severe enough that they are educated in self-contained classrooms.
[7]Students who are enrolled in first grade in 1996–97 but exit NYC public schools either temporarily or permanently at some point during the 12 year period.

excluding those students living in zip codes with fewer than 25 students[1] as well as students who are ever in ungraded special education. This leaves us with a total of 81,502 first graders, who lived in 169 different zip codes and attended 685 different schools in first grade. We trace this group of 81,502 students for 11 additional years, through what would be their 12th grade year if they made standard academic progress (annual one-grade promotion).[2] Of course, while some students make standard academic progress (SAP) and successfully reach 12th grade 'on time' others are retained once (or twice) and are enrolled in an earlier grade in 2007–2008. Finally, many students leave the NYC public schools either temporarily or permanently prior to 2007–2008.

As shown in Table 1, students included in our final sample differ from those who are excluded. First graders included in our sample are much more likely to be female, Asian, white and reduced or full price lunch students than students who are excluded. Conversely, they are less likely to be black, Hispanic, ESL, LEP, SPED, native born, free lunch eligible or to speak a language other than English at home than students who are excluded. Much of this is reflective of the decision to exclude students in

ungraded special education from our sample.[3] Of the original first grade cohort included in our sample, by 2007–2008, 17.3% are retained at least once, 54.2% exit NYC public schools either temporarily or permanently during the period, and the rest, 22.8%, remain on track to graduate high school 'on time'. As is evident from these descriptive statistics, the NYC public school population is relatively disadvantaged as the extremely wealthy tend to enroll their children in private schools. Our results, therefore, largely speak to the implications of neighbourhood and school moves for the lower middle class and poor students who make up the majority of the public school population.

Neighbourhood boundaries are measured using zip codes, which we select for two reasons.[4] First, in urban areas such as New York City, the geographic area defined by zip codes tends to be quite small and provides a good compromise between census tracts, which are extremely fine grained, and either community districts or boroughs, which are quite large and heterogeneous.[5] Second, while we have information on census tract of residence starting in AY 2004–2005, we have information on zip code of residence for all years of the data, which allows us to use a consistent measure of neighbourhood over time. *Neighbourhood quality* is captured by poverty rate for families with children under 18 from the 2000 Census. Specifically, we divide neighbourhoods into deciles based on this measure, with 'higher poverty' neighbourhoods in the higher deciles and 'lower poverty' neighbourhoods in the lower deciles.[6]

*School quality* is defined separately for elementary and middle schools using student test scores. For elementary schools, school quality is measured by the standardised reading and math scores for students in grades 3–5 in 1996–1997 and 1997–1998, averaged across both subjects and years.[7] This corresponds to the years that sample students were in grades 1 and 2, respectively, so that school quality measures do not contain students' own test scores. Analogously, middle school quality is captured by the standardised reading and math scores for students in grades 6–8 in 1999–2000 and 2000–2001, averaged across both subjects and years. This corresponds to the years that sample students were in grades 4 and 5. We use such an aggregate measure rather than a change in scores between grades or years (value-added) since this analysis is focused on identifying how *overall* school quality is related to performance.[8]

## Portraits of neighbourhoods and mobility

### *How much do neighbourhood characteristics vary?*

Students in NYC public schools experience variation in the poverty they experience in their neighbourhoods; the poverty rate of families with children under the age of 18 ranges from a low of 1.3% in the Southeast Bronx to 54.5% in Hunts Point and Mott Haven in the Bronx. Additionally, a non-trivial 15.5% of neighbourhoods exhibit extreme poverty with rates above 40% (Figure 1).

In addition to the wide variation experienced by students in terms of environmental inputs such as poverty, students also experience a wide range of outcomes by neighbourhood. Among students who are still enrolled in NYC public schools during what should be their 10th grade year, an average of 62% graduate from high school by 2007–2008.[9] This average graduation rate masks significant variation, however, as the rate ranges from a low of 35% in Central Harlem to a high of 91% in lower Manhattan with 17.2% of neighbourhoods graduating less than half of 10th graders.

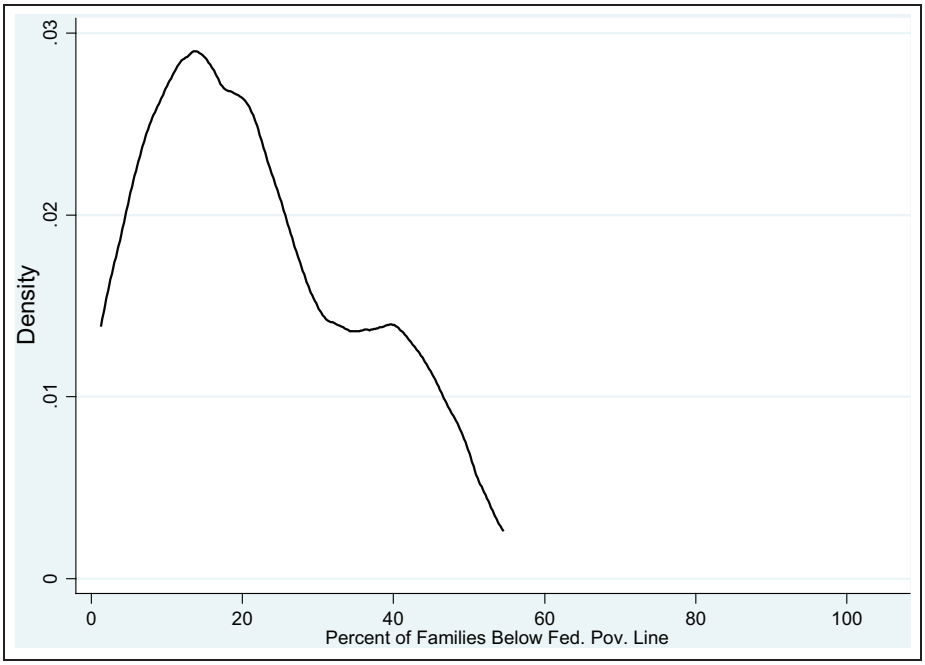


**Figure 1.** Percent poor students and families by neighbourhood, AY 1996–1997. Density is over the total number of neighbourhoods (169), where neighbourhood is defined as students' zip code of residence. Percent of families below the federal poverty line is based on the 2000 Census.

*How tight is the link between neighbourhood and school?* As discussed previously, a key way in which neighbourhood shapes schooling outcomes is that districts often assign students to schools through residentially based attendance zones.

In an average neighbourhood, students attend 22 different schools – and the range is wide (Figure 2). In some neighbourhoods, the link between neighbourhood and school is tight, and all of the first graders attend the same schools. In neighbourhoods at the other extreme, students attend as many as 76 distinct schools, and even the most widely attended elementary school contains only 8% of the first grade public school residents. This variation may reflect factors such as geography and proximity to transportation as well as the variations in the size and characteristics of the schools and, importantly, *the school choices made by families*. Thus, for many students, neighbourhood does not unilaterally determine school attended – suggesting that zip code may not, indeed, be 'destiny' for New York City school children.

*Neighbourhood mobility.* In order to determine whether and to what extent origin neighbourhoods matter in the long run and whether any influence of origin neighbourhoods disappears once students make school moves, we first examine the extent to which students ever leave their origin neighbourhoods. As shown in Figure 3, New York City includes both high mobility neighbourhoods and neighbourhoods where students make relatively few residential moves.[10] We explore the neighbourhood-level correlates of this mobility by regressing the

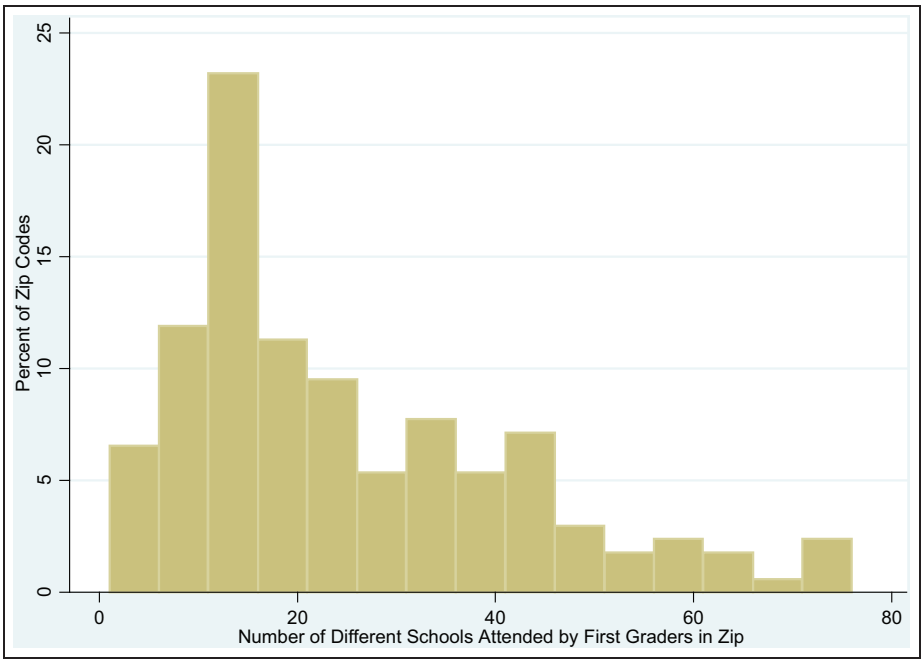


**Figure 2.** Number of distinct schools attended by first graders by neighbourhood, AY 1996–1997. Neighbourhood is defined as students' zip code of residence. Number of schools calculated as the distinct number of schools attended by students living in a particular neighbourhood.

neighbourhood average student residential mobility rate on neighbourhood poverty and public school characteristics including race, free lunch eligibility and nativity. Among these, the only significant predictor of neighbourhood mobility rates is poverty (Table 2). Specifically, in neighbourhoods with poverty rates greater than 40%, the mobility rate is between 5.2 to 8.0 percentage points higher than in neighbourhoods with poverty rates below 20%.[11] Furthermore, for each 10 percentage point increase in the number of students eligible for free lunch, the neighbourhood mobility rate increases by approximately 0.05 percentage points. This suggests that rather than being dead-end neighbourhoods where students are 'stuck', high poverty neighbourhoods exhibit particularly *high* student mobility, although these results do not indicate whether such students are able to escape to higher quality neighbourhoods.

## *Student residential mobility: How much do students move between neighbourhoods? Are students 'stuck' in poverty?*

As just discussed, high poverty *neighbourhoods* exhibit higher mobility than low poverty *neighbourhoods*. In this section, we analyse characteristics and patterns of *students* who are mobile across neighbourhoods to understand which types of students move and to where.

To document significant changes in neighbourhood quality, neighbourhood poverty is divided into deciles. Changes in neighbourhood quality are calculated by taking the difference between neighbourhood quality of student $i$ in year $t$ and neighbourhood

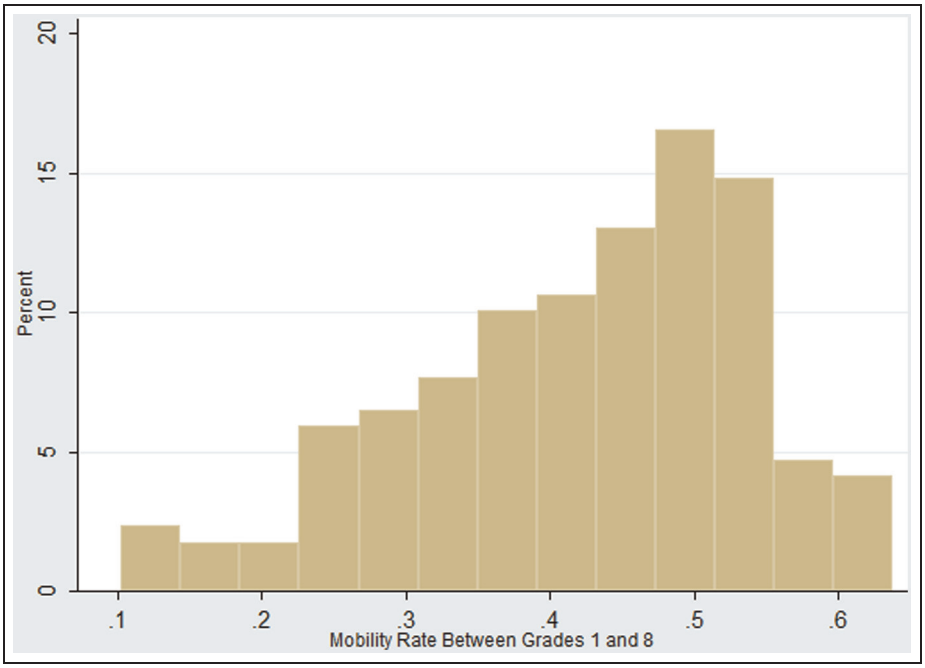


**Figure 3.** Distribution of neighbourhood mobility rates. Mobility rate is calculated as the percent of first graders in a given neighbourhood (zip code) who make any moves to a different neighbourhood between grades 1 and 8.

quality in that student's first grade year. A student is then classified as having experienced a significant change in neighbourhood quality if the level of neighbourhood poverty changes by two or more deciles between the student's first grade neighbourhood and the student's current neighbourhood. According to this definition, 19% of students in first grade experienced a significant increase in neighbourhood quality and only 10% experienced a significant decrease.[12]

Next we examine what types of neighbourhoods movers come from and where they go. If students move from one neighbourhood to another without a concomitant change in neighbourhood quality, we might not expect large effects on performance. We therefore examine the relationship between the likelihood of making a significant move in neighbourhood quality and the initial quality of a student's first grade neighbourhood. To do so, we calculate the percentage of students who move to better or worse neighbourhoods by the decile of students' first grade neighbourhood (where lower deciles correspond to lower poverty or 'better' neighbourhoods). By construction, students living in the lowest and highest deciles of neighbourhood poverty are unable to experience significant increases and decreases in neighbourhood quality, respectively, because they can only 'move down' (if starting in the highest quality neighbourhoods) or 'move up' (if starting in the lowest quality neighbourhoods), whereas students in average quality neighbourhoods can make significant moves in either direction.[13]

Consistent with this, students from low quality (high poverty) neighbourhoods are more likely to experience significant increases in neighbourhood quality compared with students in higher quality (low

**Table 2.** Regression estimates, neighbourhood mobility rate and neighbourhood characteristics.

| Variables | Neighbourhood average of % students moving between 1st and | | |
|---|---|---|---|
| | 5th grade (1) | 8th grade (2) | 10th grade (3) |
| Neighbourhood pov > 40%[1] | 0.057*** | 0.052*** | 0.080*** |
| | (0.018) | (0.020) | (0.028) |
| Neighbourhood pov > 20%[1] | −0.011 | −0.026 | 0.014 |
| | (0.015) | (0.021) | (0.023) |
| % of public school students: | | | |
| Free lunch eligible | 0.003*** | 0.005*** | 0.004*** |
| | (0.001) | (0.001) | (0.001) |
| Reduced price lunch eligible | −0.002 | −0.000 | 0.002 |
| | (0.002) | (0.002) | (0.003) |
| Black | 0.010 | 0.008 | 0.000 |
| | (0.013) | (0.019) | (0.038) |
| Hispanic | 0.009 | 0.007 | 0.001 |
| | (0.013) | (0.019) | (0.039) |
| Asian/other | 0.011 | 0.010 | 0.002 |
| | (0.013) | (0.019) | (0.038) |
| White | 0.009 | 0.007 | 0.002 |
| | (0.013) | (0.019) | (0.039) |
| Native born | −0.001 | −0.002 | −0.004* |
| | (0.001) | (0.002) | (0.002) |
| Do not speak English at home | −0.001 | −0.002 | −0.004* |
| | (0.001) | (0.001) | (0.002) |
| No. of students (in 100s) | −0.001*** | −0.001*** | −0.001** |
| | (0.000) | (0.000) | (0.000) |
| Constant | −0.737 | −0.367 | 0.559 |
| | (1.327) | (1.897) | (3.765) |
| Observations | 169 | 169 | 169 |
| $R^2$ | 0.612 | 0.627 | 0.171 |

*Notes*: Robust standard errors in parentheses, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
[1]Neighbourhood Pov greater than 40% is an indicator equal to one if the poverty rate of households with children under 18 is greater than 40% in a particular zip code. Neighbourhood Pov greater than 20% is measured analogously. Thresholds of 20% and 40% were chosen based on designations used by the Census, which labels neighbourhoods with poverty rates greater than 20% as 'poverty areas' and those with poverty rates above 40% as an 'extreme poverty areas'. The percentage of public school students with a given characteristic are based on the entire population of public schools students (grades 1–8) living in a particular zip code. All percentages are calculated based on a neighbourhoods public school population in AY 1996–1997.

poverty) neighbourhoods. As shown in Table 3, Panel A, 45.7% of students in the highest two deciles of poverty move to better neighbourhoods at some point but only 7.7% of students in the third and fourth deciles ever make such moves. In contrast, students from high quality neighbourhoods are much less likely to experience decreases in neighbourhood quality than their peers from low quality neighbourhoods. Only 11.5% of students who make moves to significantly worse neighbourhoods come from the lowest two deciles of neighbourhood poverty, whereas 26.5% of movers to worse neighbourhoods come from the seventh and eighth deciles of neighbourhood poverty. Contrary to the theory that students are stuck in bad neighbourhoods, this suggests that there is considerable mobility out of high poverty neighbourhoods, although

**Table 3.** Panel A. Percentage of students who ever experience significant increases or decreases in neighbourhood quality by decile of neighbourhood quality in 1997.

| Decile | Ever better (1) | | Ever worse (2) | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| 1 | | | 137 | 2.0 |
| 2 | | | 653 | 9.5 |
| 3 | 101 | 0.9 | 646 | 9.4 |
| 4 | 444 | 6.8 | 1246 | 18.1 |
| 5 | 816 | 6.9 | 1209 | 17.6 |
| 6 | 1252 | 10.6 | 1156 | 16.8 |
| 7 | 1656 | 14.0 | 894 | 13.0 |
| 8 | 2144 | 18.2 | 927 | 13.5 |
| 9 | 2381 | 20.2 | | |
| 10 | 3006 | 25.5 | | |
| Total | 11,800 | 100.0 | 6868 | 100.0 |

Panel A. Percentage of students who ever experience significant increases or decreases in neighbourhood quality by decile of neighbourhood quality in 1997.

| Decile | Ever better | | Ever worse | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| 1 | 3298 | 17.3 | | |
| 2 | 3481 | 18.3 | | |
| 3 | 2881 | 15.1 | 1407 | 6.5 |
| 4 | 3137 | 16.5 | 2755 | 12.8 |
| 5 | 2087 | 11.0 | 3369 | 15.6 |
| 6 | 1685 | 8.9 | 4664 | 21.6 |
| 7 | 1650 | 8.7 | 2989 | 13.9 |
| 8 | 807 | 4.2 | 2279 | 10.6 |
| 9 | | | 2467 | 11.4 |
| 10 | | | 1635 | 7.6 |
| Total | 19,026 | | 21,565 | 100.0 |

*Notes*: Students are recorded as having ever moved to a better (worse) neighbourhood or school if they experience a two decile increase (decrease) in neighbourhood or school quality at any point between 1997 and 2008.

among all mobile students, there is a mixture of moves to both significantly better and significantly worse neighbourhoods.

## *Student school mobility: How much is there? Do students move to better or worse schools?*

One of the main mechanisms through which residential mobility is expected to influence school performance is by providing access to higher quality schools. Of the initial first grade cohort, almost all students (98%) change schools at least once during their K-12 academic career, but not all of these moves result in exposure to schools of significantly different quality.

Like changes in neighbourhood quality, changes in school quality are calculated by taking the difference between school quality for student $i$ in year $t$ and school quality in that student's first grade year. Since the

measure of school quality used in this analysis is constant within most schools over time, students will only experience a change in school quality when they change schools.[14] Additionally, because any school change is likely to be accompanied by at least some small change in school quality we focus our analysis on 'significant' changes in school quality.[15]

Significant changes in school quality are defined analogously to significant changes in neighbourhood quality. That is, as a change in school quality of two or more deciles since first grade. According to this definition, 23.4% of students experience a significant increase in school quality, and 26.5% experience a significant decrease at some point in their schooling careers. Note that an increase or decrease in school quality might not be the result of a single move, but rather may occur gradually over multiple moves to slightly better or worse schools. The current analysis does not distinguish between these outcomes, as it is ultimately focused on determining the likelihood of a student 'escaping' to a significantly better or worse school conditional on the quality of the school he or she attended in first grade.

Table 3, Panel B presents information about the likelihood that students experience a significant change in school quality based on the initial quality of their first grade schools. Using this measure, students from bottom (top) decile schools are, by construction, unable to make moves to significantly worse (better) schools. It is not surprising then that 35.6% of moves to better quality schools occur among students in the lowest two deciles of school quality, and only 12.9% occur among students in the seventh and eighth deciles of school quality. Moves to lower quality schools display a much different pattern, however – students who start out in high quality schools are actually *equally likely* to make moves to lower quality schools (19.0% ) as their peers who start in lower quality schools (19.3%). Therefore, while students in the lowest decile of school quality have the highest likelihood of moving to a significantly better school, the reverse is not true – students at both the best *and worst* schools have high likelihoods of moving to a significantly worse school. First grade schools are not 'destiny'.

## Neighbourhood change and schooling outcomes: Methods

In the previous section, we saw the diverse origin neighbourhood experiences of first graders in NYC public schools and documented high levels of both neighbourhood and school mobility. Now we examine how these diverse origin neighbourhood experiences combine with neighbourhood and school mobility patterns to influence school outcomes. We do so using regression models to explain the influence of neighbourhoods (and schools) on both short- and long-term student outcomes including test scores, progression through school and high school graduation. As mobility is likely an endogenous process, the models outlined below are not causal, and are not to be interpreted as such. Rather, they are meant to describe and compare the outcomes of movers and non-movers and to examine the extent to which moving from one's origin neighbourhood is associated with a change in academic performance and attainment.

To determine the relationship between *neighbourhood* and *school* mobility and *short-term* outcomes, we estimate the following model:

$$\begin{aligned} P_{isng} &= \beta_0 + \beta_1 MOVE_{ig} + \beta_2 MOVEUP_{ig} \\ &+ \beta_3 MOVEDN_{ig} + \beta_4 MOVESCHL_{ig} \\ &+ \beta_5 SCHLUP_{ig} + \beta_6 SCHLDN + \beta_7 I_{ig} \\ &+ \alpha_i + \varepsilon_{isng} \end{aligned} \quad (1)$$

where $P_{isng}$ is *short-term* performance of student $i$ in school $s$ living in current neighbourhood $n$ and in current grade $g$; MOVE is an indicator of whether the student moved neighbourhoods in g; MOVEUP is an indicator of whether this move was to a significantly higher quality neighbourhood as compared with the student's origin neighbourhood; MOVEDN is an indicator of whether this move was to a significantly lower quality neighbourhood; MOVESCHL is an indicator of whether a student moved schools in $g$; SCHLUP is an indicator of whether this move was to a significantly higher quality school; SCHLDN is an indicator of whether this move was to a significantly worse school; $I_{ig}$ is a vector of observable time-varying individual characteristics including free lunch eligibility, special education, limited English proficiency (LEP), and English as a Second Language (ESL); and $\alpha_i$ are student fixed effects. Note that the inclusion of student fixed effects controls for unobserved time invariant student characteristics, such as motivation, ability or past home inputs as well as *origin neighbourhoods* and *origin schools*, so we can identify how changing neighbourhoods contributes to student achievement beyond where students originate.

To determine the relationship between *neighbourhood* and *school* mobility and *long-term* outcomes, we estimate the following model:

$$\begin{aligned} P_{isng} = {} & \beta_0 + \beta_1 MOVE_{ig} + \beta_2 MOVEUP_{ig} \\ & + \beta_3 MOVEDN_{ig} + \beta_4 MOVESCHL_{ig} \\ & + \beta_5 SCHLUP_{ig} + \beta_6 SCHLDN \\ & + \beta_7 X_{i3} + \beta_8 I_{ig} + u_{s1} + \eta_{n1} + \varepsilon_{isng} \end{aligned} \quad (2)$$

where $P_{isng}$ is now *long-term* performance or attainment of student $i$ in school $s$ living in current neighbourhood $n$ and currently in grade $g$; MOVE is an indicator of whether the student *ever* moved neighbourhoods between first grade and grade $g$; MOVEUP is an indicator of whether a student *ever* experienced a significant increase in neighbourhood quality between first grade and grade $g$; MOVEDN is an indicator of whether a student *ever* experienced a significant decrease in neighbourhood poverty between first grade and grade $g$; MOVESCHL is an indicator for whether a student *ever* moved schools between first grade and grade $g$; SCHLUP is an indicator of whether a student *ever* experienced a significant increase in school quality between first grade and grade $g$; SCHLDN is an indicator of whether a student *ever* experienced a significant decrease in school quality between first grade and grade $g$; $X_{i3}$ is a vector of test scores as measured in third grade; $I_{i1}$ is a vector of observable individual characteristics measured in first grade including nativity, ESL, LEP, receipt of special education services, race, gender, free lunch eligibility and whether the student speaks a language other than English at home. The model includes controls for third grade test scores to capture student ability as well as school and family inputs into a student's learning experience up through 3rd grade.[16] The remaining terms, $u_{s1}$ and $\eta_{n1}$, are first grade school and origin neighbourhood fixed effects, respectively, which allow us to estimate the relationship between long-term achievement and moving neighbourhoods, conditional on students' origin school and neighbourhood experiences.[17]

Using this model we examine a number of performance measures including 8th grade test scores, New York State high school exam scores (Regents exams),[18] and high school graduation outcome at the end of 12 years.[19] We also examine measures of attainment, including the number of years it takes to get to different grade levels (longer is worse) and the likelihood of attaining

**Table 4.** Descriptve statistics, short-term and long-term student performance outcomes.

| Variable name | Mean | SD | 10th percentile | 90th percentile | *N* |
|---|---|---|---|---|---|
| *Short-term performance outcomes* | | | | | |
| 3rd grade Math | 0.05 | 0.95 | −1.08 | 1.07 | 70,057 |
| 3rd grade ELA | 0.03 | 0.95 | −1.13 | 1.02 | 67,427 |
| 4th grade Math | 0.03 | 0.95 | −1.11 | 1.21 | 65,182 |
| 4th grade ELA | 0.02 | 0.96 | −1.10 | 1.24 | 65,220 |
| 5th grade Math | 0.03 | 0.94 | −1.03 | 1.05 | 62,277 |
| 5th grade ELA | 0.02 | 0.94 | −1.04 | 1.16 | 62,146 |
| 6th grade Math | 0.06 | 0.94 | −1.03 | 1.10 | 58,947 |
| 6th grade ELA | 0.02 | 0.98 | −1.09 | 1.13 | 58,891 |
| 7th grade Math | 0.06 | 0.93 | −0.99 | 1.10 | 56,909 |
| 7th grade ELA | 0.03 | 0.96 | −1.14 | 1.21 | 56,689 |
| 8th grade Math | 0.06 | 0.91 | −1.02 | 1.12 | 53,754 |
| 8th grade ELA | 0.04 | 0.97 | −0.98 | 1.27 | 54,504 |
| *Long-term performance outcomes* | | | | | |
| 8th grade Math | 0.06 | 0.91 | −1.02 | 1.12 | 53,754 |
| 8th grade ELA | 0.04 | 0.97 | −0.98 | 1.27 | 54,504 |
| Regents Math | 0.14 | 0.89 | −0.97 | 1.32 | 37,798 |
| Regents English | 0.17 | 0.82 | −0.75 | 1.12 | 37,715 |
| Graduate | 0.55 | 0.50 | 0 | 1 | 47,170 |
| *Long-term attainment outcomes* | | | | | |
| Years to 5th grade | 4.20 | 0.46 | 4 | 5 | 44,131 |
| Years to 8th grade | 7.25 | 0.54 | 7 | 8 | 44,239 |
| Years to 10th grade | 9.52 | 0.89 | 9 | 11 | 47,170 |
| SAP student | 0.43 | 0.49 | 0 | 1 | 47,170 |

standard academic progress over the full period of our analysis.

## Neighbourhood and school change and schooling outcomes: Results

Before turning to our regression estimates, we first examine the descriptive statistics for all short- and long-term student performance measures (Table 4). Note that all average 3rd- through 8th-grade *z*-scores are above the grade-wide averages of zero, because our sample includes only students who remain in NYC public schools over time (which tends to be a positively selected group). Additionally, there is considerable variation in these outcomes, as evidenced by the wide ranges between the 10th and 90th percentiles. For example, standardised scores on 4th-grade ELA range from −1.10 to 1.24, and the number of years it takes a student to reach 10th grade ranges from 9 to 11 years.

Panel A in Table 5 (columns 1 and 2) presents estimates from models of short-term performance (equation 1). The results show that, there is no relationship between neighbourhood changes and test scores in the short-term (Panel A), but a consistently positive (negative) relationship between performance and making a move to a higher (lower) quality school. Making any school move is negatively related to performance, even if it is to a similar quality school. Students who move to lower quality schools perform the worst (0.051 to 0.061 sds lower than their peers who do not change schools), and students who move to higher quality schools experience no change in

performance for math and a slight decrease in reading performance, where the negative relationship between moving and reading scores is significantly mitigated by increases in school quality.

In the long term, however, both neighbourhood and school moves are related to performance (see Table 5, Panel B). In particular, students who move to a similar quality neighbourhood without moving schools perform 0.026–0.030 SDs lower on both 8th grade exams and Math Regents than their peers who never move. Students who move to lower quality neighbourhoods fare consistently worse: students who move to a worse neighbourhood and remain in the same school score 0.024–0.091 SDs below their peers who never move neighbourhoods. Moves to better quality neighbourhoods appear to have mixed results, resulting in either similar or worse outcomes than moves made to similar quality neighbourhoods. Changes in school quality, however, have a more consistent relationship with student performance, such that moving to better schools helps performance and moving to worse schools harms performance. In fact, moving to better schools can be protective of the harmful effect of moving neighbourhoods, at least when moves are made to neighbourhoods of similar quality.[20]

Finally, results for attainment (Panel C) show that most moves of any kind prolong the time to 5th, 8th and 10th grades.[21] Perhaps the protection that moving to a better school provides for residential movers is at the expense of progressing in a timely way to 10th grade, as students may need additional time to catch up to classmates in these better schools, for example.

In summary, residential mobility tends to be negatively related to schooling outcomes, but moving to a significantly better quality school is positively related to student outcomes and may mitigate/overcome the additional negative impacts of moving to lower quality neighbourhoods.

## Summary and conclusions

There is a high degree of heterogeneity among origin neighbourhoods of NYC public school students, but there is no obvious set of characteristics that define a 'bad' origin neighbourhood. Moreover, there is a large amount and wide range of mobility experienced among NYC public school students. Far from supporting the simplistic story of 'dead-end' neighbourhoods, our analyses describe a situation where not only do students from poor neighbourhoods move, these students actually move more often than their peers in less disadvantaged neighbourhoods. Furthermore, students from lower quality neighbourhoods and schools are more likely to experience changes in neighbourhood and school quality, with school quality changes more likely to be positive than negative.

There is little evidence that moving to higher quality neighbourhoods is related to improved performance; rather, there is consistent evidence that moving neighbourhoods is associated with decreases in both short- and long-term student performance and attainment, especially among students who move to lower quality neighbourhoods. Moreover, there is evidence that moving neighbourhoods is not all about schools, as changes in neighbourhoods and neighbourhood quality continue to have statistically significant relationships with long-term student performance, even when controlling for changes in school quality. This is not to imply that schools do not matter; in fact, moving to a higher quality school has

**Table 5.** Regression results, performance, neighbourhood and school mobility, grades 3–8.

| Panel A. Short-term achievement | | | Panel B. Long-term achievement | | | | | Panel C. Long-term attainment | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Math | Reading | 8th grade Math | 8th grade Reading | Math Regents | English Regents | Graduation | Yrs to 5th | Yrs to 8th | Yrs to 10th | SAP student |
| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Move neighbourhoods | −0.007 | 0.004 | −0.026*** | −0.024*** | −0.030*** | −0.005 | −0.031*** | 0.040*** | 0.008 | 0.029*** | −0.049*** |
| | (0.005) | (0.005) | (0.007) | (0.007) | (0.010) | (0.009) | (0.005) | (0.006) | (0.006) | (0.010) | (0.005) |
| Move to better neighbourhood | 0.005 | −0.005 | −0.038*** | −0.038*** | 0.001 | −0.005 | −0.005 | 0.000 | 0.059*** | 0.046*** | −0.017*** |
| | (0.008) | (0.008) | (0.010) | (0.010) | (0.012) | (0.011) | (0.006) | (0.008) | (0.008) | (0.012) | (0.006) |
| Move to worse neighbourhood | 0.010 | 0.012 | −0.027** | 0.006 | −0.053*** | −0.041*** | −0.066*** | 0.005 | 0.089*** | 0.140*** | −0.066*** |
| | (0.009) | (0.010) | (0.012) | (0.013) | (0.015) | (0.014) | (0.008) | (0.010) | (0.010) | (0.015) | (0.008) |
| Move schools | −0.031*** | −0.023*** | −0.154** | −0.089 | −0.130 | −0.124 | −0.038 | 0.006 | −0.002 | 0.235*** | 0.232*** |
| | (0.002) | (0.003) | (0.071) | (0.089) | (0.094) | (0.081) | (0.049) | (0.011) | (0.057) | (0.087) | (0.049) |
| Move to better school | 0.032*** | 0.015*** | 0.063*** | 0.080*** | 0.079*** | 0.069*** | 0.018*** | 0.076*** | 0.017** | 0.006 | 0.053*** |
| | (0.004) | (0.005) | (0.009) | (0.009) | (0.011) | (0.010) | (0.006) | (0.008) | (0.007) | (0.011) | (0.006) |
| Move to worse school | −0.020*** | −0.038*** | −0.103*** | −0.103*** | −0.072*** | −0.048*** | −0.039*** | 0.095*** | 0.044*** | 0.072*** | −0.003 |
| | (0.004) | (0.005) | (0.009) | (0.009) | (0.011) | (0.010) | (0.006) | (0.008) | (0.007) | (0.011) | (0.006) |
| Observations | 367,126 | 364,877 | 53,718 | 54,470 | 37,784 | 37,702 | 47,153 | 44,118 | 44,219 | 47,152 | 47,153 |
| $R^2$ | 0.790 | 0.767 | 0.487 | 0.509 | 0.373 | 0.360 | 0.212 | 0.211 | 0.223 | 0.194 | 0.207 |
| No. of students | 71,067 | 71,296 | 53,718 | 54,470 | 37,784 | 37,702 | 47,153 | 44,118 | 44,219 | 47,152 | 47,153 |

*Notes*: Robust standard errors in parentheses, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

All models in Panel A include student fixed effects. A student is recorded as 'changing' neighbourhoods in any year that they make a residential move to a different neighbourhood. Moving to a better neighbourhood is coded 1 in the year that a student makes a move to a zip code that is two or more deciles lower in the poverty distribution. Moving to a worse neighbourhood is coded as 1 in the year that a student makes a move to a neighbourhood that is two or more deciles higher in the poverty distribution. Regressions in Panels B and C also include controls for student characteristics as measured in first grade, 1st grade school and origin neighbourhood effects and indicators for whether school quality measures are imputed. Regents test score regressions include indicators for the grade in which a student took the Regents exam.

positive effects on short- and long-term student performance, and in some cases these are large enough in magnitude to swamp the additional negative effects of moving to a worse neighbourhood.

These results, although not causal, have important implications. Students and families who make moves to higher quality neighbourhoods are unlikely to be an average group, but are likely different in important respects (e.g. more concerned about their children's education outcomes, more ambitious, more informed, etc.). This is particularly true given that our measures of moving to better neighbourhoods and schools are non-marginal, considering only substantial changes in quality (two or more deciles). Nonetheless, these families do manage to move themselves out of their origin schools in ways that improve outcomes for students, even when they begin in poor neighbourhoods and low quality schools. Thus, there are possibilities for improving the life chances of central city students, so that neighbourhood is *not* destiny. Providing enough 'good' schools, helping families choose the good ones when they move neighbourhoods, and even allowing them to stay in good schools if they must move neighbourhoods are all mechanisms that could improve student outcomes. It should be noted that the findings presented here use a relative measure of school quality. Defining an absolute measure of 'good' schools is outside the scope of this paper, but nonetheless a valuable area for future research.

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## Notes

1. These zip codes contain portions that fall both inside and outside the city limits, but the majority of their area falls outside the city, and are therefore not appropriate to include in this analysis.
2. This includes students who are repeating first grade. Results are not sensitive to excluding them.
3. According to the New York State report card data glossary (http://data.nysed.gov/glossary.php?report=reportcards), 'Ungraded students are those assigned to a class that is not organized on the basis of grade grouping and has no standard grade designation. This includes both regular and special classes that have no grade designations. Such a class may contain students of different ages who are identified according to level of performance in one or more areas of instruction, rather than according to grade level or age level'. Students in ungraded special education typically do not take standardised exams.
4. Zip codes have been used by others in neighbourhood studies (see for example Datcher, 1982; Ku et al., 1993).
5. This is well documented in other work on New York City (see for example Ellen et al., 2002).
6. We experimented with alternative measures of neighbourhood quality, including a neighbourhood advantage index based on percent of families with children under 18 NOT living in poverty, percent of 8th grade students passing the ELA exam in AY 1999–2000, and percent of students passing the math exam in AY 1999–2000. Results are similar.
7. Standardised scores have citywide means of 0 and standard deviations of 1 based on scores of all students in a grade in a year.
8. Average test scores are commonly used as a summary measure of multiple dimensions of school quality including the quality of peers, level of resources and quality of the school itself.
9. Using all first grade students to calculate graduation rates is problematic because we do not have graduation information on students who exit NYC public school students. That is, many students who exit NYC public schools to attend private schools and schools in another district may very well graduate, but we do not have a record of this, so that our graduation rate calculated from all first

grade students is almost certainly an underestimate. Focusing attention on students who are still enrolled by their 10th grade year should mitigate this problem. There are 47,170 students who fall into this category.

10. This distribution widens as students progress through school (data not shown).
11. Thresholds of 20% and 40% were chosen based on designations used by the Census, which labels neighbourhoods with poverty rates greater than 20% as 'poverty areas' and those with poverty rates above 40% as an 'extreme poverty areas'. See http://www.census.gov/population/socdemo/statbriefs/povarea.html.
12. In results not shown here, we also examine gentrification/decline over time in a neighbourhood for those students who do not move, defining a changes in neighbourhood quality by differences in poverty between the 2000 and 2010 Census. We find no change in outcomes among such students and therefore do not address this in the remainder of the paper. We feel this is justified by the relatively small number of students who experience such changes, approximately 156 of whom live in neighbourhoods that deteriorate over time and 4312 of whom live in neighbourhoods that improve.
13. Thus 'ever better' moves from the lowest poverty deciles (1 and 2) and 'ever worse' moves from the highest poverty decides (9 and 10) are left blank in Table 3.
14. Because measures of school quality are calculated separately for elementary and middle school grades, schools that contain both elementary and middle grades will have school quality measures that change depending on what grade the student is in. The majority of schools, however, do not fit this case and we would expect such 'changes' in quality to be small within a single school.
15. In most cases, one would expect that 'standard' moves to a feeder school (e.g. a student in a K-5 school moving to a 6–8 school in 6th grade) would not involve large changes in quality because such a move is likely to be to a school of similar quality. Rather, the measure below is designed to capture either strategic moves to better schools, or reactive moves that accompany unforeseen events such as a residential move or school closure, that result in substantive changes in school quality.
16. Note that unlike the short-term models, we cannot include student fixed effects in the long-term models since we observe students at one point in time (8th grade or 12 years in NYC public schools) for these models. We use 3rd grade test scores because this is the earliest grade that performance is measured in NYC.
17. We also estimate models including interactions between all neighbourhood and school move variables. The results are qualitatively similar to those from the more parsimonious model and for ease of interpretation, we include only the latter here. Results from models including interaction terms are available from the authors upon request.
18. These are called Regents exams after the governing body responsible for supervision of all educational activities within New York State (The New York State Board of Regents).
19. For models where the dependent variable is Regents test scores, we include indicators of the grade the student was in when he/she took the Regents as additional controls.
20. Models are also estimated using the full sample of students (including exiters) and also using a Heckman-style correction for selection of students out of the sample. In order to perform the Heckman-style correction, we use data on housing from the 1990 Census. Specifically, we include percentage of households living in the same house as five years ago, percentage of households in the same MSA as five years ago, and homeownership rate. Results from these alternative specifications are similar and available from authors upon request.
21. The coefficients on all move variables are either in the direction of worse attainment or are statistically insignificant.

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