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Student Transience in North Carolina

The Effect of School Mobility on Student Outcomes Using Longitudinal Data

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Student Transience in North Carolina: The Effect of School Mobility on Student Outcomes Using Longitudinal Data

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CALDER Working Paper No. 22

Abstract

This paper describes the school mobility rates for elementary and middle school students in North Carolina and attempts to estimate the effect of school mobility on the performance of different groups of students using student fixed effects models. School mobility is defined as changing schools at times that are non-promotional (e.g., moving from middle to high school). We used detailed administrative data on North Carolina students and schools from 1997 to 2005 and followed four cohorts of 3rd graders for six years each. School mobility rates were highest for minority and disadvantaged students. School mobility rates for Hispanic students declined across successive cohorts, but increased for Black students. Findings on effects were most pronounced in math. School mobility hurt the math performance of Black and Hispanic students, but not the math performance of white students. School mobility improved the reading performance of white and more advantaged students, but had no effect on the reading performance of minority students. "Strategic" school moves (cross-district) benefitted or had no effect on student performance, but "reactive" moves (within district) hurt all groups of students. White and Hispanic students were more likely to move to a higher quality school while Blacks were more likely to move to a lower quality school. The negative effects of school mobility increased with the number of school moves.

1. Introduction and Background

This paper attempts to estimate the effect of student school mobility on student school performance. In many schools and districts throughout the United States, student school mobility—defined as students making non-promotional school changes—is widespread. One in six of the nation's third-graders have attended at least three different schools since the beginning of the first grade (GAO 1994); and student school mobility remains a common phenomenon at all school levels based on more recent national data as well as state and district data. The National Assessment of Educational Progress (NAEP) 1998, for example, shows that 34 percent of 4th graders, 21 percent of 8th graders, and 10 percent of 12th graders changed schools at least once in the previous two years (Rumberger 2003). Between 1994 and 1997, one-third of all children in Texas public schools made non-promotional schools changes at least once between grades 4 and 7 (Hanushek, Kain, and Rivkin 2004). In Chicago, only 50 percent of the students in a typical elementary school are still enrolled in the same school three years later (Kerbow 1996). And in California, almost 75 percent of students made non-promotional school changes between grades 1 and 12 (Rumberger, et al. 1999).

Student school mobility is an important aspect of student's education experience, and it has many inter-connected causes and consequences. Although residential mobility does not always result in school changes, the majority of student school mobility in the United States is the result of residential change (Rumberger 2003). Families' decision to move could be the result of financial stress or family instability, such as job loss and divorce; it could also be the result of parents' attempt in seeking better education prospects for their children. Further complicating the research on the impact of student school mobility on children's academic success, a significant

number of school switches are also associated with school-related factors, such as safety concerns, overcrowding, class size reduction, suspension and expulsion policies, and limited academic opportunities (Kerbow, Azcoitia, and Buell 2003; Rumberger 2003).

The complex causes underlying student school mobility have at least two implications. First, the incidence of student school mobility varies greatly by individual, family and school characteristics. Low-income, inner city, migrant, and LEP students are generally more likely to change schools frequently (GAO 1994), and so are students from single-parent and stepfamilies (Astone and Mclanahan 1994). Student school mobility is also more prevalent in schools with large enrollment and a high percentage of minority students (Rumberger 2003).

The second implication is that the effect of school mobility is not always easy to measure. Observed differences in academic performance between mobile and stable students typically come from two potential sources: the effect of school mobility itself and the effect of preexisting student and family characteristics that contribute to both school mobility and educational outcomes. As there are wide variations in the underlying reasons leading to a school change, some moves are considered "reactive moves" and others as "strategic moves" (Rumberger, et al. 1999). "Reactive moves" are often dictated by changes in family structures and financial conditions, such as divorce and job loss. They could also be initiated by students or schools as a result of behavioral/disciplinary problems. These underlying causes of student school mobility are also risk factors to students' academic success themselves. Therefore, reactive moves are expected to disrupt students' academic progress through these factors. By comparison, "strategic moves" are often prompted by motivated parents in search of better education for their children,

whether by moving into a district with better schools or by taking advantage of available school choices such as magnet schools or open enrollment programs. These moves are meant to improve student academic performance.[1]

Regardless of the underlying reasons for a school change, student school mobility itself will have a direct impact on academic outcomes. School change presents potential risks of disruption of curriculum and instruction. Mobile student may also face challenges in adjusting to and engaging in the new school environment psychologically, socially and academically. Although after adjusting to the new settings students may recover from the disruption following a school change, the effect of school mobility will be compounded with multiple moves. Many highly mobile students experience isolation after a move, which affects attendance and performance (Rumberger, et al. 1999). The adjustment period of *frequent* movers becomes extended over several years and across multiple schools (Kerbow, Azcoitia, and Buell 2003). The cumulative effect of school mobility becomes a serious concern for these frequent movers.

Empirical literature on the effect of school mobility on student outcomes

There is a large empirical literature on the effect of student school mobility.[2] Yet what effect these studies are capturing is not always clear; often the estimated "school mobility effect" is a mixture of effects due to a) factors that motivated a school change and b) school mobility itself, as discussed above. Additionally, changes in school quality and other education inputs pursuant

[1] Whether such strategic moves actually succeed in procuring better school quality or not is another issue. Studies on Chicago public schools find that school shifts are often made within specific clusters of schools that share similar racial, ethnic, income, and achievement characteristics, even among students who cite moving to a higher-achieving school as their only reason of school change (Kerbow, Azcoitia and Buell 2003). Cullen, Jacob, and Levitt (2000) find similar patterns when they examine students who take advantage of an open enrollment policy.

[2] Although this study will focus on the effect of school mobility on transient students' academic performance, it should be noted that student school mobility not only affects transient students themselves psychologically, behaviorally and academically, but also affects stable students and schools (Hanushek, Kain and Rivkin 2004).

to a school change may also contribute to the overall effect of school change. Therefore, it is not surprising that findings on the school mobility effect, often estimated as an average overall effect across school changes of different types, are largely inconclusive. A few studies have found no effect or positive effects of school transfers on student achievement when background characteristics and prior academic performance are controlled (e.g. Alexander, Entwisle and Dauber 1996; Heinlein and Shinn 2000). Other studies find that the effect of student transience is reduced once the differences in background characteristics of mobile and non-mobile students are controlled, but it remains negative and significant (e.g. Wright 1999; Paik and Philips 2002).

Some consistent findings do emerge from the student school mobility literature. For example, students who change schools *frequently* are found to face greater risk of declines in academic achievement (Hartman 2002). Research indicates that frequent school changes have a cumulative effect on students' achievement that can place them as much as a year behind their peers (Kerbow 1996). Frequent school change has also been found to have a negative impact on sixth-grade reading achievement (Mehana and Reynolds 1995) and puts high school students at greater risk of dropping out (Rumberger and Larson 1998).

The literature also shows the importance of distinguishing between different types of moves. The destination and timing are often used to categorize school changes. The relatively well-to-do and white students are more likely to make cross-district moves, whereas lower income students transferred within the district more often (Alexander, Entwisle, and Dauber 1996). Cross-district moves are often “strategic moves”, or moves that are well-planned and occur between school years (Rumberger, et al. 1999). Within-school year moves are more likely to be “reactive moves”

and hence more disruptive (Wright 1999; Hanushek, Kain, and Rivkin 2004). Without detailed information on the underlying causes of school change, these observed move patterns help differentiate school changes into broad categories. As a result, studies that take into account move types yield more consistent findings. Within-district and within-school year student school mobility are found to have negative impact on student achievement (Hanushek, Kain, and Rivkin 2004; Wright 1999; Rumberger, et al. 1999).

Most existing studies on the effect of student school mobility compare education outcomes of mobile students with those of non-mobile students, even when longitudinal data are available. However, students do not change schools at random. Hanushek, Kain, and Rivkin (2004) highlight the fact that students who make non-promotional school changes are different from those who do not along a number of dimensions even after background characteristics and previous achievement are controlled. Some of the important differences, such as motivation, ability, and value placed on education, are usually unobserved to researchers and will confound the estimated school mobility effect. As a result, these authors estimated the school mobility effect using a fixed-effects model by comparing student achievement gains following a school change to the expected gains in years when the *same* student did not move. To the best of our knowledge, this is the only student school mobility study to date that uses this type of method. Student school mobility is shown to entail a substantial cost for movers in this study.

Focusing on North Carolina

Because of the uneven distribution of student school mobility, often disproportionately concentrated among at-risk and low-performing students (Rumberger and Larson, 1998), and

because of different propensities in making “reactive moves” as opposed to “strategic moves” across ethnic and socio-economic groups (Rumberger, et al. 1999), student school mobility may perpetuate or even further widen preexisting education gaps between disadvantaged students and their peers.

Given the importance of student school mobility, this study aims to provide a timely assessment of the prevalence and impact of student school mobility among elementary and middle school students in North Carolina, a state which has seen one of the most dynamic population movements in recent years, driven mostly by dramatic growth in its immigrant population. The population mobility rate in North Carolina has been higher than the national average and shows no evidence of decline (U.S. Census Bureau, 2004-06 ACS). In recent decades, North Carolina has experienced significant growth among its immigrant population. From 1990-2000, North Carolina’s immigrant population grew by 274%, the highest rate among all states (1990, 2000 U.S. Census). Exposed to such dramatic demographic changes in North Carolina, a large number of school-age children are expected to move with their families and change schools frequently. In addition, there have been increased opportunities of school choice in North Carolina. Even though North Carolina does not have state open-enrollment programs, several districts (e.g. Mecklenburg, Wake, Forsyth, and Cumberland) have established magnet schools or choice-based enrollment policies (John Locke Foundation 2008), some of these established as part of county-wide economic integration plans (such as the Wake County). The establishment of charter schools has also increased school choices that may lead to higher student school mobility rates.

2. Research Questions

Using student-level longitudinal data provided by the North Carolina Education Research Data Center (NCERDC), this study will answer the following two major research questions:

i). What are the student school mobility rates among elementary and middle school students in North Carolina and how do they change over time and vary by student, family, and school characteristics?

ii). How does student school mobility affect performance on state standardized tests, and how does the effect vary by student and family characteristics?

3. Methods

We investigate student school mobility among public elementary and middle school students in North Carolina in two steps. First, our report provides a descriptive analysis on the prevalence and time trends of student school mobility by student, parent, and school characteristics. Second, we estimate the effect of student school mobility using fixed-effects models and compare these estimates across student groups with different characteristics.

Defining school mobility

School mobility is defined as non-promotional changes in school from the previous year. A non-promotional school change occurs when a student switches schools outside of the routine promotions to middle and high school. Empirically, a school change is coded as a structural move when a student attended a different school in the previous year and 10 percent or more of prior-year classmates made the same move, the same threshold used by Bifulco and Ladd (2006); otherwise a school change is considered a non-promotional move.

We are not able to distinguish the reasons underlying a school switch due to data limitations. Therefore, we will not be able to disentangle a pure "school mobility effect" from other factors that may lead to both a move and affect academic outcomes; rather, we can only estimate a combined effect of school mobility and other factors. We can, however, distinguish between within-district and cross-district moves, a distinction highlighted in recent literature. [3] We estimate school mobility effects separately for these two types of moves.

Model

A key challenge to the estimation of the school mobility effect is that movers and non-movers are different along a number of dimensions. A few of these differences are observable to researchers, such as a student's prior achievement level, race/ethnicity, and parents' education attainment. However, there are unobserved differences that are crucial to a student's academic progress but cannot be captured by observed attributes; these may include systematic differences in student motivation, family's belief in the importance of education, and expectations. When both the school-switching decision and academic performance of a student are related to these unobserved factors, OLS estimates of the school mobility effect on academic performance will be biased.

To mitigate such potential biases resulting from the non-randomness of moving decisions, we estimate a fixed-effects model with score gains (difference between End-of-Grade test scores

[3] Another important dimension in distinguishing different types of moves is the timing of a school change. In our data set, students who have enrolled in more than one school in the same year can be identified as within-year movers. However, the data do not tell us the order of these enrollments. As a result, we are not able to distinguish pre-move and post-move test scores for these students.

standardized by subject, year, and grade) as the dependent variable. Fixed-effects models take advantage of repeated student performance measures over time, and identify the school mobility effect using within-student variation of mover status:

$$(1)\ \Delta y_{it} = \beta_0 + X_{it}\beta + m_{it}\delta + c_i + u_{it}$$

y_{it} represents student *i*'s standardized test score in year *t*, and Δ denotes score gains in year *t* from year *t-1*. *X* is a vector of time-varying control variables. *m*=1 if student *i* made a non-promotional move at the beginning of year *t* (and 0 otherwise). In this model, the residual term includes two components: a time-constant component c_i, and an idiosyncratic residual component u_{it} that is homoskedastic, uncorrelated with any independent variables or c_i, and not autocorrelated. c_i captures any student characteristics that are fixed over time, both observed (such as gender and race/ethnicity) and unobserved characteristics (such as motivation and expectation) that may be related to both school change decisions and academic performance. It is this unobserved component in the error term that violates the key OLS assumption of independence between the errors and independent variables. However, since these characteristics are constant or near constant for each student over time, they drop out of the equation if we demean equation 1. In this way, confounding factors resulting from the non-randomness of moving decisions are removed, and school mobility effects can be consistently estimated. In other words, FE models circumvent the self-selection issue by comparing movers to themselves, rather than comparing movers with non-movers.

As mentioned earlier, school changes often indicate changes in students' lives that may also have direct effects on academic growth. These time-variant factor will not be removed by student fixed-effects and will compound the "pure" school mobility effect. To reduce the heterogeneity

of moves, we estimate the model separately by student race/ethnicity, free/reduced-price lunch (FRPL) eligibility, limited English proficiency (LEP) status, special education status, and by school mobility types (within-district moves and cross-district moves).

Our dependent variables are gains scores in reading and math. Each year North Carolina public schools administer end-of-grade standardized tests in reading and math to students in grades 3 through 8 as part of its statewide ABC accountability program to assess academic performance. Using end-of-grade tests in reading and math, we are able to measure gains in achievement for an individual student before and after a school move. Because test scales are not comparable across years, we standardize test scores using grade by year means and standard deviations so that each test has a mean of zero and standard deviation of one. Therefore, a student's standardized score should be interpreted as the student's relative standing to his/her peers in the same grade, year and subject.

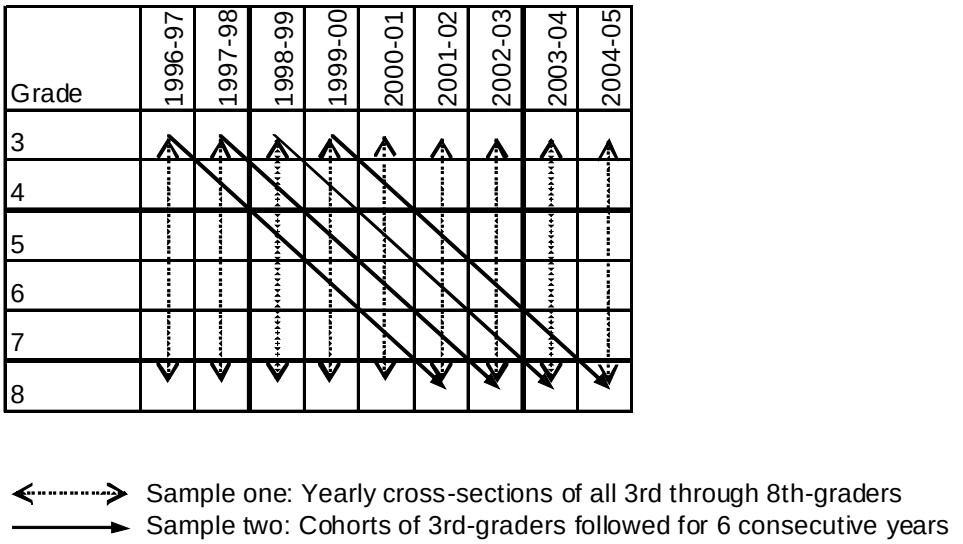
In addition to student fixed effects, our models control for school quality (as measured by percentage of students performing at grade level or higher), school size, locale and Title I eligibility. We also include dummy variables that flag structural moves and grade repetition, two factors that are found to affect test score gains significantly. Finally, all models also include grade fixed effects.

4. Data Source and Samples

Data used in this analysis were collected by the North Carolina Department of Instruction (NCDPI) and contain detailed administrative records on students, teachers, and schools. Each

student enrolled in North Carolina public schools is assigned a unique randomized identifier which allows us to track individual students over time. Student level information include school attended, ethnicity, sex, free/reduced price lunch status, English proficiency, special education status, level of parental education, and end-of-grade test scores in reading and math. School level data include information on Title I status, student membership, locale, grade span, and AYP status. Data are compiled each year by the North Carolina Education Research Data Center (NCERDC) at Duke University. We formed a student level longitudinal file by merging annual datasets. School level information was then linked to the student level longitudinal data file.

Exhibit 1: Analytical samples



Note: The cohort samples shown in this exhibit represent the trajectory of a typical student who has been promoted on time. He/she would reach the 8th grade at the end of our six-year period.

We conduct analyses on two analytical samples (Exhibit 1). The first sample consists of yearly cross-sections of all students in grades 3 through 8 from 1997 to 2005. We analyze changes in the rate of enrollment and student turnover over time to obtain a sense of demographic changes

occurring in the student population and to present broad patterns of school mobility. Our second and primary sample takes advantage of the longitudinal nature of the data and consists of four cohorts of 3rd grade students who were enrolled in North Carolina public schools for six consecutive years. This allows us to provide descriptive trends in school mobility across cohorts and estimate school mobility using fixed-effects models. The first cohort entered the 3rd grade in 1997; the last cohort entered 3rd grade in 2000. If a student is retained or skips a grade then he/she may not be in the 8th grade in the sixth year as would the vast majority of students. If a student repeated 3rd grade and stayed in our sample long enough he/she might also be included in multiple cohorts; in other words, our 3rd-grade cohorts are not limited to first-time 3rd-graders but rather representative of typical incoming 3rd-grade classes. Table 1 provides the percentage of students retained after restricting our sample to students who were enrolled in North Carolina public schools for six consecutive years. Using this approach, we retain over 75% of students in each of the four cohorts (Table 1).

5. Findings

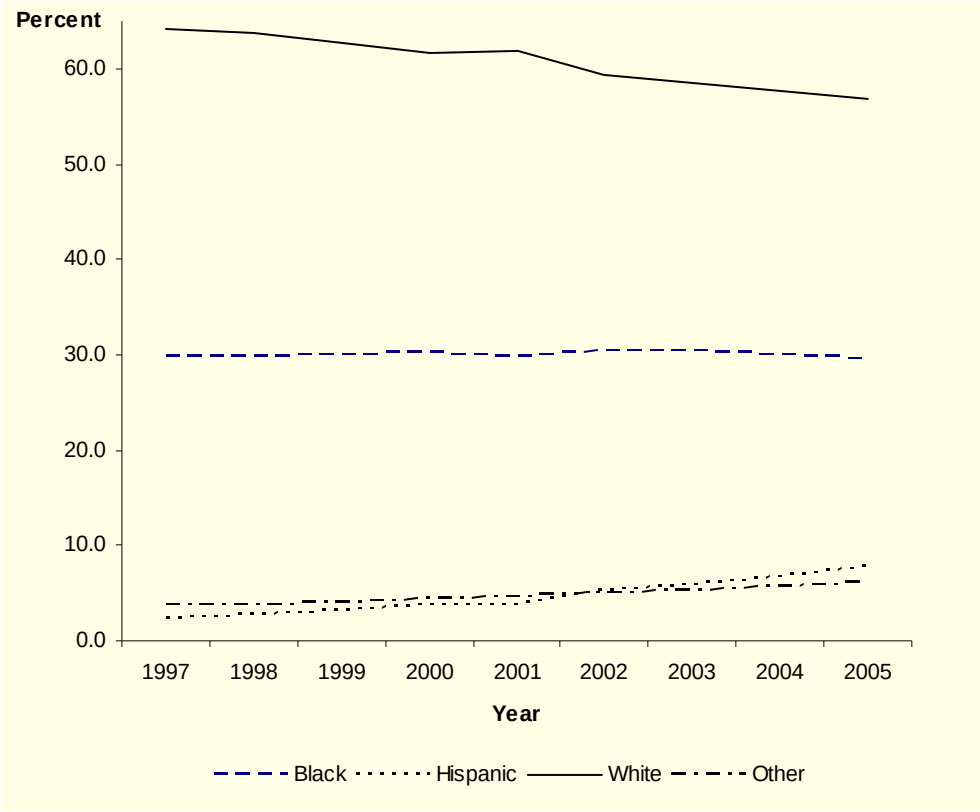
Prevalence and trends of student school mobility in North Carolina

Enrollment, student composition, and school turnover rate: Significant demographic shifts in the composition of North Carolina's overall population are reflected in changing rates of enrollment and student turnover[4]. Third through eighth grade enrollment has increased by nearly 15 percent between 1997 and 2005. The percentage distribution of students from different racial/ethnic backgrounds has also changed dramatically. Although the percentage of black students has remained mostly stable at around 30 percent, the percentage of white students has declined by nearly 8 percentage points, from 64 percent in 1997 to 57 percent in 2005. The

[4] All numbers presented in this section and other "Findings" section count non-promotional school changes only.

percentage of enrolled Hispanic students has more than tripled, reaching nearly 8 percent of the student population in 2005 (Figure 1 and Table 2).

Figure 1. Percentage distribution of 3rd through 8th grade enrollment in North Carolina public schools, by race/ethnicity: School years 1996-97 through 2004-05



During the same time period, the share of students who have limited proficiency in English rose to over 4 percent in 2005 from under 2 percent in 1997. The percentage of students eligible for Free/Reduced Price Lunch increased markedly from 38 percent in 1999, the first year for which we have data on free/reduced price lunch eligibility, to 47 percent in 2005 (Table 2).

Along with these big shifts in student composition, turnover rates among 3-8 grade students have increased across schools. Student turnover captures the overall stability in a school, measured by

summing the percent of students who transfer into the school at the beginning of a school year and the percent of students who leave by the end of the year. For schools in all locales, the average turnover rate has increased by three to four percentage points from 1998 to 2004 (Table 3). Urban schools experience the highest rates of student turnover, reaching 33 percent in 2004. Turnover rates in suburban schools are lower at an average of 22 percent, and schools in rural areas have the lowest rates of student turnover (16 percent). Schools with various Title I status (school-wide Title I, targeted-assistance, and non-Title-I) have comparable student turnover rates (Table 4). However, further analysis indicates that Title I schools have more difficulty retaining students, losing about 12 percent of their students on average every year, compared with 8 percent among Non-Title I schools.

Clear patterns emerge when considering student turnover rates by other school characteristics (Table 5 presents findings for year 2000. Similar patterns appear in other years). Schools with a higher proportion of students performing at grade level or higher tend to be more stable. Among schools performing at the top quartile (in terms of percentage of students performing at grade level), the average turnover rate is 15 percent in 2000, compared with 27 percent among schools in the bottom quartile. Student turnover rates also increase as the proportions of students who are minorities or eligible for free/reduced price lunch increases. Schools with the highest percentages of minority students or FRPL eligible students have average annual turnover rates of more than 26 percent, 10 to 15 percentage points higher than schools with the smallest attendance of these students.

Finally, increased opportunities for school choice also appear to be associated with higher student turnover rates. Charter schools, an important form of school choice first established in North Carolina in 1998-99, experience higher turnover rates (over 30 percent) than traditional public schools (22 percent) (Table 6). In addition, districts that have established magnet schools or choice-based enrollment (Mecklenburg, Wake, Forsyth, and Cumberland) have significantly higher school turnover rates (5 to 10 percentage points higher) than districts where choices are more limited, even after controlling for school locale, Title I status, charter status, as well as school size and percentage of students who are minority and FRPL eligible[5].

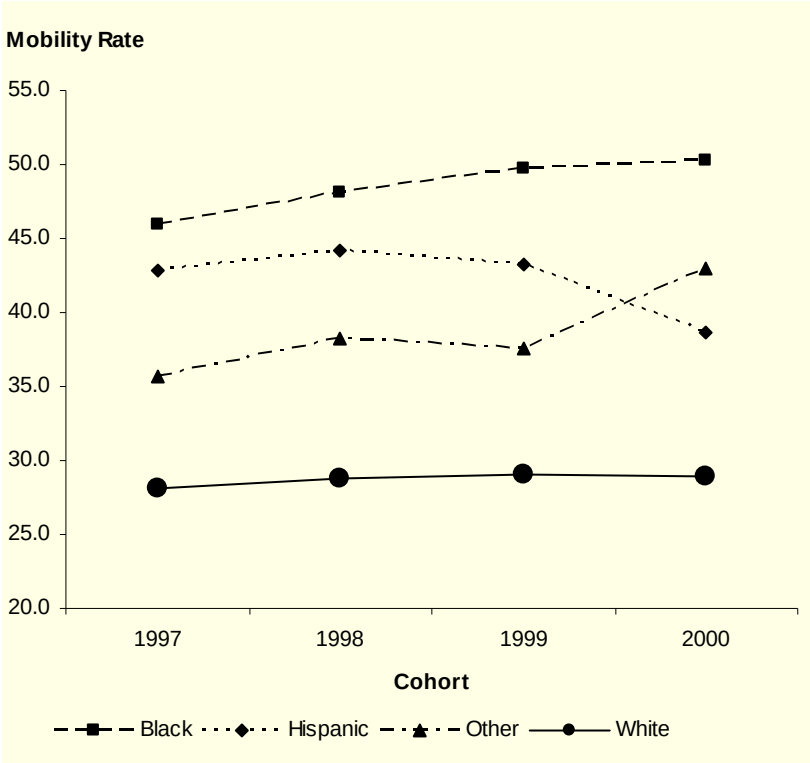
***Incidence of non-promotional school changes*:** The remainder of the findings refers to the second analytical sample comprised of four cohorts of 3rd graders enrolled in North Carolina public schools for six consecutive years.

First, we examine the percent of students who have ever made a non-promotional move over a period of six years by race, cohort, and other characteristics. The percentage of students who have ever made a non-promotional move has remained stable across the four cohorts, increasing slightly from 34 percent for the 1997 3rd-grade cohort to 37 percent for the 2000 cohort. School mobility rates have remained stable across cohorts for white students, at about 29 percent (Figure 2 and Table 7). By comparison, black students have become increasingly mobile. Among students in the first cohort, school mobility rates of black students were 18 percentage points higher than that of white students; for students in the fourth cohort, this difference widened to 21 percentage points. By contrast, school mobility rates among Hispanic students decreased by 4 percentage points, with 39 percent of students ever making a non-promotional move in six years

[5] Regression results not shown in table but available upon request.

for the 2000 cohort, possibly reflecting an increasingly stable population. This decline in school mobility coincides with a steady increase in the Hispanic enrollment each year observed in Table 2.

Figure 2. Percentage of 3rd-graders who ever made a non-promotional move in six years, by cohort and race/ethnicity



In each cohort, black students had the highest school mobility rate, followed by the Hispanic students and white students. Because of the difference in school mobility trends, the gap in student school mobility rates between Hispanic students and black students increased to 11 percentage points in the 2000 cohort, even though they were similar in the 1997 cohort.

Students eligible for free/reduced price lunch switch schools at much higher rates than students who are not eligible. This pattern holds true across race/ethnicity and cohorts. Among all

students in all four cohorts, about 45 percent of FRPL-eligible students made at least one non-promotional move within six years, compared with less than 25 percent among ineligible students. The gap in school mobility rates between these two types of students, however, varies by student race/ethnicity. Particularly, it appears that all Hispanic students had similar school mobility rates regardless of their FRPL eligibility in the 1997 cohort. The gap widened in later cohorts and became comparable to that of other racial groups (Figure 3).

For all race/ethnic groups and across cohorts, school mobility rates for students who had limited proficiency in English or who received Special education services were consistently higher than for their counterparts. The gap of school mobility rates between LEP and non-LEP students range from 7 percentage points (cohort 2000) and 14 percentage points (cohort 1997), and shows a narrowing trend over time. Similar to the school mobility gap by FRPL eligibility, the gap by LEP status shows a different pattern for Hispanic students as compared with that of other racial/ethnic groups. However, the trend is just the opposite. The school mobility gap between LEP and non-LEP Hispanic students narrowed from a 5-percentage-point difference in the earliest cohort to virtually no difference in the 2000 cohort (Figure 4).

Figure 3. Percentage of Black and Hispanic 3rd-graders who ever made a non-promotional move in six years, by cohort and free/reduced-price lunch eligibility

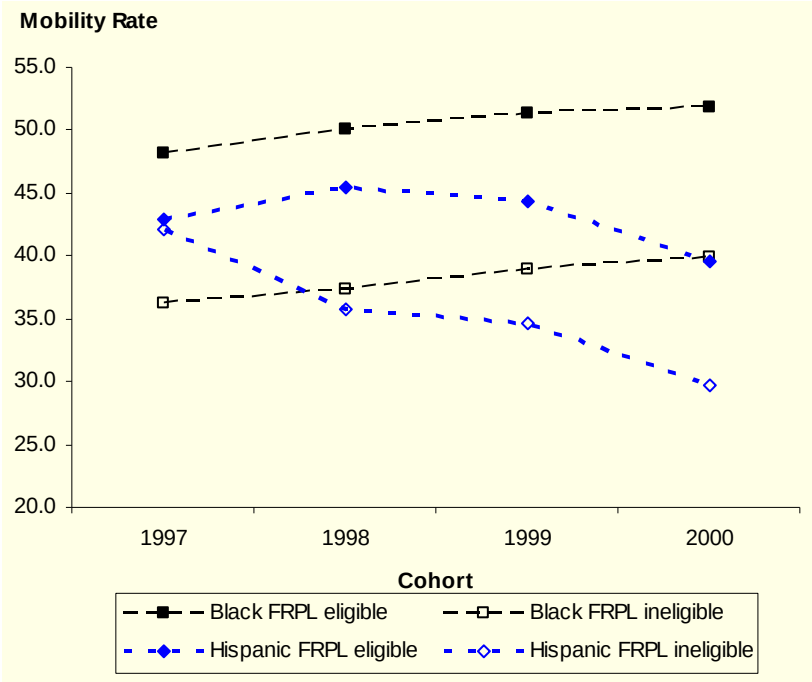
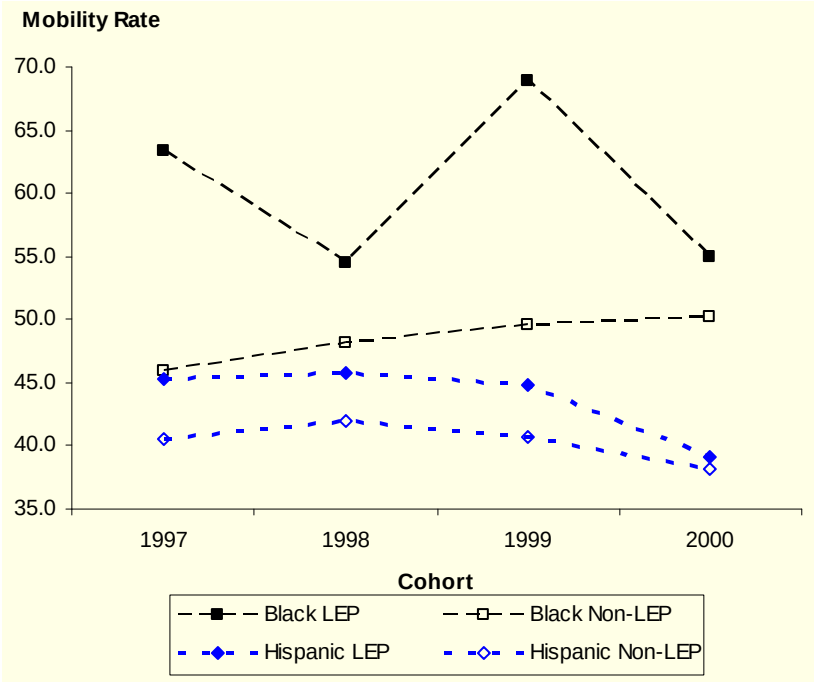
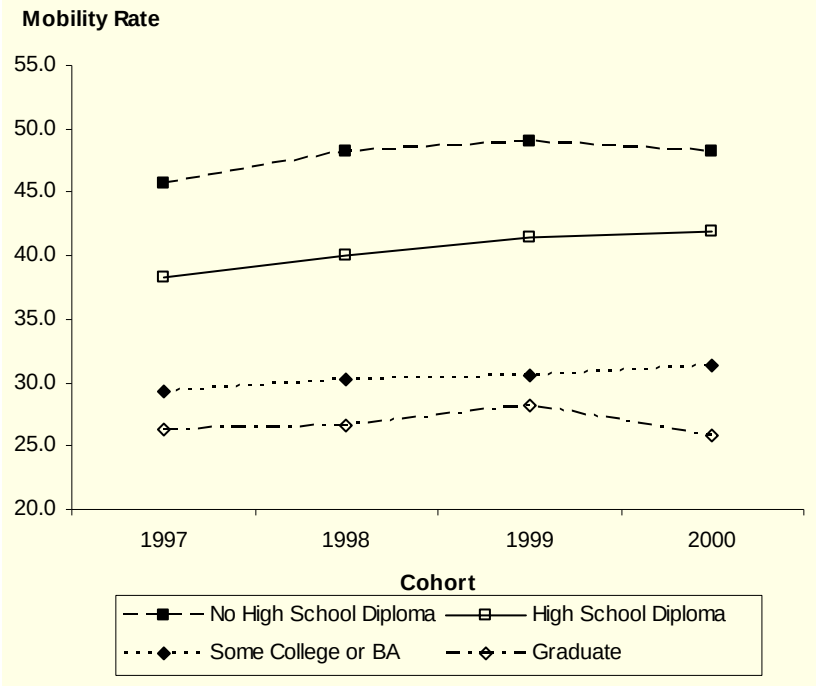


Figure 4. Percentage of Black and Hispanic 3rd-graders who ever made a non-promotional move in six years, by cohort and limited English proficiency status



Finally, and in keeping with previous findings, figure 5 and table 7 shows that an increase in parental education levels is associated with a decline in school mobility rates. This pattern is consistent across student racial/ethnic groups and over time.

Figure 5. Percentage of 3rd-graders who ever made a non-promotional move in six years, by cohort and parental education attainment



***Frequency of non-promotional school changes*:** Since frequent school changes have been consistently found to have negative effects on students' academic outcomes, we next identify characteristics of frequent movers. Table 8 presents the percentage of non-promotional *movers (not all students)* who made two or more non-promotional school moves over a period of six years. The patterns emerging from this table are very similar to what we have seen in table 6. Among all students who have ever made a non-promotional move, about 36 to 38 percent of

them changed schools twice or more (not including school changes when they moved from elementary schools to middle schools, i.e. “structural moves”). White students were less likely to be frequent movers, but still about one-thrid of movers changed schools twice or more. By comparison, nearly half of black students, if they have ever made a non-promotional school change, became frequent movers. And that percentage increased over time. Among Hispanic students, however, the percentage of frequent movers declined in each successive cohort, from 37 percent to 34 percent.

FRPL-eligible movers are roughly twice as likely as their non-eligible counterparts to become frequent movers. An interesting observation is that within each FRPL eligibility group, Hispanic students (who ever moved) are almost always the least likely to become frequent movers among all racial groups, even though as an entire group Hispanic students are the second most likely frequent movers (an example of the “Simpson’s Paradox”). The percentages of movers who made two or more moves are also higher among students who have limited English proficiency, receive special education services and have parents with lower education attainment than their peers.

***Changes in school quality associated with non-promotional moves*:** In an effort to differentiate between moves that may have been strategic, such as moves to a magnet school, versus those that were caused by unintended circumstances, such as divorce or a parent’s job loss, we evaluate changes in school quality for mobile students. School quality is captured by the percentage of students in the school who perform at grade level or higher, and is divided into deciles within each year. Change in school quality is then derived by comparing the quality of a

student's current school and the quality of his/her former school in the current year (which represents the school quality that the student would have procured had he/she not moved).

Parental education and change in school quality exhibit a clear pattern (table 9-12). The best way to interpret these tables is to examine the differences between the percentage of students who moved to a better school and the percentage of student who moved to a worse school. While students whose parents had some college education or higher move to a better school more often than moving to a worse school, the opposite pattern is true among students whose parents received no college education. Similarly, students from lower-income families tend to move to a lower quality school more often than moving to a better school, the opposite is true for their non-poor peers.

Across racial/ethnic groups, white students are consistently more likely to procure higher school quality in all four cohorts, whereas black students move to worse schools more often than to better schools. School change leads Hispanic students to better schools more frequently than to worse schools in all but the earliest cohort (1997). These findings suggest that it is important to control for school quality changes following a school switch in estimating the effect of student school mobility.

The results of the descriptive analysis indicate that typically disadvantaged student populations suffer from high rates of school mobility, and that they are more likely to become frequent movers. Black and low-income students consistently rank highest on both measures of school

mobility. While Hispanic students are also subject to high rates of school mobility, their school mobility rates and frequencies have declined over time.

The effect of school mobility on student achievement

The school mobility effect of concurrent moves: Fixed effect regression models were run to estimate the effect of school mobility on achievement in math and reading in the period right after a school change, first for all students and then for various subsamples. Effects are estimated for all non-promotional moves, cross-district moves and within-district moves separately. Effect estimates are summarized in table 13 (math) and 14 (reading). For math scores, consistent with previous findings, non-promotional moves have a negative impact on academic achievement. School change reduces the expected score gains that a student would have achieved had the student not moved by about one and a half percentage of a standard deviation (one standard deviation of math score gains is about .5). The effect is small but significant. School mobility on average has no effect on academic performance of white students, but harms black (by about .025 standard deviations) and Hispanic (by about .052 standard deviations) students. The loss in math achievement gains associated with student school mobility is three times as large for Special education students as that for non-Special education students. Low-income students also suffer academically from such moves while non-poor students on average experience no effect.[6]

[6] For the purpose of comparison, in all models, "structural move" and "grade repetition" are by far the most influential control variables. In our first model that includes all students, for example, a structural move is associated with about .1 standard deviation loss in score gains, whereas repeating a grade is associated with almost one standard deviation improvement in score gains. This makes us rethink the findings in the current literature, which generally do not control for either variable.

When we distinguish cross-district moves from within-district moves, we find that cross-district movers on average are not affected by non-promotional school changes, whereas within-district movers see mostly significant negative effects. The effects of these two types of school mobility straddle the estimated school mobility effects when we do not distinguish between school mobility types. Non-poor students who move to a different district benefit from the school change (.024 standard deviations), whereas within-district movers in almost all groups suffer significant losses of learning in math, with minority students, poor students and students receiving special education services most affected. These findings are consistent with earlier observations in the literature that cross-district movers are more likely strategic movers and that within-district movers tend to be reactive movers.

By comparison, the estimated school mobility effects on reading score gains are mostly insignificant or positive. Overall non-promotional school changes are positively related to reading score gains, and the association is only marginally significant (at the .10 level). On average, school mobility has significant positive effects on reading among white students, non-poor students, and non-special education students. Once we distinguish cross- and within-district school transfers, we find estimated effects differ by school mobility types in a way similar to what was found with math scores. Specifically, cross-district moves appear to include more "strategic moves" and within-district moves may more likely be "reactive moves".[7] On average cross-district moves are associated with just under .02 standard deviation (one standard deviation of reading score gains is .58) improvement in reading score gains. The benefit of cross-district

[7] We also examined whether moves made in school districts that had choice plans, where parents presumably can keep their children in the same school or make more "strategic moves", led to different results. We did find evidence that within such districts, non-promotional moves were associated with no change or positive change in math and reading gain scores, indicating that parents were making more strategic within-district moves when there were more school choices.

moves among white students is larger (about .05 standard deviation). Non-LEP, non-poor, and non-special education students also benefit from cross-district moves, whereas their disadvantaged peers do not. Among within-district movers, non-promotional school change is associated with zero or negative change in reading score gains.

Our results indicate that the effect of school mobility on reading and math achievement varies. Mobile students in all subgroups generally experienced declines in math learning and either no effect or positive effects on reading. These findings are consistent with a view that math learning is more school dependent than is reading learning. So any losses in learning associated with switching schools would be more likely to show in math than in reading.

The cumulative effect of multiple moves: We next investigate the effect of multiple moves. First, the number of non-promotional school changes prior to the current move was computed. If a student changed schools for the first time, for example, this variable equals zero in that year. Next, this variable and its quadratic form were added to the models estimated above. This will allow the school mobility effect to vary depending on the number of prior school changes. The cumulative effect of school mobility can then be calculated by aggregating the losses/gains associated with all previous and current moves.

This analysis adds new insights to the nature of student school mobility that has not been captured by existing research. While researchers have examined the effect of frequent school changes and consistently found harmful effects of frequent school mobility, they did so by first categorizing students into distinct groups of non-movers, movers and frequent movers, and then

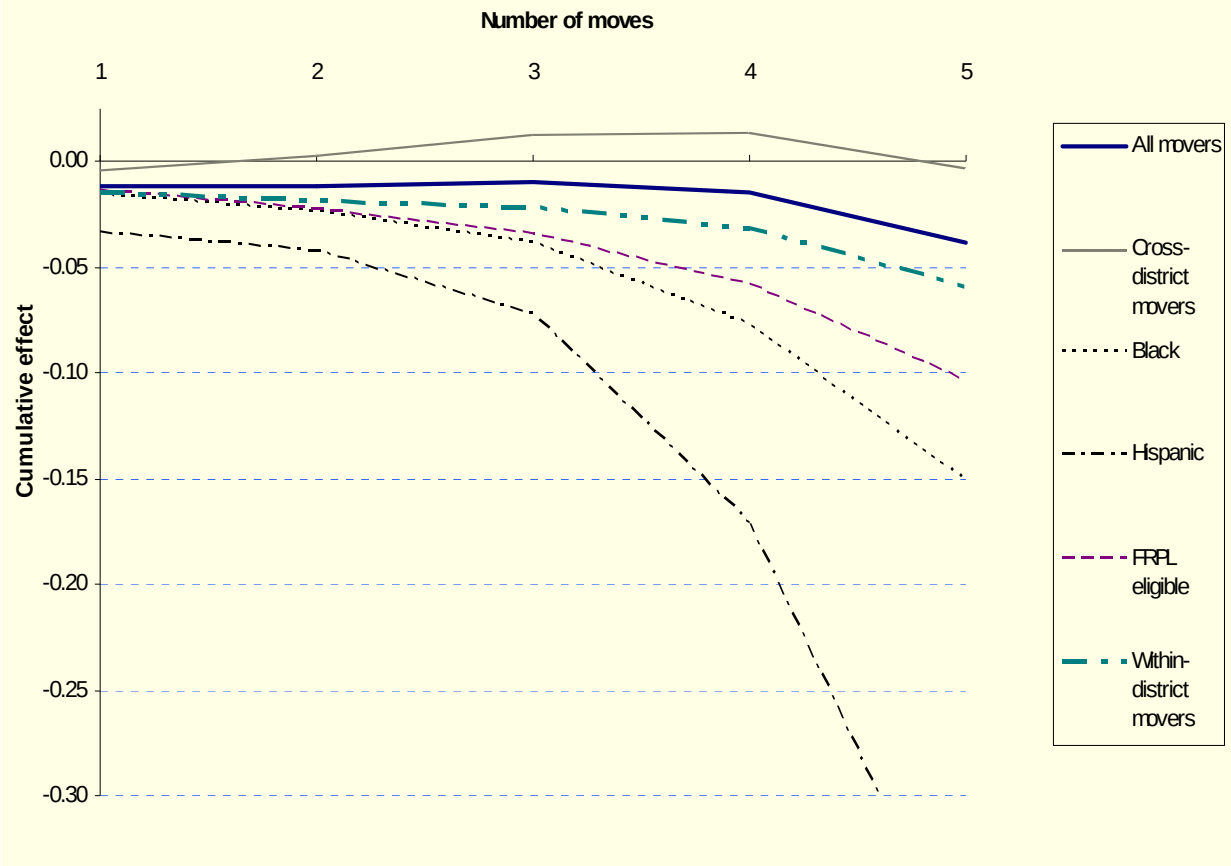
compare education outcomes (such as high school dropout) or performance trajectories between these student groups (e.g. Kerbow 1996; Rumberger and Larson 1998). Although occasionally it was suggested in the literature that students may learn to adapt and become more flexible as they experience more school changes, no study has compared the school mobility effect when a student makes his/her first move with the effect when the *same* student moves for a second time, a third time, and so on.

Our results empirically show that the school mobility effect does depend on a student's previous school change experiences. Students who are first-time movers suffer from a 2.2 percent of a standard deviation loss (compared with a loss of 1.6 percent standard deviations averaged across all moves as reported above) in math score gains relative to what they would have achieved had they not moved. If a student changes schools for a second or a third time, he/she suffers no loss in potential gains in math performance. The coefficients on both the number of prior moves and its quadratic form are significant, with the former positive and the latter negative. This indicates that the amount of loss in math score gains is diminishing first—probably because the student learns how to adapt to new school curriculum and environment faster as he/she makes a second or a third move. However, as the student becomes a chronic mover, and probably becomes discouraged, the rate of loss rises sharply. The loss in math learning associated with a fifth-time move is about 4.7 percent of a standard deviation. And cumulatively, a student who makes five non-promotional school changes loses 7.7 percent of a standard deviation in math learning. (figure 5).

Table 15 shows that similar patterns can be found among various subgroups of students as well. Specifically, cross-district movers, within-district movers, black, Hispanic and low-income students all suffer from losses (insignificant for cross-district movers) in math score gains following their first non-promotional school change, and the rates of loss are mitigated as they continue to change schools, before the rates of loss increase again as they become chronic movers. The cumulative effect of school mobility on math performance by the number of moves is shown in figure 5. The negative effect of school mobility associated with students' first school change and the cumulative effect of multiple moves are most pronounced among Hispanic, black and low-income students[8].

[8] About 10 percent of Hispanic students, 17 percent of Black students and 17 percent of FRPL-eligible students made three or more non-promotional moves.

Figure 5. Cumulative effect of school mobility on math score gains for 3rd through 8th graders in North Carolina public schools, by number of non-promotional school changes



Similar patterns are not observed for other subgroups of student, and are generally not observed for reading performance. Even though the coefficients on the number of prior moves and its quadratic form consistently remain in the right directions, they are not statistically significant.

6. Conclusions

During the years between 1996-97 and 2004-05, third through eighth grade public school enrollment in North Carolina has increased by nearly 15 percent, a rate that was twice as fast as the national average during the same period (6.8 percent, calculated based on the Digest of Education 2007, table 36). Coincidental with this dramatic change in enrollment, the

demographic composition of students shifted, with the percentage of Hispanic and other non-black minority students steadily increasing over the entire period. These changes largely mirror the broader demographic shifts in the North Carolina population. The same period also saw significant increases in the percentages of low-income students and students with limited English proficiency.

Consistent with previous research on student school mobility, minority, low-income, and LEP students as well as students whose parents have lower education attainment are at higher risk of making non-promotional school changes than their peers; they are also more likely to move frequently, which has been found in previous research to harm student academic progress. Over the study period, the average student turnover rates at the school level and the percentage of students making non-promotional moves have increased, mostly as a result of increasing school mobility among minority students. A notable exception to this trend is the school mobility rate among Hispanic students, which has decreased in more recent cohorts when compared with earlier cohorts.

The effect of school mobility on score gains in math and reading is estimated after controlling for school quality and removing confounding factors due to unobserved differences between students with student fixed-effects. The estimates are an improvement over those reported in most previous research. However, fixed effects cannot remove unobserved factors that change over time and consequently lead to school switches. As a result, our method cannot fully disentangle the "pure" school mobility effect from the effect of factors that affect both school mobility and academic performance. It is not surprising that on average, the *aggregate* effect of

school mobility—consisting of the effect of school mobility itself and the effect of changes in family, individual, and school circumstances that motivated or necessitated a school change—is mixed and small. The school mobility effect on math score gains is negative among all students, whereas no effect is observed on reading score gains. Within more homogeneous subgroups of students, we find that school mobility has negative (for math) or no effect (for reading) among minority, LEP, low-income students and students who move within districts (regardless of their racial/ethnic background or poverty status). By comparison, school mobility is associated with improved math and reading performance among non-poor cross-district movers.

The effect of student school mobility varies not only by student characteristics and destinations of school changes, but also by students' previous school switching experiences. This variation is observed for math performance but not for reading, and it is most clear among black, Hispanic, low-income students as well as students who move within district. Consistent with findings from previous research, the negative effect of school mobility on math performance is compounded by frequent moves (three or more non-promotional school changes in six years); however, students who make their second or third school changes experience less loss in math performance than the loss they experience when moving for the first time. This might indicate that students learn from their first school change experience and become more flexible and adaptable when moving again.[9]

[9] This may also simply reflect the possibility that moving at earlier grades is more harmful to a student than moving at later grades, as some researchers find (e.g. Heinlein and Shinn 2000). However, we estimated models that allow school mobility effect to interact with grade, and found no significant interaction between the effect of school mobility and grade.

The propensity and frequency of student school mobility vary greatly by student, family and school characteristics, as do the effects of concurrent school changes and the cumulative effects of multiple moves. Minority and disadvantaged students are most susceptible to circumstances that necessitate non-promotional school changes; they are also more likely to experience harmful academic consequences related with school mobility. With increases in both the number and percentage of minority and disadvantaged students in North Carolina's elementary and middle schools, the state public education system is faced with challenges in providing support to mobile students, non-mobile students and teachers alike to minimize potential disruptions of instruction and learning.

While ameliorating family circumstances that prompt school moves is likely beyond the control of school districts, school districts should consider "flagging" students who are chronic movers (who make three or more moves over a span of six years, i.e. who changes schools every other year) and work through school counselors to see if there are ways to encourage school stability at least until the end of the school year. Actions might include providing transportation. Students should not have to pay the price any more than necessary for family disruptions. In addition, the learning costs to students of changing schools underscores the importance of a common district, if not state, curriculum and pacing guide across schools.

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Appendix

Table 1. Percentage of 3rd-graders retained in cohort samples

Cohort	Percent retained
1997	76.75
1998	76.95
1999	77.52
2000	78.02

Note: Our cohort samples are restricted to 3rd-graders who had six consecutive years of data. The vast majority of students who progressed on time would have been in the 8th grade by the end of this period. All years refer to the spring of school years.

Table 2. Third through eighth grade enrollment in North Carolina public schools and percentage distribution by race/ethnicity, Free/Reduced price lunch status, Limited English Proficiency status, and Special education status: school years 1996-97 through 2004-05

Year	Total Enrollment	Race/Ethnicity (%)				FRPL (%)	LEP (%)	Special education (%)
		Black	Hispanic	White	Other			
1997	563,955	29.7	2.4	64.2	3.7	—	—	13.8
1998	579,678	29.9	2.7	63.7	3.7	—	1.6	14.2
1999	596,392	30.1	3.2	62.8	4.0	38.4	1.8	14.5
2000	609,752	30.2	3.7	61.7	4.4	39.0	2.1	14.6
2001	593,834	29.9	3.7	61.9	4.6	38.5	1.6	11.9
2002	633,576	30.5	5.2	59.4	4.9	42.3	2.9	14.7
2003	638,522	30.4	5.9	58.5	5.3	45.0	3.5	14.5
2004	642,667	30.1	6.7	57.6	5.6	46.1	4.1	14.3
2005	645,322	29.6	7.7	56.7	6.0	47.2	4.3	13.9

— Data not available

Note: All years refer to the spring of school years

Source: North Carolina Education Research Data Center (NCERDC)

Table 3. Average turnover rates for the third through eighth grade student population in North Carolina public schools, by school locale and year

	Urban		Suburban		Rural	
year	Mean (%)	S.E.	Mean (%)	S.E.	Mean (%)	S.E.
1998	28.1	0.70	18.1	0.47	13.3	0.42
1999	29.6	0.76	19.1	0.59	15.2	0.39
2000	29.3	0.76	18.3	0.52	15.3	0.39
2001	30.8	0.74	19.2	0.57	15.6	0.39
2002	31.7	0.75	19.3	0.56	15.6	0.40
2003	33.7	0.80	21.0	0.58	16.3	0.42
2004	32.8	0.75	21.3	0.61	16.4	0.40

Note: All years refer to the spring of school years. Because we cannot calculate the percentage of students who were new to a school for 1996-97, or the percentage of students who left by the end of 2004-05, turnover rates cannot be calculated for those two years.

Source: North Carolina Education Research Data Center (NCERDC)

Table 4. Turnover rates for the third through eighth grade student population in North Carolina public schools by Title I status and year

	School-wide Title I		Targeted-assistance		Non-Title I	
year	Mean (%)	S.E.	Mean (%)	S.E.	Mean (%)	S.E.
1998	20.0	0.55	20.7	2.13	20.8	0.49
1999	20.7	0.56	18.5	0.46	20.9	0.64
2000	20.6	0.53	17.4	0.44	20.7	0.60
2001	20.5	0.40	21.4	1.32	21.2	0.64
2002	21.6	0.52	18.1	0.47	21.8	0.61
2003	23.1	0.54	21.4	0.68	22.0	0.63
2004	22.1	0.44	21.7	0.76	21.9	0.66

Note: All years refer to the spring of school years. Because we cannot calculate the percentage of students who were new to a school for 1996-97, or the percentage of students who left by the end of 2004-05, turnover rates cannot be calculated for those two years.

Source: North Carolina Education Research Data Center (NCERDC)

Table 5. Turnover rates for the third through eighth grade student population in North Carolina public schools, by school characteristics: 1999-2000

School characteristics (quartiles)	Percent turnover	S.E.	Percent of students leaving	S.E.	Percent of students new	S.E.
Percent of students performing at grade level or higher						
Bottom quartile	26.6	0.8	13.6	0.4	13.0	0.6
2nd quartile	19.8	0.5	10.8	0.3	9.1	0.4
3rd quartile	15.8	0.4	8.2	0.2	7.7	0.3
Top quartile	15.1	0.4	7.5	0.2	7.5	0.3
Percent of minority students						
Bottom quartile	13.2	0.5	5.9	0.1	7.3	0.5
2nd quartile	17.3	0.5	8.0	0.2	9.3	0.5
3rd quartile	21.3	0.5	11.3	0.3	10.0	0.4
Top quartile	28.2	0.9	14.0	0.4	14.2	0.8
Percent of FRPL eligible students						
Bottom quartile	15.5	0.3	7.8	0.2	7.7	0.2
2nd quartile	17.6	0.5	8.9	0.3	8.7	0.4
3rd quartile	19.2	0.5	10.4	0.3	8.8	0.4
Top quartile	25.6	0.9	12.5	0.4	13.1	0.8

Source: North Carolina Education Research Data Center (NCERDC)

Table 6. Turnover rate by year and charter status

	Charter schools		Non-charter schools	
year	turnover	S.E.	turnover	S.E.
2003	33.4	1.9	21.9	0.4
2004	31.1	1.8	21.6	0.4

Note: Charter schools are first reported in North Carolina in school year 1998-99. However, data were not collected for charter school students until the 2002-03 school year

Table 7. Percentage of 3rd- grade students in North Carolina public schools who have ever made a non-promotional move over a 6 year period, by race/ethnicity, cohort, gender, FRPL eligibility, LEP status, and parental education attainment

	All		Black		Hispanic		Other		White	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
All										
1997 3rd graders	34.14	0.17	45.95	0.33	42.78	1.25	35.67	1.19	28.15	0.20
1998 3rd graders	35.44	0.17	48.14	0.32	44.13	1.11	38.28	1.18	28.75	0.20
1999 3rd graders	36.22	0.17	49.67	0.31	43.24	0.99	37.57	1.05	29.04	0.20
2000 3rd graders	36.55	0.17	50.24	0.31	38.68	0.96	42.95	0.90	28.96	0.20
Student characteristics										
Female										
1997 3rd graders	34.30	0.25	46.45	0.47	42.54	1.74	34.49	1.67	28.34	0.29
1998 3rd graders	35.72	0.24	49.17	0.46	44.42	1.56	38.72	1.73	28.84	0.29
1999 3rd graders	36.58	0.24	50.99	0.45	42.38	1.38	37.44	1.49	29.27	0.28
2000 3rd graders	37.15	0.24	51.36	0.44	38.15	1.35	45.33	1.30	29.45	0.29
Male										
1997 3rd graders	33.98	0.24	45.47	0.46	43.02	1.79	36.86	1.70	27.95	0.29
1998 3rd graders	35.16	0.24	47.17	0.44	43.77	1.58	37.89	1.63	28.66	0.29
1999 3rd graders	35.85	0.24	48.39	0.44	44.18	1.42	37.69	1.49	28.80	0.29
2000 3rd graders	35.93	0.24	49.14	0.44	39.21	1.36	40.68	1.25	28.45	0.29
FRPL eligible										
1997 3rd graders	44.17	0.26	48.09	0.36	42.91	1.36	36.96	1.38	39.83	0.40
1998 3rd graders	45.41	0.25	50.02	0.35	45.43	1.19	39.89	1.35	40.16	0.38
1999 3rd graders	45.94	0.24	51.36	0.34	44.33	1.05	39.11	1.20	40.30	0.36
2000 3rd graders	45.89	0.23	51.76	0.33	39.51	1.00	45.28	1.04	39.74	0.36
FRPL ineligible										
1997 3rd graders	24.66	0.22	36.23	0.75	42.04	3.16	31.62	2.36	23.02	0.23
1998 3rd graders	24.50	0.22	37.42	0.80	35.79	2.92	32.52	2.44	22.87	0.23
1999 3rd graders	24.32	0.23	38.86	0.83	34.63	2.83	31.94	2.19	22.56	0.23
2000 3rd graders	24.36	0.23	39.83	0.85	29.68	3.09	35.87	1.75	22.40	0.24
LEP										
1997 3rd graders	47.03	1.66	63.27	6.96	45.23	1.81	52.63	11.77	52.33	5.42
1998 3rd graders	46.36	1.35	54.41	6.08	45.81	1.47	41.18	12.30	47.66	4.43
1999 3rd graders	45.98	1.19	68.92	5.42	44.85	1.27	52.00	10.20	45.07	4.19
2000 3rd graders	43.80	1.09	54.95	5.24	39.06	1.23	66.20	2.81	44.70	4.34
Non-LEP										
1997 3rd graders	33.99	0.17	45.92	0.33	40.51	1.72	35.47	1.20	28.10	0.20
1998 3rd graders	35.25	0.17	48.12	0.32	41.90	1.68	38.25	1.19	28.70	0.20
1999 3rd graders	36.00	0.17	49.61	0.31	40.75	1.57	37.39	1.06	28.99	0.20
2000 3rd graders	36.36	0.17	50.22	0.31	38.09	1.52	40.54	0.94	28.91	0.20
Special education										
1997 3rd graders	41.99	0.42	53.04	0.72	46.78	2.91	44.19	2.83	35.50	0.52
1998 3rd graders	43.01	0.41	55.03	0.70	51.99	2.58	47.06	2.94	35.63	0.51
1999 3rd graders	43.62	0.41	56.57	0.70	50.57	2.38	45.36	2.57	35.86	0.51

Table 7. Percentage of 3rd- grade students in North Carolina public schools who have ever made a non-promotional move over a 6 year period, by race/ethnicity, cohort, gender, FRPL eligibility, LEP status, and parental education attainment—continued

	All		Black		Hispanic		Other		White	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
2000 3rd graders	43.75	0.41	56.63	0.69	45.50	2.4	46.02	2.23	35.89	0.52
Non-special education										
1997 3rd graders	32.32	0.19	44.07	0.37	41.85	1.38	33.64	1.31	26.55	0.22
1998 3rd graders	33.69	0.19	46.34	0.36	42.31	1.22	36.47	1.29	27.25	0.22
1999 3rd graders	34.57	0.19	47.97	0.35	41.67	1.08	35.87	1.15	27.59	0.22
2000 3rd graders	34.96	0.18	48.66	0.35	37.32	1.04	42.34	0.98	27.51	0.22
Parents' education attainment										
No High school diploma										
1997 3rd graders	45.68	0.75	50.14	1.32	41.01	1.99	39.84	4.34	44.41	1.05
1998 3rd graders	48.17	0.74	56.83	1.32	40.53	1.75	47.33	4.38	45.49	1.05
1999 3rd graders	49.07	0.76	55.70	1.40	42.23	1.61	43.09	4.48	48.47	1.11
2000 3rd graders	48.25	0.78	58.84	1.46	37.69	1.55	53.44	3.64	46.77	1.16
High school diploma										
1997 3rd graders	38.26	0.27	46.87	0.42	46.14	1.94	36.33	1.58	31.26	0.35
1998 3rd graders	39.98	0.26	48.54	0.41	48.86	1.74	38.26	1.59	32.47	0.35
1999 3rd graders	41.41	0.26	50.76	0.41	45.38	1.51	38.39	1.45	33.28	0.36
2000 3rd graders	41.91	0.26	50.74	0.40	40.28	1.42	44.39	1.27	33.83	0.36
Some college or Bachelors										
1997 3rd graders	29.23	0.25	43.51	0.58	38.95	2.89	33.60	2.10	24.91	0.27
1998 3rd graders	30.20	0.24	45.84	0.56	40.69	2.63	37.22	2.00	25.32	0.27
1999 3rd graders	30.60	0.24	46.98	0.54	39.86	2.33	36.03	1.71	25.24	0.26
2000 3rd graders	31.40	0.23	48.63	0.52	36.06	2.43	40.08	1.40	25.39	0.26
Graduate										
1997 3rd graders	26.28	0.75	41.46	2.78	38.46	14.04	33.93	6.38	24.53	0.78
1998 3rd graders	26.69	0.76	47.41	3.04	47.37	8.21	22.86	7.20	24.62	0.79
1999 3rd graders	28.15	0.78	45.45	2.95	46.67	9.26	31.25	5.84	26.23	0.81
2000 3rd graders	25.86	0.76	40.83	2.90	41.38	9.31	34.52	5.22	23.95	0.80

Note: A move is defined as non-promotional when a student attended a different school in the previous year and less than 10 percent of prior-year classmates made the same move. FRPL eligibility, LEP and Special education status are categorized based on whether a student had *ever* been in such a status over a period of six years.

Source: North Carolina Education Research Data Center (NCERDC)

Table 8. Percentage of 3rd grade *non-promotional movers* in North Carolina public schools who have moved at least twice over six years, by race/ethnicity, sex, Free/Reduced price lunch eligibility, Limited English proficiency status, Special Education status and parental education attainment

	All		Black		Hispanic		Other		White	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
All										
1997 3rd graders	35.98	0.30	43.31	0.48	36.61	1.86	35.49	1.49	30.23	0.39
1998 3rd graders	37.14	0.29	46.41	0.46	38.22	1.63	33.45	1.41	29.73	0.38
1999 3rd graders	38.25	0.28	46.86	0.44	35.42	1.45	34.73	1.29	31.37	0.38
2000 3rd graders	38.21	0.28	47.08	0.44	34.23	1.50	34.65	1.15	30.93	0.38
Student characteristics										
Female										
1997 3rd graders	35.21	0.42	41.60	0.67	36.06	2.65	34.73	2.08	30.07	0.56
1998 3rd graders	36.61	0.41	45.82	0.65	34.95	2.30	34.15	1.99	29.25	0.54
1999 3rd graders	37.81	0.40	46.01	0.63	35.99	2.07	33.59	1.85	31.11	0.55
2000 3rd graders	37.56	0.40	46.00	0.62	33.40	2.09	34.50	1.65	30.46	0.55
Male										
1997 3rd graders	36.76	0.42	45.06	0.69	37.13	2.62	36.27	2.13	30.38	0.56
1998 3rd graders	37.68	0.41	47.02	0.65	41.19	2.31	32.72	2.01	30.22	0.54
1999 3rd graders	38.66	0.40	47.68	0.63	34.86	2.04	35.80	1.81	31.60	0.54
2000 3rd graders	38.84	0.39	48.14	0.62	35.08	2.14	34.79	1.60	31.38	0.54
FRPL eligible										
1997 3rd graders	43.87	0.39	46.12	0.52	39.54	2.05	40.14	1.80	41.20	0.64
1998 3rd graders	44.89	0.36	49.01	0.49	39.49	1.74	37.73	1.71	40.04	0.59
1999 3rd graders	45.42	0.35	48.73	0.47	36.82	1.54	39.30	1.55	42.37	0.57
2000 3rd graders	45.61	0.34	49.31	0.46	35.53	1.56	40.06	1.37	42.03	0.57
FRPL ineligible										
1997 3rd graders	22.63	0.43	26.34	1.14	20.39	3.99	23.81	2.49	21.89	0.47
1998 3rd graders	21.49	0.43	26.70	1.20	27.84	4.57	22.44	2.37	20.41	0.46
1999 3rd graders	21.79	0.43	31.09	1.27	21.43	4.17	22.25	2.18	20.06	0.47
2000 3rd graders	20.16	0.43	27.25	1.23	15.38	4.51	18.62	1.87	18.96	0.47
LEP										
1997 3rd graders	39.60	2.00	45.16	9.09	41.35	2.67	35.14	1.64	31.11	6.98
1998 3rd graders	35.89	1.67	32.43	7.80	39.43	2.13	28.64	3.21	31.15	5.98
1999 3rd graders	35.80	1.48	45.10	7.04	36.16	1.84	31.91	2.91	40.63	6.19
2000 3rd graders	33.00	1.43	48.00	7.14	31.88	1.88	31.01	2.45	44.07	6.52
Non-LEP										
1997 3rd graders	35.90	0.30	43.31	0.48	31.72	2.56	37.16	3.58	30.22	0.40
1998 3rd graders	37.18	0.29	46.46	0.46	36.46	2.53	34.50	1.57	29.73	0.38
1999 3rd graders	38.34	0.29	46.86	0.45	34.16	2.37	35.39	1.44	31.33	0.38
2000 3rd graders	38.40	0.28	47.07	0.44	37.98	2.47	35.60	1.30	30.88	0.38
Special education										
1997 3rd graders	40.32	0.63	47.11	0.98	42.03	4.22	45.03	3.61	34.15	0.86
1998 3rd graders	41.72	0.62	50.59	0.95	43.88	3.55	32.20	3.27	34.38	0.84

Table 8. Percentage of 3rd grade *non-promotional movers* in North Carolina public schools who have moved at least twice over six years, by race/ethnicity, sex, Free/Reduced price lunch eligibility, Limited English proficiency status, Special Education status and parental education attainment—continued

	All		Black		Hispanic		Other		White	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
1999 3rd graders	43.88	0.62	52.21	0.94	39.46	3.28	41.63	3.16	36.89	0.86
2000 3rd graders	43.99	0.62	51.68	0.93	37.56	3.46	44.24	3.03	37.20	0.87
Non-special education										
1997 3rd graders	34.68	0.34	42.09	0.55	35.21	2.07	33.33	1.62	29.08	0.44
1998 3rd graders	35.81	0.33	45.12	0.52	36.61	1.83	33.74	1.57	28.42	0.43
1999 3rd graders	36.68	0.32	45.30	0.50	34.38	1.62	33.21	1.41	29.84	0.43
2000 3rd graders	36.63	0.31	45.75	0.49	33.42	1.66	32.87	1.23	29.22	0.43
Parents' education attainment										
No high school diploma										
1997 3rd graders	45.56	1.09	47.36	1.86	39.44	3.09	43.08	4.36	45.96	1.58
1998 3rd graders	47.33	1.05	52.70	1.77	38.32	2.72	39.17	4.47	46.94	1.57
1999 3rd graders	49.34	1.07	56.53	1.87	33.50	2.37	36.67	4.42	52.20	1.60
2000 3rd graders	48.21	1.10	53.87	1.92	30.62	2.40	38.27	3.83	53.19	1.70
High school diploma										
1997 3rd graders	41.37	0.43	46.13	0.61	38.69	2.79	39.80	2.19	35.99	0.64
1998 3rd graders	43.58	0.42	50.09	0.59	39.41	2.43	36.56	2.12	36.32	0.63
1999 3rd graders	43.90	0.41	49.23	0.57	38.71	2.19	39.78	1.95	37.73	0.63
2000 3rd graders	45.23	0.41	50.72	0.57	37.06	2.20	40.64	1.73	39.12	0.64
Some college or Bachelors										
1997 3rd graders	28.48	0.46	37.02	0.86	26.13	4.19	28.03	2.42	24.22	0.54
1998 3rd graders	28.40	0.43	38.30	0.81	35.92	4.04	28.78	2.24	22.97	0.51
1999 3rd graders	30.71	0.43	41.21	0.78	29.38	3.43	31.00	2.07	24.68	0.52
2000 3rd graders	29.65	0.41	40.24	0.73	35.46	4.04	30.04	1.77	22.94	0.50
Graduate										
1997 3rd graders	18.61	1.26	29.01	3.98	0.00	0.00	25.86	5.80	16.45	1.35
1998 3rd graders	18.66	1.26	25.78	3.88	27.78	10.86	27.94	5.48	16.35	1.36
1999 3rd graders	19.55	1.24	28.46	3.97	50.00	13.87	20.37	3.89	17.40	1.36
2000 3rd graders	18.43	1.29	27.12	4.11	16.67	11.24	7.06	2.79	18.41	1.48

Note: A move is defined as non-promotional when a student attended a different school in the previous year and less than 10 percent of prior-year classmates made the same move. FRPL eligibility, LEP and Special education status are categorized based on whether a student had *ever* been in such a status over a period of six years.

Source: North Carolina Education Research Data Center (NCERDC)

Table 9. Percentage of non-promotional moves made over a period of six years by change in school quality, by student and parental characteristics: 1997 3rd-grade cohort

	Moves to an worse performing school		Moves to a comparable school		Moves to a better performing school	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Ethnicity						
White	38.49	0.36	14.42	0.26	47.10	0.37
Black	42.43	0.38	14.44	0.27	43.13	0.38
Hispanic	38.08	1.54	13.83	1.09	48.10	1.58
Other	38.79	1.19	16.32	0.90	44.89	1.22
Sex						
Female	40.08	0.35	14.11	0.25	45.81	0.36
Male	40.38	0.36	14.88	0.26	44.74	0.36
FRPL eligibility						
FRPL	42.23	0.31	14.40	0.22	43.37	0.31
Non-FRPL	35.93	0.44	14.70	0.32	49.37	0.45
LEP status						
LEP	42.13	0.52	15.26	1.19	45.44	1.65
Non-LEP	39.62	0.29	14.48	0.18	45.28	0.26
Special Ed Status						
Special Ed	42.13	0.52	14.47	0.37	43.39	0.52
Non-Special Ed	39.62	0.29	14.50	0.21	45.88	0.29
Parental education						
No high school diploma	43.06	0.85	15.47	0.62	41.47	0.85
High school diploma	41.71	0.35	14.33	0.25	43.96	0.35
Some college or Bachelors	37.77	0.42	14.19	0.30	48.05	0.43
Graduate	34.11	1.40	18.10	1.13	47.79	1.47

Note: School quality change is derived using changes in school deciles based on the percentage of students performing at grade level or higher in school. A student's new school is compared with his/her former school based on contemporaneous rankings. A move is defined as non-promotional when a student attended a different school in the previous year and less than 10 percent of prior-year classmates made the same move. FRPL eligibility, LEP and Special education status are categorized based on whether a student had *ever* been in such a status over a period of six years.

Source: North Carolina Education Research Data Center (NCERDC)

Table 10. Percentage of non-promotional moves made over a period of six years by change in school quality, by student and parental characteristics: 1998 3rd-grade cohort

	Moves to an worse performing school		Moves to a comparable school		Moves to a better performing school	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Ethnicity						
White	41.39	0.35	13.17	0.24	45.44	0.36
Black	44.07	0.36	15.64	0.26	40.29	0.36
Hispanic	44.09	1.39	13.84	0.96	42.07	1.38
Other	38.45	1.12	16.67	0.86	44.89	1.15
Sex						
Female	42.30	0.34	14.54	0.24	43.16	0.34
Male	42.83	0.34	14.40	0.24	42.77	0.34
FRPL eligibility						
FRPL	43.80	0.29	14.58	0.20	41.61	0.28
Non-FRPL	39.32	0.45	14.19	0.32	46.48	0.46
LEP status						
LEP	43.30	1.44	14.32	1.02	42.38	1.43
Non-LEP	42.54	0.25	14.48	0.17	42.98	0.25
Special Ed Status						
Special Ed	44.26	0.50	14.15	0.35	41.59	0.50
Non-Special Ed	42.04	0.28	14.57	0.20	43.39	0.28
Parental education						
No high school diploma	44.63	0.82	14.43	0.58	40.94	0.81
High school diploma	43.94	0.33	14.96	0.24	41.10	0.33
Some college or Bachelors	40.35	0.40	13.53	0.28	46.12	0.41
Graduate	37.81	1.43	17.35	1.12	44.84	1.47

Note: School quality change is derived using changes in school deciles based on the percentage of students performing at grade level or higher in school. A student's new school is compared with his/her former school based on contemporaneous rankings. A move is defined as non-promotional when a student attended a different school in the previous year and less than 10 percent of prior-year classmates made the same move. FRPL eligibility, LEP and Special education status are categorized based on whether a student had *ever* been in such a status over a period of six years.

Source: North Carolina Education Research Data Center (NCERDC)

Table 11. Percentage of non-promotional moves made over a period of six years by change in school quality, by student and parental characteristics: 1999 3rd-grade cohort

	Moves to an worse performing school		Moves to a comparable school		Moves to a better performing school	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Ethnicity						
White	40.84	0.34	13.48	0.24	45.68	0.35
Black	43.96	0.35	16.00	0.26	40.04	0.34
Hispanic	42.28	1.27	12.41	0.85	45.31	1.28
Other	40.11	1.04	16.94	0.80	42.95	1.05
Sex						
Female	42.29	0.33	14.65	0.24	43.06	0.33
Male	42.29	0.33	14.89	0.24	42.82	0.33
FRPL eligibility						
FRPL	43.54	0.27	14.77	0.19	41.70	0.27
Non-FRPL	38.55	0.46	14.80	0.33	46.65	0.47
LEP status						
LEP	43.05	1.27	12.85	0.86	44.10	1.27
Non-LEP	42.26	0.24	14.84	0.17	42.89	0.24
Special Ed Status						
Special Ed	44.48	0.49	14.55	0.35	40.97	0.49
Non-Special Ed	41.64	0.26	14.84	0.19	43.52	0.27
Parental education						
No high school diploma	44.39	0.82	13.98	0.57	41.64	0.81
High school diploma	43.64	0.32	15.15	0.23	41.21	0.32
Some college or Bachelors	40.13	0.38	14.11	0.27	45.76	0.39
Graduate	38.66	1.37	18.70	1.10	42.64	1.40

Note: School quality change is derived using changes in school deciles based on the percentage of students performing at grade level or higher in school. A student's new school is compared with his/her former school based on contemporaneous rankings. A move is defined as non-promotional when a student attended a different school in the previous year and less than 10 percent of prior-year classmates made the same move. FRPL eligibility, LEP and Special education status are categorized based on whether a student had *ever* been in such a status over a period of six years.

Source: North Carolina Education Research Data Center (NCERDC)

Table12. Percentage of non-promotional moves made over a period of six years by change in school quality, by student and parental characteristics: 2000 3rd-grade cohort

	Moves to an worse performing school		Moves to a comparable school		Moves to a better performing school	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Ethnicity						
White	41.78	0.35	13.63	0.24	44.59	0.35
Black	42.22	0.33	16.48	0.25	41.30	0.33
Hispanic	40.83	1.18	12.94	0.81	46.23	1.20
Other	41.41	1.01	15.76	0.74	42.83	1.01
Sex						
Female	41.49	0.33	15.25	0.24	43.26	0.33
Male	42.36	0.32	14.87	0.23	42.77	0.32
FRPL eligibility						
FRPL	42.14	0.26	15.34	0.19	42.51	0.26
Non-FRPL	41.24	0.47	14.11	0.33	44.64	0.48
LEP status						
LEP	40.76	1.25	12.73	0.85	46.51	1.27
Non-LEP	41.97	0.23	15.14	0.17	42.89	0.23
Special Ed Status						
Special Ed	44.07	0.49	15.14	0.35	40.79	0.48
Non-Special Ed	41.31	0.26	15.03	0.19	43.66	0.26
Parental education						
No high school diploma	44.94	0.84	14.90	0.60	40.16	0.83
High school diploma	42.30	0.32	15.64	0.23	42.05	0.32
Some college or Bachelors	40.65	0.37	14.30	0.27	45.04	0.38
Graduate	44.29	1.50	14.43	1.06	41.28	1.49

Note: School quality change is derived using changes in school deciles based on the percentage of students performing at grade level or higher in school. A student's new school is compared with his/her former school based on contemporaneous rankings. A move is defined as non-promotional when a student attended a different school in the previous year and less than 10 percent of prior-year classmates made the same move. FRPL eligibility, LEP and Special education status are categorized based on whether a student had *ever* been in such a status over a period of six years.

Source: North Carolina Education Research Data Center (NCERDC)

Table 13. Summary of student school mobility effect on math score gains using fixed-effects estimator: by subsample and type of move

	All moves			Cross district moves			Within district moves		
Student subsamples	Coef.	SE		Coef.	SE		Coef.	SE	
All students	-0.008	0.002	*	0.000	0.003		-0.012	0.002	*
By student groups									
Race									
White	-0.004	0.003		0.005	0.004		-0.010	0.003	*
Black	-0.014	0.003	*	-0.009	0.005		-0.016	0.003	*
Hispanic	-0.028	0.011	*	-0.026	0.019		-0.029	0.013	*
Other	-0.011	0.009		0.007	0.016		-0.018	0.010	
LEP Status									
LEP	-0.019	0.012		-0.018	0.020		-0.020	0.013	
Non-LEP	-0.008	0.002	*	0.000	0.003		-0.012	0.002	*
Free/Reduced Price Lunch Status									
FRPL	-0.012	0.002	*	-0.008	0.004		-0.015	0.003	*
Non-FRPL	-0.002	0.003		0.013	0.005	*	-0.009	0.004	*
Special Ed Status									
Special Ed	-0.020	0.005	*	-0.005	0.007		-0.027	0.005	*
Non-Special Ed	-0.006	0.002	*	0.000	0.003		-0.009	0.002	*
Sex									
Male	-0.007	0.003	*	0.004	0.004		-0.013	0.003	*
Female	-0.010	0.003	*	-0.005	0.004		-0.012	0.003	*

* Significant at level .05

Note: All models include the following control variables: structural move dummy, percentage of students performing at grade level, school size, school locale, Title 1 eligibility, grade repetition, and grade fixed effects. Model for cross-district moves also includes a within-district move indicator. Model for within-district moves also includes a cross-district move indicator.

Source: North Carolina Education Research Data Center (NCERDC)

Table 14. Summary of student school mobility effect on reading gains scores using fixed-effects estimator: by subsample and type of move

	All moves			Cross district moves			Within district moves	
Student subsamples	Coef.	SE		Coef.	SE		Coef.	SE
All students	0.004	0.002		0.011	0.003	*	0.000	0.002
By student groups								
Race								
White	0.011	0.003	*	0.018	0.004	*	0.006	0.004
Black	-0.003	0.003		0.004	0.006		-0.005	0.004
Hispanic	-0.002	0.012		0.005	0.021		-0.004	0.014
Other	-0.013	0.010		-0.021	0.017		-0.010	0.011
LEP Status								
LEP	0.008	0.013		0.026	0.022		0.001	0.015
Non-LEP	0.003	0.002		0.010	0.003	*	0.000	0.002
Free/Reduced Price Lunch Status								
FRPL	0.001	0.003		0.006	0.004		-0.002	0.003
Non-FRPL	0.010	0.003	*	0.020	0.006	*	0.004	0.004
Special Ed Status								
Special Ed	-0.004	0.005		0.002	0.008		-0.007	0.006
Non-Special Ed	0.005	0.002	*	0.013	0.004	*	0.002	0.003
Sex								
Male	0.005	0.003		0.017	0.005	*	0.000	0.004
Female	0.002	0.003		0.006	0.005		0.001	0.003

* Significant at level .05

Note: All models include the following control variables: structural move dummy, percentage of students performing at grade level, school size, school locale, Title 1 eligibility, grade repetition, and grade fixed effects. Model for cross-district moves also includes a within-district move indicator. Model for within-district moves also includes a cross-district move indicator.

Source: North Carolina Education Research Data Center (NCERDC)

Table 15. Estimates of school mobility effect on math gains using student fixed-effects model and controlling for the number of prior moves, by subsample and type of move

	Coefficient and standard error of variable					
Student subsample and type of move	Non-promotional move	SE	Number of prior moves	SE	Number of prior moves squared	SE
All moves	-0.012	0.002 *	0.017	0.005 *	-0.005	0.002 *
Cross-district moves	-0.004	0.003	0.016	0.005 *	-0.005	0.002 *
Within-district moves	-0.015	0.002 *	0.016	0.005 *	-0.005	0.002 *
Black	-0.015	0.003 *	0.015	0.007 *	-0.007	0.003 *
Hispanic	-0.034	0.012 *	0.049	0.031	-0.024	0.015
FRPL eligible	-0.014	0.003 *	0.009	0.005	-0.004	0.002 *
Male	-0.012	0.003 *	0.023	0.007 *	-0.006	0.003 *

* Significant at level .05

Note: All models include the following additional control variables: structural move dummy, percentage of students performing at grade level, school size, school locale, Title 1 eligibility, grade repetition, and grade fixed effects. Model for cross-district moves also includes a within-district move indicator. Model for within-district moves also includes a cross-district move indicator.

Source: North Carolina Education Research Data Center (NCERDC)


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